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Exhibit NRC E1A

NUREG-2105, Vol. 1

Environmental Impact Statement for the Combined License (COL) for Enrico Fermi Unit 3

Final Report

Chapters 1 to 6

U.S. Nuclear Regulatory Commission
Office of New Reactors
Washington, DC 20555-0001

Regulatory Office
Permit Evaluation, Eastern Branch
U.S. Army Engineer District, Detroit
U.S. Army Corps of Engineers
Detroit, MI 48226

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Manuscript Completed: December 2012
Date Published: January 2013

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Final Environmental Impact Statement
for Combined License (COL) for Enrico Fermi Unit 3

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Abstract:

This environmental impact statement (EIS) has been prepared in response to an application submitted to the U.S. Nuclear Regulatory Commission (NRC) by Detroit Edison for a construction permit and operating license (combined license or COL). The proposed actions related to the Detroit Edison application are (1) NRC issuance of a COL for a new power reactor unit at the Detroit Edison Enrico Fermi Atomic Power Plant (Fermi) site in Monroe County, Michigan; and (2) U.S. Army Corps of Engineers (USACE) permit action to perform certain regulated activities on the site. The USACE is participating with the NRC in preparing this EIS as a cooperating agency and participates collaboratively on the review team.

This EIS includes the NRC staff's analysis, which considers and weighs the environmental impacts of constructing and operating a new nuclear unit at the Fermi site and at alternative sites, and mitigation measures available for reducing or avoiding adverse impacts. Based on its analysis, the staff determined that there are no environmentally preferable or obviously superior sites.

The EIS includes the evaluation, in part, of the proposed action's impacts on the public interest, including impacts on waters of the United States pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Appropriations Act of 1899. The USACE will decide whether to issue a permit on the basis of the EIS evaluation of the probable impacts on the public interest, including cumulative impacts, of Detroit Edison's proposed activities that are within the USACE scope of analysis; USACE verification of compliance with the requirements of USACE regulations and the Clean Water Act Section 404(b)(1) Guidelines; and any supplemental information, evaluations, or verifications that may be outside the NRC's scope of analysis and not included in this EIS, but are required by the USACE to support its permit decision.

After considering the environmental aspects of the proposed action, the staff's recommendation to the Commission is that the COL be issued as proposed.[a] This recommendation is based on (1) the application, including the Environmental Report (ER) submitted by Detroit Edison; (2) consultation with Federal, State, Tribal, and local agencies; (3) the staff's independent review; (4) the staff's consideration of comments related to the environmental review that were received during the public scoping process

(a) As directed by the Commission in CLI-12-16, the NRC will not issue the COL prior to completion of the ongoing rulemaking to update the Waste Confidence Decision and Rule (see Section 6.1.6 of this EIS).

and on the draft EIS; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and this EIS. The USACE permit decision would be made following issuance of this final EIS and completion of its permit application review process and permit decision documentation.

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Executive Summary

By letter dated September 18, 2008, the U.S. Nuclear Regulatory Commission (NRC or the Commission) received an application from Detroit Edison Company (Detroit Edison) for a combined license (COL) for a new power reactor unit, the Enrico Fermi Unit 3 (Fermi 3), at the Detroit Edison Enrico Fermi Atomic Power Plant (Fermi) site in Monroe County, Michigan.

The proposed actions related to the Fermi 3 application are (1) NRC issuance of COLs for construction and operation of a new nuclear unit at the Fermi site and (2) U.S. Army Corps of Engineers (USACE) permit action pursuant to Section 404 of the Federal Water Pollution Control Act, as amended (33 USC 1251, *et seq*.) (Clean Water Act), and Section 10 of the Rivers and Harbors Appropriation Act of 1899 (33 USC 403 *et seq.*) (Rivers and Harbors Act of 1899) to perform certain regulated activities associated with the Fermi 3 project, within the USACE jurisdiction and scope of analysis. The USACE is participating with the NRC in preparing this environmental impact statement (EIS) as a cooperating agency and participates collaboratively on the review team. The reactor specified in the application is an Economic Simplified Boiling Water Reactor (ESBWR) designed by GE-Hitachi Nuclear Energy Americas, LLC (GEH). The GEH design was approved by the NRC in March 2011. The final design approval was published in the *Federal Register* on March 16, 2011 (76 FR 14437).

The NRC staff completed its safety review of the ESBWR design on March 9, 2011 and issued a final safety evaluation report (FSER, Agencywide Documents Access and Management System [ADAMS] accession number ML103470210). The NRC staff also issued a standard design approval (SDA) via letter to GE Hitachi Nuclear Energy on March 9, 2011 (ADAMS accession number ML110540310). This SDA signified that the NRC staff reviewed the design and found the design met all applicable regulations.

In parallel with the SDA, the NRC staff began preparing a rulemaking to certify the design approved in the SDA. Based on the completion of its safety review, the NRC published a proposed rule on March 24, 2011 (77 FR 16549) that would certify the ESBWR design in Appendix E to 10 CFR Part 52.

In late 2011, while the NRC staff was preparing the final rule, issues were identified with the ESBWR steam dryer, which is a non-safety component. These issues called into question certain conclusions in the staff's safety review under the SDA. Resolution of these issues requires additional analyses by the applicant and review by the NRC staff in order for the NRC staff to conclude the design is acceptable for certification. The design certification rulemaking process is delayed pending resolution of these issues. If the additional analyses resolve the issues, certification, via publication of a final rule, is expected to be completed in 2013.

Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321 *et seq*.), directs that an EIS be prepared for major Federal actions that significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in Title 10 of the Code of Federal Regulations (CFR), Part 51. Further, in 10 CFR 51.20, the NRC has determined that the issuance of a COL under 10 CFR Part 52 is an action that requires an EIS.

The purpose of Detroit Edison's requested NRC action – issuance of the COL – is to obtain a license to construct and operate a new nuclear unit. This license is necessary but not sufficient for construction and operation of the unit. A COL applicant must obtain and maintain the necessary permits from other Federal, State, Tribal, and local agencies and permitting authorities. Therefore, the purpose of the NRC's environmental review of the Detroit Edison application is to determine if a new nuclear power plant of the proposed design can be constructed and operated at the Fermi site without unacceptable adverse impacts on the human environment. The objective of Detroit Edison's anticipated request for USACE action would be to obtain a decision on a permit application proposing structures and/or work in, over, or under navigable waters and/or the discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands. Upon acceptance of the Detroit Edison application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing in the *Federal Register* (FR) a Notice of Intent (73 FR 75142) to prepare an EIS and conduct scoping. On January 14, 2009, the NRC held two scoping meetings in Monroe, Michigan, to obtain public input on the scope of the environmental review. To gather information and to become familiar with the sites and their environs, the NRC and its contractors, Argonne National Laboratory, Energy Research, Inc., and Ecology and Environment, Inc., visited the Fermi site in February 2009 and the four alternative sites, Belle River/St. Clair, Greenwood Energy Center, and two greenfield sites (Petersburg and South Britton sites) in January 2009.

During the Fermi site visit, the NRC staff, its contractors, and the USACE staff met with Detroit Edison staff, public officials, and the public. The NRC staff reviewed the comments received during the scoping process and contacted Federal, State, Tribal, regional, and local agencies to solicit comments. Included in this EIS are (1) the results of the review team's analyses, which consider and weigh the environmental effects of the proposed action (i.e., issuance of the COL) and of building and operating a new nuclear unit at the Fermi site; (2) mitigation measures for reducing or avoiding adverse effects; (3) the environmental impacts of alternatives to the proposed action; and (4) the staff's recommendation regarding the proposed action.

To guide its assessment of the environmental impacts of a proposed action or alternative actions, the NRC has established a standard of significance for impacts based on Council on Environmental Quality guidance (40 CFR 1508.27). Table B-1 of 10 CFR Part 51, Subpart A,

Appendix B, provides the following definitions of the three significance levels – SMALL, MODERATE, and LARGE:

> SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Mitigation measures were considered for each resource category and are discussed in the appropriate sections of the EIS.

In preparing this EIS, the NRC staff and USACE staff reviewed the application, including the Environmental Report (ER) submitted by Detroit Edison; consulted with Federal, State, Tribal, and local agencies; and followed the guidance set forth in NUREG-1555, *Environmental Standard Review Plan*. In addition, the NRC staff considered the public comments related to the environmental review received during the scoping process. Comments within the scope of the environmental review are included in Appendix D of this EIS.

A 75-day comment period began on October 28, 2011, when the U.S. Environmental Protection Agency (EPA) issued a FR Notice of Availability (76 FR 66925) of the draft EIS to allow members of the public to comment on the results of the environmental review. Two public meetings were held on December 15, 2011, at Monroe County Community College, in Monroe, Michigan. During these public meetings, the review team described the results of the NRC environmental review, answered questions related to the review, and provided members of the public with information to assist them in formulating their comments. The comment period for the draft EIS ended January 11, 2012. Comments on the draft EIS and the staff's responses are provided in Appendix E of this EIS.

The USACE issued LRE-2008-00443-1-S11 public notice for a 30-day review on December 23, 2011, describing the proposed USACE-regulated activities associated with the Fermi 3 project; proposed water of the United States avoidance and minimization plan and conceptual mitigation strategy; and USACE preliminary assessment of certain impacts. The purpose of the public notice was to solicit comments from the public; Federal, State, and local agencies and officials; Indian Tribes; and other interested parties in order to consider and evaluate the impacts of regulated activities within the USACE scope of analysis that are associated with the Fermi 3 project. The comments received during the public comment period are under review by USACE.

The NRC staff's recommendation to the Commission related to the environmental aspects of the proposed action is that the COL be issued as requested.[a] This recommendation is based on (1) the application, including the ER submitted by Detroit Edison and the applicant's supplemental letters and responses to the staff's Requests for Additional Information; (2) consultation with other Federal, State, Tribal, and local agencies; (3) the staff's independent review; (4) the staff's consideration of public comments related to the environmental review that were received during the scoping process and on the draft EIS; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and this EIS. The USACE will base its evaluation of Detroit Edison's permit application on items (1), (2), (4), and (5) listed above; USACE consideration of public comments received in response to the USACE public notice; the requirements of USACE regulations and the Clean Water Act Section 404(b)(1) Guidelines; and the USACE public interest review. The USACE's permit decision will be based, in part, on this EIS and will be made after issuance of the final EIS and completion of its permit application review and decision-making process.

The NRC staff's evaluation of the site safety and emergency preparedness aspects of the proposed action will be addressed in the NRC's Safety Evaluation Report anticipated to be published in the future.

(a) As directed by the Commission in CLI-12-16, NRC will not issue the COL prior to completion of the ongoing rulemaking to update the Waste Confidence Decision and Rule (see Section 6.1.6 of this EIS).

Abbreviations/Acronyms

χ/Q	dispersion values
°F	degree(s) Fahrenheit
ABWR	advanced boiling water reactor
ac	acre(s)
AC	alternating current
ACHP	Advisory Council on Historic Preservation
ADAMS	Agencywide Documents Access and Management System
ADG	ancillary diesel generator
ADT	average daily traffic
AEC	Atomic Energy Commission
AHS	Auxiliary Heat Sink
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
APE	area of potential effects
AQCR	Air Quality Control Region
Argonne	Argonne National Laboratory
AST	aboveground storage tank
ASLB	Atomic Safety and Licensing Board
AWEA	American Wind Energy Association
BA	Biological Assessment
BACT	Best Available Control Technology
BEA	Bureau of Economic Analysis (U.S. Department of Commerce)
BEIR	Biological Effects of Ionizing Radiation
BGEPA	Bald and Golden Eagle Protection Act of 1940
BIA	Bureau of Indian Affairs
BiMAC	basemat internal melt arrest and coolability
BMP	best management practice
Bq	Becquerel
Bq/MTU	Becquerel per metric ton uranium
BRC	Blue Ribbon Commission
Btu	British thermal unit(s)
BWR	boiling water reactor
CAA	Clean Air Act
CAES	compressed air energy storage
CAIR	Clean Air Interstate Rule

CCR	coal combustion residuals
CCRG	Commonwealth Cultural Resources Group, Inc.
CCS	carbon capture and sequestering/sequestration
CDC	Centers for Disease Control and Prevention
CDF	core damage frequency
CEQ	Council on Environmental Quality
CER	Capital Expenditure and Recovery
CFR	Code of Federal Regulations
cfs	cubic feet per second
cfu	colony forming units
CH_4	methane
CHP	combined heat and power
Ci	curie(s)
CIRC	Circulating Water System
CIS	containment isolation system
CN	Canadian National
CNF	Capacity Need Forum (MPSC)
CO	carbon monoxide
CO_2	carbon dioxide
CO_2-e	carbon dioxide-equivalent
COL	combined construction permit and operating license
CSAPR	Cross-State Air Pollution Rate
CSP	concentrated solar power
CSX	CSX Transportation
CT	combustion turbine
CWA	Clean Water Act
CWIS	Cooling Water Intake Structure
CZMA	Coastal Zone Management Act
DA	Department of the Army
dB	decibel
dBA	A-weighted decibel
DBA	design-basis accident
dbh	diameter at breast height
DC	direct current
DCD	Design Control Document
DDT	dichlorodiphenyltrichloroethane
Detroit Edison	Detroit Edison Company
DHS	U.S. Department of Homeland Security
DNL	equivalent continuous sound level

DNR	Designated Network Resource
DOC	U.S. Department of Commerce
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOT	Department of Transportation
D/Q	deposition factor
DRIWR	Detroit River International Wildlife Refuge
DSM	demand-side management
DTW	Detroit Metropolitan Wayne County Airport
DWSD	Detroit Water and Sewerage Department
E&E	Ecology and Environment, Inc.
EAB	Exclusion Area Boundary
EERE	U.S. Department of Energy Office of Energy Efficiency and Renewable Energy
EGS	engineered geothermal system
EIA	Energy Information Administration
EIS	environmental impact statement
ELF	extremely low frequency
EMF	electromagnetic field
EOP	emergency operating procedure
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
EPT	Ephemeroptera, Plecoptera, Trichoptera (index)
EPZ	emergency planning zone
ER	Environmental Report
ERI	Energy Research, Inc.
ESA	Endangered Species Act of 1973, as amended
ESBWR	Economic Simplified Boiling Water Reactor
ESRP	Environmental Standard Review Plan
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
Fermi	Enrico Fermi Atomic Power Plant
Fermi 1	Enrico Fermi Unit 1
Fermi 2	Enrico Fermi Unit 2
Fermi 3	Enrico Fermi Unit 3
FES	Final Environmental Statement
FIRM	Flood Insurance Rate Map
FIS	Financial Reporting and Analysis

FP	fire pump
fps	feet per second
FPS	Fire Protection System
FR	*Federal Register*
FSAR	Final Safety Analysis Report
FSER	Final Safety Evaluation Report
ft	foot (feet)
ft/day	feet per day
ft^3	cubic feet
FTE	full-time equivalent
FWS	U.S. Fish and Wildlife Service
FY	fiscal year
GAF	Generation and Fuel
gal	gallon
GBq	gigabecquerel
GC	gas centrifuge
GD	gaseous diffusion
GEH	General Electric-Hitachi Nuclear Energy Americas, LLC
GEIS	*Generic Environmental Impact Statement for License Renewal of Nuclear Plants*
GEIS-DECOM	*Generic Environmental Impact Statement for Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*
GHG	greenhouse gas
GIS	geographical information system
GLC	Great Lakes Commission
GLENDA	Great Lakes Environmental Database
GLOFS	Great Lakes Operational Forecast System
GLWC	Great Lakes Wind Council
gpd	gallon(s) per day
gpm	gallon(s) per minute
GWh	gigawatt hour(s)
GWP	global warming potential
ha	hectare
HAP	hazardous air pollutant
HCMA	Huron-Clinton Metropolitan Authority
HDR	hot dry rock
HEPA	high-efficiency particulate air
HFC	hydrofluorocarbon

HFE	hydrofluorinated ether
HLW	high-level waste
HQUSACE	U.S. Army Corps of Engineers Headquarters
hr	hour(s)
HRSG	heat recovery steam generator
HUD	U.S. Department of Housing and Urban Development
HVAC	heating, ventilating, and air-conditioning
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
IEEE	Institute of Electrical and Electronics Engineers
IGCC	integrated gasification combined cycle
IGLD 85	International Great Lakes Datum of 1985
IJC	International Joint Commission
in.	inch(es)
INAC	Indian and Northern Affairs Canada
IOU	investor-owned utility
IPCC	Intergovernmantal Panel on Climate Change
IPCS	Integrated Plant Computer System
IPP	independent power producer
IRP	Integrated Resource Plan
ISD	Intermediate School District
ISFSI	Independent Spent Fuel Storage Installation
ITC	ITC Holdings Corporation
JPA	Joint Permit Application
kg	kilogram(s)
KiKK	Childhood Cancer in the Vicinity of Nuclear Power Plants (German acronym)
km	kilometer(s)
km^2	square kilometer(s)
kV	kilovolt(s)
kW	kilowatt(s)
kWh	kilowatt hour(s)
L	liter(s)
L_{90}	sound level exceeded 90 percent of the time
LaMP	Lakewide Management Plan
lb	pound(s)
L_{dn}	day-night average sound level
LEDPA	least environmentally damaging practicable alternative

LEOFS	Lake Erie Operational Forecast System
L_{eq}	equivalent continuous sound level
LET	Lake Erie Transit
LFA	Load Forecasting Adjustment
LLW	low-level waste
LOLE	Loss of Load Expectation
LOLP	Loss-of-Load Probability
LOS	level of service
LPZ	low population zone
LRF	large release frequency
LTRA	Long-Term Reliability Assessment (NERC)
LW	long wave
LWR	light water reactor
μg	microgram(s)
m	meter(s)
m^3	cubic meter(s)
MACCS2	MELCOR Accident Consequence Code System
MBTA	Migratory Bird Treaty Act of 1918
MCCC	Monroe County Community College
mCi	millicurie
MCL	maximum contaminant level; Michigan Compiled Laws
MCRC	Monroe County Road Commission
MDCH	Michigan Department of Community Health
MDCT	mechanical draft cooling tower
MDELEG	Michigan Department of Energy, Labor and Economic Growth
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MDOT	Michigan Department of Transportation
MDSP	Michigan Department of State Police
MEI	maximally exposed individual
METC	Michigan Electric Transmission Company
mGy	milliGray
MGD	million gallons per day
mi	mile(s)
mi^2	square mile(s)
MichCon	Michigan Consolidated Gas Company
MISO	Midwest Independent System Operator
MIT	Massachusetts Institute of Technology
mL	milliliter(s)
MMT	million metric tons

$MMTCO_2$-e	million metric tons of carbon dioxide equivalent
MNFI	Michigan Natural Features Inventory
mo	month(s)
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
mph	mile(s) per hour
MPSC	Michigan Public Service Commission
mrad	milliradian
mrem	millirem(s)
MSA	Metropolitan Statistical Area
MSW	municipal solid waste
MT	metric ton(s) (or tonne[s])
MTEP	MISO Transmission Expansion Plan
MTU	metric ton(s) of uranium
MW	megawatt(s)
MW(e)	megawatt(s) electrical
MW(t)	megawatt(s) thermal
MWd	megawatt-day(s)
MWd/MTU	megawatt-day(s) per metric ton of uranium
MWh	megawatt hour(s)
NAAQS	National Ambient Air Quality Standard
NACD	Native American Consultation Database
NaCl	sodium chloride
NAGPRA	Native American Graves Protection and Repatriation Act of 1990
NAS	National Academy of Sciences
NAVD 88	North American Vertical Datum of 1988
DCDC	National Climate Data Center
NCI	National Cancer Institute
NCRP	National Council on Radiation Protection and Measurements
NDCT	natural draft cooling tower
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act of 1969, as amended
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NESHAP	National Emission Standards for Hazardous Air Pollutants
NF_3	nitrogen trifluoride
NGCC	natural gas combined-cycle
NHPA	National Historic Preservation Act of 1966, as amended
NIEHS	National Institute of Environmental Health Sciences
NMFS	National Marine Fisheries Service

NML	noise monitoring location
NNW	north-northwest
N_2O	nitrous oxide
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NPHS	normal power heat sink
NPS	National Park Service
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
NREPA	Natural Resources and Environmental Protection Act
NRHP	*National Register of Historic Places*
NS	Norfolk Southern
NSPS	New Source Performance Standard
NSR	new source review
NTC	Nuclear Training Center
NTU	nephelometric turbidity unit
NWI	National Wetland Inventory
NWIS	National Water Information System
NWR	National Wildlife Refuge
O_3	ozone
ODCM	Offsite Dose Calculation Manual
ODNR	Ohio Department of Natural Resources
OGS	off-gas system
OSHA	Occupational Safety and Health Administration
PAM	primary amebic meningoencephalitis
PAP	personnel access portal
Pb	lead
PC	personal computer
PCB	polychlorinated biphenyl
pCi/L	picocurie(s) per liter
PCTMS	Plant Cooling Tower Makeup System
PEM	palustrine emergent marsh
PESP	Pesticide Environmental Stewardship Program
PFC	perfluorocarbon
PFO	palustrine forested wetland
P-IBI	Planktonic Index of Biotic Integrity

PIPP	Pollution Incident Prevention Plan
PJM	PJM Interconnection
PM	particulate matter
$PM_{2.5}$	particulate matter with a mean aerodynamic diameter of less than or equal to 2.5 μm
PM_{10}	particulate matter with a mean aerodynamic diameter of less than or equal to 10 μm
PRA	probabilistic risk assessment
PRB	Powder River Basin
PSD	Prevention of Significant Deterioration
psia	pounds per square inch absolute
PSR	Physicians for Social Responsibility
PSS	palustrine scrub-shrub wetland
PSWS	Plant Service Water System
PTE	potential to emit
Pu-239	plutonium-239
PV	photovoltaic
PWSS	pretreated water supply system
RAI	Request for Additional Information
RCRA	Resource Conservation and Recovery Act of 1976, as amended
RDF	refuse-derived fuel
REIRS	Radiation Exposure Information and Reporting System
rem	roentgen equivalent man
REMP	radiological environmental monitoring program
RESA	Regional Educational Service Agency
RFC	Reliability*First* Corporation
RHAA	Rivers and Harbors Appropriation Act of 1899
RHR	residual heat removal
RIMS II	Regional Input-Output Modeling System
ROI	region of interest
ROW	right-of-way
RPS	Renewable Portfolio Standard
RRD	Remediation and Redevelopment Division
RSICC	Radiation Safety Information Computational Center
RTO	Regional Transmission Organization
RTP	Regional Transportation Plan
RV	recreational vehicle
Ryr	reactor-year

SACTI	Seasonal/Annual Cooling Tower Impact
SAMA	severe accident mitigation alternative
SAMDA	severe accident mitigation design alternative
SAMG	severe accident management guidelines
SBO	station blackout
SCPC	supercritical pulverized coal
SCR	selective catalytic reduction
SDA	standard design approval
SDG	standby diesel generator
sec	second(s)
SEGS	Solar Energy Generating System
SEMCOG	Southeast Michigan Council of Governments
SER	Safety Evaluation Report
SESC	soil erosion and sedimentation control
SF_6	sulfur hexafluoride
SHPO	State Historic Preservation Office(r)
SO_2	sulfur dioxide
SO_x	sulfur oxides
SOARCA	State-of-the-Art Reactor Consequence Analyses
SRHP	*State Register of Historic Places*
SRREN	Special Report on Renewable Energy Sources and Climate Change Mitigation
SSC	system, structure, and component
SSE	safe shutdown earthquake ground motion
STG	steam turbine generator
STORET	Storage and Retrieval Database
SUV	sport-utility vehicle
Sv	sievert
SWMS	solid radioactive waste management system
SWPPP	Stormwater Pollution Prevention Plan
SWS	Station Water System
TDS	total dissolved solids
TEDE	total effective dose equivalent
THPO	Tribal Historic Preservation Office
TI	Temporary Instruction
TIP	Transportation Improvement program
TLD	thermoluminescent dosimeter
TMDL	total maximum daily load
TRAGIS	Transportation Routing Analysis Geographic Information System
TRU	transuranic

U.S.	United States
USC	United States Code
U_3O_8	triuranium octoxide (“yellowcake”)
UF_6	uranium hexafluoride
UMTRI	University of Michigan Transportation Research Institute
UO_2	uranium dioxide
USACE	U.S. Army Corps of Engineers
USBLS	U.S. Bureau of Labor Statistics
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
VIB	Vehicle Inspection Building
VOC	volatile organic compound
WHO	World Health Organization
WNW	west-northwest
WPSCI	Wolverine Power Supply Cooperative, Inc.
WRA	Wind Resource Area
WTE	waste-to-energy
WWSL	wastewater stabilization lagoon
WWTP	wastewater treatment plant
yd^3	cubic yard(s)
yr	year(s)

1.0 Introduction

By letter dated September 18, 2008, the Detroit Edison Company (Detroit Edison) submitted to the U.S. Nuclear Regulatory Commission (NRC) an application for a combined license (COL) for Enrico Fermi Unit 3 (Fermi 3) to be located adjacent to the existing Units 1 (Fermi 1) and 2 (Fermi 2) on the Detroit Edison Enrico Fermi Atomic Power Plant (Fermi) site. The site proposed by Detroit Edison for Fermi 3 is located in Monroe County, Michigan, approximately 30 miles (mi) southwest of Detroit, Michigan, and 7 mi from the United States-Canada international border. The proposed Fermi 3 and facilities would be completely within the confines of the current Fermi site, and would be located adjacent to the existing Fermi 2. Fermi 1, also on the Fermi site, is in the process of being decommissioned.

Detroit Edison is a wholly owned subsidiary of DTE Energy and would be the owner of Fermi 3. Detroit Edison is the licensed operator of the existing Fermi 2 nuclear power plant and would be responsible for construction and operation of the proposed project.

The U.S. Army Corps of Engineers (USACE) is participating with the NRC in the preparation of this environmental impact statement (EIS) as a cooperating agency. As a cooperating agency, the USACE participates collaboratively with the NRC staff on the review. Throughout this EIS, the staffs from the NRC and USACE are collectively referred to as the “review team.” The NRC and USACE staffs focused their review on Revision 4 of the COL application, responses to requests for additional information, and supplemental letters. Part 3 of the application contains Detroit Edison’s Environmental Report (ER) (Detroit Edison 2011a).

The proposed actions related to the Fermi 3 application are (1) NRC issuance of a COL for construction and operation of a power reactor at the Fermi site in Monroe County, Michigan, and (2) USACE permit action pursuant to Section 404 of the Federal Water Pollution Control Act, as amended (33 USC 1251 *et seq.*) (Clean Water Act) (CWA), and Section 10 of the Rivers and Harbors Appropriation Act of 1899 (33 USC 403) (RHAA) to perform certain preconstruction activities, as appropriate to the USACE scope of analysis, on the site.

Detroit Edison initiated coordination with USACE through pre-application and jurisdictional determination meetings and submitted a Joint Permit Application (for activities associated with the proposed Fermi 3 project) to USACE on September 9, 2011 (Detroit Edison 2011b).

1.1 Background

A COL is a Commission approval for the construction and operation of one or more nuclear power facilities. NRC regulations related to COLs are primarily found in Title 10 of the Code of Federal Regulations (CFR) Part 52, Subpart C.

Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321 *et seq*.), requires the preparation of an EIS for major Federal actions that have the potential to significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in 10 CFR Part 51. Further, in 10 CFR 51.20, the NRC has determined that the issuance of a COL under 10 CFR Part 52 is an action that requires an EIS.

According to 10 CFR 52.80(b), an application for a COL must contain an ER. The ER provides input that the staff evaluates in preparing the NRC's EIS. NRC regulations related to ERs and EISs are found in 10 CFR Part 51.

The reactor specified in the Detroit Edison application is an Economic Simplified Boiling Water Reactor (ESBWR) designed by GE-Hitachi Nuclear Energy Americas, LLC (GEH). Subpart B of 10 CFR Part 52 contains NRC regulations related to standard design certification. An application for a standard design certification undergoes an extensive review, usually taking several years. The GEH ESBWR design was approved by the NRC on March 2011. The final design approval was published in the *Federal Register* (FR) on March 16, 2011 (76 FR 14437). Where appropriate, this EIS incorporates the results of the ESBWR design review.

The NRC staff completed its safety review of the ESBWR design on March 9, 2011, and issued a Final Safety Evaluation Report (FSER, Agencywide Documents Access and Management System [ADAMS] accession number ML103470210). The NRC staff also issued a standard design approval (SDA) via letter to GE Hitachi Nuclear Energy on March 9, 2011 (ADAMS accession number ML110540310). This SDA signified that the NRC staff reviewed the design and found the design met all applicable regulations.

In parallel with the SDA, the NRC staff began preparing a rulemaking to certify the design approved in the SDA. Based on the completion of its safety review, the NRC published a proposed rule in the *Federal Register* on March 24, 2011 (77 FR 16549) that would certify the ESBWR design in Appendix E to 10 CFR Part 52.

In late 2011, while the NRC staff was preparing the final rule, issues were identified with the ESBWR steam dryer, which is a non-safety component. These issues called into question certain conclusions in the staff's safety review under the SDA. Resolution of these issues requires additional analyses by the applicant and review by the NRC staff in order for the NRC staff to conclude the design is acceptable for certification. The design certification rulemaking process is delayed pending resolution of these issues. If the additional analyses resolve the issues, certification, via publication of a final rule, is expected to be completed in 2013.

1.1.1 Applications and Reviews

The purpose of Detroit Edison's requested NRC action is to obtain from the NRC a COL to construct and operate a baseload nuclear power plant. This license is necessary but not sufficient by itself for construction and operation of Fermi 3. In addition to the COL, Detroit Edison must obtain and maintain permits from other Federal, State, and local agencies and permitting authorities. The objective of Detroit Edison's request for USACE action is to obtain a decision on a permit application proposing structures and/or work in, over, or under, or affecting navigable waters and the discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands.

1.1.1.1 NRC COL Application Review

The NRC regulations setting standards for review of a COL application are listed in 10 CFR 52.81. Detailed guidance for the NRC staff to use in conducting its environmental review is set forth in NUREG-1555, *Environmental Standard Review Plan* (NRC 2000), and recent updates, hereafter referred to as the ESRP. Additional guidance on conducting environmental reviews is provided in the NRC Staff Memorandum, *Addressing Construction and Preconstruction, Greenhouse Gas Issues, General Conformity Determinations, Environmental Justice, Need for Power, Cumulative Impact Analysis, and Cultural/Historic Resources Analysis Issues in Environmental Impact Statements* (Staff Memorandum) (NRC 2011).

In this EIS, the NRC staff evaluates the environmental effects of construction and operation of one new boiling water reactor of the GEH ESBWR design, with a thermal power rating of 4500 megawatt thermal (MW(t)) at the Fermi site. The new unit would use a closed cycle, wet cooling system that uses a natural draft cooling tower for heat dissipation. In addition to considering the environmental effects of the proposed action, the NRC considers alternatives to the proposed action including the no-action alternative and the construction and operation of new reactors at one of four alternative sites. Also, the benefits of the proposed action (e.g., need for power) and measures and controls to limit adverse impacts are evaluated.

Upon acceptance of the Detroit Edison application, the NRC began the environmental review by publishing on December 10, 2008, a Notice of Intent to prepare an EIS and conduct scoping (73 FR 75142). On January 14, 2009, the NRC held two scoping meetings in Monroe, Michigan, to obtain public input on the scope of the environmental review and contacted Federal, State, Tribal, regional, and local agencies to solicit comments. A list of the agencies and organizations contacted is provided in Appendix B. The staff reviewed the comments received during the scoping process, and responses were written for each comment. Comments within the scope of the NRC environmental review and their associated responses are included in Appendix D. A complete list of the scoping comments and responses is documented in the Fermi 3 combined license scoping summary report (NRC 2009).

To gather information and to become familiar with the sites and their environs, the NRC, its contractors Argonne National Laboratory (Argonne), Energy Research, Inc. (ERI), and Ecology and Environment, Inc. (E&E), and the USACE visited the Fermi site in February 2009 and the alternative sites of Belle River-St. Clair, the Greenwood Energy Center, and two greenfield sites

(Petersburg and South Britton sites) in January 2009. During the Fermi site visit, the NRC staff and USACE met with Detroit Edison staff, public officials, and the public. Documents related to the Fermi site were reviewed and are listed as references where appropriate.

To guide its assessment of environmental impacts of a proposed action or alternative actions, the NRC has established a standard of significance for impacts based on Council on Environmental Quality guidance (40 CFR 1508.27). Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, provides the definitions of the three significance levels established by the NRC – SMALL, MODERATE, or LARGE – which are defined as follows:

> SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

This EIS presents the NRC staff's and the review team's analysis and presents impact level determinations based on the three significance levels discussed above. The analysis considers and weighs the environmental impacts of the proposed action at the Fermi site, including the environmental impacts associated with construction and operation of the proposed new reactor at the site, the cumulative effects of the proposed action and other actions, the impacts of construction and operation of a reactor at alternative sites, the environmental impacts of alternatives to granting the COL, and the mitigation measures available for reducing or avoiding adverse environmental effects. This EIS also provides the NRC staff's recommendation to the Commission regarding the issuance of the COL for the proposed Fermi 3.

A 75-day comment on the draft EIS began on October 28, 2011, when the U.S. Environmental Protection Agency (EPA) issued a Notice of Availability (76 FR 66925) to allow members of the public to comment on the results of the NRC and USACE staff review. Two public meetings were held on December 15, 2011, at the Monroe County Community College, in Monroe, Michigan. During these public meetings, the review team described the results of the NRC environmental review, answered questions related to the review, and provided members of the public with information to assist them in formulating their comments. The comment period on the draft EIS ended January 11, 2012. Comments on the draft EIS and the review team's and staff's responses are provided in Appendix E of this EIS. This final EIS has change bars in the page margins to denote where information has been updated or added in response to public comment or where a technically substantive change has been made.

1.1.1.2 USACE Permit Application Review

This EIS provides environmental information the USACE needs to complete, in part, its NEPA and public interest factor reviews and draw conclusions regarding the least environmentally damaging practicable alternative (LEDPA) and the public good for its permitting decision.

On receipt of a complete permit application, USACE issued a Public Notice on December 23, 2011 (USACE 2011) to solicit comments from local, State and Federal agencies and the public about Detroit Edison's proposal and proposed mitigation measures, to guide the USACE permit evaluation and decision.

The USACE's independent regulatory permit decision documentation will reference relevant analyses from the EIS and, as necessary, include a supplemental public interest factor review, a CWA 404(b)(1) evaluation, a supplemental evaluation of cumulative impacts, and other information and evaluations that may be outside the NRC's scope of analysis and not included in this EIS, but are required by the USACE to support its permit decision. In its capacity as a cooperating agency in the preparation of this EIS, the USACE role also involves verification that the information presented is adequate to fulfill the requirements of USACE regulations applicable to regulated activities within the USACE scope of analysis associated with construction and operation of the preferred alternative identified in the EIS.

In this EIS, USACE evaluates the impacts of certain construction and maintenance activities proposed in waters of the United States, including jurisdictional wetlands that would be affected by the proposed activities. The USACE decision would reflect the national concern for both protection and use of important resources. The benefit, which reasonably may be expected to accrue from the proposal, must be balanced against its reasonably foreseeable detriments.

The decision whether to issue a permit would be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest. Evaluation of the probable impacts that the proposed activity may have on the public interest requires a careful weighing of all of the factors that become relevant in each particular case, as well as application of the Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR Part 230) (Guidelines). The USACE decision to authorize Detroit Edison's proposal, and the conditions under which it would be allowed to occur, are therefore determined by the outcome of this general balancing process. All factors that may be relevant to the proposal must be considered including the cumulative effects. Some of the public interest review factors that may be relevant to the anticipated Detroit Edison permit application proposal are considered in this EIS. USACE public interest review factors are discussed in Appendix J.

For activities involving discharges regulated by the CWA Section 404, a permit would be denied if the discharge would not comply with the Guidelines, which contain the substantive environmental criteria used by the USACE in evaluating discharges of dredged or fill material into waters of the United States. Among the criteria, the Guidelines stipulate that no discharge of dredged or fill material shall be permitted if there is a practicable alternative that would have less adverse impact on the aquatic environment, so long as the alternative does not have other significant adverse environmental consequences. If an applicant's preferred alternative is determined to be the LEDPA, the USACE must still determine its effect on the other criteria contained in the Guidelines as well as the applicable public interest factors. A permit would not be issued for an alternative that is not the LEDPA.

In addition, subject to the Guidelines as discussed above and criteria (see 33 CFR 320.2 and 320.3), a permit will be granted unless the USACE District Engineer determines that it would be contrary to the public interest. The following general criteria are considered by the USACE in the evaluation of every application:

- The relative extent of the public and private need for the proposed work;
- Where there are unresolved conflicts about resource use, the practicability of using practicable and reasonable alternative locations and methods to accomplish the objective of the proposed structure or work; and
- The extent and permanence of the beneficial and/or detrimental effects that the proposed structure or work is likely to have on the public and private uses to which the area is suited.

The USACE would address its LEDPA and public interest review determinations and the final mitigation plan in its permit decision documentation. A partial public interest review, a preliminary 404(b)(1) analysis including Detroit Edison's proposed LEDPA determination, and Detroit Edison's proposed mitigation plan to compensate for the unavoidable aquatic resource loss attributable to its proposed LEDPA, are included in this EIS.

1.1.2 Preconstruction Activities

In a final rule dated October 9, 2007 (72 FR 57416), the Commission limited the definition of "construction" to those activities that fall within its regulatory authority in 10 CFR 51.4. Many of the activities required to construct a nuclear power plant are not part of the NRC action to license the plant. Activities associated with building the plant that are not within the purview of the NRC action are grouped under the term "preconstruction." Preconstruction activities include clearing and grading, excavating, dredging, discharge of fill, erection of support buildings and transmission lines, and other associated activities. These preconstruction activities may take place before the application for a COL is submitted, during the staff's review of a COL application, or after a COL is granted. As of October 2012, no preconstruction activities related to development of Fermi 3 or associated facilities have occurred on the Fermi site and none are expected in the immediate future. Although preconstruction activities are outside the NRC's regulatory authority, many are within the regulatory authority of local, State, or other Federal agencies, and certain preconstruction activities require a permit from USACE.

Because the preconstruction activities are not part of the NRC action, their impacts are not reviewed as a direct effect of the NRC action. Rather, the impacts of the preconstruction activities are considered in the context of cumulative impacts. Certain preconstruction activities (e.g., those actions related to work or the building of structures in navigable waters or to the discharge of dredged or fill material into waters of the United States) require USACE authorization, and impacts are viewed as direct effects of a USACE permit action. Such activities are included in the EIS as part of the USACE review. For purposes of this EIS, both construction and preconstruction activities are described in Chapter 4. Chapter 4 of this EIS describes the relative magnitude of impacts related to preconstruction and construction activities. It should be noted that Chapter 4 contains a partial evaluation of the public interest factors required as part of the USACE permit decision-making process. The USACE's independent regulatory permit decision documentation will reference relevant analyses from the EIS, and, as necessary, include supplemental public interest factor evaluations that may be outside of the NRC's scope of analysis and not included in the EIS, but required by the USACE in support of its permit decision.

1.1.3 Cooperating Agencies

Most proposed nuclear power plants require a permit from the USACE if structures or work would occur in, over, under, or affecting, and/or involving the discharge of dredged material or fill in waters of the United States, in addition to a license from the NRC. Therefore, the NRC and USACE decided that the most effective and efficient use of Federal resources in the review of nuclear power projects would be achieved by a cooperative agreement. On September 12, 2008, the NRC and USACE signed a Memorandum of Understanding (MOU) regarding the review of nuclear power plant license applications (USACE and NRC 2008). Therefore, the Detroit District of USACE is participating as a cooperating agency as defined in 10 CFR 51.14.

As described in the MOU, the NRC is the lead Federal agency and the USACE is a cooperating agency in the development of a COL EIS. Under Federal law, each agency has jurisdiction related to portions of the proposed project as major Federal actions that could significantly affect the quality of the human environment. The goal of this cooperative agreement is the development of one EIS that serves the needs of the NRC license decision process and the USACE permit decision process. While both agencies must meet the requirements of NEPA, both agencies also have mission requirements that must be met in addition to the NEPA requirements.

The NRC makes license decisions under the Atomic Energy Act (42 USC 2011 *et seq.*), and the USACE makes permit decisions under the Rivers and Harbors Appropriation Act and Clean Water Act, and the USACE is cooperating with the NRC to ensure that the information presented in the EIS is adequate to fulfill the requirements, to the extent possible, of USACE regulations, Section 404 of the CWA, Section 10 of the RHAA, the Guidelines, and the USACE public interest review.

As a cooperating agency, USACE is part of the NRC review team and is involved in all aspects of the environmental review, including scoping, public meetings, public comment resolution, and EIS preparation. USACE refers to public meetings as hearings, but there is no judge or legal process involved as there is for NRC hearings conducted by the Atomic Safety and Licensing Board. For the purposes of the assessment of environmental impacts under NEPA, the EIS uses the SMALL/MODERATE/LARGE criteria discussed in Section 1.1.1.1 of this EIS; this approach has been vetted by the Council on Environmental Quality. However, for permit decisions under Section 404 of the CWA, USACE can only permit the USACE LEDPA and must address public interest review factors. The EIS is intended to provide the information needed in support of the USACE's regulatory permit decision for Detroit Edison's permit application.

The USACE would complete its assessment of the LEDPA and other criteria and address whether the LEDPA criteria are met in its permit decision document, after issuance of the Final EIS. A goal of the EIS process is that USACE will have the information necessary to make a permit decision when the final EIS is issued. However, it is possible that USACE will still need some information from the applicant to complete its permit documentation that the applicant could not make available by the time of final EIS issuance. Also, any conditions required by USACE, such as the final compensatory mitigation plan, would be addressed in the USACE permit (if issued). Compensatory mitigation may only be employed after all appropriate and practical steps to avoid and minimize adverse impacts to aquatic resources, including wetlands and streams, have been taken. All remaining unavoidable impacts must be compensated to the extent appropriate and practicable. The USACE permit, if issued, would include special conditions under which Detroit Edison must confirm that the proposed mitigation meets the Federal wetland criteria outlined in the report, *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987), related regional supplement (USACE 2012), and associated Final National Wetland Plant List (77 FR 11176) in accordance with Compensatory Mitigation for Losses of Aquatic Resources; Final Rule, as published in April 10, 2008 (73 FR 19594) (33 CFR Parts 325 and 332), and compensates for lost aquatic functions. If the USACE does not find the mitigation satisfactory, it would determine the need for project and/or mitigation modifications necessary for compliance with permit conditions. Detroit Edison would assume all liability for accomplishing the permitted work including any required mitigation.

1.1.4 Concurrent NRC Reviews

In reviews separate from but parallel to the EIS process, the NRC analyzes the safety characteristics of the proposed site and emergency planning information. These analyses are documented in a Safety Evaluation Report (SER) issued by the NRC. The SER presents the conclusions reached by the NRC regarding (1) whether there is reasonable assurance that one new Detroit Edison ESBWR unit can be constructed and operated at the Fermi site without undue risk to the health and safety of the public; (2) whether the emergency preparedness program meets the applicable requirements in 10 CFR Part 50, 10 CFR Part 52, 10 CFR Part 73, and 10 CFR Part 100; and (3) whether site characteristics are such that adequate security plans and measures can be developed. The final SER for Detroit Edison's COL application is anticipated to be published in May 2013.

The reactor design referenced in the application is the ESBWR. The ESBWR design was approved by the NRC in March 2011, and the final design approval was published in the *Federal Register* on March 16, 2011 (76 FR 14437). Final design certification rulemaking is expected to be completed by early 2013.

On July 18, 2011, DTE Energy submitted a letter of intent to the NRC to file an application in 2014 for renewal of the operating license of Fermi 2 (DTE Energy 2011). As a part of that application review process, the NRC will analyze the environmental impacts of renewing the license for an extended period of operation and document its analysis in an EIS. The NRC will also evaluate whether the effects of aging on plant equipment will be managed such that Fermi 2 can be operated during the period of extended operation without undue risk to the health and safety of the public, and will document its conclusions in an SER.

1.2 The Proposed Federal Actions

The proposed NRC Federal action is issuance, under the provisions of 10 CFR Part 52, of a COL authorizing the construction and operation of one new GEH ESBWR at the Fermi site. The proposed USACE Federal action would be the decision whether to issue a permit pursuant to the CWA and RHAA for the authorization of certain preconstruction activities that could affect waters of the United States, including jurisdictional wetlands, based on an evaluation of the probable impacts, including cumulative impacts, on the public interest.

This EIS presents the NRC and USACE analyses of the environmental impacts that could result from the building and operation of a new unit at the Fermi site or at one of the four alternative sites. These impacts are analyzed by the NRC to determine if the proposed site is suitable for the new unit and whether any of the alternative sites is considered obviously superior to the proposed site. These impacts are analyzed by USACE to determine effects on public interest review factors and if there is a practicable alternative with less adverse impact on the aquatic ecosystem and public interest review factors, provided that the alternative does not have other significant adverse consequences. However, the USACE's independent regulatory permit decision documentation will reference relevant analyses from the EIS, and, as necessary, include supplemental public interest factor reviews, a CWA 404(b)(1) evaluation, a supplemental cumulative impact evaluation, and other information and evaluations that may be outside the NRC's scope of analysis and not included in the EIS, but required by the USACE to support its permit decision.

1.3 The Purpose and Need for the Proposed Action

The purpose and need for the proposed NRC and USACE actions is described below.

1.3.1 NRC's Proposed Action

The purpose and need for the proposed NRC action is to provide for additional large baseload electrical generating capacity to address Michigan's expected future peak electric demand. Detroit Edison has indicated that new baseload electric generating capacity will be needed to compensate for the expected retirement of aging baseload generating units and diminishing availability of the Midwest Independent Service Operator region's baseload generation capacity (Detroit Edison 2011a). Chapter 8 of this EIS evaluates the need for power. Chapter 9 of the EIS discusses the alternatives to the proposed action, including the no-action alternative.

A license from the NRC is necessary for the construction and operation of the power plant. Preconstruction and certain long lead-time activities, such as ordering and procuring certain components and materials necessary to construct the plant, may begin before the COL is granted. Detroit Edison must obtain and maintain permits or authorizations from other Federal, State, and local agencies and permitting authorities prior to undertaking certain activities. The ultimate decisions on whether or not to build a facility and the schedule are not within the purview of the NRC or USACE and would be determined by the license holder if the authorization is granted.

1.3.2 The USACE Permit Action

The Detroit Edison permit application submitted to the USACE proposes work to prepare the site and build support facilities for a nuclear power plant at the existing Fermi site. Defining the project purpose is critical to the evaluation of any project and in evaluating compliance with the Section 404(b)(1) Guidelines. The Section 404(b)(1) Guidelines necessitate that the USACE define the basic project purpose and the overall project purpose to ensure appropriate consideration of alternatives.

The basic purpose is the simplest purpose of the project and is used when discharges are proposed in special aquatic sites to determine whether the applicant's proposed activity is "water dependent" (the term "water dependent" is discussed in 40 CFR 230.10(a)(3)). The water dependency test contained in the Section 404(b)(1) Guidelines requires a determination as to whether or not activities require access or proximity to or siting within special aquatic sites.[a] If the activity is not water dependent, the Section 404(b)(1) Guidelines state that practicable alternatives to the use of special aquatic sites are presumed to exist, are less damaging, and are environmentally preferable to alternatives that involve discharges into special aquatic sites (e.g., wetlands) (40 CFR 230.10(a)(3)). The basic purpose of the Fermi 3 project is to generate electricity for additional baseload capacity. Generating electricity does not require siting in wetlands, and, in accordance with 40 CFR 230.10(a)(3), practicable, less damaging alternatives that do not involve discharges into special aquatic sites are presumed to exist unless clearly demonstrated otherwise (40 CFR 230.10(a)(3)).

The overall project purpose establishes the scope of the alternatives analysis and is used for evaluating practicable alternatives under the Section 404(b)(1) Guidelines. In accordance with the Section 404(b)(1) Guidelines and USACE Headquarters guidance, the overall project purpose must be specific enough to define the applicant's needs, but not so narrow and restrictive as to preclude a proper evaluation of alternatives. USACE is responsible for controlling every aspect of the Section 404(b)(1) Guidelines analysis. In this regard, defining the overall project purpose for issuance of USACE permits is the sole responsibility of USACE. While generally focusing on the applicant's statement, USACE will in all cases exercise independent judgment in defining the purpose and need for the project from both the applicant's and the public's perspective in accordance with 33 CFR Part 325, Appendix B (9)(c)(4) (also 53 FR 3136).

The overall purpose of the project is to provide baseload electrical generating capacity to address future peak electric demand in the Detroit Edison service area. USACE concurs with the stated project purpose and long-term need to generate electricity to meet this need.

1.4 Alternatives to the Proposed Action

The review team addresses five categories of alternatives in Chapter 9 and Appendix J: (1) the no-action alternative, (2) energy source alternatives, (3) system design alternatives, (4) alternative sites, and (5) alternatives related to the location of proposed facilities on the Fermi site.

(a) Special Aquatic Sites are a subset of areas identified as "Waters of the United States" regulated under the Clean Water Act (CWA). Section 404(b)(1) of the Act required that EPA establish guidelines used by the U.S. Army Corps of Engineers to evaluate discharges of dredged and fill material regulated under Section 404 of the CWA. The Guidelines (40 CFR 230) identify fish and wildlife sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffles and pool complexes as Special Aquatic Sites. The Guidelines define Special Aquatic Sites as areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection or other important and easily disrupted ecological values. These sites are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region, and are subject to greater protection than other waters of the United States because of their significant contribution to the overall environment.

Under the no-action alternative, the proposed action would not go forward. NRC could deny Detroit Edison's application for a COL or USACE could deny a Detroit Edison a permit. If the application and/or permit were denied, the construction and operation of a new unit at the existing Fermi site would not occur nor would any benefits intended by an approved COL be realized. Energy source alternatives that could generate baseload power include energy replacement technologies such as oil- and gas-fired generation and wind power. System design alternatives include heat dissipation and circulating water systems, intake and discharge structures, and water use and treatment systems; the proposed system is a natural draft cooling tower.

In its ER, Detroit Edison defines a region of interest for use in identifying and evaluating potential sites for power generation (Detroit Edison 2011a). In this EIS, the review team evaluates the region of interest and the process by which alternative sites and the proposed site were selected by Detroit Edison and evaluates the environmental impacts of construction and operation of a new power reactor at these sites. For alternative sites, the review team evaluation uses reconnaissance-level information. The alternative sites include a coal-fired plant site (Belle River-St. Clair) and an oil- and gas-fired plant site (Greenwood Energy Center), both owned by Detroit Edison, and two greenfield sites (Petersburg and South Britton) that are in multiple private ownership. The objective of the comparison of environmental impacts is to determine if any of the alternative sites is obviously superior to the Fermi site.

As part of the evaluation of permit applications subject to Section 404 of the CWA, USACE is required by regulation to apply the criteria set forth in the Section 404(b)(1) Guidelines. These Section 404(b)(1) Guidelines establish criteria that must be met in order for the proposed activities to be permitted pursuant to Section 404. Specifically, these Section 404(b)(1) Guidelines state, in part, that no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have less adverse impact on the aquatic ecosystem, provided the alternative does not have other significant adverse consequences. An area not presently owned by the applicant that could reasonably be obtained, used, expanded, or managed in order to fulfill the overall purpose of the proposed activity may be considered if it is otherwise a practicable alternative. An analysis of onsite alternatives to avoid and minimize impacts on waters of the United States including wetlands, prepared by Detroit Edison and under review by the USACE is included in Appendix J of this EIS.

1.5 Compliance and Consultations

Prior to construction and operation of a new unit, Detroit Edison is required to hold certain Federal, State, and local environmental permits, as well as to meet applicable statutory and regulatory requirements. Potential authorizations, permits, and certifications relevant to the proposed COL are included in Appendix H. The NRC staff reviewed this list and has contacted the appropriate Federal, State, Tribal, and local agencies to identify any compliance, permit, or significant environmental issues of concern to the reviewing agencies. A chronology of the correspondence is provided in Appendix C. A list of the key consultation correspondence is provided in Appendix F, which also contains the Biological Assessment submitted to the U.S. Fish and Wildlife Service (FWS) to support compliance with the Endangered Species Act. This Biological Assessment presents the review team's assessment of the impacts on Federally listed threatened and endangered species of building and operating Fermi 3.

1.6 Report Contents

The subsequent chapters of this EIS are organized as follows. Chapter 2 describes the proposed site and discusses the environment that would be affected by the addition of the new unit. Chapter 3 describes the power plant layout, structures, and the activities related to construction and operation to be used as the basis for evaluating the environmental impacts. Chapters 4 and 5 examine site acceptability by analyzing the environmental impacts of construction (Chapter 4) and operation (Chapter 5) of the proposed Fermi Unit 3. Chapter 6 analyzes the environmental impacts of the uranium fuel cycle, transportation of radioactive materials, and decommissioning, while Chapter 7 discusses the cumulative impacts of the proposed action as defined in 40 CFR Part 1508. Chapter 8 addresses the need for power. Chapter 9 discusses alternatives to the proposed action and analyzes energy sources, alternative sites, and system designs, and compares the proposed action with the alternatives. Chapter 10 summarizes the findings of the preceding chapters, provides a benefit-cost evaluation, and presents the NRC staff's recommendation with respect to the Commission's approval of the proposed site for a COL based on the staff's evaluation of environmental impacts.

The appendices to the EIS provide the following additional information:

- Appendix A – Contributors to the Environmental Impact Statement
- Appendix B – Organizations Contacted
- Appendix C – Chronology of NRC and USACE Staff Environmental Review Correspondence Related to Detroit Edison Company's Application for a Combined License for the Proposed Fermi Nuclear Power Plant Unit 3
- Appendix D – Scoping Comments and Responses
- Appendix E – Draft Environmental Impact Statement Comments and Responses
- Appendix F – Key Consultation Correspondence Regarding the Fermi Nuclear Power Plant Unit 3 Combined License Application including the Biological Assessment of the Impacts on Federally Listed Threatened and Endangered Species of Building and Operating Fermi 3
- Appendix G – Supporting Documentation on Radiological Dose Assessment

- Appendix H – Authorizations, Permits, and Certifications
- Appendix I – Severe Accident Mitigation Alternatives
- Appendix J – USACE Public Interest Review Factors and Detroit Edison's Onsite Alternatives Analysis
- Appendix K – Detroit Edison's Proposed Compensatory Mitigation Plan for Aquatic Resources
- Appendix L – Carbon Dioxide Footprint Estimates for a 1000 MW(e) Light Water Reactor
- Appendix M – Environmental Impacts from Building and Operating Transmission Lines Proposed to Serve Fermi 3

1.7 References

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy,* Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy,* Part 52, "Early Site Permits, Standard Design Certifications, and Combined Licenses for Nuclear Power Plants."

10 CFR Part 73. Code of Federal Regulations, Title 10, *Energy*, Part 73, "Physical Protection of Plants and Materials."

10 CFR Part 100. Code of Federal Regulations, Title 10, *Energy*, Part 100, "Reactor Site Criteria."

33 CFR Part 320. Code of Federal Regulations, Title 33, *Navigation and Navigable Waters*, Part 320, "General Regulatory Policies."

33 CFR Part 325. Code of Federal Regulations, Title 33, *Navigation and Navigable Waters*, Part 325, "Processing of Department of the Army Permits."

33 CFR Part 332. Code of Federal Regulations, Title 33, *Navigation and Navigable Waters*, Part 332. "Compensatory Mitigation for Losses of Aquatic Resources."

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2.0 Affected Environment

The proposed Enrico Fermi Unit 3 (Fermi 3) would be located in Monroe County in rural southeastern Michigan. Detroit Edison Company (Detroit Edison) applied to the U.S. Nuclear Regulatory Commission (NRC) for a combined license (COL) for Fermi 3. In addition to the COL application, Detroit Edison applied for a Department of Army permit from the U.S. Army Corps of Engineers (USACE) on September 9, 2011 (Detroit Edison 2011f), to conduct activities that affect waters of the United States, including wetlands. The proposed new unit would be situated wholly within the existing Enrico Fermi Atomic Power Plant (Fermi) site and adjacent to the existing Enrico Fermi Unit 2 (Fermi 2). Enrico Fermi Unit 1 (Fermi 1), also located on the Fermi site, is being decommissioned. The Fermi site is located approximately 30 miles (mi) southwest of Detroit, Michigan, and 7 mi from the United States-Canada border. The proposed Fermi 3 location is described in Section 2.1, followed by descriptions of the land, water, ecology, socioeconomics, environmental justice, historic and cultural resources, geology, meteorology and air quality, and radiological environment of the site presented in Sections 2.2 through 2.11, respectively. Section 2.12 examines related Federal projects, and references are presented in Section 2.13.

2.1 Site Location

Detroit Edison's selected location for the proposed Fermi 3 is entirely within the Fermi site and is adjacent to and southwest of existing operating Fermi 2 and west of Fermi 1, which is in the process of being decommissioned (Figure 2-1). Lake Erie borders the Fermi site on the east. Toll Road is located along the west boundary, Swan Creek is to the north, and Pointe Aux Peaux Road is to the south. The entire site is relatively flat, with large areas of developed land, but also extensive emergent wetlands, early successional habitats, and forest.

The population centers nearest to the Fermi site that have more than 25,000 residents are Detroit, Michigan, with approximately 900,000 residents; Windsor, Ontario, with approximately 200,000 residents; and Toledo, Ohio, with approximately 300,000 residents. Figure 2-2 shows the location of Fermi 3 in relationship to the counties and important cities and towns within a 50-mi radius of the site. Figure 2-3 shows the location of Fermi 3 in relation to features in the vicinity of the project, defined as the area within 7.5 mi of the site.

2.2 Land Use

This section discusses land use for the Fermi site; Section 2.2.1 describes the site and the vicinity around the site (i.e., the area within 7.5 mi of the site); Section 2.2.2 discusses the existing and proposed transmission line corridors; and Section 2.2.3 briefly discusses the region, defined as the area within 50 mi of the Fermi site boundary.

Figure 2-1. Fermi Site Boundary (Detroit Edison 2011a)

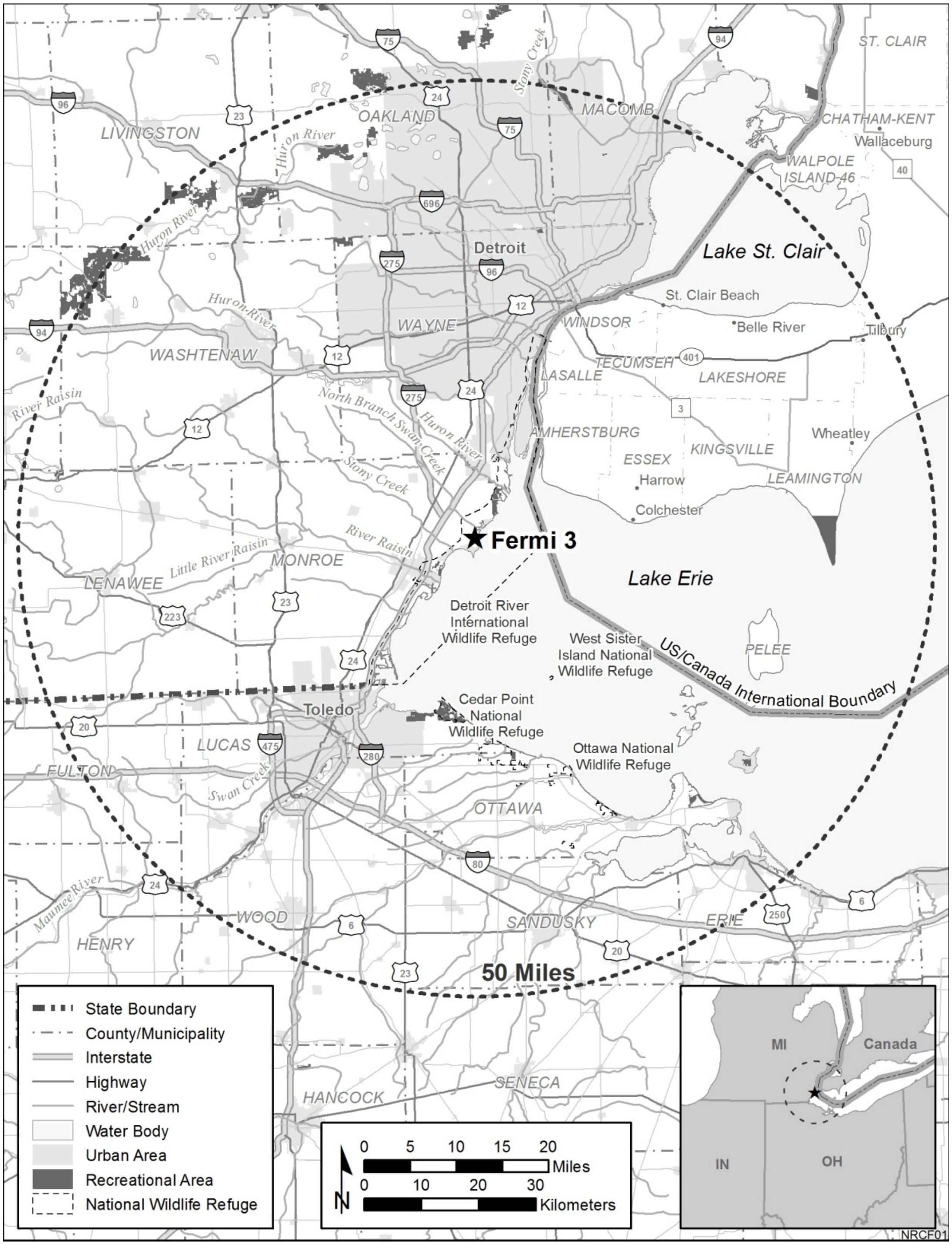

Figure 2-2. Proposed Location of Fermi 3 and 50-mi Region (Detroit Edison 2011a)

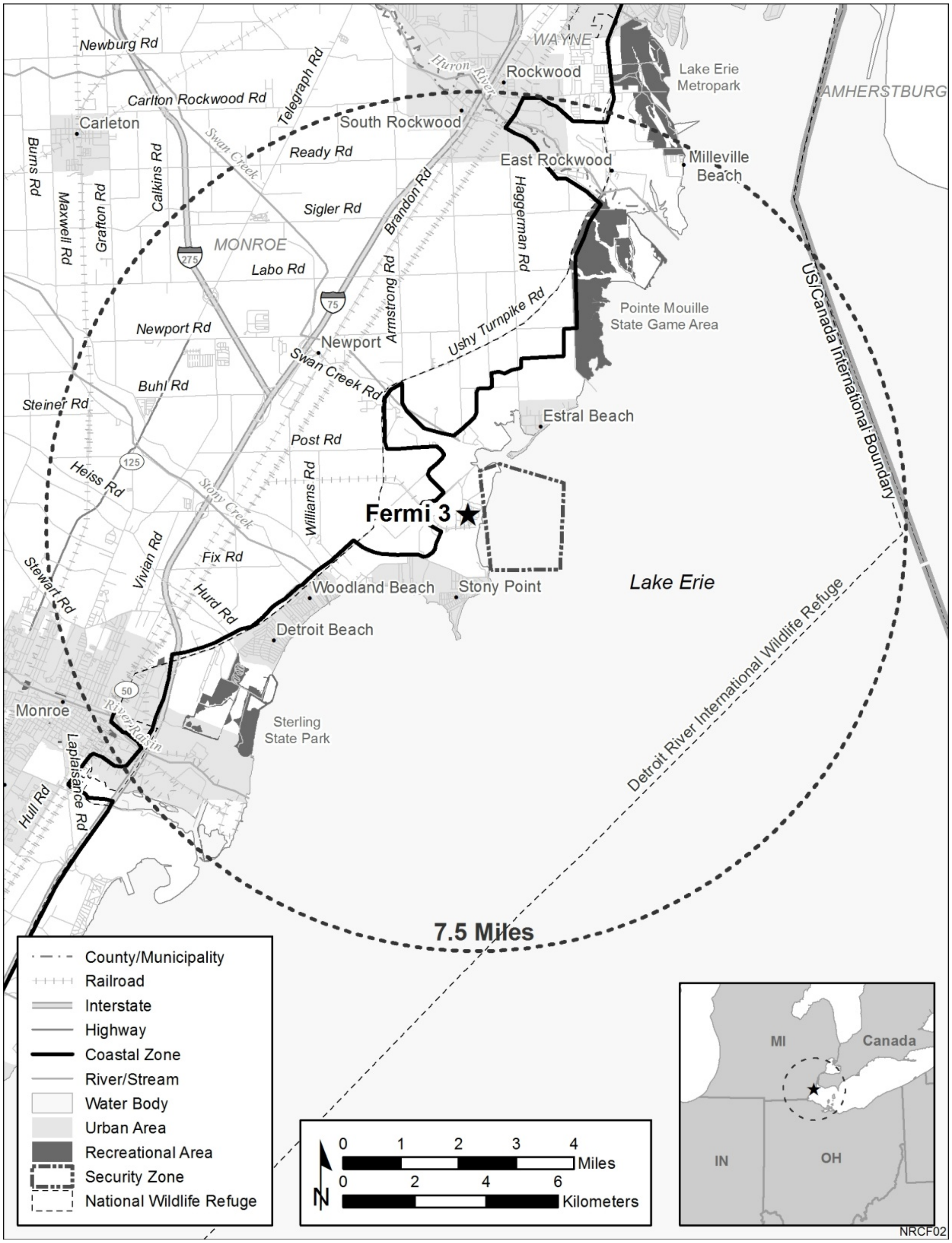

Figure 2-3. Proposed Location of Fermi 3 and 7.5-mi Vicinity (Detroit Edison 2011a)

2.2.1 The Site and Vicinity

The Fermi site includes the entire Fermi tract owned by Detroit Edison, including, but not limited to, the land where Fermi 3 would be constructed. The site consists of approximately 1260 ac within Frenchtown Township, in an unincorporated part of Monroe County, Michigan. The site is approximately 30 mi southwest of the southern suburbs of Detroit, Michigan; about 24 mi northeast of the northern extent of Toledo, Ohio; and 7 mi from the United States-Canada border (Figure 2-2) (Detroit Edison 2011a). The existing site layout and property boundary are shown in Figure 2-1.

The Fermi site contains one existing nuclear generating unit, Fermi 2, with a generating capacity of 1122 megawatts electric (MW(e)). Fermi 2 began commercial operation in 1988 (NRC 2010a). The first unit at the site, Fermi 1, a prototype fast breeder reactor, had a generating capacity of 94 MW(e) and began commercial operation in 1957. It was deactivated in 1972, and decommissioning, which is still in progress, began in 1975 (NRC 2010b).

The Independent Spent Fuel Storage Installation (ISFSI) for Fermi 2 is located west of Fermi 2 about 820 ft away from the edge of the nearest land to be used for building Fermi 3. As of June 2012, construction of the Fermi 2 ISFSI pad was complete and preoperational dry run activities had begun. However, normal operations at the ISFSI had not yet started.

Approximately 212 acres (ac) (16.8 percent) of the Fermi site are occupied by existing Fermi 2 facilities, the partially decommissioned Fermi 1 plant, and associated support facilities (Table 2-1). The northern and southern portions of the site feature large lagoons, while the

Table 2-1. Onsite Land Use at the Fermi Site

Land Use	Acres	Percent
Developed areas[(a)]	212	16.8
Coastal wetlands[(b)]	273	21.6
Forest	256	20.3
Water	215	17.1
Grassland (including onsite agricultural land and onsite transmission corridor)	168	13.3
Shrubland and thicket	136	10.8
Total	1260	100.0

Source: Detroit Edison 2011a

(a) Developed land includes existing power generation facilities and associated infrastructure.

(b) Includes coastal emergent wetlands only. Other wetlands are a subcomponent of the other land uses shown in the table.

western area is partially forested. Vegetated wetlands, forested areas, and open water make up approximately 744 ac (59.0 percent) of the site; and grassland and other uses make up approximately 304 ac (24.1 percent), which includes approximately 30 ac of grassland underlying onsite transmission corridors. The Quarry Lakes, in the western part of the site, occupy two adjacent quarries that were used to provide construction materials for Fermi 2. The eastern portion of the site, adjacent to Lake Erie, contains the existing power plant structures.

Approximately 656 ac of undeveloped lands on the Fermi site are managed as part of the Detroit River International Wildlife Refuge (DRIWR). The DRIWR extends along the shore of Lake Erie from the Erie State Game Area, near Toledo in the south to the Detroit River in the north, and it contains habitat for common species as well as some wetland and water dependent species (FWS 2010a). Detroit Edison has had a cooperative agreement with the U.S. Fish and Wildlife Service (FWS) since 2003 that allows the FWS to assist in managing the refuge areas while Detroit Edison retains ownership and control of the entire site (Detroit Edison 2009a).

The topography of the Fermi site and vicinity is generally flat, with the largest wetland areas located along the Lake Erie shoreline. In addition to Lake Erie, natural features in the vicinity of the Fermi site include Stony Point, a distinctively shaped landform projecting into Lake Erie south of the Fermi site, and several other bodies of water, including Swan Creek and the Huron River to the north and Stony Creek and River Raisin to the southwest.

Access to the Fermi site is provided by Fermi Drive, which connects US Route 24 (Dixie Highway) with the main gate. Interstate 75 (I-75) is the major transportation route in the vicinity. It runs north-south through Monroe and Wayne Counties and is located about 4 mi of the northwest side of the Fermi site. Major rail lines near the site include the Canadian National and Norfolk Southern lines, both of which run in a roughly north-south direction, about 3 mi to the west. A rail spur off the Canadian National main line extends into the Fermi site for large and heavy equipment transport (MichiganRailroads.com 2010). Two natural gas pipelines are located in the vicinity of the Fermi site, running roughly southwest-northeast, about 10 mi to the west.

Detroit Edison has surface ownership of all the land within the Fermi site property boundary and controls nearly all of the mineral rights. The only exception is that the Michigan Department of Natural Resources (MDNR) owns 0.88 ac of mineral rights in the southeastern part of the site (Detroit Edison 2011a), located away from the area occupied by existing power plant and auxiliary facilities as well as the area where the proposed Fermi 3 facilities would be situated. Currently there is no exploration or commercial mineral production on the Fermi site or on properties adjoining the site, and none is expected in the foreseeable future (Detroit Edison 2011a). In addition, there has been no commercial harvesting of timber onsite, and none is anticipated in the future (Detroit Edison 2009b).

Because of its proximity to Lake Erie, the Fermi site falls under the Coastal Zone Management Act of 1972 (16 USC 1451 *et seq.*), which is intended to encourage a balance between conservation and economic activities typical of coastal areas. Individual States are responsible for their own coastal management programs, and the Michigan program is administered by the Michigan Department of Environmental Quality (MDEQ). Section 307(c)(3)(A) of the Coastal Zone Management Act (16 USC 1456(c)(3)(A)) requires applicants for Federal permits who propose activities in a coastal zone area to provide a certification that the proposed activity complies with the enforceable policies of the State's coastal zone program. Detroit Edison received Permit Number 10-58-0011-P from MDEQ on January 24, 2012. Issuance of this permit constitutes a Coastal Zone Consistency Determination from MDEQ for Fermi 3.

Three agencies are responsible for land use planning in the vicinity of the Fermi site. The Monroe County Planning Department and Commission is responsible for land use planning, zoning, specialized research, interfacing with State and Federal agencies, and reviewing all township zoning applications and providing recommendations on zoning cases to individual townships (Monroe County Planning Department and Commission 2010). The Southeast Michigan Council of Governments (SEMCOG) addresses local and county issues at a regional level, including governmental efficiency, economic development, water quality, and transportation, thus providing assistance to county and local governments' efforts (SEMCOG 2010a). Frenchtown Township, in which the Fermi site is located, has zoning authority over land on the Fermi site. The township also has a local planning authority that provides local land use planning, including housing and transportation planning. Berlin Township, which adjoins Frenchtown Township close to the Fermi site, has a similar local planning authority (Detroit Edison 2011a).

Land on the Fermi site is designated as "industrial" by Monroe County and zoned as "public service" by Frenchtown Township, and future land use maps produced by both planning agencies indicate that industrial and utility uses are anticipated to continue on the Fermi property (Monroe County Planning Department and Commission 2010; James D. Anulewicz Associates, Inc. and McKenna Associates, Inc. 2003).

In the vicinity of the Fermi site, most land is rural and zoned agricultural by Monroe County and Frenchtown Township. In 2000, agriculture accounted for more than 63 percent of the acreage in Monroe County, although agricultural acreage had declined 7 percent from 1990 (Monroe County Planning Department and Commission 2010). Residential land use occupied approximately 13 percent of the county, forest cover made up approximately 10 percent, nonresidential land uses made up approximately 6 percent, and grassland and shrub made up approximately 3 percent. Approximately 2 percent of the county consisted of water, while approximately 1 percent consisted of nonforested wetlands, and approximately 1 percent was used for extractive purposes or was barren land. Industrial and commercial/office land uses, while making up less than 1 percent each of the county in 2000, grew 41 percent and

32 percent, respectively, between 1990 and 2000 (Monroe County Planning Department and Commission 2010). In Frenchtown Township, agricultural land use, wooded land, and vacant land accounted for approximately 57 percent of the total acreage in 2002, followed by residential land use (approximately 20 percent), transportation and utility uses (approximately 14 percent), parks and recreational land (approximately 6 percent), and other nonresidential developed land (approximately 4 percent) (James D. Anulewicz Associates, Inc. and McKenna Associates, Inc. 2003).

Although agricultural land uses adjoin most of the landward boundary of the Fermi site, there are areas of residential and limited industrial development near the City of Monroe, approximately 8 mi to the southwest (Figure 2-4). Most land to the north of the Fermi site, near Swan Creek, is designated as residential and agricultural in the Monroe County land use plan, while the Stony Point area, directly southeast of the Fermi site, is residential (Monroe County Planning Department and Commission 2010). The majority of the land west of the Fermi site is zoned agricultural. There are a number of industrial areas located to southwest of the site along the Lake Erie shoreline and in the city of Monroe, including the Detroit Edison Monroe Power Plant, the Automotive Components Holdings, LLC plant, and the Port of Monroe (Monroe County Planning Department and Commission 2010). Uses in areas to the south of the site are anticipated to remain low- and medium-density residential uses. Elsewhere, the site will continue to be surrounded primarily by agricultural lands, with open areas and woodlands to the west and north. Frenchtown Township has designated a Waterfront Opportunity Area northeast of the Fermi site where commercial development would be allowed (James D. Anulewicz Associates, Inc. and McKenna Associates, Inc. 2003).

A portion of the roughly 60-ac agricultural field in the west-southwest corner of the Fermi site contains prime farmland (Detroit Edison 2011a). Prime farmland is defined by the U.S. Department of Agriculture as available cultivated land, pastureland, forestland, or other land that has the appropriate combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. Substantial areas of prime farmland occur in the vicinity of the Fermi site as well. A program of farmland preservation and conservation that includes prime farmland is an important part of planning in Monroe County and may prevent additional residential and other development from occurring on undeveloped land used for agriculture in close proximity to the Fermi site (Monroe County Planning Department and Commission 2010).

Recreational facilities within 5 mi of the Fermi site include Stony Point Beach and Estral Beach, Swan Creek and Swan Creek Boat Club, Pointe Aux Peaux State Wildlife Area, Pointe Mouillee State Game Area, and William C. Sterling State Park (Detroit Edison 2011a). There are various other areas in the vicinity of the site used for wildlife conservation, hiking, fishing, and other recreational opportunities.

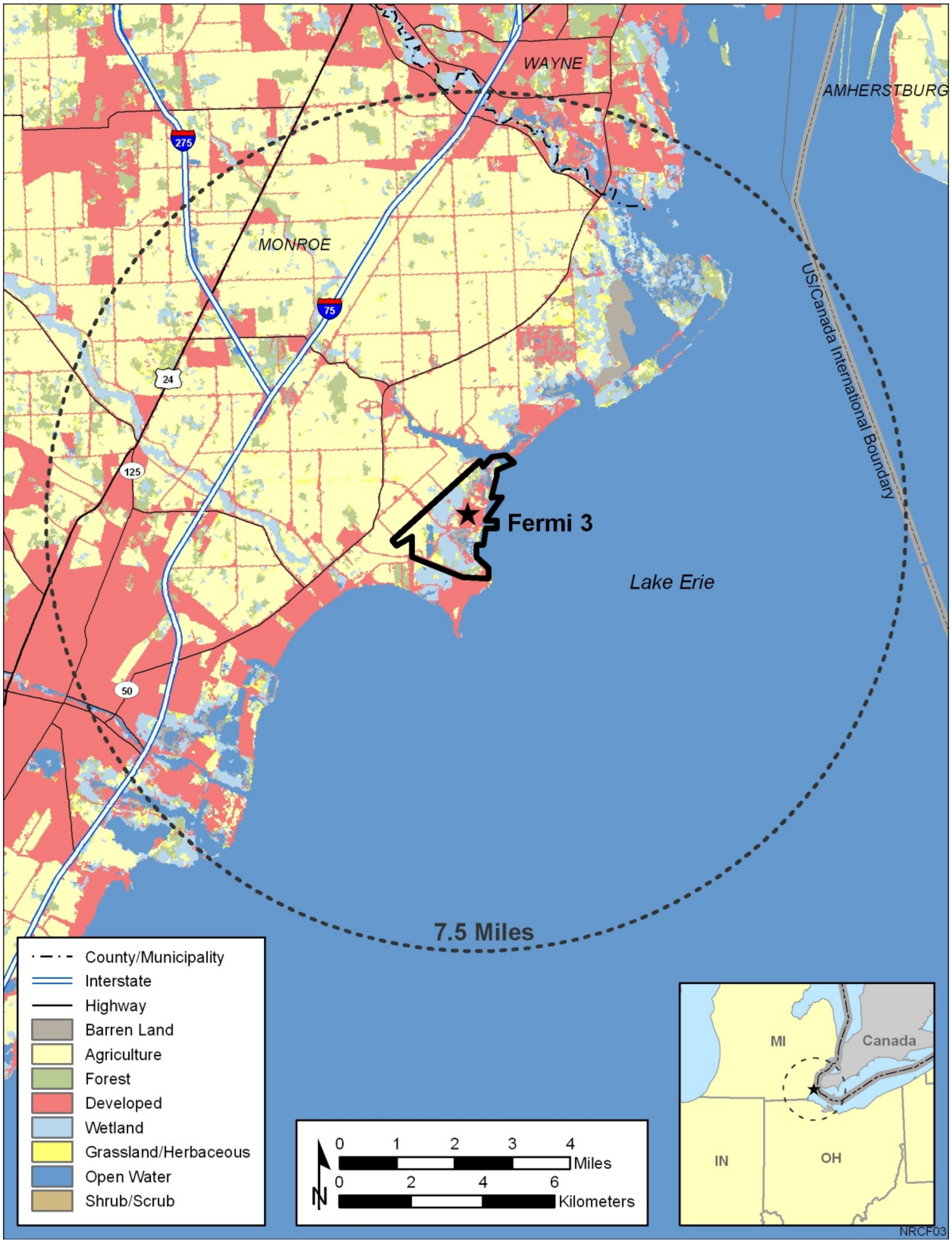

Figure 2-4. Land Use within 7.5 mi of the Fermi Site (Detroit Edison 2011a)

Part of the Fermi site lies in the 100-year floodplain associated with the shore of Lake Erie (Detroit Edison 2011a). Floodplains and other surface water hydrology elements are discussed further in Section 2.3.1.1. Cultural resources and historic properties have been identified within the area. Cultural resources include archaeological and architectural resources; historic properties consist only of architectural resources. Cultural resources are discussed in Section 2.7.

2.2.2 Transmission Lines

A single onsite transmission corridor accommodates the existing 345-kV transmission lines that originate at the Fermi 2 switchyard and extend to the west perimeter fence, near Doxy Road and Fermi Drive (Detroit Edison 2011a). A portion of the onsite transmission corridor just east of the site boundary and north of Fermi Drive has been restored to native tallgrass prairie vegetation. A new onsite corridor would be developed for a new 345-kV transmission line carrying power from Fermi 3 (Detroit Edison 2011a). Existing offsite transmission infrastructure serving Fermi 2 consists of two 345-kV power lines extending from the Fermi site approximately 5 mi to a point west of I-75 where the lines turn north for about 12 mi adjacent to I-275 (Figure 2-5) (Detroit Edison 2011a).

ITC*Transmission* has not yet formally announced a route for the offsite portion of the proposed new transmission line serving Fermi 3. Detroit Edison expects that the proposed new transmission line would be built within the existing Fermi 2 transmission corridor for approximately 18.6 mi extending outward from the Fermi site boundary. Detroit Edison expects that the remaining 10.8 mi, extending to the Milan Substation, would be built within an undeveloped right-of-way (ROW) possessed but not yet used by ITC*Transmission* (Detroit Edison 2011a). The route for the undeveloped ROW crosses mostly agricultural and forest land with scattered wetlands. No part of the route crosses designated or protected natural or recreational areas or areas with planned minerals development, although the route likely crosses some prime farmland. Land use restrictions within the corridor segments are governed by agreements between ITC*Transmission* and individual property owners along the corridor (Detroit Edison 2011a).

2.2.3 The Region

The 50-mi region surrounding the Fermi site is shown in Figure 2-2. The region includes all of the Toledo metropolitan area (approximately 300,000 residents) and most of the Detroit metropolitan area (approximately 900,000 residents). Land use within the U.S. portion of the 50-mi region is generally similar to land use in the vicinity of the Fermi site as shown in Table 2-2. Agriculture and urban land development are the most important land uses. Principal agricultural products and livestock in the region include soybeans, corn, wheat, milk, cattle, and pigs (Detroit Edison 2011a). In the Canadian portion of the 50-mi region, more than 57 percent

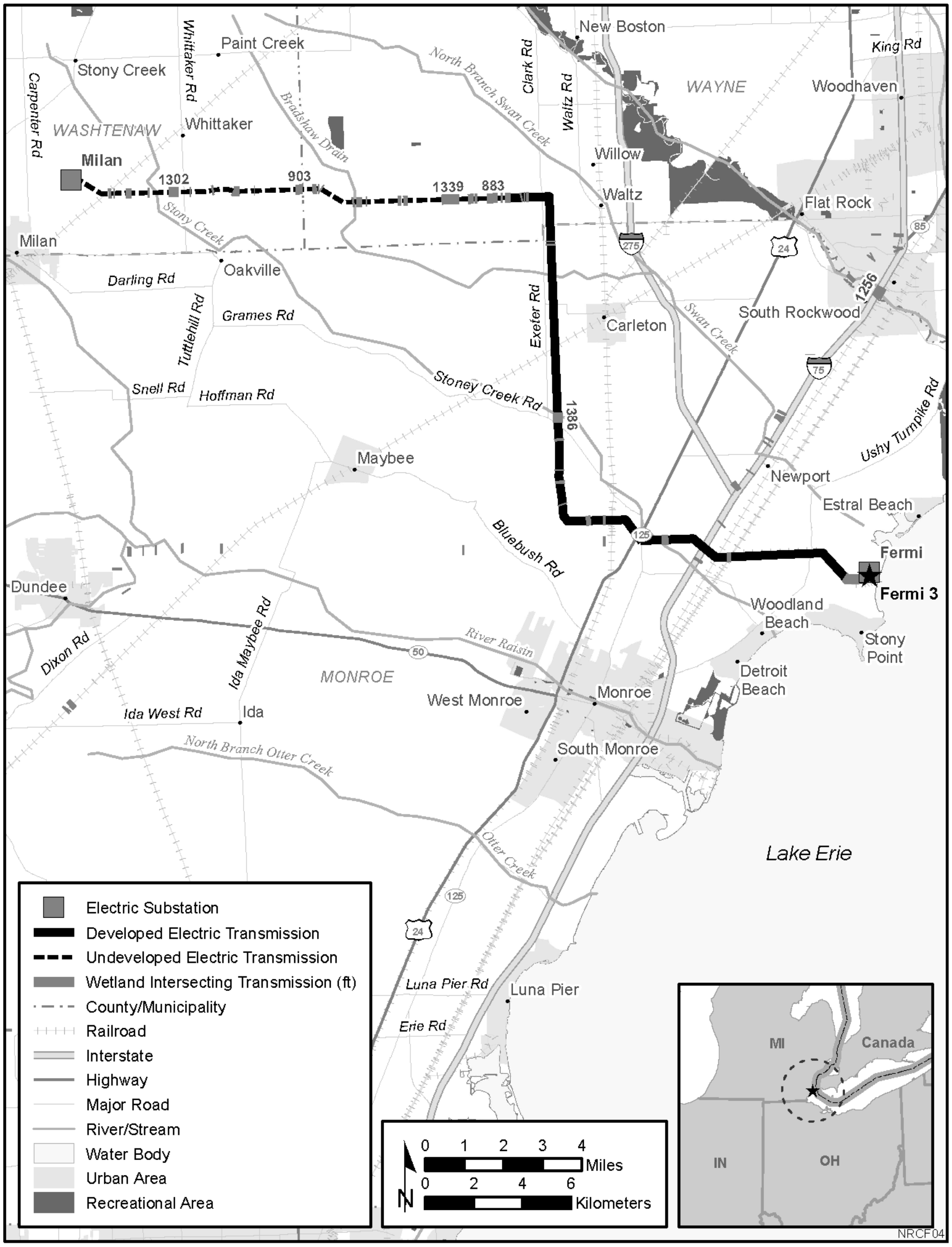

Figure 2-5. Proposed Transmission Corridor from Fermi 3 to the Milan Substation (Detroit Edison 2011a)

Table 2-2. Land Use within 50 mi of the Fermi Site

	United States		Canada	
Land Use	**Acres**	**Percent**	**Acres**	**Percent**
Agriculture	1,436,930	37.9	413,825	35.0
Urban	1,089,795	28.8	60,749	5.1
Open water	725,910	19.2	678,492	57.4
Forest or undeveloped	349,361	9.2	22,173	1.9
Wetlands	184,801	4.9	6826	0.6

Source: Detroit Edison 2011a

of the total acreage is open water, approximately 35 percent is agricultural, and approximately 5 percent is urban.

The City of Monroe and various smaller communities in Monroe County and in the surrounding counties are shown in Figure 2-5, together with the principal highways, parks, and wildlife refuges. The topography of the region around the Fermi site is fairly flat, with wetland areas concentrated along the Lake Erie shoreline. The Detroit Arsenal is located in Warren, near northern Detroit, and the Selfridge Air National Guard Base is located 30 mi to the northeast of Detroit (Global Security.org 2011). There are no wild and scenic rivers within the region (National Wild and Scenic Rivers System 2011).

There are no lands of Tribal entities recognized and eligible for funding and services from the U.S. Bureau of Indian Affairs within the U.S. portion of the 50-mi region (Michigan Department of Human Services 2010). Additional discussion of Federally recognized Indian Tribes is provided in Section 2.7.

Eighty-seven percent of employees currently working at the Fermi site reside in Monroe County and Wayne County in Michigan and Lucas County in Ohio (Detroit Edison 2011a).

2.3 Water

This section describes the hydrological processes governing the movement and distribution of water in the existing environment at and around the Fermi site, the existing and potential future water use, and the quality of water in the Fermi site environment. Descriptions of the building impacts, operating impacts, cumulative impacts, and alternative sites and alternative plant systems are provided in Chapters 4, 5, 7, and 9, respectively.

During the operation of the proposed Fermi 3, the western basin of Lake Erie would be the source of cooling system makeup water and the only recipient of plant blowdown discharge water. Lake Erie would also be the only source of water used during building activities. The Frenchtown Water Plant would be the source for potable sanitary water and for makeup demineralized water during operations. Sanitary effluent would be discharged to the Monroe Metropolitan Wastewater Treatment Facility. Although dewatering would occur during construction, groundwater would not be used for any purpose during construction and operation of Fermi 3.

Detroit Edison (2011a) presents the elevations of various hydrologic and plant features by using three different reference data sources. The three sources referenced in Section 2.3 of the Fermi 3 Environmental Report (ER) include the North American Vertical Datum of 1988 (NAVD 88), the Fermi plant grade datum (Plant), and the International Great Lakes Datum of 1985 (IGLD 85). Table 2-3 displays elevations of important hydrological features in each datum. The NAVD 88 coordinate system (current mean sea level) is used throughout this document to describe hydrological features.

Table 2-3. Reference Datums for Fermi Site Elevations

	Elevations by Reference Datum (ft)		
Feature	**NAVD 88**	**Plant**	**IGLD 85**
Current Fermi plant grade	581.8	583.0	581.5
Fermi 3 safety structures	589.3	590.5	589.0
Lake Erie low water datum	569.5	570.7	569.2
Elevation of water intake pipe	553.3	554.5	553.0
100-year lake level calculated by the applicant (Detroit Edison 2012b, Section 2.4.5)	575.1	576.3	574.8
100-year lake level calculated by FEMA (2000)	578.5	579.4	577.9
Average elevation of Lake Erie, 1918–2010 (USACE 2011a)	571.6	572.8	571.3

2.3.1 Hydrology

This section describes the site-specific and regional hydrological features that could be altered by building and operating the proposed Fermi 3. A summary of the hydrological conditions of the proposed Fermi 3 site is provided in Section 2.3 of the ER (Detroit Edison 2011a). A description of the site's hydrological features related to site safety (e.g., probable maximum flood) was presented in Section 2.4 of the Final Safety Analysis Report (FSAR) (Detroit Edison 2012b). The elevations of all safety-related systems, structures, and components (SSCs) of Fermi 3 would be at or above 589.3 ft NAVD 88. Both the FSAR and ER were informed by the hydrology characterization conducted prior to building Fermi 2 and the results of investigations performed to support the Fermi 3 COL application.

2.3.1.1 Surface Water Hydrology

Figure 2-3 shows the location of Fermi 3 on the western edge of Lake Erie. Historically, surface wetlands dominated the Fermi site vicinity. Much of the wetland area was drained in the 1800s to accommodate the development of local agriculture. Fermi 2 lies entirely on fill material placed and graded after significant volumes of natural material were excavated. However, much of the Fermi site is still characterized as surface wetlands. As shown in Figure 2-3, much of the Fermi site is located in the coastal zone of Lake Erie. Approximately 656 ac of undeveloped lands on the Fermi site are managed as part of the DRIWR (see Section 2.2.1).

The Fermi property is bordered by Lake Erie along its eastern edge, and the site drains to Lake Erie and to Swan Creek. The Fermi site is partially bounded by the 100-year floodplain of these water bodies (FEMA 2000). Swan Creek drains into Lake Erie approximately 0.5 mi north of the Fermi site (Figure 2-1). Other nearby water bodies near the Fermi site include Stony Creek about 3 mi southwest, the River Raisin about 6 mi southwest, the Huron River about 6 mi north, and the mouth of the Detroit River approximately 6.5 mi northeast (Figure 2-2).

Lake Erie has an open water surface area of 9910 square miles (mi^2) and a total watershed area of 30,140 mi^2 (EPA 1995). Lake retention time is approximately 2.6 years. The volume of Lake Erie is approximately 116 cubic miles (mi^3) or about 128 trillion gallons (EPA 1995). Because of the lake's large size, there is considerable uncertainty in the estimates of the Lake Erie water balance (Neff and Nicholas 2005). The Detroit River, which connects Lake Huron and Lake Erie, contributes about 80 percent of Lake Erie's total inflow. The other major inputs to Lake Erie are from precipitation (11 percent) and tributaries (9 percent) flowing through watersheds in Michigan, Ohio, Pennsylvania, New York, and Ontario (Environment Canada and EPA 2005). Annual average rainfall over Lake Erie is about 35 in./yr and is estimated to contribute approximately 25,497 cubic feet per second (cfs) (+/- 15 to 45 percent) to the water balance (NOAA 2003; Neff and Nicholas 2005). Runoff from tributaries to Lake Erie is estimated to be 21,189 cfs (+/- 15 to 35 percent) (Neff and Nicholas 2005). The inflow from the Detroit River is estimated to be 188,333 cfs (+/- 5 to 15 percent), and the outflow to Lake Ontario is estimated to be 206,202 cfs (+/- 4 to 10 percent) (Neff and Nicholas 2005). The average annual evaporation from Lake Erie is estimated to be 36 in./yr and is estimated to remove approximately 26,027 cfs (+/- 10 percent) from the water balance (NOAA 2003; Neff and Nicholas 2005). Between 2000 and 2006, the average water use in the basin was 53,285 million gallons per day (MGD), or about 19,449 billion gallons per year (GLC 2005a, b, c; 2006a, b; 2009a, b).

Lake Erie is usually divided into three separate drainage basins: western basin, central basin, and eastern basin. The western basin of Lake Erie is situated east of the Fermi site and would provide the operational water for Fermi 3. The western basin of Lake Erie is very shallow, with an average depth of 24 ft, and is partially restricted from the rest of Lake Erie by chains of barrier beaches and islands. Major streams that flow into the western basin are the Detroit

River, River Raisin, and Maumee River. The typical wind current pattern for the western basin is west to east (EPA 1995). Flow velocity varies due to wind currents and seasonal climate variations and was measured to be an average of 0.4 ft/second (fps) in the western basin of Lake Erie during an experiment and 0.3 fps between the Detroit River and the Toledo water intake after a salt spill (Verber 1953; Kovacik 1972).

The average water elevation for Lake Erie is estimated to be 571.6 ft NAVD 88 (NOAA 2009a). A rock barrier is present along the shoreline on the eastern edge of the Fermi site at 581.8 ft NAVD 88, which is also the current plant grade, to protect the Fermi site against high water levels of Lake Erie. According to the Federal Emergency Management Agency (FEMA 2000), the 100-year flood level is at 578.5 ft NAVD 88 at the Fermi site. Lake Erie water levels are measured hourly by the National Oceanic and Atmospheric Administration (NOAA) at the Fermi site gage (ID 9063090). Water levels are typically higher in the spring and summer and lower in the fall and winter. The record low water elevation of Lake Erie at the Fermi gage is 563.9 ft NAVD 88. The highest recorded water elevation at the Fermi gage is 576.8 ft NAVD 88. Winds blowing across the lake can cause surges in lake levels and subsequent seiches, which are oscillations of water levels in response to atmospheric conditions. USACE estimates that the maximum 100-year storm-induced surge on Lake Erie is 3.9 ft at the Fermi site (USACE 2011b). In the FSAR, Detroit Edison (2012b) presented the historical records of seiches recorded in the western basin of Lake Erie in Toledo. The maximum recorded rise was 6.3 ft and the maximum recorded fall was 8.9 ft for the period from 1941 to 1981.

Over the past 30 years, the Lake Erie shoreline at the Fermi site has remained fairly stable. Erosion and sediment transport in the western basin of Lake Erie near the proposed Fermi 3 are dictated primarily by two major streams: the Detroit River to the north and the River Raisin to the south. The Maumee River farther south, however, is the major sediment source to Lake Erie and contributes the highest amount of suspended solids per year of any other tributary to the Great Lakes (Bridgeman 2006).

The Swan Creek watershed has a drainage area of 106 mi^2. The watershed is an elliptically shaped basin trending northwest-southeast. The average slope of the creek is 5.15 ft/mi. The Swan Creek watershed has a maximum elevation of approximately 700 ft NAVD 88 at 25 mi inland, and it drains to Lake Erie to the east, where elevations at the mouth of the creek are approximately 575 ft NAVD 88. The entire Swan Creek watershed is situated within flat to gently rolling plains. In general, the surface soils within the basin are primarily lacustrine clay, with some sand ridges at the head of the watershed. The soils have low infiltration capacity, resulting in poor surface drainage. Floodplains occupy areas along the creek, and wetlands are well developed at its mouth near Lake Erie. No significant impoundments or reservoirs are present along Swan Creek, according to the *National Inventory of Dams* (USACE 2007).

Currently, Swan Creek is ungaged. The MDEQ (2009a) calculated Swan Creek flows by using data collected from a gaging station installed in a neighboring watershed with similar geologic characteristics. The harmonic mean annual daily flow rate was estimated to be 4.6 cfs. Monthly mean flows were estimated to vary from 6 cfs in August to 140 cfs in March. The 90-day mean low flow rate that occurs, on average, once in 10 years (10 percent chance of occurring in any one year) was estimated to be 0.9 cfs.

Other nearby watersheds include Stony Creek (120 mi^2) about 3 mi southwest, River Raisin (1072 mi^2, average flow rate of 671 cfs) about 6 mi southwest, and Huron River (908 mi^2, average flow rate of 565 cfs) about 5.75 mi north (Herdendorf 1987). These watersheds are not likely to be affected by the Fermi site because of their distances from the site.

The North Lagoon and South Lagoon are located near the proposed Fermi 3 site. They are hydraulically connected to Lake Erie through direct contiguous waterways (Figure 2-6). There are two man-made canals on the western side of the Fermi site. The north canal (also known as the overflow canal), located northwest of the proposed Fermi 3, flows to the North Lagoon. The south canal (also known as the discharge canal), west of the proposed Fermi 3, flows to the South Lagoon. A small pond (the central canal) is located between the north and south canals. Nearby wetlands are hydraulically connected to the canals through culverts, but the central canal is not directly connected to any surface water features. The wetlands, north and south canals, and lagoons are all hydraulically connected to the western basin of Lake Erie.

There are two Quarry Lakes and one man-made water basin on the Fermi site (Figure 2-6). The Quarry Lakes resulted from rock quarry operations in support of the building of Fermi 2. They are located about 3000 ft southwest of the proposed location of Fermi 3 in the area of office buildings (Figure 2-6). The man-made water basin is in the northern part of the Fermi site and is the reservoir for the circulating water system for Fermi 2. Fermi 3 would not use the water basin.

The intake from Lake Erie for Fermi 2 is located between the two rock groins that extend into Lake Erie to minimize shoaling and protect the Fermi 2 water intake (Figure 2-6). Dredging is periodically performed in the area between the two groins. The current dredge cycle is 4 years (Detroit Edison 2011a). Dredging activities are regulated by two existing permits: (1) the USACE Permit Number LRE-1988-10408, which authorizes activities under Section 10 of the Rivers and Harbors Act of 1899, and (2) the MDEQ Permit Number 11-58-0055-P under Act 451, Natural Resources and Environmental Protection Act, Part 325, “Great Lakes Submerged Lands.” Dredge spoils are placed in the Spoils Disposal Pond that is supported by embankments and located near the Lake Erie shore to the south of the proposed location for Fermi 3. The Spoils Disposal Pond has an outfall associated with the Fermi 2 National Pollutant Discharge Elimination System (NPDES) Permit MI0037028 (MDEQ 2005). NPDES regulated outfalls are shown in Figure 2-6.

Fermi 2 discharges water directly to both Lake Erie through a discharge pipe and to Swan Creek through the north canal under the MDEQ NPDES permit (Figure 2-6). The Fermi 2

Figure 2-6. Surface Water Features, Discharge Outfalls, and Water Quality Sampling Locations on the Fermi Site

cooling water discharge is located along the shoreline of Lake Erie, north of Fermi 2 and east of the cooling towers (Outfall 001 in Figure 2-6). The discharge structure from the Fermi 2 circulating water reservoir consists of a subgrade pipe entering into an onshore concrete basin with an invert elevation of 575 ft NAVD 88 (NRC 1981). At the end of the concrete basin, discharge enters a riprap-covered open channel at a 2:1 horizontal-to-vertical slope to an elevation of 571 ft NAVD 88. The open channel has 3-ft channel sides that also have a 2:1 horizontal-to-vertical slope. The riprap-covered channel continues out into Lake Erie at a 100:1 horizontal-to-vertical slope for approximately 100 ft (NRC 1981).

The Fermi 3 discharge pipe would be located 1300 ft out into Lake Erie where the lake bed has an elevation of approximately 563 ft NAVD 88. The average elevation of Lake Erie at the Fermi site is 571.6, so there would be an average depth of 8.6 ft of water in the vicinity of the discharge pipe (NOAA 2007).

2.3.1.2 Groundwater Hydrology

In this section, “regional” refers to Monroe County, Michigan, and the five counties adjacent to Monroe County. “Local” refers to the Fermi site and its vicinity. The following descriptions are based on information from the ER, the FSAR, and independent sources.

The Fermi site is located on a glacial plain. The local groundwater system is composed of two zones: unconsolidated overburden and several carbonate bedrock aquifers. The overburden materials consist of the fill material and clay dikes in addition to the native lacustrine and glacial deposits. The uppermost carbonate bedrock formation is the Bass Islands Group, composed of dolomite bedrock. The geology of the Fermi site is discussed further in Section 2.8.

During the building of Fermi 2, gravel and cobble gravel fill were placed to provide a structural base for the power plant. Some of the fill material came from an onsite quarry that mined the Bass Islands Group carbonate bedrock. The fill extends across most of the area associated with the construction of Fermi 2 (Detroit Edison 2009c). In logs for boreholes drilled in the immediate location of Fermi 3, the fill was classified as cobbles, well graded gravel, poorly graded gravel, graded gravel with silt, and boulders. The fill ranges from 10 to 15 ft thick across most developed plant areas (Detroit Edison 2009c). However, the fill is estimated to extend to below the original top of the bedrock in the vicinity of Fermi 2 buildings that also extend to below bedrock. In addition to the fill, a system of clay dikes was installed on the Fermi site (Detroit Edison 2009c; 2011a). The presence of the dikes restricts the lateral movement of infiltrated water in the fill beyond the areas enclosed by the dike. Recharge of the fill is through precipitation that flows downward into the underlying geologic units (lacustrine sediments, glacial till, or carbonate bedrock).

The native overburden of the Fermi site is composed of peaty silt and clay of lacustrine origin (0 to 9 ft thick) and a brown and gray glacial till of late Pleistocene age (6 to 19 ft thick) (Detroit Edison 2011a). The native overburden has a relatively low hydraulic conductivity and an average thickness of about 28 ft, which is consistent with the regional conditions in much of Monroe County, Michigan. It should be noted that as much as 20 ft of the overburden was excavated and replaced with fill material in most of the areas of the Fermi site during the building of Fermi 2 (Detroit Edison 2011a). The overburden is recharged with precipitation and is hydraulically connected to nearby water bodies.

Two regional aquifers, the Bass Islands Group aquifer and the Salina Group aquifer, lie beneath the overburden at the Fermi site. There is a weathered zone at the boundary of the Bass Islands Group aquifer and the glacial overburden. The Bass Islands Group aquifer is composed of dolomite bedrock, and the thickness of the unit varies between approximately 50 and 100 ft beneath the Fermi site.

Unit F of the Salina Group underlies the Bass Islands Group at the site. The unit is primarily composed of dolomite, shale, breccia, and limestone and is considered to be an aquifer. The thickness of the unit is over 100 ft. It is recharged by the Bass Islands Group aquifer.

As a part of the Fermi 3 hydrogeologic investigation, 17 monitoring wells and/or piezometers were installed into the overburden at the site, 11 monitoring wells and/or piezometers were installed into the Bass Islands Group, and one piezometer was installed in the Salina Group Unit F (Detroit Edison 2011a).

Hydraulic Properties

Slug tests were performed in monitoring wells and piezometers screened in both the rock fill and the overburden to estimate hydraulic conductivity (Detroit Edison 2011a). Hydraulic conductivity of the rock fill from six slug tests was found to be very high and ranged from 251 to 1776 ft/day (Detroit Edison 2011a). The hydraulic conductivity of the glacial overburden from five slug tests ranged from 0.028 to 16.5 ft/day (Detroit Edison 2011a).

Packer tests were performed at multiple depths in wells screened in the Bass Islands Group (Detroit Edison 2011a). Hydraulic conductivity values calculated from the packer tests ranged from 0.11 to 40.1 ft/day. However, the average hydraulic conductivity was calculated to be 3.28 ft/day in wells with no suspected hydraulic connection to zones above or below the zone being tested (Detroit Edison 2011a). Regional estimates of hydraulic conductivities of the Bass Islands Group have ranged from 5 to 36 ft/day (Reeves et al. 2004; Detroit Edison 2011a).

Potentiometric Surfaces

Figure 2-7 shows the water table contour map for the overburden at the site. Groundwater mounds are present in the areas of lower hydraulic conductivity, and flow in the overburden is primarily toward the surface water bodies. The groundwater flow velocity in the overburden is expected to vary locally because of the complex arrangement of natural and fill material with widely varying hydraulic conductivities.

Figure 2-8 shows the potentiometric surface of the Bass Islands Group aquifer at the site. This deeper groundwater flows to the south-southwest and then to the west at the Fermi site, discharging at the Quarry Lakes. The regional groundwater flow in the bedrock aquifer is shown in Figure 2-9 and is dominated by the dewatering operations of two quarries that are located northwest and southwest of the site. The dewatering activities create a groundwater divide in a northwest-southeast direction south of the Fermi site. The dewatering wells for the quarries are two regional groundwater discharge zones. However, regional gradients historically were to the east toward Lake Erie (NRC 1981; Detroit Edison 2011a).

On the basis of an average hydraulic gradient of 0.002 ft/ft and an assumed effective porosity of 0.1 percent, the groundwater flow velocities in the Bass Islands Group at the Fermi site are between 0.2 and 35 ft/day for minimum and maximum hydraulic conductivity, respectively. Groundwater in the aquifer is thought to flow along fractures in the bedrock and the weathered zone near its top (Detroit Edison 2011a). All wells except one installed in the aquifer demonstrate that the groundwater is under artesian conditions. The direction of the vertical gradient in groundwater at the site is downward, so water moves from the overburden to the Bass Islands Group aquifer below. The regional aquifer is recharged from the west and from the glacial overburden from above.

2.3.2 Water Use

This section describes water use near the Fermi site, including the use of water resources from Lake Erie and groundwater. The total water use is divided into consumptive use and nonconsumptive use. Consumptive use is the portion of water withdrawn or withheld from a water source and assumed to be lost or otherwise not returned to the source as a result of its evapotranspiration, its incorporation into products (e.g., crops), or other processes (e.g., export from the basin). Nonconsumptive use is the portion of water withdrawn from a water source that returns to the source.

2.3.2.1 Surface Water Use

Lake Erie is a major water source in southeastern Michigan. The existing Fermi 2 uses the lake water for cooling, and Fermi 3 would also use Lake Erie water for cooling. Lake Erie would also be the source of water used during building activities. The Fermi site uses the local water

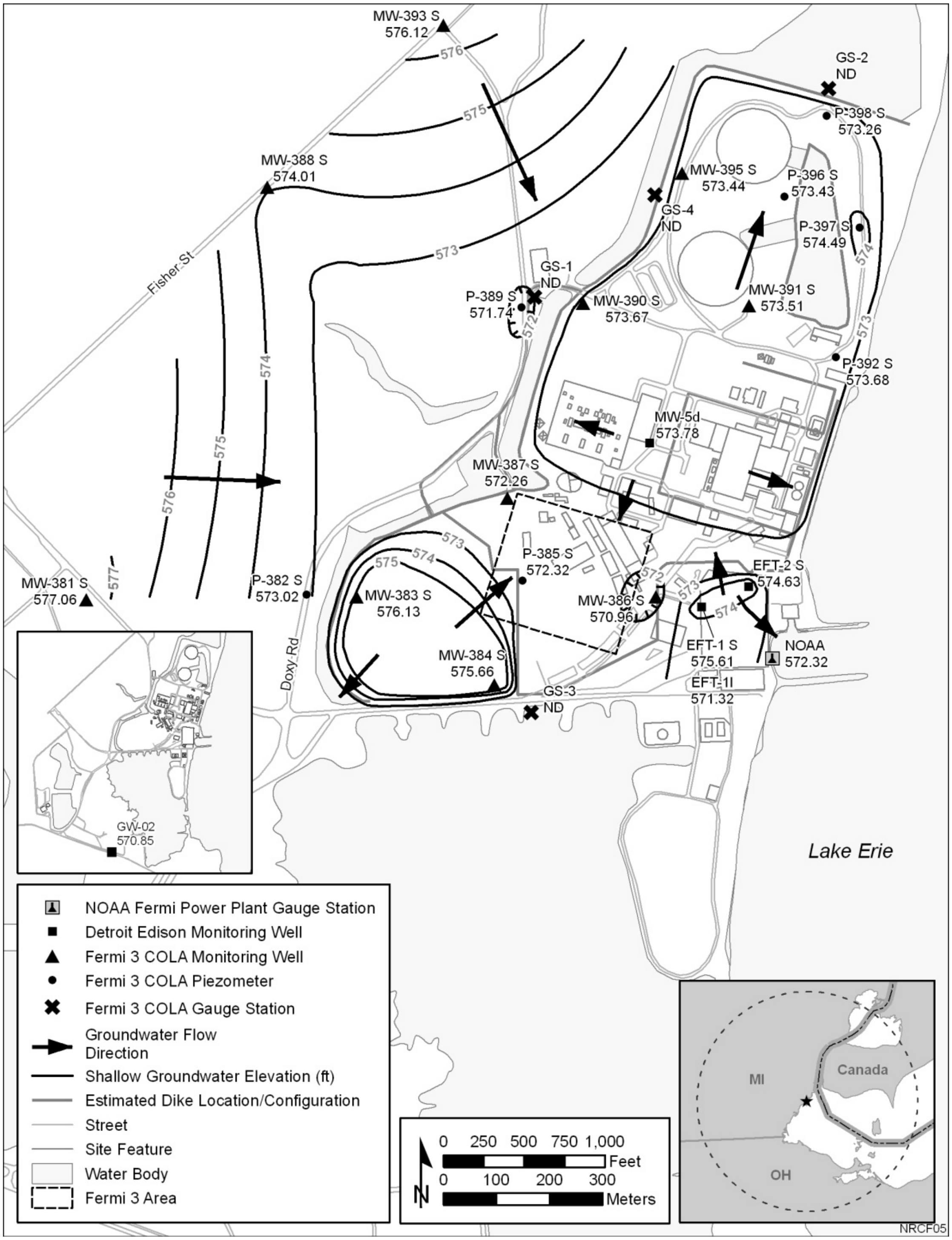

Figure 2-7. Overburden Water Table Map on March 29, 2008 (Detroit Edison 2011a)

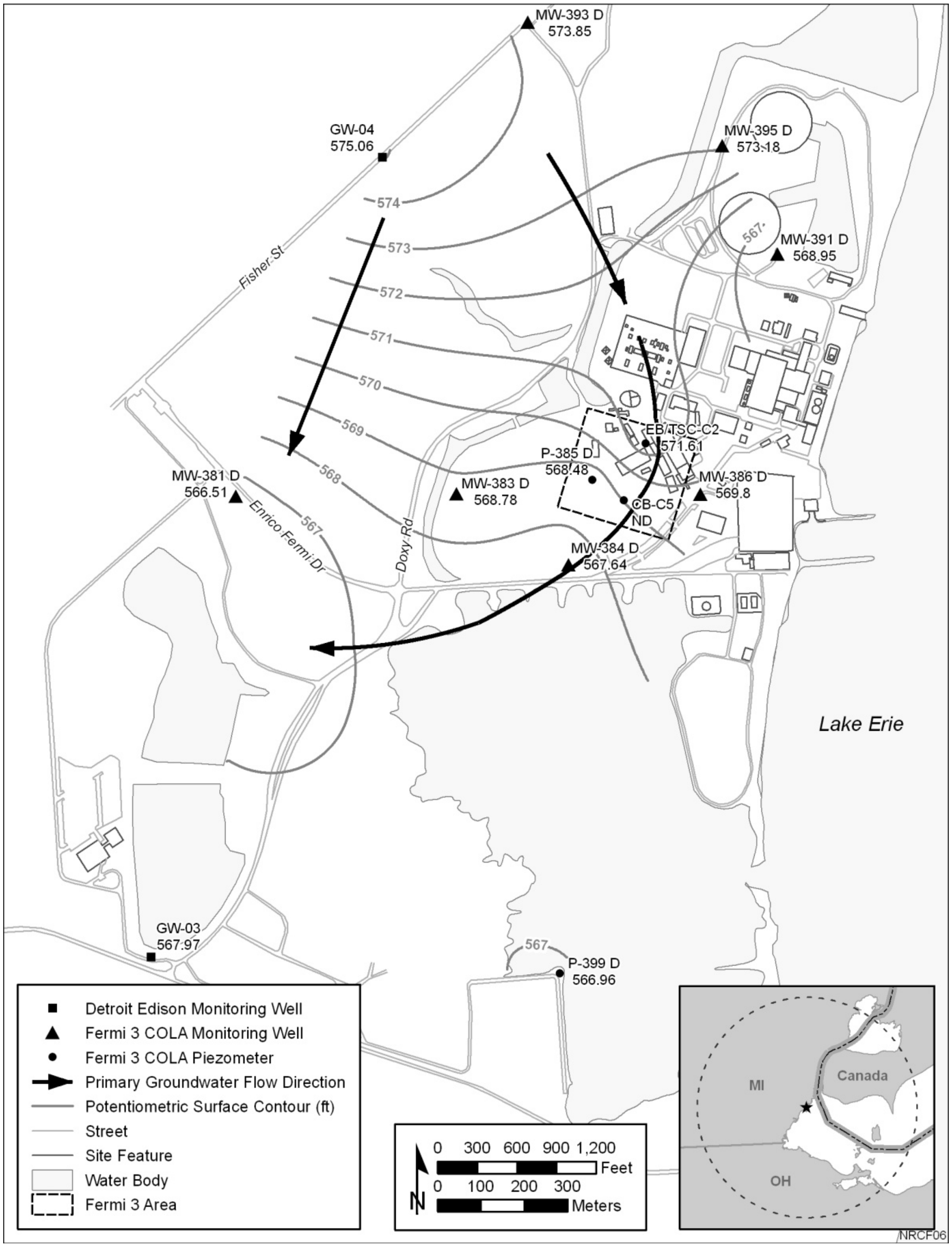

Figure 2-8. Potentiometric Surface Map of the Bass Islands Group Aquifer at the Fermi Site on March 29, 2008 (Detroit Edison 2011a)

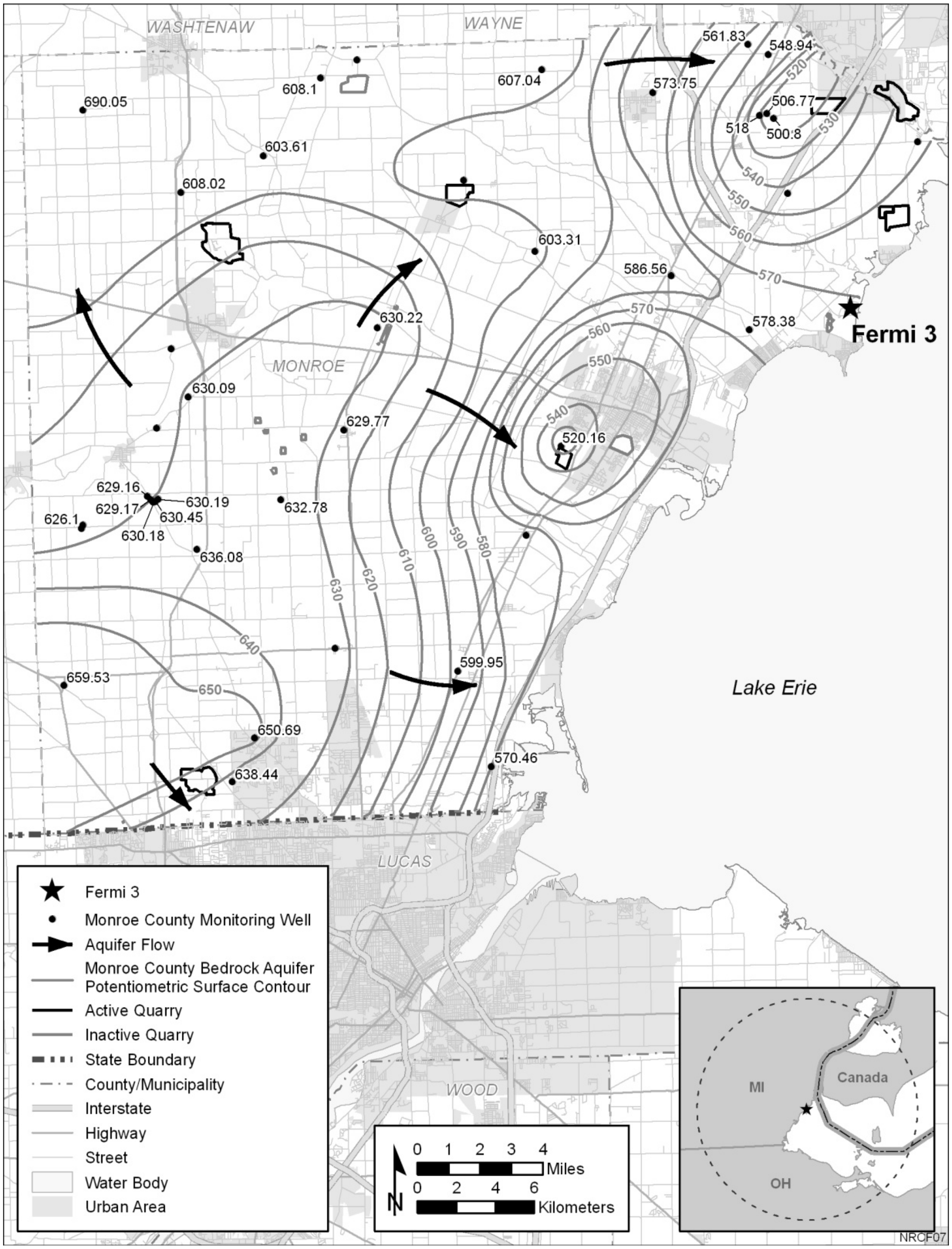

Figure 2-9. Regional Potentiometric Surface Map of the Bass Islands Group Aquifer (Detroit Edison 2011a)

supply (Frenchtown Township) for potable water. This water is withdrawn from Lake Erie. The Great Lakes Commission (GLC) issues yearly reports on use of water withdrawn from Lake Erie, and a summary of the last seven reports is provided in Table 2-4.

Table 2-4. Annual Lake Erie Water Use

Year	Total Withdrawn (MGD)[(a)]	Power Plant Withdrawals (MGD)	Public Supply Withdrawals (MGD)	Total Consumptive Use (MGD)
2000	50,455	48,448	1189	526
2001	47,786	45,737	1228	525
2002	53,938	51,991	1205	504
2003	49,440	47,500	1243	495
2004	56,543	54,723	1106	486
2005	58,812	55,185	1234	496
2006	56,024	50,518	1212	477

Sources: GLC 2005a, b, c; 2006a, b; 2009a, b
(a) MGD = million gallons per day.

Mean total consumptive use within the Lake Erie basin was 1.0 percent between 2000 and 2006. Power plants withdrew the largest amount of water in each of the years listed in Table 2-4; however, public water supply and industrial categories were the top two consumptive water uses. Between 2000 and 2006, the U.S. and Canadian nuclear power industry withdrew an average of 168 MGD from Lake Erie and consumed an average of 14 MGD, amounting to an average consumptive use rate of approximately 8 percent (GLC 2005a, b, c; 2006a, b; 2009a, b). The average consumptive use of Fermi 2 was estimated as approximately 40 percent of total withdrawal according to the Fermi 2 Final Environmental Statement (FES) (NRC 1981). Different cooling systems account for the variance in consumptive water use among nuclear plants in the Lake Erie basin.

Mean water withdrawals from Lake Erie in Monroe County, Michigan, from 2000 to 2006 were 1740 MGD for thermoelectric power and 12.4 MGD for public water supply (MDEQ 2000, 2001, 2002, 2003, 2004). Average Monroe County use of Lake Erie water for all uses between 2000 and 2004 was 1735 MGD (MDEQ 2000, 2001, 2002, 2003, 2004). Average use of other surface water resources in Monroe County was 4.8 MGD between 2000 and 2004 (MDEQ 2000, 2001, 2002, 2003, 2004).

To estimate future water use in Monroe County to 2060, the review team used projected population estimates presented in Section 2.5.1 of the ER and the reported water use in Monroe County as presented in the ER. If it is assumed that per capita water use does not change from present amounts and that the population will increase 74 percent by 2060 (Detroit Edison 2011a), the quantity of Lake Erie water used for the public water supply in Monroe County would increase from approximately 12 MGD in 2000 to 23 MGD in 2060. The total surface water used in Monroe County for public water supply, agricultural irrigation, self-supply industrial, and golf course irrigation would increase from 4.4 MGD in 2000 to 7.8 MGD in 2060. If water use for thermoelectric power generation increased linearly at the same rate as population growth in the county, then the total Lake Erie water used in Monroe County for thermoelectric power generation would increase from approximately 1700 MGD in 2000 to 2990 MGD in 2060. Between 2000 and 2006, the average water use in the basin was 53,285 MGD or about 19,449 billion gallons per year, with approximately 1 percent (507 MGD or 185 billion gallons per year) as consumptive use (GLC 2005a, b, c; 2006a, b; 2009a, b). The total volume of Lake Erie is approximately 128 trillion gallons, so the average annual consumptive use in the Lake Erie basin is approximately 0.14 percent of the total lake volume.

With the passing of the Great Lakes Compact in 2008, any new water withdrawals within the Great Lakes Basin that would result in a consumptive use of 5 MGD or more were made subject to review by all of the States and provinces in the region. The requirements of the Great Lakes Compact are met by the State of Michigan under the MDEQ Large Quantity Withdrawal Permit through the authority of MCL 324.32723. This permit would be required for Fermi 3, is listed in Appendix H, Table H-1, and is also discussed in Section 5.2. Recent studies of the effects of climate change indicate that there could be declines in the overall Lake Erie water levels of as much as 1.5 ft (USGCRP 2009).

2.3.2.2 Groundwater Use

Groundwater withdrawal in Monroe County is substantially less than withdrawal from Lake Erie. Between 2000 and 2004, groundwater withdrawals ranged from 9.4 to 17.7 MGD and averaged 14.0 MGD (MDEQ 2000, 2001, 2002, 2003, 2004). Self-supply industrial companies were the largest users of groundwater in Monroe County, accounting for 83 to 93 percent between 2000 and 2006 (Detroit Edison 2011a). The remaining water use was for thermoelectric power facilities, public water supply, agricultural irrigation, and golf course irrigation.

Fermi 2 does not use groundwater, and Detroit Edison does not plan to use groundwater for the proposed Fermi 3.

Detroit Edison (2011a) relied on groundwater use information for the year 2000 from U.S. Geological Survey (USGS) Water-Resources Investigations Report 03-4312 (Reeves et al. 2004) and population estimates presented in Section 2.5.1 of the ER to estimate future water use. The USGS report presented groundwater use values for quarries in Monroe County and at nearby quarries in Wayne County that are higher than the values presented by the MDEQ for Monroe County (2000). The USGS estimate is conservative because it includes withdrawals from outside Monroe County that impact water levels within the county. Detroit Edison (2011a) used the USGS values to estimate that total freshwater groundwater withdrawals in Monroe County would increase from approximately 28 MGD in 2000 to 49 MGD in 2060.

2.3.3 Water Quality

The water quality of Lake Erie, Swan Creek, Fermi site surface water bodies, and the groundwater in the vicinity of the Fermi site is described in the following sections. Shallow groundwater at the Fermi site is hydraulically connected with the surface water, as discussed in Section 2.3.1.2.

Water quality data are available from the following sources: (1) U.S. Environmental Protection Agency (EPA), which maintains the Great Lakes Environmental Database (GLENDA) and the Storage and Retrieval Database (STORET); (2) MDEQ; (3) USGS, which maintains the National Water Information System (NWIS) database; (4) NOAA; and (5) Fermi site data.

2.3.3.1 Surface Water Quality

Surface water bodies whose quality could be affected by the proposed Fermi 3 include Lake Erie, Swan Creek, and various onsite water bodies. Onsite surface water bodies include the North Lagoon, South Lagoon, overflow canal, discharge canal, small pond between the two canals, and the two Quarry Lakes. However, the primary water body of concern is Lake Erie, which would be the sole source of water to Fermi 3 and would receive the majority of discharges from Fermi 3. Swan Creek would receive stormwater discharge and discharge from the dewatering system during construction of Fermi 3. The overflow canal, discharge canal, and pond would be either fully or partially filled in during Fermi 3 building activities. In addition, onsite water bodies would receive some stormwater runoff during building and operations.

Lake Erie water is used for the public water supply in Monroe County and many other locations across the Lake Erie basin. Current water quality concerns with regard to Lake Erie include (1) increased phosphorus loading from regional agricultural activities, which causes toxic algal blooms, and (2) elevated concentrations of three bioaccumulative contaminants (mostly from historical industrial activities), such as dioxin, polychlorinated biphenyls (PCBs), and mercury (Hartig et al. 2007; Brannan 2009). In 2005, the EPA Large Lakes and Rivers Forecasting Research Branch began the Detroit River-Western Lake Erie Basin Indicator Project (Hartig et al. 2007). The EPA identified the following current challenges to the Detroit River-Western Lake Erie Basin water resources: (1) population growth and accompanied land use changes, (2) nonpoint source pollution, (3) toxic substances contamination, (4) habitat loss and degradation, (5) exotic species, and (6) greenhouse gases and global warming (Hartig et al. 2007).

The MDEQ is responsible for assessing the support of beneficial uses of surface water bodies in Michigan and subsequently listing water bodies on the Clean Water Act Section 303(d) list of impaired waters, if they do not support those beneficial uses. Currently Lake Erie waters under Michigan jurisdiction are on the Section 303(d) list for not supporting fish consumption because of the elevated concentrations of PCBs and dioxins in fish tissue. The total maximum daily load

(TMDL) determination is scheduled to be completed in 2015 (MDEQ 2009b). In general, Lake Erie public water supply use was not assessed and neither were total/partial body contact uses. The Lake Erie shoreline from the Detroit River to the Michigan-Ohio border has not been assessed for most beneficial uses, and there is insufficient information on total and partial body contact uses. However, the Lake Erie coastline at Luna Pier Beach, in Monroe County south of the Fermi site, is on the Section 303(d) list for not supporting total or partial body contact uses as a result of pathogen concentrations (MDEQ 2009b).

A TMDL for *Escherichia coli* (*E. coli*) in the Detroit River was issued by MDEQ in August 2008 (MDEQ 2008a). The TMDL addresses sources of *E. coli* in the U.S. portions of the Detroit River watershed. The Detroit River is also on the Section 303(d) list for dioxin (fish tissue only), dichlorodiphenyltrichloroethane (DDT) (fish tissue only), PCBs (both fish tissue and water column), and mercury (both fish tissue and water column) (MDEQ 2009b).

Swan Creek downstream of Sigler Road to Lake Erie is on the Section 303(d) list for not supporting fish and macroinvertebrate communities. MDEQ (2009b) noted the causes as direct habitat alterations, anthropogenic substrate alterations, and flow regime alterations.

Water quality in the western basin of Lake Erie is monitored at several stations. Surface water quality data for the vicinity of the Fermi site is collected by a number of agencies: EPA maintains the GLENDA and STORET databases; USGS maintains the NWIS database; and MDEQ performs monitoring in many locations. Temperature data are also available from NOAA from four gages on the coast of Lake Erie, with two stations being located within the western basin: Toledo, Ohio, and Marblehead, Ohio. Monthly average temperatures recorded at Toledo only vary between 50.4°F and 59.0°F annually and reflect temperatures of the Maumee River. Temperatures measured at the Marblehead station are presented in Table 2-5, along with the average monthly Lake Erie surface temperatures presented in the ER (Detroit Edison 2011a) that were modeled by the NOAA Great Lakes Environmental Research Laboratory. Additional monitoring of Lake Erie is done at the Fermi site, as described in text that follows.

Depending on the constituent, monitoring required by Fermi NPDES Permit No. MI0037028 occurs daily, weekly, monthly, or quarterly at wastewater Outfall 001, Outfall 009, Outfall 011, and Outfall 013 and monthly at the Fermi 2 intake (MDEQ 2005). Figure 2-6 shows the locations of the NPDES outfalls, including stormwater discharge outfalls. Detroit Edison has reported spills to the MDEQ regularly and submitted copies of the notification letters to the review team. Leaks of chlorine, ethylene glycol, sanitary waste, oil and grease, and other constituents to both wastewater and stormwater outfalls have been reported at Fermi 2, and descriptions follow of some of the discharges reported to MDEQ by Detroit Edison (Detroit Edison 2009d):

Table 2-5. Measured and Modeled Lake Erie Monthly Average Temperatures

Month	Measured Temperature at Marblehead, OH (°F)(a)	Modeled Water Surface Temperature (°F)(b)
January	34.2	33.5
February	33.8	32.3
March	37.2	32.7
April	49.3	36.6
May	59.5	49.6
June	72.3	63.4
July	75.2	72.1
August	77.0	74.2
September	68.2	71.2
October	55.4	63.2
November	45.2	52.8
December	39.0	41.5

(a) Source: NOAA 2011
(b) Source: Detroit Edison 2011a

- On March 6, 1987, fluid was observed to be emanating from sanitary sewer manholes. The spill was stopped within 30 minutes of the time of discovery, and waste was observed to reach Lake Erie. Estimates of the quantity of sanitary waste lost to Lake Erie were not made.
- On January 9, 1996, Detroit Edison (2009d) reported a leak of 200 gallons of 50 percent ethylene glycol solution to the cooling water reservoir, which discharges to Outfall 001.
- On March 15, 2000, a leak of cooling water with a chlorine concentration above the NPDES-permitted discharge limitations was found flowing overland from the south cooling tower to the overflow canal. Within two hours of the discovery of the leak, earthen berms were constructed to block the flow of water to the overflow canal. The cooling tower leak was repaired within 2 days of the discovery of the leak.

As a part of the COL application for Fermi 3, a year of quarterly surface water sampling was done at six locations throughout the site (see Figure 2-6), including two locations within Lake Erie (AECOM 2009a). The sampling indicated that the surface water quality at the Fermi site was typical of the area, with elevated levels of nutrients including total phosphorus, orthophosphorus, nitrate and nitrite nitrogen, and total Kjeldahl nitrogen. On average, concentrations of mercury in site surface water exceeded MDEQ Rule 57 for human noncancer values (0.0018 μg/L) and wildlife values (0.0013 μg/L); however, these values are consistent with values measured at the intake to Fermi 2 from Lake Erie. When surface water quality is compared to primary and secondary drinking water standards (EPA 2009a), color, turbidity, and fecal coliform concentration in most samples exceed drinking water standards. Concentrations of sulfate and total dissolved solids (TDS) exceed secondary drinking water standards in the southern Quarry Lake (location QU-W).

The ER presents 2007 sample results from two locations within Lake Erie near the Fermi site in which coliforms (total and fecal) were detected in the samples (Detroit Edison 2011a). Total coliforms were found at concentrations of 200 and 500 colony-forming units/100 mL (cfu/100 mL), and fecal coliforms were not detected in one sample and were detected at 100 cfu/100 mL in the other. Also, quarterly sampling at six surface water locations on the site from July 2008 through April 2009 was done to test for fecal coliform (AECOM 2009a). It was detected at five of the six locations (not detected at location QU-W); average concentrations were 8 to 39 cfu/100 mL (AECOM 2009a). Concentrations at Lake Erie location LE1-W, near where the Fermi 3 outfall pipe would end, were between 4 and 17 cfu/100 mL.

Grab samples from Swan Creek in the early 1970s and early 1990s showed that concentrations of nitrate nitrogen, total phosphorus, Kjeldahl nitrogen, and sulfate were elevated when compared with the most recent Fermi site data.

If water levels in Lake Erie were to decline significantly as a result of climate change, water temperatures would also likely rise in the summer, especially in the shallow western basin of Lake Erie.

2.3.3.2 Groundwater Quality

Groundwater samples were collected in Fermi site wells from 2007 through 2009 (Detroit Edison 2011a; AECOM 2009a). In 2007, 20 groundwater samples were analyzed, and the results were reported in the ER (Detroit Edison 2011a). Between July 2008 and April 2009, a year of quarterly groundwater sampling was done at four locations throughout the site (AECOM 2009a). When groundwater quality was compared to primary and secondary drinking water standards (EPA 2009a), color, turbidity, and concentrations of sulfate, iron, and TDS exceeded drinking water standards in many of the samples. In some cases, the pH values of the samples were more or less than the secondary drinking water standards.

Tritium has not been detected in most onsite monitoring wells (Detroit Edison 2009a). Data from four quarters of groundwater monitoring in late 2007 through 2008 were presented in the 2008 radiological environmental monitoring program (REMP) report. These data indicated that tritium was detected once in one of the nine deep wells at an activity concentration of 573 pCi/L. In shallow monitoring wells, tritium was detected in 9 of 28 wells at activity concentrations up to 1950 pCi/L (Detroit Edison 2009a). At five of these wells, results were usually below the detection limit, with detectable concentrations up to 740 pCi/L occurring sporadically in one or two quarters. At the other four wells, concentrations above detectable limits were common (though some results were below the detection limit in some quarters). The wells and their highest results during the period of record were 13S (1950 pCi/L), 14S (800 pCi/L), 24S (860 pCi/L), and 25S (1050 pCi/L). Wells where tritium was detected are located east and south of the Fermi 2 emissions stack. Detroit Edison proposed a scenario of the washout of tritium by precipitation (Detroit Edison 2009a), which is realistic given the locations of the stack and the wells. At the monitored wells, no trend was apparent in the tritium data. All detected concentrations were well below the EPA drinking water standard of 20,000 pCi/L.

Groundwater sampling at the Fermi site in 1969, 1970, and 2007 indicated sulfate concentrations exceeding the EPA secondary standard in most of the samples and chloride concentrations exceeding the secondary standard in several samples (Detroit Edison 2011a). In eastern Monroe County, high sulfate is common due to natural sources (Apple and Reeves 2007).

In wells within a 5-mi radius of the Fermi site, elevated concentrations of arsenic above the EPA (2009a) maximum contaminant level (MCL) were found in groundwater samples (Detroit Edison 2011a). In this county-wide study by MDEQ, forty-two samples were measured for arsenic between 1985 and 2007 from wells serving single-family dwellings, schools, industrial facilities, and the City of Monroe. The sampled wells were not located close to the Fermi site, and the arsenic concentrations are not attributed to the site. Elevated concentrations of nitrate as nitrogen were also found in some wells, but these did not exceed the MCL (Detroit Edison 2011a). More than 1100 samples were measured for nitrate between 1983 and 2007 from wells serving single-family dwellings, golf courses, churches, schools, farms, industrial facilities, and the City of Monroe. Concentrations of volatile organic carbons (VOCs) measured in wells within 5 mi of the Fermi site between 1993 and 1999 were not above water quality standards (Detroit Edison 2011a).

Several spills associated with the operation of Fermi 2 have affected groundwater quality, and these were reported by Detroit Edison to MDEQ (Detroit Edison 2009e). They are as follows:

- In 1987, a leak of sodium hydroxide to groundwater was identified, and the pH of the groundwater in the area of the spill was measured to be 12.8. Detroit Edison excavated the soil in the area of the spill and pumped groundwater from the excavated area until the groundwater pH was diluted to a measurement of 9.5.
- According to MDEQ (2010), a diesel tank leak at the Fermi site was discovered on October 18, 2001. The investigation for this leak was closed on December 19, 2001 (MDEQ 2010).
- In 2002, 20 gal of 15 percent sodium hypochlorite solution were accidentally spilled on soil, and the soil was subsequently excavated and neutralized.
- Remedial action was taken to clean up a diesel spill to groundwater that was identified in 2002 (Envirosolutions 2007).

- Free phase diesel fuel was found in a dewatering sump within the Fermi 2 residual heat removal (RHR) complex in June 2002. A leak in the emergency fuel drain pipe was thought to be the source, and the leak was repaired. Diesel fuel contamination was monitored and remediated as regulated by the MDEQ Remediation and Redevelopment Division (RRD) under Part 201, “Environmental Remediation,” of the Natural Resources and Environmental Protection Act (451 MCL 201). During the investigation and cleanup activities, 21 monitoring wells were installed to delineate the extent of the contamination at the site (Envirosolutions 2007). Concentrations of fuel fell below cleanup criteria specified in Part 201 (Subsection 20120a[1][a] to [e]) in November 2006 (Envirosolutions 2007). Closure of this site was accepted by the MDEQ in 2009 (MDEQ 2009c).

2.3.4 Water Monitoring

Monitoring of water flow and quality in Lake Erie, Swan Creek, Fermi site surface water, and the groundwater in the vicinity of the Fermi site are described in the following sections.

2.3.4.1 Lake Erie Monitoring

There is a NOAA gaging station (ID 9063090) on Lake Erie in the vicinity of the Fermi 2 intake structure. The Fermi gage has monitored water levels at the Fermi site hourly since 1970. Additional NOAA National Ocean Service gaging stations in the western basin of Lake Erie are at Marblehead, Ohio (water levels and temperatures monitored since 1959), and Toledo, Ohio (water levels monitored since 1904).

The EPA performs water quality monitoring at five locations within the western basin of Lake Erie, and the data are available on the GLENDA database. MDEQ also monitors Lake Erie at 109 stations, and the monitoring data are available on the EPA STORET database.

A full suite of historical Lake Erie water level and water quality data are presented in the ER (Detroit Edison 2011a).

2.3.4.2 Swan Creek Monitoring

There has been no consistent historical flow monitoring of Swan Creek. The review team identified measurements taken from 12 locations in the upper watershed of Swan Creek by the USGS, but the data were limited to between one and four measurements per site. In addition, the MDEQ performed water quality monitoring on Swan Creek in 1993. Results of Swan Creek monitoring are presented in the ER (Detroit Edison 2011a).

2.3.4.3 Fermi Site Surface Water Monitoring

Discharges at the Fermi 2 plant have been monitored in accordance with the NPDES permit since 1988 when operations began. The NPDES permit for Fermi 2 requires regular monitoring of four wastewater outfalls and the water intake; each has different monitoring requirements (see Section 2.3.3.1; Figure 2-6). In addition, Fermi 2 is required by the NPDES permit to analyze the intake water for total mercury on a monthly basis.

Between July 2008 and April 2009, a year of quarterly surface water sampling was done at six locations throughout the Fermi site, including two locations within Lake Erie (AECOM 2009a).

2.3.4.4 Groundwater Monitoring

Currently, Fermi 2 has four groundwater monitoring wells (GW-02 which is shown in Figure 2-7, GW-03 and GW-04 which are shown in Figure 2-8, and GW-1 which is located along the lakeshore south of Fermi 1) that are sampled quarterly for the radionuclides specified in the ODCM (Offsite Dose Calculation Manual) for the REMP. Samples are collected on a quarterly basis and are analyzed for tritium. In addition to these wells, 16 groundwater wells have been installed around Fermi 1 to support decommissioning activities, and 28 monitoring wells have been installed for the proposed Fermi 3. The locations of the Fermi 3 wells are shown in Figures 2-7 and 2-8.

Between July 2008 and April 2009, a year of quarterly groundwater sampling for inorganics and general water quality parameters was done at four locations on the Fermi site (AECOM 2009a). These wells are identified in the report as MW-381, MW-384, MW-391, and MW-393, and their locations are shown in Figure 2-8.

Section 4.2.4 describes the hydrologic and water quality groundwater monitoring proposed during facility building activities, and Section 5.2.4 describes the hydrologic and water quality groundwater monitoring proposed during operations. Radiological monitoring of groundwater is discussed in Sections 2.10 and 5.9.

2.4 Ecology

The Fermi 3 site is located on the western shore of Lake Erie in the Lower Peninsula physiographic province. The site is also situated in the Southern Lower Peninsula Ecoregion (MDNR 2005). This section describes the terrestrial and aquatic ecological environment on the Fermi 3 site and in the vicinity of the site, defined as the area within a 7.5-mi radius of the site, as described in Section 2.1 and shown in Figure 2-3. This section also describes the ecological environment of the proposed new transmission line corridor and other areas likely to be affected by development and operation of the proposed facilities.

2.4.1 Terrestrial and Wetland Ecology

Prior to development of Fermi 1 and 2, most of the Fermi site was used for agriculture or otherwise disturbed. Undeveloped areas on the Fermi site have reverted to vegetated cover types through ecological succession. The history of vegetative cover prior to development of Fermi 2 was documented in a study conducted from 1973 to 1974 (NUS Corporation 1974). That study found that nearly all of the habitats on the site at that time (after development of Fermi 1 but prior to development of Fermi 2) were in the early stages of succession. Vegetative cover currently is composed of a mix of emergent wetland, forest, grassland, developed areas, cropland, and shrubby vegetation (Detroit Edison 2011a). The primary types of vegetative cover are described below and shown in Figure 2-10.

Areas west of the Fermi site consist mostly of agricultural land (row crops) with scattered rural residences. To the south are residential properties and a narrow lagoon off Lake Erie that is surrounded by shrubland and thicket. Immediately north of the site is Swan Creek. Lake Erie lies to the east of the site.

2.4.1.1 Terrestrial Resources – Site and Vicinity

Existing Cover Types and Vegetation

Vegetation at the Fermi site was studied as part of field reconnaissance-level surveys between 2006 and 2008 (Detroit Edison 2011a) and again in detailed field surveys between 2008 and 2009 (Detroit Edison 2009e). Vegetation cover type boundaries were provisionally drawn by using aerial photography dated from 2006 to 2008. Field personnel refined the boundaries by using field survey observations (Detroit Edison 2011a). Cover types were identified according to Michigan's *Wildlife Action Plan* (MDNR 2005) categorization system, with minor modifications. The surveys were conducted during the spring, summer, and fall to account for the variation in flowering time for different plant species. Field surveys included characterizations of the structure and species composition of the plant communities of each area (Detroit Edison 2009e).

Within each delineated cover type occurrence, representative transects were examined to identify dominant species and confirm the preliminary cover type assignments (Detroit Edison 2011a). At least two transects were examined in each cover type occurrence. Plants were randomly sampled within each transect to more thoroughly examine localized differences and better understand the species diversity present. The results of the field studies were used to better understand the character and refine the boundaries of the cover types. Twelve major cover types were identified. They are described in the following sections in order of decreasing extent on the site. Acreages are summarized in Table 2-6.

The following cover type descriptions are based on information provided by Detroit Edison (2011a), unless otherwise noted.

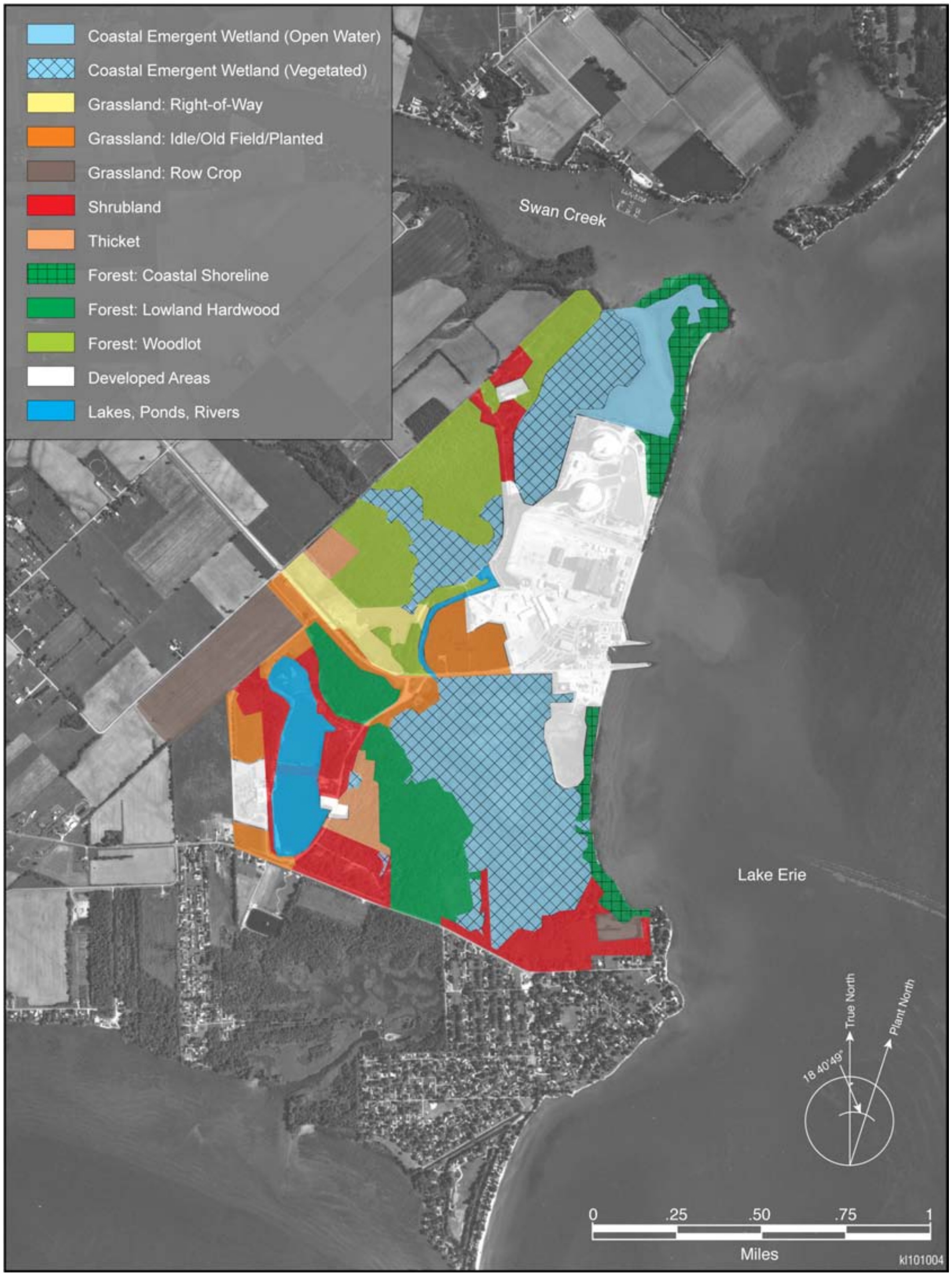

Figure 2-10. Primary Vegetation Cover Types of the Fermi Site (Detroit Edison 2011a)

Table 2-6. Vegetative Cover Types on the Fermi Site

Cover Type (Habitat)[a]	Dominant Species	Acres	Percent of Site
Terrestrial and wetlands			
Coastal emergent wetland	Common reed *(Pragmites australis)*, cattail species *(Typha* spp.*)*, American lotus *(Nelumbo lutea)*	273	21.7
Grassland: right-of-way	Big bluestem *(Andropogon gerardii)*, Indiangrass *(Sorghastrum nutans)*	29	2.3
Grassland: idle/old field/planted	Smooth brome *(Bromus inermis)*, Canada goldenrod *(Solidago canadensis)*	75	6.0
Grassland: row crop	Corn *(Zea mays)*, soybeans *(Glycine max)*	64	5.1
Shrubland	Dogwood species (*Cornus* spp.), common buckthorn *(Rhamnus cathartica)*, multiflora rose *(Rosa multiflora)*, blackberry species (*Rubus* spp.)	113	9.0
Thicket	Hawthorn species (*Crataegus* spp.), box elder *(Acer negundo)*, dogwoods	23	1.8
Forest: coastal shoreline	Cottonwood *(Populus deltoides)*, peach-leafed willow *(Salix amygdaloides)*	47	3.7
Forest: lowland hardwood	Cottonwood, peach-leafed willow, oak species (*Quercus* spp.), basswood *(Tilia americana)*, hickory species (*Carya* spp.)	92	7.3
Forest: woodlot	Cottonwood, box elder, green ash *(Fraxinus pennsylvanica)*	117	9.3
Developed areas	NA[b]	212	16.8
Open water			0.0
Lakes, ponds, rivers	NA	44	3.5
Lake Erie (main body)	NA	171	13.6
Total		**1260**	**100**

Source: Adapted from Detroit Edison 2011a
(a) Vegetative cover types are based on MDNR 2005.
(b) NA = not applicable.

Coastal Emergent Wetland

Coastal emergent wetland is the most extensive cover type represented on the Fermi site, covering about 273 ac or 21.7 percent of the site. The largest coastal wetland features on the site include a North and South Lagoon and an unnamed drainage corridor that flows from the west. The hydrology of the coastal emergent wetlands is controlled almost entirely by Lake Erie and Swan Creek surface water elevations (Detroit Edison 2011d). From the most recent study (Detroit Edison 2011a), it is estimated that only about 238 ac of coastal emergent wetland is vegetated and that the remaining area that is so designated (approximately 35 ac) is actually open water. However, the extent of emergent vegetation appears to fluctuate annually, depending primarily on water conditions in Lake Erie. There is more open water in high-water years than in low-water years. For example, water conditions were relatively high in 1981 compared with 2005. Aerial photographs from the low-water year of 2005 show a marked increase in emergent vegetation in the lagoons.

At the present time, the lagoons are dominated by dense and extensive stands of common reed (*Phragmites australis*) and cattail species (*Typha* spp.). Purple loosestrife (*Lythrum salicaria*), an invasive non-native herbaceous wetland plant species, is present throughout most of the coastal emergent wetland areas on the Fermi site. The west-side drainage corridor has virtually no open water because of the dense growth of common reed, cattails, and purple loosestrife. Because the extent of dense common reed and other non-native plant cover, the coastal emergent wetlands on the Fermi site likely provide low-quality habitat for wildlife, especially waterfowl.

Moderately shallow areas of the South and North Lagoons and the south canal contain stands of American lotus (*Nelumbo lutea*), which is a State-listed threatened species. The status of the American lotus is discussed in detail in Section 2.4.1.3. Most of the South Lagoon is quite shallow, with fill deposits scattered throughout. Wading birds such as herons and egrets use the shallow water areas for foraging. Some species of songbirds, including the red-winged blackbird (*Agelaius phoeniceus*), use the cattails and reeds for nesting.

Developed Areas

Developed areas include buildings, parking areas, equipment storage areas, roadways, maintained lawns, and similar areas. Approximately 212 ac or 16.8 percent of the site is developed. Most plant species present have been planted for ornamental value or grow naturally in heavily disturbed settings. Wildlife value is generally low because of low plant species diversity, sparse cover, and frequent disturbance.

Open Waters of Lake Erie

The main body of Lake Erie lies north and east of the project. The open waters of Lake Erie account for about 171 ac or 13.6 percent of the site. Aquatic areas are addressed in Section 2.4.2.

Forest: Woodlot

The “forest: woodlot” cover type is found in the east-central and northwestern portions of the Fermi site and accounts for about 117 ac or 9.3 percent of the site. It occurs mostly on fill material from development of Fermi 1 and 2 or on land otherwise heavily disturbed by Fermi 1 and 2 activities. Until recently, the tree canopy was well developed and composed mostly of eastern cottonwood (*Populus deltoides*), box elder (*Acer negundo*), and green ash (*Fraxinus pennsylvanica*). Since 2002, an accidentally introduced non-native insect pest, the emerald ash borer (*Agrilus planipennis*), has killed many mature green ash trees on the Fermi site and surrounding areas. As a result, the canopy has become more open, and more light reaches the ground. Introduced tree species such as the tree-of-heaven (*Ailanthus altissimus*) are present in the canopy in some places. The understory is composed of saplings of tree canopy species of variable density. Vines of poison ivy (*Toxicodendron radicans*), grape (*Vitis* spp.), and trumpet creeper (*Campsis radicans*) form localized thickets. The non-native invasive shrub species European privet (*Ligustrum vulgare*) and common buckthorn (*Rhamnus cathcartica*) are relatively common. The ground cover is generally sparse and composed mostly of relatively aggressive native plant species and non-native invasive plant species. Some of the more common herbaceous species include burdock (*Arctium minus*) and heal-all (*Prunella vulgaris*) (both of which are native) and the highly invasive garlic mustard (*Alliaria petiolata*). The value of the forest: woodlot vegetation on the Fermi site to wildlife is generally limited to providing nesting and den areas and sheltered resting areas. Dead ash trees provide good foraging for woodpeckers, nuthatches, and creepers. Other foraging opportunities are limited because of reduced vegetative diversity caused by non-native understory and groundcover species.

Shrubland

Shrublands at the Fermi site are upland areas with relatively dry soils that are dominated by deciduous shrubs. Approximately 113 ac or 9.0 percent of the site is shrubland. On the Fermi site, most shrubland is located in areas that were filled or otherwise severely disturbed by development of Fermi 1 and 2, with the possible exception of some shrubland in the extreme southeastern corner of the site. Shrub species such as dogwoods (*Cornus* spp.), common buckthorn, multiflora rose (*Rosa multiflora*), and blackberries (*Rubus* spp.) dominate areas of shrubland vegetation on the Fermi site. Tree saplings such as honey locust (*Gleditsia triacanthos*), eastern cottonwood, and green ash are also common. Despite the cover of shrubs and saplings, there generally is substantial ground cover in the form of grasses and forbs. Since these areas have been previously disturbed, it is not surprising to find that many of the species present are introduced or, if they are native, tend to be opportunistic. Examples include smooth brome (*Bromus inermis*), prickly lettuce (*Lactuca serriola*), Canada goldenrod (*Solidago canadensis*), and Missouri ironweed (*Vernonia missurica*). Wildlife use would include cover, nesting sites, and bedding areas, but forage value is limited due to the prevalence of less palatable introduced plant species.

Forest: Lowland Hardwood

The "forest: lowland hardwood" cover type represents the most mature vegetation on the Fermi site. It accounts for about 92 ac or 7.3 percent of the site, mostly in areas immediately northeast of Quarry Lake and the south-central portion of the site along the west side of the South Lagoon. Eastern cottonwood and peach-leaved willow (*Salix amygdaloides*) are present, but oak species (*Quercus* spp.), American basswood (*Tilia americana*), and hickory species (*Carya* spp.) are better represented. Overall, the habitat is drier and more stable than that found in the "forest: coastal shoreline" cover type, and the topsoil is organic or clayey rather than sandy. The largest trees are found in the area northeast of the Quarry Lakes, where numerous specimens can be found that range from 18 to 26 in. in diameter at breast height (dbh). In the south-central area, scattered trees reach this size, but most are less than 14 in. dbh. Larger specimens appear to have been logged years ago, as evidenced by scattered old stumps. Shrubs are widely scattered in the understory. Ground cover is generally sparse but consists of a variety of woodland species such as woodland bluegrass (*Poa sylvestris*), scattered sedges (*Carex* spp.), enchanter's nightshade (*Circaea lutetiana*), false spikenard (*Smilacina racemosa*), and Virginia stickseed (*Hackelia virginiana*). Poison ivy is common, as are grapes. This vegetation provides substantial cover, shelter, and foraging for a variety of wildlife in the area, as evidenced by observed tracks, nests, and scat.

Grassland: Row Crops

"Grassland: row crop" areas are agricultural fields that are planted with a single species such as corn (*Zea mays*) or soybeans (*Glycine max*) and harvested annually. Approximately 64 ac or 5.1 percent of the Fermi site is of this cover type.

Grassland: Idle/Old Field/Planted

"Grassland: idle/old field/planted" vegetation comprises opportunistic plants that take over areas that had once been cleared for agriculture or other purposes. In some cases, these areas were initially planted with a cover grass, usually perennial brome or fescue. Areas of this vegetation at the Fermi site are dominated by smooth brome grasses but contain a mix of opportunistic (weedy and invasive) native and introduced species such as Canada thistle (*Cirsium arvense*), Canada goldenrod, and flattop-fragrant goldenrod (*Euthamia graminifolia*). Native shrubs such as blackberry and non-native invasive shrubs such as multiflora rose may also be present but are not dominant. This is a disturbed type of vegetation that has limited value for wildlife, although it provides shelter for small mammals, birds, and reptiles and has some forage value. Approximately 75 ac or 6.0 percent of the site is grassland: idle/old field/planted vegetation.

Forest: Coastal Shoreline

"Forest: coastal shoreline" vegetation occurs in a narrow, interrupted band along the east side of the site adjacent to Lake Erie. It covers about 47 ac of land, or 3.7 percent of the site. The area is dominated by large eastern cottonwoods, some of which are 2 ft or more dbh, and peach-leaved willow. Box elder is also scattered in the area. Green ash was formerly scattered in the area before the emerald ash borer killed virtually all ash trees on the site. Shrub growth varies from dense to sparse depending on lake exposure and the extent of high-water ponding that occurs. Ground cover is sparse in heavily shaded areas, but the edges include dense stands of reed canarygrass (*Phalaris arundinacea*). Forbs are primarily species capable of withstanding fluctuations in moisture availability and generally sandy soil conditions, such as stinging nettle (*Urtica dioica*). In this area, it is also common to discover unexpected native and introduced species that have likely been dispersed here from other areas via the waters of Lake Erie. Examples include jimson-weed (*Datura strumonium*) and clammy-weed (*Polanisia dodecandra*). Overall, the forest: coastal shoreline vegetation at the Fermi site is a dynamic mix of opportunistic early-succession species. Wildlife value of the area includes roosting or nesting by birds and use by muskrat *(Ondatra zibethicus)*, red fox *(Vulpes vulpes)*, raccoon *(Procyon lotor)*, small mammals, and amphibians.

Lakes, Ponds, and Rivers

Lakes, ponds, and rivers (exclusive of Lake Erie) account for approximately 44 ac or 3.5 percent of the Fermi site. These water bodies include an unnamed stream draining east across the central portion of the site and Quarry Lakes, two adjacent abandoned rock quarries used as a source of materials during Fermi 1 construction. No substantial emergent or submerged aquatic vegetation communities have been described by Detroit Edison or others, except for noting that cut-leaf water-milfoil (*Myriophyllum pinnatum*) has been observed. These waters are discussed further in Section 2.4.2.

Grassland: Right-of-Way

"Grassland: right-of-way" vegetation is associated with linear features such as roadways, rail lines, transmission lines, pipelines, etc. Approximately 29 ac or 2.3 percent of the Fermi site supports grassland: right-of-way vegetation, including areas along roadways. An existing onsite transmission line corridor accounts for most of the land supporting this vegetation. The corridor is periodically mowed to keep it free of trees for line clearance. About one-half of the corridor is an intentionally established prairie area. The prairie was planted in 2003 by Detroit Edison with the assistance of a North American Wetland Conservation Act grant managed by

Ducks Unlimited and the Natural Resources Conservation Service (NRCS). The prairie is dominated by big bluestem (*Andropogon gerardii*) and Indiangrass (*Sorghastrum nutans*). Broomsedge (*Andropogon virginicus*), a less desirable native grass, is also relatively common, with dense localized patches. Undesirable plants are also present, including purple loosestrife, common reed, and teasel (*Dipsacus sylvestris*). Surveys of the area between 2006 and 2009, as well as earlier observations, note approximately 110 plant species in this area. To date, management has consisted of periodic mowing to discourage the growth of woody species. In the lowest elevation areas of grassland: right-of-way vegetation, large grasses like bluestem and Indiangrass become less dominant. Where broomsedge has not overtaken the ground cover, composition tends to be somewhat representative of a perennial herbaceous wetland. Grasslike bulrushes (*Scirpus* spp.), rushes (*Juncus* spp.), and sedges (*Carex* spp.) are present in some areas, as are broadleaf forbs such as common boneset (*Eupatorium perfoliatum*) and southern blue flag (*Iris virginica*). An unmanaged portion of the corridor is dominated by broomsedge in the driest areas and by cattails in the lowest areas. The variation in hydrologic conditions across this area has encouraged the growth of a substantial variety of native and introduced forbs. The grassland: right-of-way vegetation presently has value for wildlife in the form of diverse foraging and shelter for small mammals, birds, and reptiles, especially those favoring forest edges. It may offer some grazing opportunities for white-tailed deer.

Thicket

Areas identified as thicket on the Fermi site are generally located in transitional areas between wetlands and uplands. This cover type occurs lower on the landscape than the shrubland cover type, but, like shrubland, this is a successional stage that is expected to progress over time toward forest conditions. Approximately 23 ac or 1.8 percent of the site is designated as thicket. These areas are densely covered with saplings and small trees such as hawthorns (*Crataegus* spp.) and box elder. Shrubs are also common and include European privet and dogwoods. Saplings of eastern cottonwood, peach-leaved willow, and green ash are also prevalent, and poison ivy is abundant. Ground cover is sparse except in a few open areas. The prevalence of aggressive early successional and non-native plant species suggests that most areas of this vegetation on the Fermi site were disturbed in the past. Successional change has occurred from shrub/grassland habitat to thicket, as evidenced by changes in aerial photographs taken more than 20 years apart. The thicket vegetation is probably most beneficial to small mammals and birds for shelter and foraging. Large mammals may sometimes find it difficult to move through the dense brush.

As indicated in Section 4.1, land cover in the vicinity of the Fermi site (other than the open waters of Lake Erie) is largely composed of row crop agriculture, pasture and hay, residential and other developed land uses, and some forest land. Vegetation in unfarmed and undeveloped areas is generally similar to that in similar areas on the Fermi site (Detroit Edison 2011a).

Wildlife

The Fermi site was extensively surveyed for wildlife during site reconnaissance between late 2006 and mid-2008 and during a detailed wildlife survey from mid-2008 until mid-2009 to evaluate the diversity of species potentially present (Detroit Edison 2009e).

Mammals

Terrestrial wildlife surveys of the Fermi site were conducted for Fermi 3 from mid-2008 to mid-2009 (Detroit Edison 2009e). During these Fermi 3 studies, 16 mammal species were observed. White-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), raccoon, eastern cottontail (*Sylvilagus floridanus*), and eastern fox squirrel (*Sciurus niger*) were among the most frequently observed mammals on the Fermi site.

The area surrounding Fermi 1 and 2 and associated facilities is a mosaic of developed land, mowed grass, woodlots, and successional forest that does not appear to provide significant travel corridors, such as might be found along watercourses or entry/exit locations for desirable foraging or resting habitats. The Fermi site is surrounded by a high chain-link fence in terrestrial areas, which is expected to inhibit movement of larger mammals. However, the Lake Erie waterfront and North Lagoon areas may provide access via water. White-tailed deer, for instance, are frequently seen on the site. The boundary fence does not appear capable of affecting the movement of small mammals that can move through fence openings or burrow underneath. The varied habitats around the site, however, are well-suited to small mammals, although the great extent of non-native and/or invasive species in most of the vegetation cover types provides less-than-ideal foraging opportunities. None of the mammal species observed or reported at the site is unusual for the region.

Birds

Birds in the Fermi region include year-round residents, seasonal residents, and transients (birds stopping briefly during migration). A large percentage of the species occurring in Michigan are migratory, and because Fermi lies on the western shore of Lake Erie, it lies on the Atlantic flyway, which is one of several major migratory flyways in North America.

Bird surveys conducted at the Fermi site between 1973 and 1974 by NUS Corporation (NUS Corporation 1974) listed about 150 species of birds on the site. The ER (Detroit Edison 2011a) cites a Wildlife Management Plan developed by Detroit Edison in 2000. Although the 2000 plan provided a list of 287 species potentially occurring in the Fermi vicinity, only 150 were noted as observed on the Fermi property. These species were the same 150 species noted in the 1973-1974 NUS Corporation study. The list of 287 species was derived from surveys conducted at the Ottawa National Wildlife Refuge, located along Lake Erie about 30 mi southeast of the Fermi site near Oak Harbor, Ohio. The ER (Detroit Edison 2011a) also cites

Detroit Edison's Wildlife Habitat Program re-certification as adding six new species to the list of species provided in the 2000 Wildlife Management Plan. According to the ER, a bird survey conducted in April 2002 by the Detroit Edison Wildlife Habitat Team at the Fermi site counted 293 individuals and 31 species. Five species accounted for 50 percent of the birds counted in the 2002 survey: common grackle (*Quiscalus quiscula*), red-winged blackbird (*Agelaius phoencieus*), herring gull (*Larus argentatus*), brown-headed cowbird (*Molothrus ater*), and northern pintail (*Anas acuta*).

Fermi 3 bird studies were conducted between late 2006 and mid-2008 (Detroit Edison 2009e, 2011a). Point surveys were conducted for 5 days during each quarter of the year. Surveys were conducted at different starting times on alternating days in areas across the Fermi site that were considered representative of the habitats present. The sampling periods accounted for seasonal variation, such as spring and fall migration periods. These surveys confirm that the birds at Fermi are diverse but also indicate that a small number of common species make up a large percentage of the individuals present. Among the most common birds observed on the Fermi site were the red-winged blackbird, ring-billed gull (*Larus delawarensis*), American robin *(Turdus migratorius),* Canada goose *(Branta canadensis),* and European starling *(Sturnus vulgaris).* The following are brief discussions of the bird groups observed at Fermi.

Forest, Shrub, and Grassland Birds. According to Detroit Edison (2011a), these birds nest in trees, shrubs, or grasses and include year-round and seasonal residents. Examples include the American robin, blue jay (*Cyanocitta cristata*), brown thrasher (*Toxostoma rufum*), and eastern meadowlark (*Sturnella magna*). During the spring and fall, large flocks of non-native European starlings pass through the area. Open areas, such as the prairie under the transmission lines and other grass/shrub habitats, are likely used by many birds to forage for seeds, insects, or other forms of food.

Waterfowl, Shorebirds, Wading Birds, and Other Wetland Birds. Approximately 38 percent of the observed bird species are in this classification (Detroit Edison 2011a). These birds occur on the Fermi site mostly in association with the Lake Erie shoreline and areas designated as coastal emergent wetlands (Figure 2-10) because they require surface water to complete at least part of their life cycle. Great blue herons (*Ardea herodias*), great egrets (*Ardea alba*), common mergansers (*Mergus merganser*), American coots (*Fulica americana*), and mallards (*Anas platyrhynchos*) have been observed foraging in the shallow open water areas of the lagoons. Red-winged blackbirds nest in the tall cattails and reeds. In most past surveys, red-winged blackbirds accounted for a large percentage of the birds observed on the Fermi site. Many more birds have been observed in the lagoons than along the shore of Lake Erie, where the most common sightings are of various gull species.

Birds of Prey (Raptors). Birds of prey have not been frequently observed on the Fermi site. The most common sightings were of turkey vultures (*Cathartes aura*) and red-tailed hawks (*Buteo jamaicensis)*. In 1973, a single peregrine falcon (*Falco peregrinus*) and a single osprey

(*Pandion haliaetus*) were observed over the site (NUS Corporation 1974). No peregrine falcons were observed in recent studies, but several ospreys have been observed at the site. No evidence of nesting on the site by either species has been observed. In the fourth quarter of 2007, three bald eagle (*Haliaeetus leucocephalus*) nests were observed on the site: two were north and one was south of Fermi 2 in the large trees of the coastal shoreline forest adjacent to Lake Erie. Eagles may be more common around the plant during the winter months at locations where the warmer cooling water keeps some areas of the lake ice-free. Additional discussion regarding legislated protection of this species is found in Section 2.4.1.3. By May 2008, only the two bald eagle nests north of Fermi 2 remained because the southernmost nest had been destroyed by winter storms. Only one of the remaining nests was occupied. As of January 2011, none of the previously observed bald eagle nests could be seen on the Fermi site and had presumably deteriorated because of nonuse and weather (Detroit Edison 2012b).

Upland Game Birds. The mourning dove (*Zenaida macroura)* is the only upland game bird observed on the Fermi site during the 2008–2009 surveys (Detroit Edison 2009e). Wild turkey (*Meleagris gallopavo*) may be in the area, but none were observed directly or indirectly (i.e., observations of tracks, feathers, or calls) during site evaluations between 2006 and 2008.

<u>Reptiles and Amphibians</u>

The lagoons, other wetlands areas, and adjacent habitats on the Fermi site provide substantial areas of potential habitat for amphibians and reptiles. Direct and indirect observations, however, have been infrequent both in recent and past studies (Detroit Edison 2011a). The 2000 Wildlife Management Plan listed 18 species of amphibians whose geographic ranges include the Fermi site, but only three species were observed. The same report did not list any reptiles. The 2002 Wildlife Habitat Re-certification document listed three additional amphibian species and three reptile species. No surveys specifically for amphibians and reptiles were made for the Fermi 3 project, but observations were recorded during the course of other studies conducted for terrestrial resources. During the 2008–2009 surveys, six amphibian species and four reptile species were observed (Detroit Edison 2009e). The most commonly observed reptiles were the midland painted turtle (*Chrysemys picta marginata*) and eastern garter snake (*Thamnophis sirtalis sirtalis*). Among amphibians, only the American toad (*Bufo americanus*) was observed during two different counts. The western chorus frog (*Pseudacris triseriata)* was heard on the site, but only during the April 2009 count.

Existing Natural and Human-Induced Ecological Effects on the Fermi Site

While much of the Fermi site consists of natural habitats, most of these have been fragmented by roads and other development associated with Fermi 2 and decommissioned Fermi 1. The existing power blocks (for Fermi 1 and 2), support facilities, roads, parking areas, maintained landscaping, and deposited dredge spoils represent the most obvious disturbances. Other areas have been cleared and/or covered by fill materials during development of existing facilities. Some of the forested areas, such as those along the southern edge of the site, were logged in the past. The South Lagoon contains large deposits of dredged and other fill materials. These and similar past activities have degraded the habitat value of most vegetated areas on the site.

While there are no adequate historic quantitative data available with which to compare today's conditions, the current level of disturbance suggests a diminished quality of habitat for most wildlife compared with conditions prior to European settlement or conditions prior to initial industrial development of the Fermi site. The existing perimeter fence and other internal fences restrict movement and habitat use by most larger nonflying wildlife. The existing hyperbolic cooling towers (approximately 400 ft tall) may have a minor, localized impact on birds migrating through the area. Bird collisions are not monitored by Detroit Edison, but dead birds are occasionally found around the towers. Typically only a few birds are observed at any one time, but on one occasion in September 1973, 15 dead birds were found at the Fermi 2 south cooling tower. More recently, during a one-week period in October 2007, 45 dead birds were found at the Fermi 2 south cooling tower (Detroit Edison 2011a).

Noise can be a deterrent to wildlife when it is abrupt and irregular. However, some wildlife at the Fermi site apparently have adapted to constant noise. For example, songbirds, wading birds, and waterfowl have consistently been observed in the North Lagoon immediately west of the cooling towers (Detroit Edison 2011a). This area has one of the highest outdoor noise levels on the site, with measured noise levels nearest the cooling towers being between 68 and 72 A-weighted decibels (dBA) (see Section 2.10.2).

No unusual human disease vectors or pest species were listed for the Fermi site in the ER (Detroit Edison 2011a) or other documents, and none have been identified by Federal or State agencies. Mosquitoes in the area, including *Culex pipiens,* could be carriers of West Nile disease. Ticks, including American dog tick *(Dermacentor variabilis),* black legged tick *(Ixodes scapularis)*, and lone star tick *(Amblyomma americanum*), could be carriers of Lyme disease.

The emerald ash borer is a non-native beetle discovered in southeastern Michigan near Detroit in the summer of 2002. It probably arrived in the United States on solid wood packing material carried in cargo ships or airplanes originating in its native Asia (Iowa State University 2010). Because ash trees (*Fraxinus* spp.) in North America have no known resistance to the insect and many natural diseases and predators from the insect's native range are not known to occur here, the emerald ash borer is thought to have the potential to kill more than 800 million ash trees in Michigan (Poland 2007). Since 2002, it has killed more than 20 million ash trees in the core of the infested area (Poland 2007), including most of the ash trees on the Fermi site. State and Federal agencies in Michigan and researchers at Michigan State University (MSU) are working to stop the emerald ash borer from spreading (MSU 2010). Activities to prevent the spread of the borer include initiating quarantines to stop the movement of infested ash wood and wood products, researching the pest's life cycle and methods and strategies that can control or eradicate it, and developing educational and informational materials to help communities detect and deal with borer infestations (MDA 2009).

Dutch elm disease is fatal to American elms and some other elm species and first entered Michigan about 1950. The disease is caused by any of three species of fungi (*Ophiostoma ulmi, O. himal-ulmi,* or *O. novo-ulmi)* and is transmitted by bark beetles. This disease probably accounts for the lack of large American elm specimens on the site and for the remains of old, fallen specimens.

Two non-native invasive plant species were observed in emergent wetlands on the site during the 2006 and 2008–2009 surveys: common reed and purple loosestrife. The widespread common reed forms dense monocultures within wetlands and moist soils, eliminating other native wetland plants and changing wetland ecology. Although common reed as a species is native to North America, it is thought that most monocultures observed today are the result of introduced non-native Eurasian genotypes (Saltonstall 2002). At the present time, parts of both lagoons are dominated by dense and extensive stands of common reed and native cattail species. The non-native invasive purple loosestrife is present throughout most wetlands on the Fermi site. The west-side drainage corridor has virtually no open water because of the common reed, cattails, and purple loosestrife. Because these stands are so uniform, they provide a low diversity of food sources for wildlife species and hence generally minimal habitat for most species, especially waterfowl.

Other invasive non-native plant species identified on the site include reed canarygrass, European privet, and garlic mustard. Reed canarygrass can form dense stands that crowd out native vegetation, especially in wet soils. European privet was observed in forest: woodlot cover type areas. It can form dense thickets in the understory of forests. Garlic mustard shades out native forest understory plants and produces allelopathic compounds that inhibit seed germination of other species (NPS 2010c). In upland areas, common buckthorn is a dominant species in shrubland areas. Once established, it can form dense understory stands that are difficult to eliminate and crowd out native species.

2.4.1.2 Terrestrial Resources – Transmission Lines

The existing 345-kilovolt (kV) transmission system and associated corridors outside the Fermi site are exclusively owned and operated by ITC*Transmission*. Any new transmission lines built outside of the Fermi site to serve Fermi 3 would also be owned and operated by ITC*Transmission*. Detroit Edison has no control over the design or operation of transmission lines off of its plant sites. Accordingly, the description presented here of the terrestrial resources that interface with the transmission line corridors is based on publicly available information and reasonable expectations of the configurations that ITC*Transmission* would likely use based on standard industry practice. The information described in this subsection does not imply commitments were made by ITC*Transmission* or Detroit Edison, unless specifically noted.

New offsite transmission lines built to support Fermi 3 would consist of three 345-kV lines running north from the Fermi site in a single corridor extending west to the Milan Substation for a distance of about 29.4 mi. The corridor is located in portions of Monroe, Wayne, and Washtenaw Counties and is illustrated in Figure 2-5. Approximately 18.6 mi of the new lines would be installed alongside existing 345-kV lines serving Fermi 2. For a portion of this eastern 18.6-mi segment of the proposed route, reconfiguring existing conductors may allow for the use of existing transmission infrastructure without the need for building additional transmission infrastructure. The need for additional transmission towers and additional corridor width will be determined by ITC*Transmission* when it designs the system. The final western 10.8 mi of transmission lines would be built in an undeveloped segment of an existing transmission ROW that was previously authorized for transmission line use. Some transmission tower footings were installed there as part of earlier plans but were never used, and the corridor has been only minimally maintained. Most of the eastern 18.6 mi of the corridor cross agricultural land, but the undeveloped western 10.8-mi portion crosses a variety of land cover types, including forest, agricultural lands, rural residential areas, and a golf course.

To accommodate the new transmission lines, it is assumed the Milan Substation would be expanded from its current size of 350 by 500 ft to approximately 1000 by 1000 ft, which would affect lands currently occupied by maintained grasses and cropland.

Existing Cover Types and Vegetation

Major vegetation types occurring along the proposed transmission corridor for Fermi 3 are summarized in Table 2-7. Except for Lake Erie and associated coastal and shoreline habitats (coastal emergent wetland and forest: coastal shoreline), which do not exist west of the Fermi site, the plant communities found along the corridor are similar to those described for the site in Section 2.4.1.1.

The eastern 18.6 mi of the proposed corridor follows an existing transmission line corridor that crosses mostly cropland. Non-cropland areas are generally pasture, open developed space, and emergent wetlands. No forested areas are present within the corridor because normal maintenance has already removed most trees. The corridor passes through only a few small forested areas. Emergent wetlands and waters crossed by the corridor are generally narrow. As currently anticipated, none of the existing towers are located in wetlands, with the exception of one set of towers at Stony Creek (north of Stony Creek Road), where the crossing is more than 1300 ft.

The western 10.8-mi segment of the proposed transmission corridor, which does not follow previously cleared and regularly maintained corridors, crosses a mosaic of pastures and forest, including forested wetlands, shrub/scrub, cropland, and developed land (Detroit Edison 2011a). Forested and emergent wetlands are present, and three wetlands extend more than 900 ft along the corridor (Detroit Edison 2011a). It is possible that towers may need to be placed in these

Table 2-7. Vegetative Cover Types Occurring in the Proposed 29.4-mi Fermi 3 Transmission Corridor

Vegetative Cover Type	Acres in Corridor (assumes 300-ft width)	Percent of Vegetative Cover Type in Region	Acres in Region[(a)]
Open water	1.5	0.00	725,910
Developed	158.9	0.01	1,089,795
Barren land	2.8	0.03	10,346
Deciduous forest	151.5	0.05	282,046
Evergreen forest	0.2	0.00	6717
Mixed forest	0.8	0.01	5765
Shrub/scrub	5.0	0.16	3179
Grassland/herbaceous	35.1	0.08	41,308
Pasture/hay	152.2	0.07	219,241
Cultivated crops	454.8	0.04	1,217,689
Woody wetlands	93.4	0.07	128,090
Emergent herbaceous wetland	13.0	0.02	56,711
Total	**1069.2**	**0.03**[(b)]	**3,786,797**

Source: Adapted from Detroit Edison 2011a

(a) The region is defined as the area within a 50-mi radius of the Fermi site. Only the areas of vegetation cover types in the United States are presented.

(b) Calculated as 1069.2 as a percent of 3,786,797.

wetlands in order to construct crossings (Detroit Edison 2011a). The proposed Milan Substation site is located entirely in an area of cropland and planted grassland (Detroit Edison 2011a).

Wildlife

The wildlife found along the proposed new transmission line corridor is expected to be similar to that found on the Fermi site, as described in Section 2.4.1.1. The corridor lies entirely within the same ecoregion as the Fermi site, and the habitats in and along the corridor are similar to those on the Fermi site. The exceptions are that there is no lakeshore habitat along the corridor and that the transmission line corridor crosses a number of habitats that are not present on the Fermi site in significant quantities, including low-intensity development and pasture/hay. Certain birds favoring areas near surface waters, such as the bald eagle and many waterfowl species, are less likely to be found along the new transmission corridor than they are on the Fermi site because of the proximity of the Fermi site to the coastline of Lake Erie. Wildlife habitat on developed land and pasture/hay is likely to include some of the species present in grassland and shrubland, but with less diversity and with more species tolerant of disturbance.

Existing Natural and Human-Induced Ecological Effects on the Transmission Corridor

The 18.6-mi eastern segment of the proposed route crosses mostly crop and pasture land and land uses resulting from development. Corridor maintenance, including the removal of undesirable vegetation by mechanical means and herbicides, imposes stress on terrestrial resources. Other areas of the eastern segment support herbaceous plant communities; however, rural residences are common and cropland is scattered throughout the section. Disease vectors and pests along the proposed new transmission line route are expected to be the same as those on the Fermi site as described in Section 2.4.1.1.

2.4.1.3 Important Terrestrial Species and Habitats – Site and Vicinity

NUREG-1555 (NRC 2000) defines “important species” as (1) species listed or proposed for listing as threatened, endangered, candidate, or species of special concern in Part 17, Title 50 of the *Code of Federal Regulations* (50 CFR 17.11 and 17.12) by the FWS or the State in which the project is located; (2) commercially or recreationally valuable species; (3) species essential to the maintenance and survival of rare or commercially or recreationally valuable species; (4) species critical to the structure and function of local terrestrial ecosystems; or (5) species that could serve as biological indicators of effects on local terrestrial ecosystems. Several species meeting definitions (1) and (2) occur on the Fermi site and vicinity. “Important habitat” is defined by the NRC in NUREG-1555 (NRC 2000) as wildlife sanctuaries, refuges, or preserves, wetland, floodplains, and areas identified as critical habitat by the FWS. The terrestrial species and habitats deemed important by these definitions are addressed in the sections below (see Table 2-8). Section 4.3.1 describes the preconstruction and construction impacts on the terrestrial ecosystem and potential needs for mitigation.

The white-tailed deer is a recreationally important species in the vicinity of the Fermi site and is present on the Fermi site. This species is a valued game animal, but no hunting is allowed on the Fermi site. According to Detroit Edison (2011a), the mourning dove (*Zenaida macroura)* is the only upland game bird commonly observed on the Fermi property. Wild turkey and ring-necked pheasant (*Phasianus colchicus*) may be in the area, but none were observed directly or indirectly (e.g., tracks or feathers) during site evaluations between 2006 and 2008 (Detroit Edison 2011a). Canada geese and other waterfowl, including mallard ducks, are common to abundant on the Fermi site, at least during some parts of the year. Detroit Edison manages wildlife on the Fermi property in coordination with the FWS and the DRIWR.

The following discussion reflects information provided by the FWS, MDNR, the results of the detailed wildlife surveys conducted in 2008 and 2009 (Detroit Edison 2009e), and other information sources as cited.

Table 2-8. Protected Species Known or with Potential to Occur on the Fermi 3 Site

Common Name	Scientific Name	Federal Status[(a)]	State Status[(b)]
Plants			
American lotus	*Nelumbo lutea*	ESA-NL	T
Arrowhead	*Sagittaria montevidensis*	ESA-NL	T
Eastern prairie fringed orchid	*Platanthera leucophaea*	ESA-T	T
Red mulberry	*Morus rubra*	ESA-NL	T
Insects			
Karner blue butterfly	*Lycaeides melissa samuelis*	ESA-E	T
Reptiles			
Eastern fox snake	*Pantherophis gloydi*	ESA-NL	T
Birds			
Bald eagle	*Haliaeetus leucocephalus*	ESA-NL, BGEPA, MBTA	SC
Barn owl	*Tyto alba*	ESA-NL, MBTA	E
Common tern	*Sterna hirundo*	ESA-NL, MBTA	T
Mammals			
Indiana bat	*Myotis sodalis*	ESA-E	E

Sources: Detroit Edison 2009f; FWS 2009

(a) ESA-E = listed under the ESA as endangered, ESA-NL = not listed under the ESA, ESA-T = listed under the ESA as threatened, BGEPA = protected under the Bald and Golden Eagle Protection Act, MBTA = protected under the Migratory Bird Treaty Act. These birds are protected under the MBTA, but this is not an exhaustive list of species in the project area covered under the MBTA.

(b) E = endangered, SC = species of special concern, T = threatened.

Federally and State-Protected Species

Detroit Edison contacted FWS in 2007 concerning the occurrence or potential occurrence of species on or in the vicinity of the Fermi site that are protected under the Endangered Species Act of 1973 (ESA). In its initial response, FWS stated that the project occurs within the potential range of several Federally listed species, but that FWS had no records of occurrence, nor was there any designated critical habitat in the area (Detroit Edison 2010b). FWS further stated that because of the types of habitat present at the Fermi site, no further action was required under ESA. However, FWS requested that if more than six months passed before the project was initiated, FWS be contacted to ensure there had been no changes from a regulatory perspective (Detroit Edison 2011a). Furthermore, in later correspondence with the NRC (FWS 2009), FWS noted the potential for several Federally listed species to occur in Monroe, Washtenaw, and Wayne Counties. According to the FWS scoping letter (FWS 2009), three terrestrial species that are Federally listed as threatened or endangered may occur at the Fermi site: eastern prairie fringed orchid, Indiana bat, and Karner blue butterfly. Each is discussed further below.

Detroit Edison also contacted MDNR and consulted the Michigan Natural Features Inventory (MNFI) regarding the presence of known or potential occurrences of State-listed threatened and endangered animals and plants in the project area. Eight terrestrial species were identified by MDNR as occurring or being potentially present (Detroit Edison 2009f). Since that time, two species, the bald eagle and Frank's sedge, have been removed from threatened status. The bald eagle is now designated a "species of special concern," and Frank's sedge no longer has special status. Three of the species listed by the State (Indiana bat, Karner blue butterfly, and eastern fringed prairie orchid) are also listed by the FWS. Species listed by MDNR as "species of special concern" are not protected under State endangered species legislation. Terrestrial species listed as threatened by MDNR are discussed below.

In addition to the species noted by MDNR, the vegetation surveys conducted by Detroit Edison in 2000 and 2002 found red mulberry (*Morus rubra*), another plant species listed by the State as threatened (Detroit Edison 2009e). This species was not observed during the surveys conducted by Detroit Edison for the Fermi 3 project (Detroit Edison 2009e).

The bald eagle, which is protected by the Bald and Golden Eagle Protection Act of 1940 (BGEPA), has been observed on the Fermi site and in the site vicinity. The Indiana bat, Federally listed as endangered, has been sighted within the Fermi region but is not known to occur on the Fermi site (MNFI 2007b). These species are discussed further below.

<u>Bald Eagle</u>

The FWS delisted the bald eagle under ESA, effective August 8, 2007 (50 CFR Part 17). However, the species continues to receive Federal protection under the BGEPA, which prohibits the take, transport, sale, barter, trade, import and export, and possession of eagles, making it illegal for anyone to collect eagles and eagle parts, nests, or eggs without an FWS permit. It is also protected under the Migratory Bird Treaty Act (MBTA). The bald eagle also is a State-listed species of special concern. MDNR guidelines for bald eagle management follow those provided by the FWS *National Bald Eagle Management Guidelines* (FWS 2007).

Two bald eagle nests were observed on the Fermi site in May 2008; one was occupied (Detroit Edison 2011a). Both nests were located north of Fermi 2 in the large trees of the forested coastline immediately adjacent to Lake Erie. Biologists from FWS usually check the nests for young late each winter. If present, the young are banded, and blood samples are taken (Detroit Edison 2011a). As of January 2011, however, none of the previously observed bald eagle nests could be seen on the Fermi site (Detroit Edison 2012b).

As long as there is open water where they can forage, bald eagles typically remain in the region throughout the year, according to MNFI (MNFI 2007a). During Michigan winters, bald eagles are seen throughout the State. They nest mainly in the Upper Peninsula and the northern portion of the Lower Peninsula. Bald eagles reach maturity at 4 to 5 years of age. The beginning of the breeding season, from mid-February to mid-March, consists of the establishment of a territory, nest building, and mating displays. The nest is usually built in the tallest tree in the area, often a white pine (*Pinus strobus*) or dead snag. From late March to early April, one to four eggs are laid. Both male and female bald eagles participate in incubation and feeding of the chicks, which hatch around seven weeks later. In about three months, by late summer, the fledglings are ready for flight. When it is time to move for the winter, the young birds are abandoned by their parents (Gehring 2006). A 1999 survey in Michigan found 343 nests that produced 321 young throughout the State. The productivity was calculated as 96 percent, based on the number of young per successful nest (MDNR 2010).

Eastern Prairie Fringed Orchid

The eastern prairie fringed orchid (*Platanthera leucophaea*), also known as the prairie white fringed orchid, is Federally listed as threatened and State-listed as endangered. The species has not been observed on the Fermi site, but it has been reported in Monroe County as recently as 2006 (MNFI 2007c). This species has not been observed on or near the Fermi site in any vegetation studies conducted on the site since 1973. The plant is known mostly from lakeplain prairies around Saginaw Bay and western Lake Erie. No such habitat occurs on the project site or in the immediate vicinity.

Indiana Bat

The Indiana bat (*Myotis sodalis*) is Federally and State-listed as endangered. In its scoping letter, FWS (2009) identified the Indiana bat as potentially occurring in Monroe County. MDNR expressed no specific concern for the species in informal correspondence in 2007 (Detroit Edison 2009f), and, according to MNFI, there are no reported occurrences of the Indiana bat in Monroe County. The species has not been observed on the Fermi site, nor has it been reported from Monroe County, according to MNFI (MNFI 2007b). However, MNFI records indicate that the Indiana bat has been observed in counties to the north and west of Monroe County. Also, FWS identified the Indiana bat as being at least potentially present in all three counties that the anticipated transmission line route would cross (FWS 2009), including Monroe County.

The bat is distributed from the Ozarks of Oklahoma east to Tennessee and northern Florida, and north to Vermont, northern Indiana, and southern Michigan. During the winter, the bats migrate south to hibernate in caves in the Ohio Valley or more southern areas. Hibernacula have been identified in southern Indiana, southern Ohio, and western Pennsylvania, among other States. The species is found in Michigan only during late spring to early fall when it roosts in forested areas beneath loose bark of large trees or in hollow snags (MNFI 2007b). They leave their roosts to forage for insects from one hour to one-half hour before dark in or near forested areas (MNFI 2007b). Although portions of the Fermi site are forested, large live trees with loose bark that would provide roosting habitat for the Indiana bat are not common there. However, with the death of many green ash trees caused by the emerald ash borer, there are some trees that may be suitable for summer roosting habitat. Mist-net surveys for Indiana bats using FWS protocols have not been conducted on the Fermi site.

Karner Blue Butterfly

The Karner blue butterfly (*Lycaeides melissa samuelis*) is Federally listed as endangered and State-listed as threatened. It has not been seen in Monroe County since 1986, but most recent observations have been in the west-central portion of lower Michigan. Suitable habitat, which consists of openings with lupine in dry forests, does not exist on the Fermi site or in the immediate vicinity (Detroit Edison 2011a, 2009e).

American Lotus

The American lotus (*Nelumbo lutea*) is State-listed as threatened. Healthy populations of the American lotus are found in scattered areas of southern Michigan. The species is distributed from New England to Florida and west to Michigan and Texas. It occurs in shallow water, usually in marshes, quiet backwaters, and nearshore areas of large rivers and lakes. This large perennial plant grows from thick tubers, and it flowers in mid-summer. American lotus is abundant in moderately shallow areas of the South and North Lagoons and in the south canal on the Fermi site (Detroit Edison 2011a).

Arrowhead

The arrowhead (*Sagittaria montevidensis*) is State-listed as threatened. It is primarily distributed sporadically along the Mississippi River drainage, but it is reported in other areas of the eastern United States. Southeastern Michigan populations represent a northern limit of distribution for the species (MNFI 2007f). This perennial grows in wet to shallowly inundated mud flats and banks, lagoons, and estuaries. It flowers in mid to late summer and sets fruit by fall. This wetland species was not recorded on the Fermi site during the recent ecological surveys (Detroit Edison 2009e), but it is not clear if the surveys specifically looked for this species in suitable habitat. Arrowhead was observed in Monroe County as recently as 2001 (MNFI 2007f).

Barn Owl

The barn owl (*Tyto alba*) is State-listed as endangered. It is a distinctive species that uses a wide array of habitats, including agricultural lands and buildings. These birds may be found year-round if prey species (mostly small mammals) are abundant. Although reported in the region in the early 1980s (MNFI 2007d), there appear to be no recent reports of occurrence, and no observations were made during project-related studies. Preferred prey species are uncommon in the project area and nesting/roosting habitat does not occur. Accordingly, no further consideration is being given to this species as being potentially affected by Fermi 3.

Common Tern

The common tern (*Sterna hirundo*) is State-listed as threatened. The species prefers nesting on islands to avoid terrestrial predators but may be observed using gravelly shores and bars (MNFI 2007e). This bird has not been observed in Monroe County (MNFI 2007e). Accordingly, no further consideration is being given to this species as being potentially affected by Fermi 3.

Eastern Fox Snake

The eastern fox snake (*Pantherophis gloydi*) is State-listed as threatened. Primarily an open wetland species, this snake inhabits emergent wetlands along Great Lakes shorelines and associated drainages where cattails (*Typha* spp.) are common. Although primarily an open wetland species, eastern fox snakes also occupy drier habitats such as vegetated dunes and beaches, and they occasionally travel along ditches and into nearby farm fields, pastures, and woodlots. Little is known about the life history of the eastern fox snake. They are typically active from mid-April to late October, usually throughout the day except during periods of intense heat. Breeding probably occurs annually beginning at 2 to 4 years of age, with mating occurring in June or early July. The eggs are deposited in rotten stumps, mammal burrows, soft soil, or mats of decaying vegetation. Eastern fox snakes eat small rodents and amphibians, insects, and earthworms (Lee 2000). In 2007, nine occurrences were reported in Monroe County (Detroit Edison 2011a). The snake was sighted twice on the Fermi site in June 2008 (Detroit Edison 2011a). Detroit Edison records show 15 sightings on the Fermi site between 1990 and 2007. Sightings have occurred on or near roads and buildings. All undeveloped areas of the Fermi site can be considered habitat for the eastern fox snake (Detroit Edison 2010b).

Frank's Sedge

Frank's sedge (*Carex frankii*) was noted in a letter from MDNR to Detroit Edison as State-listed as threatened (Detroit Edison 2009f). However, this species was delisted in 2009 because it is more common than originally thought. Frank's sedge is no longer listed as endangered, threatened, or a species of special concern by MNFI (MNFI 2009).

Red Mulberry

Red mulberry (*Morus rubra*), which is listed by the State as threatened, was observed during the vegetation studies of the Fermi site in 2000 and 2002, but was not observed during any surveys conducted by Detroit Edison for the Fermi 3 project (Detroit Edison 2009e). Riparian floodplain is the red mulberry's preferred habitat (MNFI 2007h) and is where it was observed in earlier surveys (Detroit Edison 2009e). This environment is limited on the Fermi site to portions of the site near Swan Creek and the South Lagoon outlet to Lake Erie, both of which would not be affected by development of Fermi 3. Accordingly, no further consideration is being given to this species as being potentially affected by Fermi 3.

Important Habitats

No areas of the Fermi site are Federally designated as critical habitat for any ESA-listed species. Other important habitats present on the site are discussed below.

Wetlands

Activities involving the discharge of dredged or fill material into waters of the United States, including wetlands, typically require permit authorization from the USACE under Section 404 of the Clean Water Act (CWA). The USACE also regulates, by permit, any work or structure in, over, under and/or affecting waters of the United States, including wetlands, under Section 10 of the Rivers and Harbors Appropriation Act.

In 1984, Michigan received authorization from the Federal Government to administer Section 404 of the Federal CWA in most areas of the State. A State-administered Section 404 program must be consistent with the requirements of the CWA and associated regulations set forth in the Section 404(b)(1) guidelines. Unlike applicants in most other States, applicants in Michigan generally need to receive only a wetland permit from the MDEQ to obtain the necessary authorizations under Section 404 and State wetland permit regulations. However, the USACE retains jurisdiction over wetlands in and adjacent to navigable waters of the United States, including the Great Lakes and connecting channels. This Federal jurisdiction includes many of the wetlands at the Fermi site. Where State and Federal authorities overlap, such as at the Fermi site, separate and different permits must be obtained from the USACE and the MDEQ. Hence, for the Fermi 3 project, Detroit Edison must obtain separate and different permits from the MDEQ and the USACE for proposed regulated activities that would affect wetlands within each agency's respective jurisdiction.

In 1979, the Michigan legislature passed the Geomare-Anderson Wetlands Protection Act, 1979 PA 203, which is now Part 303, "Wetlands Protection," of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. MDEQ has adopted administrative rules that provide clarification and guidance on interpreting Part 303. Wetlands that are within 1000 ft of a Great Lake or hydrologically connected to a Great Lake, including many of the wetlands on the Fermi site, are given further protection under Part 323, "Shorelands Protection and Management," of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. This includes most wetlands on the Fermi site because the lagoons are connected to Lake Erie (Cwikiel 2003). MDEQ issued jurisdictional determination letters on November 7, 2008 (MDEQ 2008b), and March 30, 2009 (MDEQ 2009d). Detroit Edison submitted a Joint Permit Application (JPA) to MDEQ on June 17, 2011 (Detroit Edison 2011e).

MDEQ issued permit no. 10-58-0011-P to Detroit Edison on January 24, 2012 (MDEQ 2012) (Section 4.2).

The USACE wetland delineation manual (USACE 1987) and 2012 regional supplement for the northcentral and northeast region (USACE 2012) are used for the delineation of wetlands in Michigan. USACE issued a jurisdictional letter on November 9, 2010. Detroit Edison submitted a permit application for a Department of Army permit on September 9, 2011 (Detroit Edison 2011f). The USACE issued LRE-2008-00443-1-S11 public notice (USACE 2011c) to solicit comments from the public; Federal, State, and local agencies and officials; Indian Tribes; and other interested parties in order to consider and evaluate the impacts of regulated activities associated with the Fermi 3 project. The proposed activities and the comments received during the public comment period are under review and are being considered by the USACE to determine whether to issue, modify, condition, or deny a permit.

Description of Wetlands on the Fermi Site. In June 2008, a field delineation and assessment of wetlands on the Fermi site was completed. Wetland boundaries were flagged and data were collected between May 16, 2008, and June 13, 2008 (Detroit Edison 2010b). The boundaries were delineated in accordance with procedures outlined in the USACE's 1987 *Wetland Delineation Manual* (USACE 1987). The boundaries between each type of wetland were identified and flagged to facilitate a functions and values assessment. The delineated wetlands were surveyed, and acreage was calculated for each wetland. Data were collected on wetland vegetation and on primary and secondary indicators of hydrology and soils. The wetland delineation report was supplemented with vegetation community measurements for species richness and diversity and cover and wildlife observations.

Thirty-seven wetland units covering approximately 505 ac of vegetated wetlands and 98 ac of other waters of the United States were initially delineated on the Fermi site by Ducks Unlimited (Detroit Edison 2010b) for Detroit Edison. Four additional wetland units were identified during initial field inspection with State and Federal regulators, and two units (wetlands CC and DD) were combined into one for a total of 40 wetland units (Figure 2-11). Areas within the delineation boundary did not include open water areas in Lake Erie. MDEQ identified 39 units as regulated under Michigan State law; these are identified as south canal, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, AA, BB, CC and DD (considered one unit), EE, FF, GG, HH, II, JJ, KK, WW, XX, YY, and ZZ in Figure 2-11. USACE verified 30 of those wetland units as regulated under Federal law; these are identified as south canal, B, C, D, E, F, G, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, Z, AA, BB, CC and DD, EE, FF, GG, HH, and KK in Figure 2-11. Wetland A, approximately 1.9 ac in size, is not regulated by USACE or MDEQ. The most extensive wetland type on the Fermi site is palustrine emergent marsh (PEM) making up 322 ac, followed by palustrine forested (PFO) making up 167 ac, and palustrine scrub-shrub (PSS) making up 16 ac. Wetland nomenclature is according to Cowardin et al. (1979).

Figure 2-11. Wetlands Delineated on the Fermi Site (Detroit Edison 2011a)

Wetlands dominated by woody vegetation having a basal area larger than a 3-in. dbh were classified as PFO wetlands. Some herbaceous and woody vegetation with less than a 3-in. dbh may be present but contribute less than 50 percent combined of the basal area. According to the wetland delineation report (Detroit Edison 2010b), dominant vegetation in the PFO wetlands includes silver maple (*Acer saccharinum*), shellbark hickory (*Carya laciniosa*), swamp white oak (*Quercus bicolor*), American elm (*Ulmus americana*), and eastern cottonwood. The shrub layer in the PFO wetlands is dominated by American elm saplings, silky dogwood (*Cornus amomum*), and green ash saplings. Herbaceous vegetation is sparse. Common species included black raspberry (*Rubus* spp.), mayapple (*Podophyllum peltatum*), reed canary grass, poison ivy, and Virginia creeper (*Parthenocissus quinquefolia*). Because of the seasonally variable hydrology of these PFO wetlands, several of herbaceous species were plants that favor upland areas. Soils are hydric and saturated with pockets of standing water. Approximately 167 ac of wetlands were delineated as PFO and include locations marked B, D, F, G, I, L, O, P, S, T, V, X, Y, BB, GG, and KK on Figure 2-11.

Wetlands dominated by woody vegetation smaller than 3-in. dbh but greater than 3.2 ft in height were classified as PSS. PSS wetlands may have some woody plants larger than 3 in. dbh or some herbaceous vegetation that, combined, contribute less than 50 percent of ground cover. According to the wetland delineation report (Detroit Edison 2010b), common shrub species in PSS wetlands include silky dogwood, green ash, and hawthorn species (*Crataegus* spp.). PSS wetlands on the site are largely early successional woody communities located on the fringes of PFO and upland or PFO and palustrine emergent marsh (PEM) wetland habitats. Approximately 16 ac of wetland were delineated as PSS, including locations marked E, K, Q, HH, and JJ on Figure 2-11.

PEM wetlands are characterized by a predominance of the ground surface consisting of herbaceous vegetation or woody vegetation less than 3.2 ft tall without taller woody vegetation. According to the wetland delineation report (Detroit Edison 2010b), the PEM wetlands are dominated by reed canary grass, common reed, sedge species (*Carex* spp.), narrow-leaf cattail (*Typha angustifolia*), water lily (*Nymphaea* spp.), and coontail (*Ceratophyllum demersum*). Approximately 322 ac of wetlands were delineated as PEM and include locations marked south canal, A, C, J, M, N, R, U1, W, Z, AA, CC, DD, EE, FF, II, WW, XX, YY, and ZZ on Figure 2-11. Wetlands delineated as PEM span a range of periodically inundated wet meadows to deep-water marsh systems. Because of the well-developed stands of invasive plants, including common reed and reed canary grass, vegetation diversity is relatively low in most of the PEM wetlands. There is significant buildup of plant duff in the PEM wetlands, primarily from extensive stands of common reed.

Open water habitat is characterized by inundation to a depth of more than 4 ft with no emergent vegetation present. Several open water habitats are located within the delineation boundary, including Lake Erie, Swan Creek, the Quarry Lakes, and features marked by the wetland delineation as H1, H2, and U2. There are more than 100 ac of open water habitat within the site (Figure 2-11).

Wetland Functions and Values at the Fermi Site. The functions and values of the wetlands on the Fermi site were evaluated by Ducks Unlimited for Detroit Edison (Detroit Edison 2010b) by using the USACE Highway Methodology (USACE 1999). Thirteen functions and values are considered when this method is used to evaluate wetlands; these are groundwater recharge/discharge, flood-flow alteration, fish habitat, sediment/toxicant retention, nutrient removal, production export, sediment/shoreline stabilization, wildlife habitat, recreation, educational/scientific value, uniqueness/heritage, visual quality/aesthetics, and endangered species habitat.

With the exception of a few wetlands upgradient of berms or roads, the majority of wetland communities at the Fermi site are hydrologically connected and thus, for the purposes of the functional assessment, are considered one wetland system. Separate functional assessments were, however, completed for woody (PFO and PSS) and nonwoody (PEM) wetland communities. The principal functions of the wetlands include flood-flow alteration, sediment/toxicant retention, nutrient removal, and fish and wildlife habitat. Additional functions and values of this wetland system, though not considered principal functions, are production export, sediment/shoreline stabilization, uniqueness/heritage, and endangered species habitat. The wetland system was not considered well-suited for groundwater recharge/discharge, recreation, educational/scientific value, or visual quality/aesthetics (Detroit Edison 2009c). The principal functions of the wetland system are discussed further below:

- **Flood-flow alteration, sediment/toxicant retention, and nutrient removal.** The Fermi site's wetland complex is large relative to its watershed, is relatively flat with storage potential, and contains hydric soils and dense vegetation suitable for absorbing and slowing water flow. The wetland system can therefore be expected to be highly suitable for reducing flood damage by retaining and gradually releasing floodwater following precipitation events (Detroit Edison 2011a). Fermi 2, including cooling towers and control centers, is next to the wetland system. In the event of a large storm that resulted in flood-flow from the watershed and excess water backing in from Lake Erie, the wetland system could slow and detain floodwaters for gradual release. The wetland system is also highly suitable for trapping sediments, toxicants, and pathogens as well as for nutrient retention. There are potential sources of excess sediment, chemicals, and nutrients upstream in the agriculturally dominated watershed and directly from roads, parking areas, and other impervious surfaces of the Fermi site. The EPA cites the Monroe County portion of the Ottawa-Stony watershed as being impaired by excessive nutrient levels (EPA 2010a). There is, therefore, the opportunity for sediment trapping and nutrient uptake in diffuse, slow-moving, and deepwater areas of the Fermi site wetlands that are edged or interspersed with dense herbaceous and woody vegetation.

- **Fish and wildlife habitat.** Deeper water emergent wetlands of the Fermi wetland system provide suitable fish habitat. There is an abundance of cover objects, and the wetland is large and part of a larger, persistent, contiguous water course with slow velocity. The wetlands have sufficient size and depth to retain open water areas during the winter. Direct observations of fish species were made in the wetland (Detroit Edison 2011a). The diverse wetland communities present across the entire wetland system provide suitable habitat for diverse wildlife species. Although notable direct and indirect disturbance has occurred in all wetlands on the site, significant abundance and diversity in habitat cover remain to support wildlife. However, the quality of the habitat is compromised in areas dominated by non-native invasive plant species such as common reed. With the exception of the buildings and roadways associated with the nuclear plant, the landscape is largely undeveloped, with relatively large parcels of vegetated wetlands and uplands. The majority of the wetlands evaluated are connected hydrologically despite being overlaid or crossed by multiple roadways. The wetland system presents an interspersion of open water areas with dense emergent vegetation grading into shrub-dominated and tree-dominated communities. Some portions of the wetlands have a high degree of diversity in vegetation structure and species. The CWA status report for the Monroe County portion of the Ottawa-Stony watershed cites loss of aquatic life benefits as the most common impairment of water bodies in the watershed (EPA 2010a).

Detroit River International Wildlife Refuge (DRIWR)

Detroit Edison entered into a cooperative agreement with FWS on September 25, 2003 (Detroit Edison 2009a), placing some undeveloped portions of the Fermi site under management by the DRIWR. Lands on the Fermi site managed by the DRIWR constitute the DRIWR Lagoona Beach Unit (see Figure 2-12). The four areas of the DRIWR Lagoona Beach Unit contain areas of all the terrestrial habitats of the Fermi site, as described in Section 2.4.1.1, with the exception of the “developed” habitat type. The habitat types covering the greatest area of the DRIWR Lagoona Beach Unit are coastal emergent wetland, lowland hardwood forest, and woodlot forest.

The general public does not have access to this land without the permission of FWS and Detroit Edison because all areas are within the outer fenced area of the facility. The agreement can be cancelled by either party at any time (Detroit Edison 2009a).

Transmission Line Corridor Prairie Planting

FWS, ITC*Transmission*, and Detroit Edison cooperatively funded the restoration and planting of a 29-ac prairie area in the transmission corridor on the Fermi site along the north side of the existing facility approach road (Detroit Edison 2011a). The restoration began in 2005 and was completed in 2006. The area is described earlier in Section 2.4.1.1 as a grassland: right-of-way community and is illustrated in Figure 2-10.

Figure 2-12. Boundaries of the Detroit River International Wildlife Refuge, Lagoona Beach Unit, Monroe County, Michigan (Detroit Edison 2011a)

2.4.1.4 Important Terrestrial Species and Habitats – Transmission Lines

Important Species

Important species potentially occurring along the proposed offsite transmission line corridor include many of the important species potentially occurring at the Fermi site, as described in Section 2.4.1.3. However, some species known to be present at the Fermi site may not occur along the corridor route, considering its location further inland from Lake Erie. Field surveys of the corridor route have not yet been conducted to confirm the presence of any species. All Federally and State-listed terrestrial species that occur in the counties to be crossed by the proposed transmission line are identified in Table 2-9.

FWS (2009) identified several terrestrial species that are listed under the ESA or candidates for listing that could occur in the area of the proposed offsite transmission line corridor, some of which are not known to occur at the Fermi site. Species identified as potentially present in Monroe County are the Indiana bat, Karner blue butterfly, and eastern prairie fringed orchid. For Wayne County, the species identified are the Indiana bat and eastern prairie fringed orchid. For Washtenaw County, the species identified are the Indiana bat, Mitchell's satyr butterfly, and eastern prairie fringed orchid. FWS also noted that the eastern massasauga, a candidate species, may be present in Washtenaw and Wayne Counties.

Prior to installation of the offsite transmission line, FWS and MDNR would need to review detailed information on the transmission line corridor. The agencies may, at that time, require surveys of the proposed transmission line corridor for the presence of important species and habitat. A recreationally important species present in the vicinity of the proposed transmission line corridor is the white-tailed deer. This species is an important game animal. Transmission line corridors can provide habitat for the white-tailed deer and may be used for hunting. After installation of the transmission line, operation and maintenance of the corridor are unlikely to affect the white-tailed deer population in the project area.

Important Habitats

Within the Fermi site, the proposed transmission line route crosses the DRIWR. Outside the Fermi site, with the exception of wetlands, no important habitat features are known to occur along the estimated corridor (Detroit Edison 2011a). The corridor crosses about 30 wetlands or

Table 2-9. Federally and State-Listed Terrestrial Species That Have Been Observed in Monroe, Washtenaw, and Wayne Counties and May Occur within the Transmission Line Corridor

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Plants			
American chestnut	*Castanea dentata*	NL	E
American lotus	*Nelumbo lutea*	NL	T
Arrowhead	*Sagittaria montevidensis*	NL	T
Bald-rush	*Rhynchospora scirpoides*	NL	T
Beak grass	*Diarrhena obovata*	NL	T
Blue-eyed-grass	*Sisyrinchium hastile*	NL	Presumed extirpated
Bog bluegrass	*Poa paludigena*	NL	T
Canadian burnet	*Sanguisorba canadensis*	NL	E
Canadian milk vetch	*Astragalus canadensis*	NL	T
Compass plant	*Silphium laciniatum*	NL	T
Corn salad	*Valerianella umbilicata*	NL	T
Cup plant	*Silphium perfoliatum*	NL	T
Downy gentian	*Gentiana puberulenta*	NL	E
Downy sunflower	*Helianthus mollis*	NL	T
Edible valerian	*Valeriana edulis* var. *ciliata*	NL	T
False hop sedge	*Carex lupuliformis*	NL	T
Few-flowered nut rush	*Scleria pauciflora*	NL	E
Fire pink	*Silene virginica*	NL	E
Forked aster	*Aster furcatus*	NL	T
Gattinger’s gerardia	*Agalinis gattingeri*	NL	E
Ginseng	*Panax quinquefolius*	NL	T
Goldenseal	*Hydrastis canadensis*	NL	T
Hairy mountain mint	*Pycnanthemum pilosum*	NL	T
Hairy wild petunia	*Ruellia humilis*	NL	T
Jacob’s ladder	*Polemonium reptans*	NL	T
Least pinweed	*Lechea minor*	NL	Presumed extirpated
Leggett’s pinweed	*Lechea pulchella*	NL	T
Leiberg’s panic grass	*Dichanthelium leibergii*	NL	T
Lesser ladies’-tresses	*Spiranthes ovalis*	NL	T
Low-forked chickweed	*Paronychia fastigiata*	NL	Presumed extirpated
Mat muhly	*Muhlenbergia richardsonis*	NL	T
Nodding mandarin	*Prosartes maculata*	NL	Presumed extirpated
Northern bayberry	*Myrica pensylvanica*	NL	T
Orange- or yellow-fringed orchid	*Platanthera ciliaris*	NL	E
Plains blazing star	*Liatris squarrosa*	NL	Presumed extirpated
Prairie buttercup	*Ranunculus rhomboideus*	NL	T

Table 2-9. (contd)

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Prairie trillium	*Trillium recurvatum*	NL	T
Prairie white-fringed orchid	*Platanthera leucophaea*	T	E
Pumpkin ash	*Fraxinus profunda*	NL	T
Purple coneflower	*Echinacea purpurea*	NL	Presumed extirpated
Purple milkweed	*Asclepias purpurascens*	NL	T
Purple turtlehead	*Chelone obliqua*	NL	E
Raven's-foot sedge	*Carex crus-corvi*	NL	E
Red mulberry	*Morus rubra*	NL	T
Rosepink	*Sabatia angularis*	NL	T
Rosinweed	*Silphium integrifolium*	NL	T
Round-fruited St. John's-wort	*Hypericum sphaerocarpum*	NL	E
Sand cinquefoil	*Potentilla paradoxa*	NL	T
Sedge	*Carex seorsa*	NL	T
Short-fruited rush	*Juncus brachycarpus*	NL	T
Showy orchis	*Galearis spectabilis*	NL	T
Side-oats grama grass	*Bouteloua curtipendula*	NL	E
Smooth rose-mallow	*Hibiscus laevis*	NL	Presumed extirpated
Spike rush	*Eleocharis radicans*	NL	Presumed extirpated
Spike-rush	*Eleocharis geniculata*	NL	Presumed extirpated
Stiff gentian	*Gentianella quinquefolia*	NL	T
Sullivant's milkweed	*Asclepias sullivantii*	NL	T
Swamp candles	*Lysimachia hybrida*	NL	Presumed extirpated
Swamp or black cottonwood	*Populus heterophylla*	NL	E
Tall green milkweed	*Asclepias hirtella*	NL	T
Three-awned grass	*Aristida longespica*	NL	T
Tinted spurge	*Euphorbia commutata*	NL	T
Toadshade	*Trillium sessile*	NL	T
Umbrella-grass	*Fuirena pumila*	NL	T
Upland boneset	*Eupatorium sessilifolium*	NL	T
Vasey's rush	*Juncus vaseyi*	NL	T
Violet wood sorrel	*Oxalis violacea*	NL	Presumed extirpated
Virginia flax	*Linum virginianum*	NL	T
Virginia snakeroot	*Aristolochia serpentaria*	NL	T
Virginia water-horehound	*Lycopus virginicus*	NL	T
Water willow	*Justicia americana*	NL	T
Western mugwort	*Artemisia ludoviciana*	NL	T
White gentian	*Gentiana flavida*	NL	E
White lady slipper	*Cypripedium candidum*	NL	T
Whorled pogonia	*Isotria verticillata*	NL	T

Table 2-9. (contd)

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Wild hyacinth	*Camassia scilloides*	NL	T
Wild rice	*Zizania aquatica* var. *aquatica*	NL	T
Winged monkey flower	*Mimulus alatus*	NL	Presumed extirpated
Wisteria	*Wisteria frutescens*	NL	T
Woodland lettuce	*Lactuca floridana*	NL	T
Insects			T
American burying beetle	*Nicrophorus americanus*	E	Presumed extirpated
Dukes' skipper	*Euphyes dukesi*	NL	T
Frosted elfin	*Incisalia irus*		T
Karner blue butterfly	*Lycaeides melissa samuelis*	E	T
Mitchell's satyr butterfly	*Neonympha mitchellii mitchellii*	E	E
Poweshiek skipperling	*Oarisma poweshiek*	NL	T
Regal fritillary	*Speyeria idalia*	NL	E
Silphium borer moth	*Papaipema silphii*	NL	T
Amphibians			
Blanchard's cricket frog	*Acris crepitans blanchardi*	NL	T
Smallmouth salamander	*Ambystoma texanum*	NL	E
Reptiles			
Eastern fox snake	*Pantherophis gloydi*	NL	T
Eastern massasauga	*Sistrurus catenatus catenatus*	C	Special concern
Kirtland's snake	*Clonophis kirtlandii*	NL	E
Spotted turtle	*Clemmys guttata*	NL	T
Birds			
Barn owl	*Tyto alba*	NL	E
Cerulean warbler	*Dendroica cerulea*	NL	T
Common moorhen	*Gallinula chloropus*	NL	T
Common tern	*Sterna hirundo*	NL	T
Forster's tern	*Sterna forsteri*	NL	T
Henslow's sparrow	*Ammodramus henslowii*	NL	E
King rail	*Rallus elegans*	NL	E
Least bittern	*Ixobrychus exilis*	NL	T
Louisiana waterthrush	*Seiurus motacilla*	NL	T

Table 2-9. (contd)

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Peregrine falcon	*Falco peregrinus*	NL	E
Prairie warbler	*Dendroica discolor*	NL	E
Red-shouldered hawk	*Buteo lineatus*	NL	T
Mammals			
Indiana bat	*Myotis sodalis*	E	E
Least shrew	*Cryptotis parva*	NL	T

Source: MNFI 2010
(a) C = candidate for listing, E = endangered, NL = not listed, T = threatened.

other waters, according to FWS National Wetland Inventory (NWI) mapping (FWS 2010b), that may be regulated by the USACE and/or MDEQ. The undeveloped western 10.8-mi segment of the corridor crosses eight wetlands and nine drainages or narrow streams. The majority of the wetlands in this undeveloped segment are 100 to 400 ft wide where, but three wetlands are much wider, at 1302 ft, 903 ft, and 1339 ft (Detroit Edison 2011a). Since the upper limit of spans between transmission structures is typically 900 ft, it is anticipated that development of this undeveloped segment of corridor might require the placement of one tower or pole in each of these wetlands. The wetlands include woody and emergent herbaceous community types. The 18.6-mi existing eastern section of the corridor crosses two wetlands and 12 narrow drains or small streams. The existing lines span all of these wetlands, with the exception of a 1386-ft-long wetland crossing at Stony Creek, where one set of towers is currently located in wetland.

Terrestrial Monitoring

Detroit Edison has stated that other than the biological studies performed by Detroit Edison and described above, no formal monitoring of the terrestrial environment has been conducted or is planned on the Fermi site or along the proposed transmission line corridor (Detroit Edison 2011a). The only recent study, besides the 2008-2009 vegetation and wildlife surveys discussed above, is that of the onsite transmission line corridor prairie planting that was surveyed for plant species occurrences in 2005 and 2007 (Detroit Edison 2011a). FWS, ITC*Transmission*, and Detroit Edison cooperatively funded the restoration and planting of this 29-ac prairie area in the onsite transmission line corridor along the north side of the existing facility approach road (Fermi Drive). The restoration was begun in 2005 and completed in 2006 (Detroit Edison 2011).

2.4.2 Aquatic Ecology

This section describes the aquatic environment and aquatic biota in the vicinity of the Fermi site and other areas that could be affected by the building, operation, or maintenance of the proposed Fermi 3.

The Fermi site is located on 1260 ac of developed and undeveloped land on the shoreline of the western basin of Lake Erie between Swan Creek and Stony Creek (Figure 2-1). Approximately 656 ac of this land (called the Lagoona Beach Unit) is managed as part of the DRIWR. As in many areas bordering the Great Lakes, coastal freshwater marshes are common in the vicinity of the Fermi site. These freshwater marshes play a pivotal role in the aquatic ecosystem of the Great Lakes, including storing and cycling nutrients and organic material from the land into the aquatic food web (Bouchard 2007). Most of the fish species in the Great Lakes depend on freshwater marshes during at least some portion of their life cycles (Wei et al. 2004). Freshwater marshes associated with the Great Lakes typically contain aspects of both riverine and lacustrine (standing water) habitats, are usually found in the vicinity of river mouths, and are influenced by both the level of the adjacent lake and riverine inflows. The Fermi site is located near the mouth of Swan Creek, which borders the site to the north, and it is surrounded by coastal freshwater marsh habitat. The largest water body near the site is Lake Erie, which borders the site to the east. Lake Erie would serve as the source of cooling water for Fermi 3 and would receive discharge water from Fermi 3.

2.4.2.1 Aquatic Resources – Site and Vicinity

The aquatic resources on the Fermi site and vicinity occur in a variety of natural and constructed freshwater habitats (Figure 2-6). The discussion of aquatic resources present within the potentially affected area is divided among the prominent surface water features associated with the site, including:

- Circulating water reservoir
- Overflow and discharge canals
- Drainage ditches
- Quarry Lakes
- Wetland ponds and marshes managed as part of the DRIWR
- Swan Creek
- Stony Creek
- Lake Erie.

Circulating Water Reservoir (cooling water pond, circulation pond)

The circulating water reservoir, a component of the heat dissipation system associated with the operation of Fermi 2, provides the cooling water for the circulating water system. The circulating water reservoir is located east of the Fermi 2 cooling towers in the northern portion of the developed part of the Fermi site (Figure 2-6). This man-made reservoir encompasses an area of approximately 5 ac, is approximately 20 ft deep, and is clay-lined. Although the circulating water reservoir is periodically treated with chemicals to inhibit excessive growth of vegetation and the production of aquatic organisms, some benthic organisms and aquatic vegetation do occur in the reservoir. Overall, the habitat provided by the circulating water reservoir is not suitable for supporting significant populations of aquatic species.

Overflow and Discharge Canals

One clay-lined canal, approximately 5 to 10 ft deep and 70 ft wide, originates in the central portion of the Fermi site (along the western edge of the developed portion of the site) and extends northward, where it connects with Swan Creek after passing through a marshy area known as the North Lagoon. This constructed canal is referred to as the overflow canal or the north canal (Figure 2-6). The overflow canal was historically used as a cooling water discharge and overflow canal for operation of Fermi 1 but ceased being used when Fermi 1 was temporarily shut down in the mid 1960s. The overflow canal is hydraulically connected to the wetlands to the west and provides the hydraulic connection between Lake Erie and the wetland area. Currently, the Fermi site uses the overflow canal as a permitted wastewater discharge (Outfall 009; Figure 2-6). The outfall and discharge points of the Fermi site are further discussed in Section 2.3.3. Thirty fish species were captured in the overflow canal during surveys conducted in 2008; the most abundant species were bluegill (*Lepomis macrochirus*), pumpkinseed (*L. gibbosus*), emerald shiner (*Notropis atherinoides*), and gizzard shad (*Dorosoma cepedianum*) (AECOM 2009b).

A second man-made canal, referred to as the discharge canal or the south canal, originates in the central portion of the Fermi site and extends southward, where it flows into the South Lagoon (Figure 2-6). This canal is approximately 5 to 10 ft deep and 70 ft wide and serves as the hydraulic connection between Lake Erie and the wetland areas located west of the developed portion of the Fermi site. Twenty-eight fish species were collected in the discharge canal during surveys conducted in 2008; the most abundant species were goldfish (*Carrasius auratus*), common carp (*Cyprinus carpio*), bluegill, pumpkinseed, and golden shiner (*Notemigonus crysoleucas*) (AECOM 2009b).

There is a third small water body located between the overflow and discharge canals. This man-made feature, referred to as the central canal, is stagnant and has no connections to the overflow canal or the discharge canal (Figure 2-6). Thirteen fish species were collected in the central canal during surveys conducted in 2008; the most abundant species were bluegill, gizzard shad, largemouth bass (*Micropterus salmoides*), white crappie (*Pomoxis annularis*), green sunfish (*L. cyanellus*), and bluntnose minnow (*Pimephales notatus*) (AECOM 2009b).

Drainage Ditches

Several ditches located throughout the Fermi site drain surface water runoff to Swan Creek and the nearby wetlands. The drainage ditches are regularly maintained and equipped with concrete culverts to divert runoff from the surface roads. The drainage ditches are periodically dry, and the habitat provided by the ditches is not suitable for supporting significant populations of aquatic species.

Quarry Lakes

The North and South Quarry Lakes are located in the southwestern portion of the Fermi site. The two lakes are approximately 50 ft deep and, in total, cover an area of approximately 100 ac. The quarry lakes were created when water filled abandoned rock quarries that were used for site development and for construction of Fermi 2 (Detroit Edison 1977).

The Quarry Lakes support a limited variety of aquatic species common to Lake Erie coastal marsh habitats. Nine fish species were collected in the Quarry Lakes during surveys conducted in 2008; the most abundant species were bluegill, gizzard shad, green sunfish, goldfish, and common carp (AECOM 2009b).

Wetland Ponds and Marshes Managed as Part of the DRIWR

The acreage managed as part of the DRIWR surrounds the developed portion of the Fermi site on the northern, western, and southern borders. This area encompasses approximately 656 ac that includes coastal wetlands and palustrine wetlands, such as freshwater emergent wetlands and small lakes that are semipermanently or seasonally inundated. These types of coastal wetlands are essential to many aquatic species because of the spawning, nursery, and feeding grounds they provide (Kellys Island Birds and Natural History 2006).

A fisheries survey of coastal marshes managed as part of the DRIWR was conducted in September 2005 as a joint venture by the MDNR and FWS to document fish communities associated with Michigan waters of Lake Erie and to inventory the fishery resources of the refuge. This survey used electrofishing and seining to sample four marsh complexes within the refuge, one of which was the Swan Creek Estuary located near the northern extent of the Fermi site. A total of 38 species of fish from 13 families were collected at this sampling site. Species most common in the catch included gizzard shad, bluntnose minnow, mimic shiner (*Notropis volucellus*), bluegill, pumpkinseed, goldfish, and largemouth bass. Thirty-three fish species were collected during fishery surveys conducted near the mouth of Swan Creek in 2008. The most abundant species in those collections were gizzard shad, emerald shiner, bluegill, brook silverside (*Labidesthes sicculus*), pumpkinseed, and golden shiner (AECOM 2009b).

Swan Creek

Swan Creek is located on the northern boundary of the Fermi site. It originates approximately 12 mi to the northwest of the Fermi site as small streams and then flows south and east, where it enters Lake Erie. Land use adjacent to the Swan Creek drainage includes small residential communities and agricultural development.

Swan Creek forms a freshwater estuary where it flows into Lake Erie. The aquatic habitat in this area is shallow, with large stands of submerged aquatic vegetation. Many areas along the shoreline support water lilies, cattails, common reed, and other emergent vegetation (Francis and Boase 2007; AECOM 2009b). The benthic habitat associated with this area of Swan Creek consists of sandy sediment interspersed with small pockets of gravel and flat stone (AECOM 2009b).

Benthic macroinvertebrates were collected during eight sampling events from July 2008 through June 2009 near the location where water from the North Lagoon area enters Swan Creek (AECOM 2009b). These collections were dominated by aquatic worms (*Haplotaxida,* 31 percent), small crustaceans (*Amphipoda,* 23 percent), and midge larvae (*Diptera,* 19 percent), among others (AECOM 2009b).

A fisheries survey of the Swan Creek estuary was conducted in September 2005 by the MDNR and FWS using electrofishing and seining to sample nine sites along Swan Creek ranging from approximately 0.5 to 2.5 mi from the Fermi site (Francis and Boase 2007). A total of 38 species from 13 families were collected at these sampling sites. Frequently encountered species included gizzard shad, bluntnose minnow, emerald shiner, mimic shiner, bluegill, pumpkinseed, goldfish, and largemouth bass (Francis and Boase 2007).

Fish were also collected from Swan Creek monthly from July 2008 to June 2009 (excluding winter months) near the location where water from the North Lagoon area enters Swan Creek (AECOM 2009b). Overall, the fish species encountered during these surveys were similar to those observed in the survey by Francis and Boase (2007) described above. A total of 1790 fish (33 species), were represented in the samples; dominant species included gizzard shad, emerald shiner, bluegill, brook silverside, and pumpkinseed (AECOM 2009b).

Swan Creek is popular with recreational anglers. Recreational fisheries data, discussed in Section 2.4.2.3, identify several species common to Michigan as being frequent catches in Swan Creek, including smallmouth bass (*Micropterus dolomieu*), largemouth bass, and bluegill.

Stony Creek

Stony Creek is located generally to the west of the Fermi site in Washtenaw and Monroe Counties, Michigan, and drains directly into the western basin of Lake Erie at a location approximately 3 mi southwest of the Fermi site boundary. Stony Creek is about 35 mi long. Land cover within the watershed includes forested areas, agricultural lands, and residential developments (Gustavson and Ohren 2005).

Some biological data were collected from Stony Creek and its tributaries. The Stony Creek Watershed Project performed studies focusing on water quality, nutrients, and indicator species, although the majority of the data from these studies were not collected near the Fermi site. A macroinvertebrate survey was conducted in 2004 at several sampling sites along Stony Creek to assess water quality. The nearest sampling site was located approximately 2.5 mi south-southwest of the Fermi site. Data on various hydrological parameters were collected in addition to the macroinvertebrate samples. Results from the survey indicated an increase in the number of insect families with respect to previous studies of Stony Creek. There was also an abundance and diversity of mayflies (*Ephemeroptera*), stoneflies (*Plecoptera*), and caddisflies (*Trichoptera*), which are three orders of insects that are considered sensitive to poor water quality. Together, the abundance of taxa in these three orders are used to calculate the "EPT index," (*Ephemeroptera-Plecoptera-Trichoptera* index) a measure of water quality, with a higher number of taxa from each of these orders generally indicating better water quality. The downstream sites (located nearest to the Fermi site) had a higher EPT index than did the upstream survey sites (Gustavson and Ohren 2005).

Fish surveys conducted in portions of Stony Creek located in Monroe County during 1997 indicated that the fish community in Stony Creek was dominated by taxa that are tolerant of degraded water quality conditions, although the fish community was rated as acceptable (MDEQ 1998). Dominant species found to be present included green sunfish, rock bass, (*Ambloplites rupestris*), common carp, and blackside darter (*Percina maculata*) (MDEQ 1998).

Lake Erie

The Fermi site is situated along the shoreline of Lake Erie. Lake Erie would serve as the source of cooling water for Fermi 3 and would also receive cooling water discharge from Fermi 3. Consequently, aquatic habitats and organisms in Lake Erie in the vicinity of the Fermi site have the greatest potential for being affected by building and operation of Fermi 3. This section describes the ecological setting and recent ecological history of Lake Erie, with a focus on the vicinity of the Fermi site.

Lake Erie is one of the five lakes included in the Great Lakes system and is the smallest of the group in volume (116 mi^3). Measuring 241 mi across and 57 mi from north to south, Lake Erie has a surface area of nearly 10,000 mi^2, with 871 mi of shoreline. The average depth of Lake Erie is approximately 62 ft (210 ft at its maximum depth) (EPA 2008).

Lake Erie is divided into three basins on the basis of the bathymetry of the lake: eastern basin, central basin, and western basin. Because the Fermi site is located on the shoreline of the western basin, this portion of Lake Erie is of the greatest concern with regard to construction and operation of Fermi 3. The western basin receives 95 percent of the water that drains into Lake Erie, including five major river drainages (Maumee River, River Raisin, Huron River, and Detroit River) as well numerous smaller streams that discharge directly into the western basin. Depth generally increases from west to east in Lake Erie. The western basin is the shallowest basin in the lake, averaging approximately 24 ft in depth (LaMP Work Group 2008). While thermal stratification is a frequent and persistent condition during summer months for the central basin, stratification events are relatively rare and brief in the western basin (LaMP Work Group 2008; Bolsenga and Herdendorf 1993). As a consequence, the western basin is less likely to experience severe or prolonged episodes of oxygen depletion in deeper waters, which can result in large mortality events for aquatic species that are physiologically restricted to cooler water conditions.

Water levels in Lake Erie fluctuate in response to seasonal precipitation variations. The most significant lake-level variations are observed at the western and eastern basins of the lake. During prolonged high southwesterly winds, Lake Erie is subject to surges when water from the western basin is pushed to the eastern basin, resulting in surges greater than 7 ft. Lake Erie also experiences seiches in response to such surges. A seiche is a periodic oscillation of the water level set in motion by an atmospheric disturbance passing over the lake. Major shifts in winds, a significant storm front, or strong high- or low-pressure weather systems can initiate a seiche event. Seiche events can cause shoreline flooding in low-lying areas of the eastern basin and can cause shallow bay areas of the western basin to become exposed (LaMP Work Group 2008).

The drainage basin of Lake Erie includes portions of Indiana, Michigan, Ohio, Pennsylvania, New York, and Ontario and is the most densely populated of the five Great Lakes basins (LaMP Work Group 2008). The fertile soils associated with the Lake Erie watershed support intense agricultural production throughout the entire drainage basin. Greater urbanization, industrialization, and agricultural development, along with the smaller volume of water, make the Lake Erie ecosystem more susceptible to external stressors than the ecosystems of the other Great Lakes. This became apparent by the 1960s, when decades of nutrient enrichment (eutrophication) and chemical contamination resulted in severe degradation of the Lake Erie ecosystem. By the 1980s, positive recovery of Lake Erie's water quality was observed as a result of the implementation of remediation plans through the NPDES that helped meet targets for nutrient levels (especially phosphorus) established under the Great Lakes Water Quality Agreement (LaMP Work Group 2008). In addition to pollution abatement programs, colonization of Lake Erie by invasive zebra mussels (*Driessena polymorpha*) and quagga mussels (*D. rostriformi)* during this same period helped return the lake to more mesotrophic (i.e., less nutrient-rich) conditions.

There are indications, however, that total phosphorus concentrations in Lake Erie waters have again started to increase over the past decade; this trend has been hypothesized to be related to changes in lakewide nutrient dynamics and more frequent storm events (LaMP Work Group 2008). Coincident with (and perhaps attributable to) these increasing dissolved phosphorus loads, there have been increases in blooms of some undesirable algal taxa (e.g., *Cladophora* spp. and *Microcystis spp.*). In recent years, *Lyngbya wollei*, an invasive filamentous cyanobacterial (blue-green algae) species, has become a nuisance in some areas of the western basin, such as Maumee Bay (approximately 18 mi south-southeast of the Fermi site), that continue to experience higher levels of nutrient enrichment via riverine inputs (LaMP Work Group 2008).

The following sections summarize information for major ecological groups of aquatic organisms, including plankton, benthic invertebrates, and fish, that are present in the waters of Lake Erie.

Plankton

Plankton are very small aquatic organisms that drift in the water column and are unable to move or are too small or too weak to swim against water currents. Plankton serve as the base of the aquatic food chain in Lake Erie, providing food for larger aquatic organisms. The plant-like portion of the plankton community is called phytoplankton, and the animal-like portion is called zooplankton. Most phytoplankton serve as food for zooplankton, which is directly eaten by many species of fish (at least during early fish life stages). Zooplankton include animals that spend their entire lives in the plankton community (holoplankton) and the larval forms of many species of invertebrates and fish that are planktonic during early life stages. Fish eggs, larvae, and juveniles, called ichthyoplankton, also make up an important part of the overall zooplankton community.

Phytoplankton studies conducted in the 1980s and 1990s in nearshore waters of the western basin of Lake Erie demonstrated that phytoplankton biomass fluctuates seasonally, with the highest overall phytoplankton densities occurring in the spring. Phytoplankton density also varies spatially throughout the western basin, with increased phytoplankton abundance along the entire southern shore and decreased abundance offshore and throughout deeper waters. The types of phytoplankton typically documented in greatest abundance during those earlier studies were diatoms (*Bacillariophyceae*) and green algae (*Chlorophyceae*). Millie et al. (2009) found that the phytoplankton community in the western basin during the late summer from 2003 to 2005 was dominated by various species of green algae, diatoms, and cyanobacteria (blue-green algae).

Periodically, there can be a rapid increase in the population of particular species of planktonic algae that results in unusually high densities. Such events are referred to as algal blooms. Sometimes algal blooms can discolor water or produce other undesirable conditions. Decomposition of dead cells from algal blooms (regardless of the species involved) can sometimes lower the concentration of dissolved oxygen in the water, causing hypoxic (low oxygen) or anoxic (no oxygen) conditions that can result in fish kills. Of particular concern in Lake Erie is *Microcystis* spp., a phytoplanktonic species of blue-green alga that can produce a substance (microcystin) that is toxic to fish and other organisms when concentrations are high enough (EPA 2009b). Under certain conditions (such as high nutrient concentrations, increased light levels, and calm weather, usually in summer), *Microcystis* spp. can form dense aggregations of cells that form a thick layer (mat) on the surface of the water. At higher concentrations, *Microcystis* spp. blooms can resemble bright green paint. *Mycrocystis* spp. blooms can affect water quality as well as the health of human and natural resources. NOAA has been conducting research in Lake Erie to develop methods to identify the presence of cyanobacterial blooms from satellite imagery and to determine the factors controlling production of toxins associated with *Microcystis* spp. blooms (NOAA 2012). Results of this research indicate that cyanobacterial blooms tend to occur primarily in the southwestern portion of the western basin, especially in the vicinity of Maumee Bay, during summer months (NOAA 2012).

Dominant zooplankton taxa in Lake Erie include various species of species of crustaceans such as copepods (e.g., *Cyclops* spp. and *Diaptomus* spp.), cladocerans (e.g., *Daphnia* spp., *Bosmina* spp., and *Leptodora* spp.), and rotifers (e.g., *Keratella* spp. and *Asplanchna* spp.), as well as other taxonomic groups. The very small early life stages of some fish species can be planktonic (Bolsenga and Herdendorf 1993). Zooplankton populations are typically lowest during winter months and most abundant during summer months (Bolsenga and Herdendorf 1993). Two species of zooplankton, the spiny water flea (*Bythotrephes* spp.) and the fishhook water flea (*Cercopagis pengoi*), are considered invasive species throughout Lake Erie, and are discussed further in Section 2.4.2.3.

Because plankton responds quickly to changes in nutrient inputs, phytoplankton and zooplankton are important indicators of nutrient pollution. One measure that has been developed to assess the biological health and diversity of offshore waters of Lake Erie is the Planktonic Index of Biotic Integrity (P-IBI) (Kane et al. 2009). This indicator, which is based on the abundance and number of different species groups of phytoplankton and zooplankton present in water samples, is used to evaluate the productivity level of the lake. Plankton productivity in formerly oligotrophic lakes is related to the anthropogenic introduction of phosphorus into lake waters from point sources (e.g., permitted discharge sites) or nonpoint sources (e.g., surface water runoff). Low productivity (oligotrophic condition) is associated with low phosphorus enrichment, moderate productivity (mesotrophic condition) is associated with moderate phosphorus levels, and high productivity (eutrophic condition) is associated with high phosphorus levels. Application of the P-IBI to the waters of the western basin of Lake Erie suggests that the overall condition of the western basin was mesotrophic during 1995 and became more eutrophic during the period from 2000 to 2003 (EPA 2009c).

Benthic Invertebrates

Benthic species inhabit the bottom of aquatic environments and serve as valuable indicators of the surrounding ecosystem. Benthic species include epifauna, which live on substrate surfaces, and infauna, which burrow into bottom sediments. Benthic communities consist of many different types of organisms and many different species. Examples of benthic invertebrates present in Lake Erie include mollusks (i.e., snails, mussels, and clams), various insect species (such as midges, mosquitoes, mayflies, stoneflies), and worms. The distribution and density of benthic organisms can be quite variable and are especially affected by the type of substrate (e.g., mud, sand, gravel, or cobble) and the water conditions present at a particular location. As are plankton, benthic organisms are an important link in the aquatic food chain, and the presence, absence, and abundance of some species or species groups can serve as indicators of local water conditions.

Benthic invertebrates were sampled by the applicant from two locations in Lake Erie just offshore from the Fermi site during 2008 and 2009 (AECOM 2009b) to determine those species that could be present in areas potentially affected by building and operating Fermi 3. One site (Lake Erie intake), located in water approximately 3–5 ft deep near the existing cooling water intake for Fermi 2 and the proposed intake location for Fermi 3, had a substrate that consisted of mud and sand. The benthic organisms collected at this site consisted primarily of various species of amphipods (62 percent of the organisms collected), dipterans (fly and midge larvae; 18 percent), and tubificid worms (10 percent) (AECOM 2009b). The second site, located in water approximately 1–4 ft deep at the southern end of the Fermi site near the South Lagoon, had a rocky substrate. Dominant taxa collected from this site included various species of ephemeropterans (mayflies; 19 percent), amphipods (18 percent), dipterans (14 percent), tubificid worms (13 percent), molluscs (13 percent), and water mites (11 percent) (AECOM 2009b).

There are four families of bivalve mollusks that live in the streams and lakes of Michigan: freshwater unionid mussels (*Unionidae*), fingernail and pea clams (*Sphaeriidae*), Asian clams (*Corbiculidae*), and zebra and quagga mussels (*Dreissenidae*). Unionid mussels and sphaeriid clams are native to North America, while Asian clams and zebra and quagga mussels are not native to this continent. The Asian clam (*Corbicula fluminea*) was introduced to North America in 1938 as a food species and has since spread throughout the United States. The Asian clam is present in Lake Erie. Pea clams and fingernail clams are fairly widespread and common in Michigan. Unionid mussels are of particular interest because of their unique life history, importance to aquatic ecosystems, and use as indicators of change in water and habitat quality. They have also undergone significant declines in range and abundance over the past century.

Federally and State-listed threatened and endangered unionid mussels for Monroe County, Michigan, are identified in Section 2.4.2.3.

Unionid mussels require a fish host to complete their life cycle, whereas other bivalve families produce free-swimming larvae that develop into the adult form without a host. Eggs of unionid mussels are fertilized and develop into larvae within the gills of the female mussel. These larvae, called glochidia, are released into the water and must attach to the gills or fins of a suitable fish or amphibian host to survive and transform into the adult form. Glochidia are very small (approximately 0.1 mm in length) and do not significantly harm their hosts. Some unionids are known to have only one or two suitable host species, while others are generalists and use several fish species as hosts. Without the presence of healthy fish host populations, unionid mussels are unable to reproduce.

Although they were once widely distributed and common in the western basin of Lake Erie, declines in the abundance of unionid mussels have been documented since 1961 (Schloesser and Nalepa 1994). Although earlier declines were largely attributable to declines in water quality, the introduction and subsequent proliferation of zebra and quagga mussels in the late 1980s is believed to have been a primary factor in the large declines in (i.e., near extirpation of) unionid mussel populations in a large portion of western Lake Erie between 1989 and 1991 (Schloesser and Nalepa 1994).

Lake Erie was one of the first water bodies to be colonized by zebra mussels and quagga mussels in the late 1980s. Believed to have been introduced in ballast water of ocean-going vessels entering the Great Lakes, these non-native, invasive mussels have caused extensive economic and environmental impacts on Lake Erie as well as many other freshwater systems in the United States. Many power plants, including Fermi 2, have implemented control programs specifically to address these species, which can accumulate on intake and discharge structures, potentially affecting the efficiency of cooling water operations. Populations of native mussel species have also been affected by the introduction and proliferation of zebra and quagga mussels (USGS 2008; Schloesser and Nalepa 1994). Invasive nuisance species, including zebra and quagga mussels, are further discussed in Section 2.4.2.3.

Fish

Human activities have resulted in considerable changes in the nature of the Lake Erie fish community during the past century. These changes have resulted from many causes, including overfishing, introduction and expansion of invasive exotic species, nutrient enrichment (and reversal of nutrient enrichment), deterioration of tributaries and other habitat features, and introduction of contaminants (Regier and Hartman 1973).

Van Meter and Troutman (1970) listed 138 species of fish documented to occur in Lake Erie or its tributaries. Since then, additional non-native fish species have been introduced into Lake

Erie, including ghost shiner (*Notropis buchanani*) and round goby (*Neogobius melanostomus*). Prior to 1900, lake trout (*Salvelinus namaycush*) was the dominant predator in the eastern basin of Lake Erie, with walleye (*Sander vitreus*) and burbot (*Lota lota*) as subdominants. Before 1950, the dominant predatory fish species in the western and central basins included walleye and blue pike (*S. vitreus glaucus*). The forage fish community in the western and central basins was dominated by emerald shiner, spottail shiner (*Notropis hudsonius*), and gizzard shad. In the eastern basin, the prey fish community was dominated by cisco (formerly called lake herring, *Coregonus artedi*). Changes in the structure of the fish community began to occur in the early 1900s, and fish community structure was very different by 1960 (Tyson et al. 2009). These changes were primarily attributed to invasions of fish such as sea lamprey (*Petromyzon marinus*), alewife (*Alosa pseudoharengus*), and rainbow smelt (*Osmerus mordax*); over-exploitation of important species, including the extinction of the blue pike; and declines in water quality and habitat degradation in nearshore areas and tributaries (Tyson et al. 2009). By the 1980s, Lake Erie's water quality started to improve as a result of reductions in nutrient inputs caused by remediation programs and a result of the colonization of Lake Erie by invasive zebra mussels and quagga mussels. These changes in the nutrient status of the lake, together with additional invasions by non-native species such as the round goby, have resulted in further changes in the structure of the fish community.

The western basin contains important fish spawning and nursery areas and is also important to commercial and recreational fisheries. Although movements of fish among basins make it difficult to explicitly define a fish community by basin, examples of dominant fish species in the western basin include yellow perch (*Perca flavescens*), walleye, smallmouth bass, channel catfish (*Ictalurus punctatus*), alewife, gizzard shad, carp, freshwater drum (*Aplodinotus grunniens*), and emerald shiner.

The USGS has conducted assessments of fish populations throughout the western basin of Lake Erie for a number of years to estimate density and biomass of key forage and predator species in Michigan and Ontario waters. These data are maintained in an interagency database that is used to assess seasonal and spatial distributions of fishes and year class strength of key forage and predator species. Based upon sampling conducted in the western basin during 2011 (Kocovsky et al. 2012), populations of several ecologically and economically important native fish species remained low in abundance or appeared to be declining in numbers compared to previous years. There was an indication of recent increases in the abundance of walleye and freshwater drum, but both of these species, as well as yellow perch, remained at depressed levels of abundance. Alewife, an introduced species that is an important prey species in Lake Erie, has drastically declined in abundance and was not captured during surveys for the fourth consecutive year (Kocovsky et al. 2012). Most of the 15 species examined had poor or moderate year classes in 2011; only gizzard shad, freshwater drum, and rainbow smelt had catch levels above the 8-year mean. Yearling-and-older silver chub (*Machrybopsis storeriana*) increased in abundance compared to 2010, and remains much more abundant than in the 1990s (Kocovsky et al. 2012).

Fish were collected monthly from July 2008 to June 2009 (excluding winter months) at two sampling locations in Lake Erie just offshore from the Fermi site (AECOM 2009b) to determine those species that could be present in areas potentially affected by building and operating Fermi 3. The intake location was near the existing cooling water bay for Fermi 2 and the proposed intake location for Fermi 3, while the other sampling location was along the Lake Erie shoreline near the South Lagoon. The two locations differed in the types of aquatic habitat that were present and had comparatively different species richness and abundance. The intake location was located along a sand and gravel beach in the open waters of Lake Erie and had little or no structure that would provide cover or spawning features. The South Lagoon location was near sand and gravel shoreline areas as well as vegetated shoreline areas that could provide cover and spawning areas for some fish species. In addition, the South Lagoon location was near the mouth of the drainage area for the South Lagoon, which has extensive aquatic vegetation; fish within that drainage can move freely from the lagoon out into the main body of the lake.

Overall, 5765 individual fish, composed of 40 species, were collected from the two Lake Erie sampling locations (Table 2-10). The most abundant species encountered in those collections were gizzard shad, goldfish, white perch (*Morone americana*), emerald shiner, spottail shiner, and bigmouth buffalo (*Ictiobus cyprinellus*) (Table 2-9) (AECOM 2009b).

Additional data on fish from the waters of Lake Erie near the Fermi site are provided in entrainment and impingement study results.

The rates at which fish eggs and fish larvae were entrained by the existing cooling water intake of Fermi 2 were measured from July 2008 through July 2009, excluding the months of December through February when ice cover was present and it was anticipated that spawning by fish would be at minimum levels (AECOM 2009b). Entrainment rates (fish eggs plus larvae per unit volume of water) ranged from $4.82/m^3$ in July 2009 to $0.00/m^3$ in November 2008 and March 2009. The average annual entrainment rate for all species collected from July 2008 through July 2009 was $0.98/m^3$. Of the 12 fish species identified in entrainment samples, the species with the highest annual entrainment rates included gizzard shad, emerald shiner, bluntnose minnow, and yellow perch (AECOM 2009b). Overall estimates of the total numbers of fish eggs and larvae entrained during the study period, calculated by multiplying monthly entrainment estimates by the volume of water drawn into the cooling system during each period, are presented in Table 2-11.

In general, fish species entrained during the 2008–2009 study (AECOM 2009b) were similar to those captured during a previous entrainment study (Lawler, Matusky, and Skelly Engineers 1993) conducted at the Fermi site from October 1991 to September 1992. The most

Table 2-10. Percent Abundance of Fish Species Collected in Lake Erie near the Fermi Site during 2008 and 2009[(a)]

Common Name	Scientific Name	Intake Location	South Lagoon	Overall
Alewife	*Alosa pseudoharengus*	0.1	0.0	<0.1
Banded killifish	*Fundulus diaphanus*	0.5	0.5	0.4
Bigmouth buffalo	*Ictiobus cyprinellus*	2.7	4.8	4.1
Black bullhead	*Ameiurus melas*	0.0	2.9	1.9
Bluegill	*Lepomis macrochirus*	0.6	0.9	0.8
Bluntnose minnow	*Pimephales notatus*	0.3	5.5	3.8
Bowfin	*Amia calva*	0.0	0.1	0.1
Brook silverside	*Labidesthes sicculus*	0.0	2.6	1.7
Brown bullhead	*Ameiurus nebulosus*	0.0	0.3	<0.1
Channel catfish	*Ictalurus punctatus*	0.4	0.3	0.1
Common carp	*Cyprinus carpio*	0.5	5.6	3.8
Common shiner	*Luxilus cornutus*	0.0	0.3	<0.1
Emerald shiner	*Notropis atherinoides*	6.8	13.6	11.3
Freshwater drum	*Aplodinotus grunniens*	0.0	0.1	0.1
Gizzard shad	*Dorosoma cepedianum*	44.9	15.8	25.4
Golden redhorse	*Moxostoma erythrurum*	0.0	0.1	0.1
Golden shiner	*Notemigonus crysoleucas*	0.0	2.2	1.4
Goldfish	*Carassius auratus*	4.0	28.0	19.7
Green sunfish	*Lepomis cyanellus*	0.0	0.2	0.2
Largemouth bass	*Micropterus salmoides*	0.1	2.5	1.7
Longnose gar	*Lepisosteus osseus*	0.2	0.0	0.1
Logperch	*Percina caprodes*	0.0	0.5	<0.1
Longear sunfish	*Lepomis megalotis*	0.0	0.2	<0.1
Northern pike	*Esox lucius*	0.0	0.3	0.2
Pumpkinseed	*Lepomis gibbosus*	0.0	3.2	2.1
Quillback	*Carpiodes cyprinus*	0.1	0.7	0.5
Rock bass	*Ambloplites rupestris*	0.3	0.4	0.3
Round goby	*Neogobius melanostomus*	0.0	0.6	0.4
Sand shiner	*Notropis stramineus*	0.3	0.2	0.2
Smallmouth bass	*Micropterus dolomieu*	0.0	0.3	<0.1
Spotfin shiner	*Cyprinella spiloptera*	0.8	1.9	1.5
Spottail shiner	*Notropis hudsonius*	5.8	3.2	4.1
Spotted gar	*Lepisosteus oculatus*	0.0	0.3	<0.1

Table 2-10. (contd)

Common Name	Scientific Name	Intake Location	South Lagoon	Overall
Spotted sucker	*Minytrema melanops*	0.0	0.3	<0.1
Tadpole madtom	*Noturus gyrinus*	0.0	0.5	<0.1
Western mosquitofish	*Gambusia affinis*	0.0	0.3	<0.1
White perch	*Morone americana*	33.5	1.9	12.4
White sucker	*Catostomus commersoni*	0.3	0.2	0.2
Yellow bullhead	*Ameiurus natalis*	0.0	0.3	0.0
Yellow perch	*Perca flavescens*	0.0	1.8	1.2

Source: AECOM 2009b
(a) Percent of the individuals collected at site location.

abundant larval fish taxa entrained during the earlier study included Cyprinids (22.9 percent), *Morone* spp. (20.0 percent), gizzard shad (19.5 percent), Clupeids (8.8 percent), and white perch (6.2 percent); the taxa for which fish eggs were most abundant in entrainment samples included Cyprinidae (42.1 percent of eggs) and Percidae (22.4 percent of eggs).

Impingement data collected from 1991 to 1992 from the Fermi 2 intake indicated that the dominant species impinged was the gizzard shad, which accounted for 71.5 percent of the estimated total number of individual fish impinged during the study period. White perch was the second most abundant species impinged (6.8 percent of the estimated total). Third, fourth, and fifth species ranked by the estimated number of individuals affected were the rock bass, freshwater drum, and emerald shiner, respectively. Estimated numbers of fish impinged (by species) in 2008–2009 from Fermi 2 are presented in Table 2-12. During that period, gizzard shad accounted for approximately 39 percent, emerald shiner accounted for approximately 29 percent, and white perch accounted for approximately 10 percent of the total estimated numbers of fish impinged at the plant (AECOM 2009b). Overall, it is estimated that 3102 individual fish were impinged by the Fermi 2 cooling water intake during the 2008–2009 sampling period (Table 2-12). Most of the fish species identified in impingement samples are considered forage species for other fishes. On the basis of an analysis conducted by the Lake Erie Forage Task Group (2010), it is estimated that the long-term average density of forage fish in size classes capable of being captured in nets and trawls is approximately 1,384,680 fish per square mile in the western basin. Assuming an estimate of approximately 1200 mi^2 for the western basin as a whole, the long-term average number of forage fish within the basin is estimated to be approximately 1.7 billion.

2.4.2.2 Aquatic Habitats – Transmission Lines

Aquatic habitats within or adjacent to the transmission line corridor that would serve Fermi 3 and are identified in the ER (Detroit Edison 2011a) include several small streams and numerous

Table 2-11. Estimated Numbers of Fish Eggs and Larvae Entrained by the Fermi 2 Cooling Water Intake from July 2008 through July 2009[a]

	2008					2009					
Common Name	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Annual Total[b]**
Gizzard shad	62,048							1,452,781	1,191,501	27,531,802	30,238,132
Emerald shiner	1,054,814	1,897,015					109,500	2,994,507	911,148	3,933,115	10,900,099
Bluntnose minnow		72,962					15,643	4,892,017	560,707		5,541,329
Yellow perch							140,786	4,121,154	560,707		4,822,647
Unidentified spp.				4,298,465							4,298,465
Freshwater drum										2,317,728	2,317,728
Round goby	62,048	510,735	141,109					770,863	210,265	70,234	1,765,254
Bigmouth buffalo								1,274,889	420,530		1,695,419
Channel catfish	434,335										434,335
Largemouth bass							62,571	88,946			151,517
Sunfish sp.								148,243			148,243
White perch	124,096										124,096
Unknown centrarchidae									70,088		70,088
Brook silverside								59,297			59,297
Total	**1,737,341**	**2,480,712**	**141,109**	**4,298,465**	**0**	**0**	**328,500**	**15,802,697**	**3,924,946**	**33,852,879**	**62,566,649**

Source: AECOM 2009b

(a) Based on measured entrainment rates and actual operational flow volume reported by Detroit Edison from July 2008 through July 2009.

(b) Annual estimate does not include data from December through February. The numbers of eggs and larvae are expected to be low during these months because it is outside the normal spawning period for most Lake Erie fish species.

Table 2-12. Estimated Numbers of Fish Impinged by the Fermi 2 Cooling Water Intake from August 2008 through July 2009[(a)]

	2008					2009							Annual	% of
Common Name	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr[(b)]**	**May**	**Jun**	**Jul**	**Total**	**Total**
Gizzard shad			62	150	930	62							1204	38.8
Emerald shiner	31	30	31		62	93	84	558					889	28.7
White perch	62	30	31	30	31		28	93					305	9.8
Bluegill					31	31	28	124					214	6.9
Round goby	31	30				31				31			123	4.0
Smallmouth bass	31							31					62	2.0
Spottail shiner										31		31	62	2.0
Banded killifish			31										31	1.0
Brook silverside	31												31	1.0
Largemouth bass			31										31	1.0
Bluntnose minnow		30											30	1.0
Channel catfish		30											30	1.0
Freshwater drum											30		30	1.0
Green sunfish		30											30	1.0
Rock bass		30											30	1.0
Total	**186**	**210**	**186**	**180**	**1054**	**217**	**140**	**806**		**62**	**30**	**31**	**3102**	**100.0**

Source: AECOM 2009b

(a) Based on measured impingement rates and actual operational flow volume reported by Detroit Edison from August 2008 through July 2009.

(b) Annual estimate does not include data from April 2009 because heavy debris prevented sample collection.

small drainage ditches. The new transmission line corridor does not cross any lakes, ponds, or reservoirs. Stony Creek, which is located in the developed eastern portion of the assumed route, is the largest stream crossed by the transmission line corridor and is described in Section 2.4.2.1.

Because of the small size of the streams and ditches present along the presumed transmission line path, detailed information regarding the aquatic species present in most of these water bodies is not readily available. Because of the small size of the drainages and because of the intermittent nature of flows in these surface water features, it is assumed that species diversity is similar to or less than that described for Stony Creek in Section 2.4.2.1. There are no important commercial or recreational fisheries present within the assumed 300-ft ROW as a result of the small sizes of the drainages present.

2.4.2.3 Important Aquatic Species and Habitats – Site and Vicinity

Several criteria (see Section 2.4.1.3) identify important species that may be affected by building, operating, or maintaining a new facility. Aquatic species meeting these criteria include commercially or recreationally important fishery species, species considered to have vital roles in ecosystem dynamics, and Federally or State-listed species. On the basis of these criteria, 37 species that inhabit the freshwater habitats near the Fermi site were identified as important species (Table 2-13).

Brief summaries of distribution and life history information for important species are also provided; these summaries were developed from information provided by NatureServe (2009) unless otherwise indicated. Where applicable, information about impingement and entrainment during Fermi 2 operations is presented for each species based on recently collected impingement and entrainment data for the Fermi site (AECOM 2009b).

The National Marine Fisheries Service (NMFS) has advised that it considers fishery resources within Lake Erie as non-NMFS trust resources and consultation with NMFS regarding essential fish habitat pursuant to the Magnusson-Stevens Fishery Conservation and Management Act is not required for Fermi 3. This is the case even for those species that would be considered NMFS trust resources if found in the ocean, an estuary, or a river with tidal connections (e.g., rainbow smelt, alewife, Atlantic salmon). This is because fish that are land-locked in Lake Erie are not to be considered a component of the marine or estuarine ecosystem, could not serve as prey for a Federally managed species, or could not in any way contribute to the marine fisheries under NMFS jurisdiction (Johnson 2012).

Table 2-13. Important Aquatic Species That Have Been Observed in the Vicinity of the Fermi Site[(a)]

Common Name	Scientific Name	Category[(b)]
Mollusks		
Elktoe	*Alismidonta marginata*	ESA-NL, MI-SC
Northern riffleshell	*Epioblasma torulosa rangiana*	ESA-E, MI-T
Purple lilliput	*Toxolasma lividus*	ESA-NL, MI-T
Purple wartyback	*Cyclonaias tuberculata*	ESA-NL, MI-T
Rayed bean	*Villosa fabalis*	ESA-E, MI-E
Round hickorynut	*Obovaria subrotunda*	ESA-NL, MI-T
Round pigtoe	*Pleurobema sintoxia*	ESA-NL, MI-SC
Salamander mussel	*Simpsonaias ambigua*	ESA-NL, MI-T
Slippershell	*Alismidonta viridis*	ESA-NL, MI-T
Snuffbox mussel	*Epioblasma triquetra*	ESA-E, MI-E
Wavyrayed lampmussel	*Lampsilis fasciola*	ESA-NL, MI-T
White catspaw	*Epioblasma obliquata perobliqua*	ESA-E, MI (presumed extirpated in Michigan)
Fish		
Bigmouth buffalo	*Ictiobus cyprinellus*	Commercial fishery
Brindled madtom	*Noturus miurus*	ESA-NL, MI-SC
Channel catfish	*Ictalurus punctatus*	Commercial fishery, recreational fishery
Channel darter	*Percina copelandi*	ESA-NL, MI-E
Common carp	*Cyprinus carpio*	Commercial fishery
Creek chubsucker	*Erimyzon claviformis*	ESA-NL, MI-E
Eastern sand darter	*Ammocrypta pellucida*	ESA-NL, MI-T
Freshwater drum	*Aplodinotus grunniens*	Commercial fishery
Gizzard shad	*Dorosoma cepedianum*	Commercial fishery
Goldfish	*Carassius auratus*	Commercial fishery
Lake whitefish	*Coregonus clupeaformis*	Commercial fishery
Largemouth bass	*Micropterus salmoides*	Recreational fishery
Orangethroat darter	*Etheostoma spectabile*	ESA-NL, MI-SC
Pugnose minnow	*Opsopoedus emiliae*	ESA-NL, MI-E
Quillback	*Carpiodes cyprinus*	Commercial fishery
River darter	*Percina shumardi*	ESA-NL, MI-E
Sauger	*Sander canadensis*	ESA-NL, MI-T
Silver chub	*Macrhybopsis storeriana*	ESA-NL, MI-SC
Silver shiner	*Notropis photogenis*	ESA-NL, MI-E
Smallmouth bass	*Micropterus dolomieu*	Recreational fishery
Southern redbelly dace	*Phoxinus erythrogaster*	ESA-NL, MI-E
Walleye	*Sander vitreus*	Commercial fishery, recreational fishery
White bass	*Morone chrysops*	Commercial fishery, recreational fishery
White perch	*Morone americana*	Commercial fishery
Yellow perch	*Perca flavescens*	Commercial fishery; recreational fishery

(a) Commercial and recreationally important species and Federally and State-listed species that could occur in the waters of the western basin of Lake Erie near the Fermi site and freshwater habitats of Monroe County, Michigan.
(b) ESA-E = listed under ESA as endangered, ESA-NL = not listed under ESA, MI-E = listed by the State as endangered, MI-SC = listed by the State as a species of concern, MI-T = listed by the State as threatened.

Commercially Important Species

While other waters in the vicinity of the Fermi site do not support commercial fisheries, Lake Erie supports one of the largest freshwater commercial fisheries in the world, with the majority of commercial fishing occurring along the Canadian border. Commercial landings in Lake Erie are dominated by yellow perch, walleye, rainbow smelt (*Osmerus mordax*), and white bass (*Morone chrysops*). In the western basin of Lake Erie, management of commercial fisheries falls under the jurisdiction of the MDNR, the Ohio Department of Natural Resources (ODNR), or Ontario Ministry of Natural Resources, depending upon where the fishing occurs. The Great Lakes Fisheries Commission coordinates fisheries research and facilitates cooperative fishery management among the State, Provincial, Tribal, and Federal agencies that manage fishery resources within the Great Lakes and has established a Lake Erie Committee that considers issues pertinent to Lake Erie waters.

Commercial harvest in the Michigan waters of Lake Erie for 2007 (the year for which the most recent report is available) was conducted by using shoreline seining and trap-net fishing gear. Overall, 13 species of fish were included in the harvest, for a total of 1,058,253 lb with an estimated value of $398,251 (Thomas and Haas 2008). Total weight of the 2007 commercial harvest was the highest since 1985 (Thomas and Haas 2008). As shown in Table 2-14, the commercial catch was dominated by five species that accounted for over 80 percent of the total

Table 2-14. Commercial Fishery Statistics for Michigan Waters of Lake Erie during 2007

Species	Harvest (lb)	% of Total Harvest	Reported Market Value	% of Total Value
Gizzard shad	242,695	22.9	$63,445	15.9
Common carp	241,066	22.8	$64,290	16.1
Bigmouth buffalo	215,632	20.4	$93,126	23.4
Channel catfish	98,979	9.4	$40,340	10.1
White bass	77,249	7.3	$64,113	16.1
Freshwater drum	67,072	6.3	$10,935	2.7
Goldfish	38,515	3.6	$26,278	6.6
White perch	35,946	3.4	$18,199	4.6
Lake whitefish	8800	0.8	$8540	2.1
Other species[(a)]	32,299	3.1	$8985	2.3
Total	1,058,253	100	$398,251	100

Source: Thomas and Haas 2008
(a) Other species included bullheads, suckers, quillback, and chub.

harvest by weight: gizzard shad (23 percent), carp (23 percent), bigmouth buffalo (20 percent), channel catfish (9 percent), and white bass (7 percent) (Thomas and Haas 2008). Other species harvested include freshwater drum, goldfish, white perch, and lake whitefish (*Coregonus clupeaformis*).

Commercial harvest in the Ohio waters of Lake Erie (western, central, and eastern basins combined) for 2009 was conducted by using trap-net, seining, and trotline fishing gear. Overall, 14 species (or species groups) of fish were included in the reported harvest, for a total of more than 5 million pounds with an estimated value of more than $4 million (ODNR 2010). Total weight of the 2009 commercial harvest was the highest reported in the past 10 years (ODNR 2010). Of these totals, the commercial harvest in the Ohio waters of the western basin of Lake Erie for 2009 was composed of 12 species of fish and totaled almost 2.3 million lb (Table 2-15).

Table 2-15. Commercial Fishery Statistics for Ohio Waters of the Western Basin of Lake Erie during 2009

Species	Harvest (lb)	% of Total Harvest
White bass	593,626	25.9
White perch	535,367	23.4
Freshwater drum	321,629	14.0
Lake whitefish	287,278	12.5
Channel catfish	200,839	8.8
Quillback	162,486	7.1
Bigmouth buffalo	111,881	4.9
Common carp	41,547	1.8
Suckers	27,209	1.2
Bullhead	3998	0.2
Goldfish	1694	0.1
Gizzard shad	1686	0.1
Total	2,289,240	100

Source: ODNR 2010

The catch was dominated by five species, which accounted for approximately 75 percent of the total catch by weight: white bass, white perch, freshwater drum, lake whitefish, and channel catfish (Table 2-15). Although yellow perch has historically been a significant component of the commercial fishery in the Ohio waters of the western basin, this area was closed to commercial yellow perch harvest in 2008 and 2009.

Additional information about the distribution and life history for commercially important species that could be present in Lake Erie in the vicinity of the Fermi site is summarized below.

Bigmouth Buffalo (*Ictiobus cyprinellus*)

The bigmouth buffalo is fairly common throughout North America from the Mississippi River Basin stretching from Louisiana to Ohio, to southern Michigan, Wisconsin, Minnesota, North Dakota, Montana, the lower Great Lakes Basin, the Hudson Bay Basin (Nelson River drainage) and Saskatchewan. This species makes up a portion of the commercial fishery in the western basin of Lake Erie.

The preferred habitat for bigmouth buffalo consists of the main channels, pools, and backwaters of small to large sluggish rivers, oxbows, bayous, reservoirs, and lakes. The bigmouth buffalo is tolerant of low oxygen levels and high temperatures. These fish prefer to spawn after spring floods, doing so in flooded marshes and river bottoms or in tributary streams. Both juvenile and adult members of this species rely mainly on planktonic and bottom dwelling invertebrates as food sources.

It is estimated that approximately 1.7 million bigmouth buffalo eggs and larvae were entrained at the Fermi site during 2008, primarily during the months of May and June (AECOM 2009b; Table 2-11). No bigmouth buffalo juveniles or adults were observed during impingement studies conducted at the Fermi site during 2008 and 2009 (AECOM 2009b).

Channel Catfish (*Ictalurus punctatus*)

Channel catfish occur mostly in the central drainages of North America, from southern Canada to northern Mexico. This species has been widely distributed throughout the United States as well as other countries. Channel catfish prefer clean, well-oxygenated water of rivers and streams but also inhabit ponds and lakes. They occur in locations ranging from clear, rapid-flowing waters over firm bottoms to turbid, slow-moving water over mud substrates.

Channel catfish have been known to migrate hundreds of miles throughout their lifetime. They generally spawn between April and July, and females lay up to 20,000 eggs in nests dug in sandy substrates. Males then guard and fan water across the nest during the 3- to 8-day incubation period. Larval development lasts about 2 weeks, and schools of larvae may persist for weeks after leaving the nest. Sexual maturity is reached anywhere from 2 to 8 years, and adults may reach over 130 cm and live up to 16 years.

Juvenile channel catfish eat mainly small invertebrates and insects and prey increasingly on crayfish and fishes as they grow. Adults eat mainly fish but will also feed on insects, small mammals, and vegetation.

The potentially large size and food quality of channel catfish make it a highly sought-after sport fish, and this species also has a significant commercial value in Lake St. Clair and Lake Erie. It was estimated that approximately 435,000 channel catfish eggs and larvae were entrained and 30 individual fish were impinged by the Fermi 2 cooling water intake during studies conducted in 2008 and 2009 (Tables 2-11 and 2-12).

Common Carp (*Cyprinus carpio*)

The common carp is native to temperate Eurasia, where it has been domesticated and bred for human food for several centuries. Common carp were first introduced into the United States around 1872, and the species was subsequently stocked throughout the United States. Carp are now found in every State except Hawaii and Alaska, in five Canadian provinces, and on every continent except Antarctica.

This species is typically found in rivers, lakes, ponds, reservoirs, swamps, or low-salinity estuaries, usually in shallow water with abundant vegetation and little or no current. The species is tolerant of a wide range of oxygen, salinity, turbidity, and bottom conditions. Common carp usually spawn in shallows and flooded areas, although deeper water may also be used. Eggs are dispersed and stick to submerged objects. Fry remain attached to the vegetation for about 2 days before dropping to the bottom, and inhabit shallow, warm, and slow-moving water during their first summer.

Common carp are omnivorous, and adults eat primarily invertebrates, detritus, fish eggs, and plant material. Fry feed on zooplankton but will also eat phytoplankton if zooplankton densities are low.

Common carp make up a relatively large portion of the commercial fishery within the western basin of Lake Erie, as described above. No common carp were identified in impingement or entrainment samples collected at the Fermi site during 2008 and 2009 (AECOM 2009b).

Freshwater Drum (*Aplodinotus grunniens*)

The freshwater drum occurs throughout North and Central America. The species ranges from the St. Lawrence, Great Lakes, Hudson Bay, and Mississippi River Basins, Gulf Coast drainages, south through eastern Mexico and down to Guatemala.

Freshwater drum occur in a variety of habitats but are usually found in large, silty lakes and large rivers. They generally occur over mud bottoms in open water. Freshwater drum spawn from spring to late summer as water temperatures reach 51–72°F. They broadcast eggs in shallow water, which float on the surface and hatch in about 1 day. Males generally reach sexual maturity in 2 to 4 years, while females take 4 to 6 years. Maximum life expectancy for this species is 10 years. Juvenile drum feed primarily on small crustaceans and insect larvae.

Adults are mostly benthic foragers, and prey items include insect larvae, crustaceans, fishes, and mollusks such as clams and snails.

Freshwater drum are harvested commercially in Lake Erie, although there is not a significant recreational fishery for this species. It is estimated that approximately 2.3 million freshwater drum eggs and larvae were entrained by the Fermi 2 cooling water intake during a study conducted in 2008 and 2009; entrainment was observed only in July 2009 (AECOM 2009b; Table 2-11). Approximately 30 individual freshwater drum were impinged during studies conducted at the Fermi 2 cooling water intake in 2008 and 2009 (AECOM 2009b; Table 2-12).

Gizzard Shad (*Dorosoma cepedianum*)

The gizzard shad is distributed widely in the continental United States from Utah and Arizona eastward to the Atlantic seaboard. This species occurs throughout the Great Lakes region within both the United States and Canada and is common within the western basin of Lake Erie.

As an adult, the gizzard shad can reach 9 to 14 in. in length and can weigh up to 2 lb. This fish can thrive in a wide variety of habitats, including large rivers, reservoirs, lakes, swamps, bays, sloughs, and similar quiet open waters. Young and juveniles live in relatively clear and shallow waters, while adult gizzard shad tend to stay in deeper waters or near the bottom. Although gizzard shad are capable of withstanding temperatures from approximately 43°F to 91°F, they are very sensitive to cold water temperatures, and large numbers are often found dead in the spring when the ice melts off of reservoirs and lakes.

Female gizzard shad can produce as many as 500,000 eggs, which are spawned by scattering them over sandy or rocky substrates. The eggs adhere to objects on the bottom until hatching 2 to 4 days later. Sexual maturity is generally reached in 2 to 3 years. Their lifespan is approximately 4 to 6 years, although a few individuals survive beyond 3 years of age. Because of the large numbers of eggs produced, gizzard shad populations are often capable of rebounding quickly following overwinter die-offs.

Juvenile gizzard shad are planktivores, feeding on both zooplankton and phytoplankton. Adults are primarily bottom filter-feeding detritivores, mostly eating plants and animals that live attached to hard substrates such as sand and rocks.

Gizzard shad often travel in large schools, and young gizzard shad are ecologically significant because they serve as prey for many species of commercially and recreationally important fish. Because of their rapid growth rates, many individuals are too large to be eaten by most other fish by the end of their first year of life. Recreational anglers commonly use gizzard shad as a bait fish, and the species makes up a substantial portion of the commercial harvest in the Michigan waters of Lake Erie.

Gizzard shad was the most commonly entrained species during studies conducted at the Fermi 2 cooling water intake in 2008 and 2009, and it is estimated that approximately 30.2 million gizzard shad eggs and larvae were entrained during the 1-year study period (AECOM 2009b; Table 2-11). In addition, gizzard shad was the most commonly impinged species during studies conducted at the Fermi 2 cooling water intake in 2008 and 2009, with approximately 1200 individuals impinged during the year (AECOM 2009b; Table 2-12).

Goldfish (*Carrasius auratus*)

Goldfish are native to Eurasia and have been introduced throughout the United States and in parts of southern Canada. They were first introduced in the Great Lakes around 1885 and have since become well established in the region. They are abundant in the shallow bays and marshes of western Lake Erie and can also be found in slow-moving tributaries.

Goldfish can grow to be 12 in. or larger, although most individuals are considerably smaller. Goldfish spawn during the spring and summer in shallow water, and the eggs adhere to vegetation and substrates. A single female can produce several lots of eggs within a season. Hatching occurs in 2 to 14 days, depending on water temperature.

Goldfish feed on a variety of small aquatic invertebrates and vegetation. Because of their abundance within shallow habitats, including marsh habitats, of the western basin and because of their relatively small size, goldfish are a potentially important prey species for fish-eating fish and birds. Goldfish also have some commercial importance within the western basin, making up approximately 4 percent of the commercial harvest in Michigan waters of the basin. Although goldfish were relatively abundant in collections made during fish surveys on and near the Fermi site, no goldfish were identified in impingement or entrainment samples during 2008 and 2009 (AECOM 2009b).

Lake Whitefish (*Coregonus clupeaformis*)

Lake whitefish occur throughout most of Canada and Alaska, south to northern New England, in the Great Lakes region, and in central Minnesota. Lake Erie is considered to be at the southern extent of the range for this species. Lake whitefish have also been introduced as forage and food fish in other areas, including the states of Montana, Idaho, and Washington.

The lake whitefish is a cool water species that has a narrow temperature tolerance and requires cold, well oxygenated bottom waters throughout the summer in order to survive. Optimum temperature for the lake whitefish ranges from 50 to 57°F for adults and 60 to 67°F for juveniles. This species usually spawns during late fall or early winter over rocky or sandy substrates in water less than 25 ft deep. Eggs hatch in the early spring, and sexual maturity is generally reached in 5 to 7 years. Young lake whitefish subsist primarily on zooplankton, while adults usually eat bottom-dwelling invertebrates and small fishes.

Lake whitefish are an indicator of ecosystem health and an important component of the Great Lakes food web. During the late 19th and early 20th centuries, large numbers of lake whitefish entered the Detroit River each year to spawn (EPA 2009d). Reports indicate that the lower Detroit River was a prolific spawning area prior to the construction of the Livingstone Shipping Channel. The timing of this construction coincides with the degradation of whitefish populations in the river and western Lake Erie (EPA 2009d). Recently, populations of lake whitefish were once again discovered in the Detroit River, but further studies are necessary to ascertain their presence in other tributaries of western Lake Erie (EPA 2009d).

Lake whitefish historically made up a large proportion of the commercial fishery in the western basin of Lake Erie. In the late 1800s and early 1900s, more than 500,000 lb of lake whitefish were commercially harvested each year, but catches declined drastically after that period. There have been improvements in the fishery more recently, and the commercial lake whitefish landings in all of Lake Erie exceeded 1 million lb in 2000 (EPA 2009d). In the western basin, the commercial harvest of lake whitefish was only 8800 lb in Michigan waters during 2007, and it was more than 287,000 lb in Ohio waters during 2009 (Tables 2-14 and 2-15). Lake whitefish were not observed in collections made during fish surveys on and near the Fermi site, and no lake whitefish were identified in impingement or entrainment samples during 2008 and 2009 (AECOM 2009b).

Quillback (*Carpiodes cyprinus*)

The quillback has a wide distribution in North America, with inhabited areas encompassing an area with a northward boundary from the Alberta to Quebec Provinces in Canada, southward to the Gulf Slope, and eastward to the Atlantic slope drainages. The species is relatively common in the Great Lakes, including Lake Erie.

These fish are suited to a variety of aquatic habitat conditions, including pools, backwaters, and main channels and clear to turbid waters of creeks, rivers, and lakes. Spawning usually occurs in April through May over sand and mud bottoms in quiet waters of streams, overflow areas in bends of rivers, or the bays of lakes. Quillbacks sometimes migrate up small streams and creeks during the spring and summer in order to find suitable spawning habitat. Both adults and juveniles are omnivorous, feeding on organic matter in bottom sediments, insect larvae, and plant material.

The quillback is a small component of the commercial fisheries in the Michigan and Ohio waters of the western basin (Tables 2-14 and 2-15). In Ohio, commercial harvest of quillback averaged more than 200,000 lb per year from 2000 through 2009 (ODNR 2010). Although small numbers of quillback were collected during fish surveys on and near the Fermi site, no quillback were present in impingement or entrainment samples during 2008 and 2009 (AECOM 2009b).

Walleye (*Sander vitreus*)

The walleye is the largest member of the perch family and can be found in all of the Great Lakes, where it is a native species. Walleye have been introduced and are stocked widely in the United States; the distribution for the species now extends across most of the continental United States and Canada.

The walleye can be found in a variety of large bodies of freshwater, including lakes, pools, backwaters, rivers, and flooded marshes. It prefers deep waters and avoids bright light. This species spawns in late spring or early summer in turbulent rocky areas in rivers, coarse gravel shoals in lakes, or in flooded marshes. Eggs hatch in approximately 26 days. Adults may migrate up to 100 mi between spawning habitat and nonspawning habitat. Sexual maturity is reached in 2 to 4 years for males and in 3 to 8 years for females. Young walleye up to 6 weeks of age primarily eat zooplankton and small fishes, whereas adults feed upon fishes and larger invertebrates. Adults typically range in length from 13 to 25 in. and weigh 1 to 5 lb.

The walleye is considered an extremely important commercial and recreational fishery resource in Lake Erie. Although the commercial fisheries for walleye in the Michigan and Ohio waters of Lake Erie have been closed for many years, commercial fishing for walleye in the western basin waters of Ontario has continued, and the annual harvest since 1976 has averaged approximately 1.5 million fish per year (range is approximately 113,000 to approximately 2.8 million fish) (Lake Erie Walleye Task Group 2010). The western basin also supports a popular recreation fishery, with average harvests of approximately 1.6 million, 293,000, and 39,000 fish in the western basin waters of Ohio, Michigan, and Ontario, respectively, since 1975 (Lake Erie Walleye Task Group 2010).

Because of the importance of walleye to the commercial and recreational fisheries in Lake Erie, the status of walleye populations in the lake are closely monitored by various agencies. The Lake Erie Committee of the Great Lakes Fishery Commission has formed the Walleye Task Group to bring together information from various agencies so that the population status of walleye in Lake Erie can be monitored each year. This task group maintains and updates centralized datasets, improves population models so that scientifically defensible abundance estimates and forecasts can be produced, makes recommendations regarding allowable harvest levels, and helps identify studies that need to be conducted to address data gaps (Lake Erie Walleye Task Group 2010). Modeled abundance estimates of walleye in Lake Erie for the period from 1980 to 2010 indicate that the overall numbers of walleye aged 2 and older have varied considerably, ranging from a low of approximately 15 million individuals in 2004 to a high of approximately 74 million individuals in 1988 (Figure 2-13). Estimated abundance for 2010 was approximately 30 million fish (Lake Erie Walleye Task Group 2010).

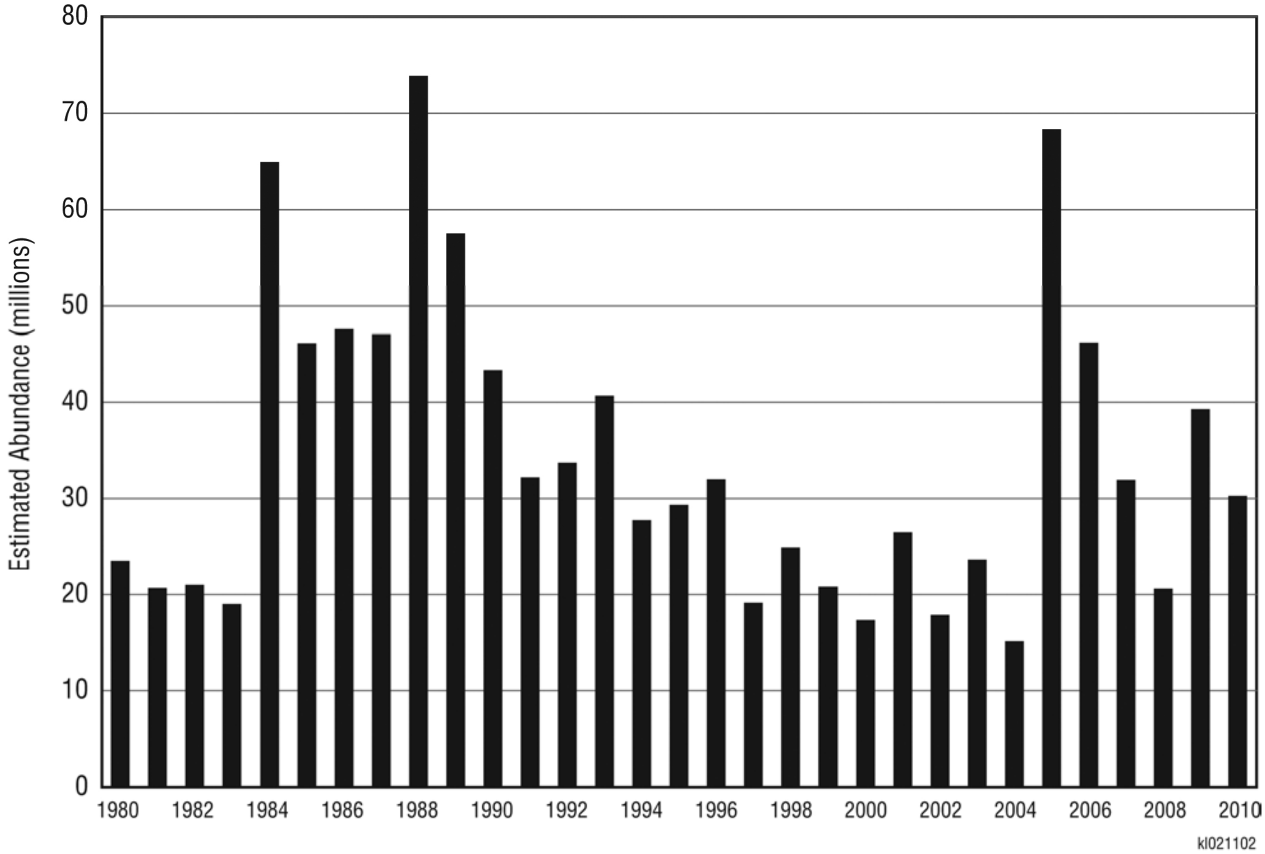

Figure 2-13. Estimated Abundance of Walleye Aged 2 and Older in Lake Erie, 1980–2010 (Lake Erie Walleye Task Group 2010)

No walleye were observed in collections made during fish surveys in aquatic habitats on and near the Fermi site, and no walleye were present in impingement or entrainment samples collected at the Fermi 2 cooling water intake during 2008 and 2009 (AECOM 2009b).

White Bass (*Morone chrysops*)

The white bass is distributed across the United States and eastern Canada. It is a relatively common species in the Great Lakes, including Lake Erie. White bass typically inhabit open waters of large lakes and reservoirs and pools of slow-moving rivers. Often travelling in schools, white bass tend to occur in offshore waters during the day and in inshore waters at night.

Tributary streams appear to be the preferred spawning habitat, but white bass may also spawn along lake shores with high wave action. Spawning occurs during the spring, usually over rock or gravel substrate in water up to 10 ft deep. After hatching, the young fish generally remain in shallow water for a period of time before migrating to deeper areas. White bass become sexually mature at 1 to 3 years of age and usually do not live past 4 years of age. As adults, they can reach up to 16 in. in length and can weigh up to 4 lb. White bass are carnivores, eating zooplankton, insect larvae, and other fish.

White bass is a notable component of the commercial fisheries in the Michigan and Ohio waters of the western basin (Tables 2-14 and 2-15). By weight, white bass accounted for approximately 7 percent of the fish commercially harvested from Michigan waters of Lake Erie in 2007 (Table 2-14) and for 25 percent of the fish commercially harvested from Ohio waters of the western basin in 2009 (Table 2-15).

White bass are also an important recreational fishing species in each of these States. In general, it is reported that very few angler boat trips specifically target white bass, and the majority of white bass are harvested as incidental catch from anglers targeting other species (ODNR 2010). However, when adult fish are moving into major tributaries to spawn during the spring, the aggregations of fish can attract many anglers, especially in major spawning tributaries such as the Maumee River (Bolsenga and Herdendorf 1993). The recreational noncharter boat harvest of white bass from Michigan waters in the western basin during 2007 was estimated to be 7911 individual fish (Thomas and Haas 2008). From 2000 to 2009, the recreational white bass harvest in the Ohio waters of the western basin averaged over 72,000 individual fish per year, with a peak of 121,000 fish caught in 2009 (ODNR 2010).

Although small numbers of white bass were collected on and near the Fermi site, no white bass were present in impingement or entrainment samples during 2008 and 2009 (AECOM 2009b).

White Perch (*Morone americana*)

White perch are native to the east coast of the United States and Canada but can be found in the Great Lakes area, where they are considered an introduced species. This species was first observed in Lake Erie in 1954 and has been abundant in the lake since the 1980s (Bolsenga and Herdendorf 1993). On the Atlantic coast, they are typically found in brackish waters, but they have adapted to inland freshwater lakes and tributaries.

White perch spawn in the spring by releasing their eggs in the shallow waters of tributaries. The eggs sink and stick to the bottom until hatching approximately 4 days later. After hatching, the young feed initially on small planktonic organisms, and, as they grow larger, their diet changes to include aquatic insects, invertebrates, other fishes, and the eggs of other fish species.

White perch make up a component of the commercial fish harvest in the western basin of Lake Erie. In 2007, approximately 36,000 lb (3.4 percent of the commercial harvest) of white perch were reported in Michigan waters of the western basin (Table 2-14). In Ohio waters of the western basin, white perch was the second most dominant species in the commercial catch during 2009, with more than 535,000 lb reported (23.4 percent of the commercial catch by weight) (Table 2-15). Although white perch is generally regarded as an undesirable sport fish in the Great Lakes, it is considered an excellent sport fish in the eastern United States.

White perch was one of the dominant fish species collected during fish surveys on and near the Fermi site during 2008 and 2009. Overall, white perch accounted for more than 12 percent of the individual fish collected during the surveys and more than 33 percent of the individuals collected in areas near the existing Fermi 2 cooling water intake location (Table 2-10). It is estimated that more than 124,000 white perch eggs and larvae were entrained during studies conducted at the Fermi 2 cooling water intake in 2008 and 2009 (AECOM 2009b; Table 2-11). In addition, white perch was the third most commonly impinged species during studies conducted at the Fermi 2 cooling water intake in 2008 and 2009, with approximately 305 individuals being impinged during the year (AECOM 2009b; Table 2-12).

Yellow Perch (*Perca flavescens*)

The yellow perch is native to the Great Lakes region but can be found in almost all 50 States as well as most of Canada. This species is one of the most common fish in Michigan waters; is commonly found in Lake Erie; and is assumed to occur throughout the Detroit River, Swan Creek, Stony Creek, and in other surface water habitats on the Fermi site.

Yellow perch usually travel in schools and are generally associated with the clear, shallower waters of lakes or weedy backwaters of creeks and rivers. Yellow perch usually grow to be 6 to 10 in. long and weigh between 6 and 16 oz. Yellow perch spawn in the spring in shallower waters over submerged beds of aquatic vegetation or over sand, gravel, or rubble. The eggs, which are laid in gelatinous strands that can be several feet long, usually hatch in 10 to 20 days. Sexual maturity is reached in 2 to 3 years for males and in 3 to 4 years for females; the maximum lifespan is about 10 years. Larval and young yellow perch feed primarily on zooplankton, whereas adults feed on larger invertebrates and small fish.

Yellow perch is one of the most popular and economically valuable sport and commercial fish in Lake Erie and is considered an indicator of the ecological condition of Lake Erie (EPA 2009f). Because of the importance of yellow perch in Lake Erie, the status of yellow perch populations in the lake is closely monitored by various agencies. The Lake Erie Committee of the Great Lakes Fishery Commission has formed the Yellow Perch Task Group to bring together information from various agencies so that the population status of yellow perch in Lake Erie can be monitored each year. This task group maintains and updates centralized datasets of information needed to evaluate population status and support population and harvest modeling efforts and makes recommendations regarding sustainable harvest levels (Lake Erie Yellow Perch Task Group 2010).

After peaking in the late 1800s, commercial catches of yellow perch in the Detroit River and the western basin of Lake Erie decreased substantially through the 1960s. These decreases are attributed primarily to a combination of high levels of fishing pressure and deteriorating water quality. Improvement in yellow perch population levels occurred during the 1970s as fishing pressure declined and as water quality improved as a result of lakewide pollution control programs that were implemented (EPA 2009f). Numbers of yellow perch in Lake Erie dropped again to very low levels during the early 1990s, possibly because of the combined effects of a lakewide invasion of zebra and quagga mussels, fishing pressure, and unsuitable weather conditions (EPA 2009f). Yellow perch populations increased again beginning in the latter portion of the 1990s, and, while they are not at the levels observed during the 1970s and 1980s, they have remained relatively stable since that time (Figure 2-14) (EPA 2009f; Lake Erie Yellow Perch Task Group 2010). In addition to potentially being affected by water quality, fishing pressure, and invasive species, yellow perch are one of the principal prey items for walleye. As a consequence, as walleye populations increase, there is often a corresponding decrease in yellow perch populations (EPA 2009f).

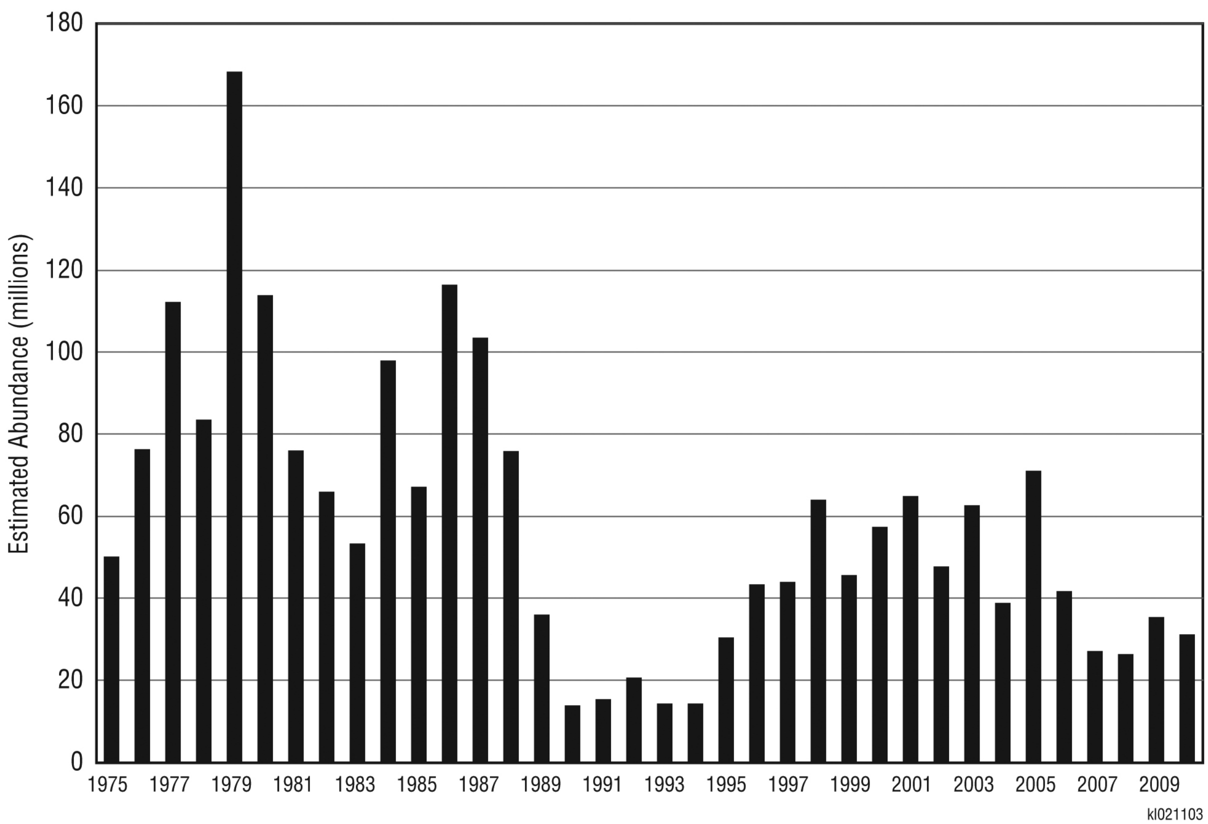

Figure 2-14. Estimated Abundance of Yellow Perch Aged 2 and Older in the Western Basin of Lake Erie, 1975–2010 (Lake Erie Yellow Perch Task Group 2010)

Although yellow perch historically made up a large portion of commercial fishery in the western basin of Lake Erie, the commercial perch fishery in Michigan waters has been closed since 1970, and the commercial perch fishery in the western basin waters of Ohio has been closed since 2008. From 1999 to 2008, the annual commercial harvest of yellow perch in Ohio waters of the western basin ranged from approximately 179,000 lb to 357,000 lb (mean of approximately 255,000 lb). Commercial fishing for yellow perch also occurs in the western basin waters of Ontario, Canada, where it ranged from approximately 534,000 lb to 1.7 million lb (mean of approximately 1.1 million lb) from 1999 to 2009 (Lake Erie Yellow Perch Task Group 2010).

Yellow perch is present in at least low numbers in most of the surface water habitats on the Fermi site, on the basis of fish surveys conducted in 2008 and 2009 (AECOM 2009b). Yellow perch was among the most common species observed during entrainment studies conducted at the Fermi 2 cooling water intake in 2008 and 2009, and it is estimated that more than 4.8 million yellow perch eggs and larvae were entrained during the year-long study (AECOM 2009b; Table 2-11). No yellow perch adults or juveniles were observed during impingement studies conducted at the Fermi 2 cooling water intake during the same period (AECOM 2009b; Table 2-12).

Recreationally Important Species

Lake Erie is the warmest and most biologically productive of the Great Lakes, producing more fish each year than any of the other Great Lakes (Bolsenga and Herdendorf 1993). Walleye and yellow perch are the most popular recreational species in the western basin of Lake Erie.

The total noncharter sport harvest from the Michigan waters of Lake Erie for 2009, based on creel surveys, was estimated at 460,425 fish (Thomas and Haas 2010). Walleye and yellow perch together accounted for 93 percent of the reported recreational fishing harvest. Walleye harvest rates had declined since the previous estimate obtained in 2007, while yellow perch harvest rates were at the highest levels observed since 1998. It is estimated that noncharter boat anglers harvested 85,348 walleye and 344,811 yellow perch during 2009, whereas charter boat anglers harvested 10,258 walleye and 9989 yellow perch (Thomas and Haas 2010). Reported recreational harvests of other species from the Michigan waters of Lake Erie were considerably lower than those of walleye and yellow perch; they included white perch, channel catfish, freshwater drum, largemouth bass, smallmouth bass, and rainbow trout (Thomas and Haas 2010).

In 2009, sport anglers made more than 300,000 trips to fish in the Ohio waters of the western basin of Lake Erie, and the private sport boat fishing effort within the Ohio waters of the basin totaled more than 1.6 million hours (ODNR 2010). Charter boat fishing effort within the Ohio waters of the western basin in 2009 totaled approximately 158,000 hours (ODNR 2010). Estimates of angler hours indicate that most of the private boat angling effort was directed toward walleye (56 percent of angler hours) and yellow perch (35 percent). Smallmouth bass (4 percent), white bass (2 percent), and largemouth bass (2 percent) were less commonly targeted by private boat anglers (ODNR 2010). Charter boat anglers mainly targeted walleye (95 percent of angler hours), followed by yellow perch (4 percent) and smallmouth bass (<1 percent). The total (combined private and charter boat) recreational harvest of fish from the Ohio waters of the western basin in 2009 was estimated at approximately 2.6 million fish, made up primarily of walleye (21 percent of harvest), yellow perch (72 percent of harvest), and white bass (5 percent of harvest). Smallmouth bass, white perch, freshwater drum, channel catfish, and other species accounted for less than 2 percent of the recreational harvest within the Ohio waters of the western basin of Lake Erie (ODNR 2010). On the basis of fish surveys conducted in 2008 and 2009, each of these recreationally important species, with the exception of walleye, is present in Lake Erie adjacent to the Fermi site and/or in onsite surface water habitats (AECOM 2009b).

Sport fish landings are managed by using State-implemented fishing regulations, such as harvest quota systems and requirements for fish to be within certain length limits to be harvested. Typical goals of such regulations are to maintain the numbers of catchable-sized and reproductive-sized individuals at desired levels and to maintain sustainable population levels. For example, walleye fisheries throughout Lake Erie were affected by reduced spawning, which resulted in a lower adult abundance during the 1990s. Harvest quotas and other fishing regulations for walleye became more restrictive because of this reduced adult population, and the result was a rebound in the adult walleye population. Subsequently, less restrictive fishing regulations for the walleye have been implemented in more recent years. Other species-specific fishing regulations have been implemented by the States of Michigan and Ohio.

Recreational angling also occurs in other waters within the vicinity of the Fermi site, such as ponds and tributary drainages of Lake Erie. Swan Creek supports a recreational fishery for common game fish, including largemouth bass and bluegill. Portions of the creek located near recreational areas, such as public parks, receive the largest share of fishing pressure. There are no significant recreational fisheries within the boundaries of Stony Creek, the area managed as part of the DRIWR, or other water bodies located at the Fermi site.

Because many of the recreationally important aquatic species that occur in the vicinity of the Fermi site are also commercially important, the distribution and life history information for those species was summarized above. The distribution and life history information for other recreationally important species that may occur in the vicinity of the site is summarized below.

Bluegill (*Lepomis macrochirus*)

The bluegill is popular with many recreational anglers and is important ecologically because it can affect the composition of aquatic communities by controlling zooplankton populations and by serving as an important prey item for many larger fishes, including largemouth bass and northern pike.

The bluegill is native to the Great Lakes and Mississippi River Basins from Quebec and New York to Minnesota and south to the Gulf of Mexico. It is also native to the Atlantic and Gulf Slope drainages from the Cape Fear River, Virginia, to the Rio Grande, Texas, and New Mexico, and also northern Mexico (Page and Burr 1991). It has been introduced throughout North America and is now found in many other parts of the world. This sunfish species most commonly inhabits shallow lakes, ponds, reservoirs, sloughs, and slow-flowing streams. It is often associated with rooted aquatic vegetation and silt, sand, or gravel substrates.

Bluegills lay eggs in a nest excavated in shallow water by the male on bottoms of gravel, sand, or mud that contain pieces of debris. Adult bluegills can reach sizes of between 10 and 16 in. and may live longer than 10 years. Young bluegill feed primarily on planktonic crustaceans, insects, and worms. Adults eat mainly aquatic insects, small crayfish, and small fishes; in some bodies of water, adults may primarily consume zooplankton.

The bluegill is very common in the immediate vicinity of the Fermi site, according to recent fish surveys. Francis and Boase (2007) found that bluegills made up approximately 9 percent of the individual fish collected during surveys in Swan Creek. Bluegills were also found in most aquatic habitats associated with the Fermi site during surveys conducted in the 2008–2009 period, and, overall, they accounted for 13 percent of the individual fish collected (AECOM 2009b). Impingement rates measured at the cooling water intake indicate that an estimated 214 bluegills were impinged at the Fermi 2 cooling water intake from August 2008 through July 2009 (Table 2-12; AECOM 2009b), accounting for approximately 7 percent of the fishes impinged by Fermi 2 during the sampling period. No bluegill eggs or larvae were specifically identified in entrainment samples collected at the Fermi 2 cooling water intake from August 2008 through July 2009 (AECOM 2009b). However, it was estimated that approximately 70,000 eggs or larval stages of fish in the same fish family (*Centrarchidae*) would be entrained annually on the basis of the presence of eggs and larvae not identifiable to the species level (AECOM 2009b). Some portion or all of these unidentified eggs and larvae could have been those of bluegill.

Largemouth Bass (*Micropterus salmoides*)

The largemouth bass is native to the Great Lakes, Hudson Bay (Red River), and Mississippi River Basins from southern Quebec to Minnesota and south to Texas, throughout the Gulf Coast and southern Florida, and in Atlantic coast drainages from North Carolina to Florida. Because of its popularity as a sport fish, this species has been introduced throughout the United States, southern Canada, and much of world. Largemouth bass occur in a variety of habitats, including clear and turbid waters of lakes, ponds, reservoirs, and swamps and pools or in backwater areas of creeks and rivers. They are often found in areas containing aquatic vegetation.

Largemouth bass spawn primarily in the spring and summer in water temperatures of 60°F or higher. Males excavate nests in shallow water. After a female deposits eggs in the nest, the male guards the eggs, which hatch within a few days. Largemouth bass reach sexual maturity in 2 to 5 years and can attain sizes as large as 38 in., although approximately 28 in. is a typical size for older adult fish. This species feeds mainly upon zooplankton as fry. As the juvenile grows, it begins to prey on larger organisms, including insects, crustaceans, and small fish. Adults prey mainly on fish but are also known to eat other organisms, including crayfish and frogs.

The largemouth bass is a popular sport fish in the Great Lakes region, including Lake Erie and its tributaries. This species is present, at least in low numbers, in most of the surface water habitats on the Fermi site, according to fish surveys conducted in 2008 and 2009 (AECOM 2009b). Largemouth bass was among the species observed during entrainment studies conducted at the Fermi 2 cooling water intake in 2008 and 2009, and it is estimated that approximately 152,000 largemouth bass eggs and larvae were entrained during the year-long study (AECOM 2009b; Table 2-11). On the basis of species-specific impingement rates measured at the Fermi 2 cooling water intake, it is estimated that a total of 31 largemouth bass individuals were impinged at the Fermi 2 cooling water intake during the period from August 2008 through July 2009 (AECOM 2009b; Table 2-12).

Smallmouth Bass (*Micropterus dolomieu*)

The smallmouth bass is native to the St. Lawrence-Great Lakes, Hudson Bay (Red River), and Mississippi River Basins from southern Quebec to North Dakota and south to northern Alabama and eastern Oklahoma. It has been widely introduced throughout the United States, southern Canada, and other countries. Smallmouth bass prefer large, clear lakes (especially in the northern part of the range) and clear, intermediate-sized streams that contain large pools and abundant cover (rocks, shelves, logs, etc.), and they prefer cool summer temperatures. Adults typically seek the shelter of pools or deep water during the day.

Spawning habitat includes shallow water in lakes or quiet areas of streams, often fairly close to shore. In lakes, spawning adults sometimes move a short distance up a stream to spawn. Spawning generally occurs in late spring or early summer. Females deposit eggs in nests that are constructed by the males; nests usually occur near cover on gravel or sand bottoms. Eggs typically hatch in 2 to 10 days, and males guard eggs and hatchlings for a period of 4 weeks or longer. Individuals usually attain sexual maturity at 2 to 6 years of age, depending on local conditions. Young fish eat primarily small crustaceans and aquatic insects (e.g., midge larvae and pupae) until the fish are about 2 in. in length. After that, smallmouth bass primarily eat fish, although crayfish, amphibians, and larger insects often become dominant foods of local populations or seasonally.

In addition to being a species that has recreational importance, smallmouth bass have ecological importance as being one of the top-level predators in aquatic habitats in the Great Lakes region. Smallmouth bass make up a small component of the aquatic community in the immediate vicinity of the Fermi site, according to recent fish surveys. Francis and Boase (2007) captured low numbers of smallmouth bass in collections from Swan Creek. Smallmouth bass were not found in most aquatic habitats on the Fermi site during surveys conducted in the 2008–2009 period (AECOM 2009b), perhaps because many of these habitats have conditions (e.g., warm summer water temperatures and high turbidity) that are not optimal for smallmouth bass. On the basis of impingement rates measured at the cooling water intake, it is estimated that 62 smallmouth bass were impinged at the Fermi 2 cooling water intake from August 2008 through July 2009 (AECOM 2009b;Table 2-12), accounting for approximately 2 percent of the fishes impinged by Fermi 2. No smallmouth eggs or larvae were identified in entrainment samples collected at the Fermi 2 cooling water intake from August 2008 through July 2009 (AECOM 2009b). However, it was estimated that approximately 70,000 eggs or larval stages of fish in the same fish family (*Centrarchidae*) would be entrained annually, on the basis of the presence of eggs and larvae not identifiable to the species level (AECOM 2009b). Some portion or all of these unidentified eggs and larvae could have been those of smallmouth bass.

Federally and State-Listed Aquatic Species

This section presents information about the Federally and Michigan State-listed threatened and endangered aquatic species in the vicinity of the Fermi site. Federally and State-listed aquatic species that may occur on or near the Fermi site or in the counties through which the proposed transmission line corridor would pass (Monroe, Washtenaw, and Wayne Counties) are indicated in Table 2-16.

Three freshwater mussel species that are Federally listed as endangered could occur within the project area based upon historic records of occurrence. The northern riffleshell (*Epioblasma torulosa rangiana*) could occur in waters of Monroe and Wayne Counties in Michigan. The rayed bean (*Villosa fabalis*) and the snuffbox mussel (*E. triquetra*) have a potential to occur within Monroe, Washtenaw, or Wayne Counties. Another freshwater mussel that is Federally listed as endangered (white catspaw, *E. obliquata perobliqua*), was last reported from Wayne and Monroe Counties in 1930 and is believed to have been extirpated from the State of Michigan. None of these species has been specifically documented to occur either on the Fermi site or along the proposed transmission line route, although they have a potential to occur within one or more of the counties where project activities (including the proposed transmission line ROW) could occur. No Federally designated aquatic critical habitats occur near the Fermi site.

Table 2-16. Federally and State-Listed Aquatic Species That Have Been Observed in Monroe, Washtenaw, and Wayne Counties, Michigan, and the Potential for Their Occurrence on the Fermi Site

Common Name	Scientific Name	Federal Status[a]	State Status[b]	Monroe County[c]	Wayne County[c]	Washtenaw County[c]	Fermi Site[d]
Mollusks							
Elktoe	*Alismidonta marginata*		SC	X		X	U
Ellipse	*Venustaconcha ellipsiformis*		SC			X	U
Gravel pyrg	*Pyrgulopsis letsoni*		SC	X		X	U
Hickorynut	*Obovaria olivaria*		E		X	X	U
Northern riffleshell	*Epioblasma torulosa rangiana*	E	E	X	X		U
Purple lilliput	*Toxolasma lividus*		E	X			U
Purple wartyback	*Cyclonaias tuberculata*		T	X	X	X	U
Rainbow	*Villosa iris*		SC		X	X	U
Rayed bean	*Villosa fabalis*	E	E	X	X		P
Round hickorynut	*Obovaria subrotunda*		E	X	X		U
Round pigtoe	*Pleurobema sintoxia*		SC	X	X	X	U
Salamander mussel	*Simpsonaias ambigua*		E	X	X		P
Slippershell	*Alismidonta viridis*		T	X		X	U
Snuffbox mussel	*Epioblasma triquetra*	E	E	X	X	X	P
Wavyrayed lampmussel	*Lampsilis fasciola*		T	X		X	U
White catspaw	*Epioblasma obliquata perobliqua*	E[e]	E[e]	X	X		U
Fish							
Brindled madtom	*Noturus miurus*		SC	X	X	X	P
Channel darter	*Percina copelandi*		E	X	X		U
Creek chubsucker	*Erimyzon claviformis*		E	X			U
Eastern sand darter	*Ammocrypta pellucida*		T	X	X		U
Lake sturgeon	*Acipenser fulvescens*		T		X		U
Northern madtom	*Noturus stigmosus*		E		X	X	U
Orangethroat darter	*Etheostoma spectabile*		SC	X		X	U
Pugnose minnow	*Opsopoedus emiliae*		E	X	X		P

Table 2-16. (contd)

Common Name	Scientific Name	Federal Status[a]	State Status[b]	Monroe County[c]	Wayne County[c]	Washtenaw County[c]	Fermi Site[d]
Pugnose shiner	*Notropis anogenus*		E		X	X	U
Redside dace	*Clinostomus elongatus*		E		X	X	U
River darter	*Percina shumardi*		E	X	X		U
River redhorse	*Moxostoma carinatum*		T		X		U
Sauger	*Sander canadensis*		T	X	X		P
Silver chub	*Macrhybopsis storeriana*		SC	X	X		O
Silver shiner	*Notropis photogenis*		E	X		X	U
Southern redbelly dace	*Phoxinus erythrogaster*		E	X		X	U
Spotted gar	*Lepisosteus oculatus*		SC			X	U

(a) Federal status rankings determined by the FWS under the Endangered Species Act: E = endangered.
(b) State species information provided by MNFI (2007g): E = endangered; T = threatened; SC = species of special concern.
(c) County-level occurrence based on information provided by MNFI (2007g): X = the species has been observed within the identified county.
(d) O = species observed on or adjacent to the Fermi site; P = possible occurrence due to presence of potentially suitable habitat and nearby populations, but has not been reported on or adjacent to the Fermi site; U = unlikely to occur due to absence of nearby populations and/or lack of suitable habitat on or adjacent to the Fermi site. Species for which there was no record of occurrence reported by the MNFI (2007g) for Monroe County were considered unlikely to occur on the Fermi site.
(e) The white catspaw is considered extirpated from Michigan (MNFI 2007g).

The State of Michigan has listed 33 aquatic species as endangered (17 species), threatened (7 species), or of special concern (9 species) in Monroe, Wayne, or Washtenaw County (Table 2-16) (MNFI 2007g). Of these, 17 species are fish and 16 species are mollusks (15 freshwater mussels and 1 snail species). Species of special concern are those that are considered to be rare in Michigan or those for which the status of the population is uncertain. Additional information about the distribution, life history, population status, and potential for occurrence of Federally and State-listed threatened and endangered aquatic species that could be present in the vicinity of the Fermi site is provided below. MNFI (2007g) presents additional information about distribution, life history, and ecology of species of special concern to the State of Michigan.

Hickorynut (*Obovaria olivaria*)

The hickorynut is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as endangered by the State of Michigan (MNFI 2007g). The historic range for the hickorynut includes eastern North America, from western Pennsylvania and New York to Missouri, Iowa, and Kansas, and from Michigan and the St. Lawrence drainage southward to Alabama and Arkansas (Badra 2004a). In Michigan, the historic range for this species included the Kalamazoo, Grand, Menominee, Saginaw, and Detroit Rivers, as well as Lake Erie and Lake St. Clair (Badra 2004a). Habitat for the hickorynut consists of sand or mixed sand and gravel substrates in large rivers and lakes (Badra 2004a).

The general life history of unionid mussels is described in Section 2.4.2.1. Gravid individuals of the hickorynut retain larvae internally over the winter and release glochidia in the spring (Badra 2004a). The shovelnose sturgeon (*Scaphirhynchus platorynchus*) and freshwater drum have been shown to be suitable hosts, and it is possible that additional species are used as hosts in natural environments (Badra 2004a). Like all freshwater mussels, the hickorynut is a filter feeder.

Principal threats to the hickorynut include siltation and runoff from human activities, damming and dredging of rivers, and the spread of introduced invasive species. Zebra mussels pose a threat for freshwater mussels because they compete for food and benthic habitat and because they attach to the shells of native mussels, making it difficult for the mussels to move and feed properly. The hickorynut was last observed in Washtenaw County in 1996 and in Wayne County in 2006; the hickorynut has not been reported from Monroe County (MNFI 2007g). Although streams with conditions suitable for the hickorynut are not present on the Fermi site, some nearshore areas in Lake Erie in the vicinity of the site could potentially provide suitable substrate. Since no large rivers will be crossed by the proposed transmission line ROW, it is unlikely that this species would be present in stream areas crossed by the transmission line corridor.

Northern Riffleshell (*Epioblasma torulosa rangiana*)

The northern riffleshell is a freshwater unionid mussel (see Section 2.4.2.1) that was Federally listed as an endangered species in 1993 and is also listed as endangered by the State of Michigan (MNFI 2007g). The historic range for the northern riffleshell includes Illinois, Indiana, Kentucky, Michigan, Ohio, Pennsylvania, West Virginia, and western Ontario (Carman and Goforth 2000b). It was once widespread in the Ohio and Maumee River Basins and in tributaries of western Lake Erie (Carman and Goforth 2000b). In Michigan, the northern riffleshell is known to currently occur only in the Black River in Sanilac County and the Detroit River in Wayne County (Carman and Goforth 2000b). More than 100 individuals from the Detroit River population were relocated to the St. Clair River in 1992 as part of an effort to establish a new population, but the success of that effort is not known (Carman and Goforth 2000b).

The habitat for the northern riffleshell is fine to coarse gravel in riffles and runs of streams with swift currents (MNFI 2007g). The general life history of unionid mussels is described in Section 2.4.2.1. The northern riffleshell holds larvae over the winter and releases glochidia in the spring (Carman and Goforth 2000b). In the laboratory, glochidia developed with brown trout (*Salmo trutta*), bluebreast darter (*Etheostoma camurum*), banded darter (*Etheostoma zonale*), and banded sculpin (*Cottus carolinae*) as hosts; however, these fish species do not occur in the areas of Michigan that could harbor northern riffleshell populations, suggesting that there are also other hosts (Carman and Goforth 2000b). The age at maturity for northern riffleshells is not known, but this species may reach 15 years of age (Carman and Goforth 2000b). Like all freshwater mussels, the northern riffleshell is a filter feeder.

The survival of this species depends on the protection and preservation of suitable habitat and host fish species. Principal threats to survival of the species are similar to those described previously for the hickorynut. The northern riffleshell was last observed in Monroe County in 1977 and in Wayne County in 2006 (MNFI 2007g). The northern riffleshell has not been reported from Washtenaw County (MNFI 2007g). Streams with conditions suitable for the northern riffleshell are not present on the Fermi site; it is currently unknown if appropriate habitats are present in stream areas that are crossed by the proposed transmission line corridor. The portions of Lake Erie adjacent to the Fermi site do not offer suitable habitat for this species.

Purple Lilliput (*Toxolasma lividus*)

The purple lilliput is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as endangered by the State of Michigan (MNFI 2007g). The historic range for the purple lilliput extends from Michigan south to Alabama and from Missouri and Arkansas eastward to Virginia (Carman 2002a). In Michigan, the purple lilliput is generally restricted to the southeastern portion of the State, and spent shells have been found from sites in the River Raisin in Monroe

Country (Carman 2002a). The purple lilliput occurs in small to medium-sized streams and occasionally in large rivers and lakes; the preferred substrate for this species is well-packed sand or gravel and a water depth of less than 1 m (MNFI 2007g).

The general life history of unionid mussels is described in Section 2.4.2.1. Gravid purple lilliputs have been known to retain the larvae internally for about a year, although populations in Michigan reportedly produce multiple broods in a single year (Carman 2002a). Fish hosts for the purple lilliput include green sunfish and longear sunfish (*Lepomis megalotis*) (Carman 2002a), both species that have been observed in aquatic habitats associated with the Fermi site (AECOM 2009b). Like all freshwater mussels, the purple lilliput is a filter feeder.

Principal threats to survival of the species are similar to those described previously for the hickorynut. The purple lilliput was last reported from Monroe County in 1977; it has not been reported from Wayne or Washtenaw County (MNFI 2007g). Streams with conditions suitable for the purple lilliput are not present on the Fermi site; it is currently unknown if appropriate habitats are present in stream areas that are crossed by the proposed transmission line corridor. The portions of Lake Erie adjacent to the Fermi site do not offer suitable habitat for this species.

<u>Purple Wartyback (*Cyclonaias tuberculata*)</u>

The purple wartyback is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as threatened by the State of Michigan (MNFI 2007g). The historic range for the purple wartyback includes eastern North America, from Ontario, Canada, south to Alabama, west to Oklahoma, and east to Pennsylvania (Badra 2004b). It is present in the Mississippi River, Ohio River, Lake Michigan, Lake St. Clair, and Lake Erie drainages (Badra 2004b). The purple wartyback is found in medium to large rivers with gravel or mixed sand and gravel substrates in areas with relatively fast current (Badra 2004b).

The general life history of unionid mussels is described in Section 2.4.2.1. Gravid individuals of the purple wartyback release glochidia during the same summer that they are fertilized (Badra 2004b). The yellow bullhead and channel catfish have been shown to be suitable hosts for the purple wartyback, and it is possible that additional species are used as hosts in natural environments (Badra 2004b). Like all freshwater mussels, the purple wartyback is a filter feeder.

Principal threats to survival of the species are similar to those described previously for the hickorynut. The purple wartyback was last reported from Monroe, Wayne, and Washtenaw Counties in 2000, 2006, and 2005, respectively (MNFI 2007g). Streams with conditions suitable for the purple wartyback are not present on the Fermi site, and Lake Erie adjacent to the Fermi site does not offer suitable habitat for this species. Since no large or medium rivers are crossed by the proposed transmission line corridor, it is unlikely that this species would be present in stream areas associated with the corridor.

Rayed Bean (*Villosa fabalis*)

The rayed bean is a freshwater unionid mussel (see Section 2.4.2.1) that was Federally listed as endangered in 2012 (77 *Federal Register* [FR] 8632). This species is listed as endangered by the State of Michigan and has been recorded in Monroe and Wayne Counties (MNFI 2007g). The rayed bean is patchily distributed in the St. Lawrence, Ohio, and Tennessee River drainages (Carman 2001f). Although it was historically widespread from Ontario to Alabama and Illinois to New York, only a few populations are currently known to exist, and it is assumed to be extirpated throughout much of its former range (Carman 2001f). As of November 2010, extant populations were known from 28 streams in Indiana, Michigan, New York, Ohio, Pennsylvania, West Virginia, and the province of Ontario in Canada. In Michigan, existing rayed bean populations are known from the Black, Pine, Belle, and Clinton River systems.

The rayed bean is generally found in smaller headwater creeks, although it has also been found in larger rivers (FWS 2002). They usually are found in or near shoal or riffle areas; there are also records of rayed bean specimens from shallow, wave-washed areas of Lake Erie, generally associated with islands in the western portion of the lake (FWS 2002). Preferred substrates are gravel and sand, and it is oftentimes found among the roots of vegetation growing in riffles and shoals (FWS 2002).

The general life history of unionid mussels is described in Section 2.4.2.1. The rayed bean reportedly holds glochidia internally over the winter for release in the spring; female rayed beans bearing eggs have been found in May (Carman 2001f). Fish hosts for the glochidia could include the Tippecanoe darter (*Etheostoma tippecanoe*), greenside darter (*Etheostoma blennioides*), rainbow darter (*Etheostoma caeruleum*), mottled sculpin (*Cottus bairdi*), and largemouth bass (FWS 2002). The limited data available suggest that the lifespan for the rayed bean is less than 20 years (FWS 2002). As are other freshwater mussels, the rayed bean is a filter feeder.

The rayed bean has experienced a significant reduction in range, and most of its populations are isolated and appear to be declining (FWS 2002). The survival of the rayed bean is threatened by a variety of stressors, especially habitat destruction associated with siltation, dredging, and channelization and the introduction of alien species such as the Asian clam and zebra and quagga mussels (FWS 2002). The rayed bean was last observed in Monroe County in 1984 and in Wayne County in 2006 (MNFI 2007g), although these observations were based on the presence of shells, not living specimens (Carman 2001f). The rayed bean has not been reported from Washtenaw County (MNFI 2007g).

There are no streams on the Fermi site with conditions suitable for the rayed bean, and no extant populations are known to occur in the stream drainages that would be crossed by the proposed transmission line route. Although there are records of rayed bean specimens (valves, not live specimens) from shallow, wave-washed areas of western Lake Erie, information supplied by Detroit Edison suggests that it is unlikely that the species occurs in the vicinity of the Fermi site for a number of reasons, as follows. First, approximately 30 years of information on mussels in the western basin of Lake Erie (including in the vicinity of the Fermi site) have been collected and evaluated by the USGS, and no rayed bean specimens have been identified. Second, the USACE conducted mussel surveys in Lake Erie approximately 2 mi south of the Fermi site and found no live specimens or shells of the rayed bean. Third, the rayed bean was not observed in surveys conducted by the MNFI just north of the Fermi site near the mouth of Swan Creek. Fourth, observations made by divers during sediment sampling and buoy maintenance activities within the exclusion zone for the Fermi site indicate that the sediment is predominantly clay hardpan and not suitable for the rayed bean (Detroit Edison 2010c).

Round Hickorynut (*Obovaria subrotunda*)

The round hickorynut is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as endangered by the State of Michigan (MNFI 2007g). The historic range for the round hickorynut includes much of eastern North America, from Ontario and New York southward to Arkansas, Mississippi, Alabama, and Georgia. It has historically been present in the Ohio, Tennessee, Cumberland, and Mississippi River systems, as well as the St. Lawrence and Lake Erie/Lake St. Clair drainages (Carman 2001g). In Michigan, the round hickorynut occurs in the Lake St. Clair and Lake Erie drainages, and it has historically been observed in Sanilac, St. Clair, Macomb, Wayne, Monroe, and Lenawee Counties (Carman 2001g). The round hickorynut is found in sand and gravel substrates of moderately flowing medium to large rivers and along the shores of Lake Erie and Lake St. Clair, near river mouths (Carman 2001g).

The general life history of unionid mussels is described in Section 2.4.2.1. Gravid individuals of the round hickorynut retain fertilized larvae over the winter and release glochidia during the early summer (Carman 2001g). The host fish species for the round hickorynut is unknown (Carman 2001g). Like all freshwater mussels, the round hickorynut is a filter feeder.

Principal threats to survival of the species are similar to those described previously for the hickorynut. The round hickorynut was last reported from Monroe and Wayne Counties in 1977 and 2000, respectively; there are no reports of this species from Washtenaw County (MNFI 2007g). Streams with conditions suitable for the round hickorynut are not present on the Fermi site, although areas in Lake Erie near the mouths of Swan Creek or Stony Creek could contain suitable substrates. Since no large or medium rivers are crossed by the proposed transmission line corridor, it is unlikely that this species would be present in stream areas associated with the corridor.

Salamander Mussel (*Simpsonaias ambigua*)

The salamander mussel is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as endangered by the State of Michigan (MNFI 2007g). The historic range for the salamander mussel includes North America from Ontario southward to Tennessee, where it is found in the Great Lakes Basin in the Lake St. Clair, Lake Huron, and Lake Erie drainages. The salamander mussel is also found in the Ohio River, Cumberland River, and upper Mississippi River drainages (Carman 2002b). The salamander mussel is found in medium to large rivers and in lakes. It is usually found in silt or sand substrates under flat stones (MNFI 2007g).

The general life history of unionid mussels is described in Section 2.4.2.1. The biology of the salamander mussel is poorly understood. Gravid females release glochidia in the spring or summer (Carman 2002b). The host for the salamander mussel is the mudpuppy (*Necturus maculosus*) (Carman 2002b), a large (8 to 15 in. long) salamander species that inhabits many water bodies in Michigan. Like all freshwater mussels, the salamander mussel is a filter feeder.

Principal threats to survival of the salamander mussel are similar to those described previously for the hickorynut. The salamander mussel was last reported from Monroe and Wayne Counties in 1977 and 1998, respectively; there are no reports of this species from Washtenaw County (MNFI 2007g). Streams with conditions suitable for the salamander mussel are not present on the Fermi site. However, areas in Lake Erie near the site could contain suitable substrates as well as the mudpuppy host. Although the exact locations are not known, the nearest reported occurrence of the salamander mussel is from Macon Creek, a medium-sized tributary of Lake Erie, and La Plaisance Bay, located 6 to 9 mi southwest of the Fermi site (Carman 2002b). Since no large or medium rivers are crossed by the proposed transmission line corridor, it is unlikely that this species would be present in stream areas associated with the corridor.

Slippershell (*Alasmidonta viridis*)

The slippershell is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as threatened by the State of Michigan (MNFI 2007g). The historic range for this species extends from southern Ontario south to Alabama and from South Dakota and Kansas east to New York, Virginia, and North Carolina (Carman 2002c). It is found in the Lake Michigan, Lake Huron, Lake St. Clair, and Lake Erie drainages of the Great Lakes Basin and is also present in the Mississippi River system from the Ohio River drainage to the Tennessee River drainage (Carman 2002c). In Michigan, this species has been observed in a number of counties, including Monroe and Washtenaw Counties. The slippershell typically occurs in creeks and headwaters of rivers in sand or gravel substrates, although it can also be present in larger rivers and lakes and has occasionally been found in mud substrates (MNFI 2007g).

The general life history of unionid mussels is described in Section 2.4.2.1. The biology of the slippershell is poorly understood. The slippershell retains larvae internally for about a year. Fish species that are hosts for the slippershell include the johnny darter (*Etheostoma nigrum*) and mottled sculpin (Carman 2002c). Like all freshwater mussels, the slippershell is a filter feeder.

Principal threats to survival of the slippershell are similar to those described previously for the hickorynut (Carman 2002c). The slippershell was last reported from Monroe and Washtenaw Counties in 2000 and 2005, respectively; there are no reports of this species from Wayne County (MNFI 2007g). Streams with conditions suitable for the slippershell are not present on the Fermi site, and Lake Erie adjacent to the Fermi site does not offer suitable habitat for this species. It is currently unknown if appropriate habitats are present in any of the smaller streams that are crossed by the proposed transmission line corridor.

Snuffbox Mussel (*Epioblasma triquetra*)

The snuffbox mussel is a freshwater unionid mussel (see Section 2.4.2.1) that was Federally listed as endangered in 2012 (77 FR 8632). This species is listed as endangered by the State of Michigan and has been recorded in Monroe, Wayne, and Washtenaw Counties (MNFI 2007g). The historic range of the snuffbox mussel extends from Ontario southward to Mississippi and Alabama and eastward to New York and Virginia; extant populations are still present in Wisconsin, Illinois, Indiana, Kentucky, Michigan, Ohio, Pennsylvania, Tennessee, and West Virginia (NatureServe 2009). In Michigan, this species is found primarily in eastern and southeastern rivers, including Otter Creek in Monroe County and the Detroit River in Wayne County (Carman and Goforth 2000c). The snuffbox mussel primarily inhabits small and medium-sized rivers, although specimens have also been collected from Lake Erie and large rivers, such as the St. Clair River. Preferred habitat usually has clear water and sand, gravel, or cobble substrate with a swift current; individuals are often buried deep in the sediment (Carman and Goforth 2000c).

The general life history of unionid mussels is described in Section 2.4.2.1. The snuffbox mussel is a late summer spawner (Carman and Goforth 2000c). Gravid females retain larvae over the winter and release glochidia from May to July (Carman and Goforth 2000c). In Michigan, the only known fish host is the log perch (*Percina caprodes*), although the banded sculpin (*Cottus carolinae*) has been identified as a fish host in other portions of the range (Carman and Goforth 2000c). The snuffbox mussel can live to be approximately 10 years of age (Carman and Goforth 2000c). Like all freshwater mussels, the snuffbox mussel is a filter feeder.

Principal threats to survival of the snuffbox mussel are similar to those described previously for the hickorynut. The snuffbox mussel was last reported from Monroe, Wayne, and Washtenaw Counties in 1933, 2000, and 1977, respectively (MNFI 2007g). Streams with conditions suitable for the snuffbox mussel are not present on the Fermi site, although there is a possibility that shoreline areas of Lake Erie near the site could contain suitable substrates. The snuffbox mussel is unlikely to inhabit any of the smaller streams that are crossed by the proposed transmission line corridor.

Wavyrayed Lampmussel (*Lampsilis fasciola*)

The wavyrayed lampmussel is a freshwater unionid mussel (see Section 2.4.2.1) that is listed as threatened by the State of Michigan (MNFI 2007g). The historic range for this species extended from Ontario to Alabama and Illinois to New York, and it is now discontinuously distributed in the Great Lakes tributaries of Lake Michigan, Lake Erie, Lake Huron, Lake St. Clair, and in the Ohio, Mississippi, and Tennessee River drainages (Stagliano 2001c). Historically, the wavyrayed lampmussel was found throughout the streams and rivers of southeastern Michigan, but the current distribution is more limited (Stagliano 2001c). It is currently known to occur in the Clinton River drainage in Macomb and Oakland Counties, the St. Joseph River in Hillsdale County, the Belle River in St. Clair County, the Huron River drainage in Washtenaw County, and the River Raisin drainage in Jackson, Lenawee, and Washtenaw Counties. It has also been reported in the past from the River Raisin in Monroe County, although the status of populations in that area is not known. The wavyrayed lampmussel occurs in small to medium-sized shallow streams, in and near riffles, with good current; it rarely occurs in medium or larger rivers (Stagliano 2001c). The preferred substrate is sand and gravel (Stagliano 2001c).

The general life history of unionid mussels is described in Section 2.4.2.1. The wavyrayed lampmussel breeding season extends from August of one year through July of the following year (Stagliano 2001c). Following fertilization, gravid females retain larvae over the winter and release glochidia during spring and summer (Stagliano 2001c; Carman and Goforth 2000c). The smallmouth bass is the only known fish host (Stagliano 2001c). After dropping off the fish host, this species reportedly does not move more than approximately 300 yd throughout its life (Stagliano 2001c). The life span of the wavyrayed lampmussel is unknown (Stagliano 2001c). Like all freshwater mussels, the wavyrayed lampmussel is a filter feeder.

Principal threats to survival of this species are similar to those described previously for the hickorynut. The wavyrayed lampmussel was last reported from Monroe, Wayne, and Washtenaw Counties in 2000, 1995, and 2005, respectively (MNFI 2007g). Streams with conditions suitable for the wavyrayed lampmussel are not present on the Fermi site, and Lake Erie adjacent to the Fermi site does not offer suitable habitat for this species. It is currently unknown if appropriate habitats are present in any of the smaller streams that are crossed by the proposed transmission line corridor.

White Catspaw (*Epioblasma obliquata perobliqua*)

The white catspaw is a freshwater unionid mussel (see Section 2.4.2.1) that is Federally listed as endangered and is also listed as endangered by the State of Michigan (MNFI 2007g). This species is considered extirpated from Michigan (MNFI 2007g). Catspaw mussels historically occurred throughout the Midwest and in eastern North America. The white catspaw is believed to have been widely distributed in the Great Lakes drainages; it has been reported from New York to Indiana and is confirmed to have once been present in several rivers in Ohio, Indiana, and southeastern Michigan (Carman 2001h). The white catspaw was also known to have been present in nearshore areas in Lake Erie (Carman 2001h). Currently, the white catspaw is a highly imperiled species, and the only known viable population remaining is in Fish Creek, Ohio (Carman 2001h).

The white catspaw is a medium-sized mussel up to 2 in. long. Little is known of its required habitat because this species is so rare, but it has historically been found in sand and gravel substrates in the riffles and runs of high-gradient streams. In Michigan, the white catspaw also occurred in large rivers (e.g., the Detroit River) and in nearshore areas of Lake Erie (Carman 2001h). The breeding season is unknown, but related mussel species typically release glochidia in late spring or early summer. It is considered likely that the host species for the white catspaw is a riffle-dwelling fish such as a darter or sculpin (FWS 1990). The lifespan is estimated to exceed 15 years (Carman 2001h).

The survival of the white catspaw mussel is currently in severe jeopardy (FWS 1990). Threats to the continued existence of the species include habitat destruction associated with siltation, dredging, and channelization (FWS 1990). The white catspaw was last observed in Monroe and Wayne Counties in 1930 and has not been reported from Washtenaw County (MNFI 2007g). High-gradient streams with conditions suitable for the white catspaw are not present at the Fermi site, although nearshore areas in Lake Erie adjacent to the site could provide suitable substrate. Given the rarity of this species and the absence of reports of individuals or other populations within the region surrounding the Fermi site, it is considered highly unlikely that this species would be present in the project area or in aquatic habitats crossed by the proposed transmission line corridor and, therefore, is not considered further in the environmental impact statement.

Channel Darter (*Percina copelandi*)

The channel darter is a small fish listed as endangered by the State of Michigan (MNFI 2007g). Its distribution extends from the upper St. Lawrence drainages, through the Great Lakes Basin, and into the Ohio River Basin. The darter is found primarily in the Ohio River Basin, but isolated populations occur southward to Louisiana (Carman and Goforth 2000a). In Michigan, the darter's range historically included nearshore areas of Lake Erie and Lake Huron, including some tributaries (Carman and Goforth 2000a). Since 1994, it has been recorded only in the Au Sable, Pine, and St. Clair Rivers in Michigan (Carman and Goforth 2000a). The channel darter's habitat includes rivers and large creeks with moderate current over sand and gravel substrate. It has also been recorded in wave-swept areas of Lake Huron and Lake Erie that have coarse-sand, fine-gravel beach and sandbar substrates (Carman and Goforth 2000a). The darter is usually found in deeper water but will move into shallow water (<3 ft) at night (Carman and Goforth 2000a).

The channel darter spawns in July in Michigan and requires flowing water conditions for successful spawning (Carman and Goforth 2000a). Spawning males maintain a territory with radius of approximately 1.6 ft around a large rock as a spawning female partially buries herself in gravel downstream of the rock and deposits her eggs (Carman and Goforth 2000a). Adults grow to be approximately 2 in. long. Channel darters are benthic feeders whose diet consists of small invertebrates, including mayfly and midge larvae, small crustaceans, and algae and organic debris (Carman and Goforth 2000a).

In Michigan, the range of the channel darter was severely reduced during the past century. Prior to 1957, this species was reported from 11 counties along Lake Huron, Lake St. Clair, the St. Clair River, and Lake Erie (Carman and Goforth 2000a). Declines in abundance and distribution have been attributed primarily to loss of suitable habitat (Carman and Goforth 2000a). The channel darter was last observed in Monroe County in 1941 and in Wayne County in 1952; there are no reports of this species from Washtenaw County (MNFI 2007g). No suitable stream habitat for the channel darter is present on the Fermi site, although there is a potential for this species to inhabit wave-swept shorelines in Lake Erie, such as that located along the eastern edge of the Fermi site. However, no channel darter individuals were collected during recent surveys of aquatic habitats on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No channel darter eggs or larvae were observed during entrainment and impingement studies conducted at the Fermi 2 intake in 2008 and 2009 (AECOM 2009b).

Creek Chubsucker (*Erimyzon oblongus claviformis*)

The creek chubsucker is listed as endangered by the State of Michigan and has been reported from Monroe County (MNFI 2007g). This fish occurs throughout most of the eastern United States but is becoming increasingly rare at the edges of its historic distribution. The northern extent of the range for the creek chubsucker terminates in Michigan, where it has been found in the Kalamazoo River, St. Joseph River, and River Raisin, and their tributaries. For the last two decades, it has been reported only in the Kalamazoo River, located west of Monroe County. The creek chubsucker inhabits headwaters and clear creeks with moderate currents over sand-gravel substrate. In Michigan, the creek chubsucker has been reported primarily from streams that are 3 to 5 ft deep with moderately swift currents and muddy bottoms (Carman 2001a).

The creek chubsucker migrates upstream to spawn in early spring. Eggs are usually scattered over substrates, although males have been observed building nests. Adults may produce up to 9000 eggs per year. Juveniles of this species often form schools in vegetated headwater areas with less current but migrate to deeper downstream areas as they become adults. Life expectancy of the creek chubsucker is approximately 5 years. The diet of the creek chubsucker is mostly small benthic invertebrates (Carman 2001a).

The preferred habitat type for this species (clear creeks with sandy substrates and moderate current) does not occur on the Fermi site. No creek chubsuckers were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) in the vicinity of the Fermi site.

Eastern Sand Darter (*Ammocrypta pellucida*)

The eastern sand darter is listed as threatened by the State of Michigan (MNFI 2007g). This fish occurs in the St. Lawrence River drainage, the Lake Champlain drainage in Vermont, south to West Virginia and Kentucky, and west through Ontario and Michigan (Derosier 2004a). Within Michigan, this darter was found historically in the Huron, Detroit, St. Joseph, Raisin, and Rouge Rivers, as well as Lake St. Clair. However, in the past two decades it has been recorded in the Lake St. Clair and Huron River drainages (Derosier 2004a). The preferred habitats of the eastern sand darter are streams and rivers with sandy substrates and lakes with sandy shoals. They frequently occur in slow-moving streams with deposits of fine sand, often just downstream of a bend (Derosier 2004a).

The spawning period for the eastern sand darter occurs from April through June. Eggs are buried singly in sandy sediments. These darters reach sexual maturity at age one and have a life expectancy of 2 to 3 years The eastern sand darter feeds mostly on chironomid larvae but will also prey upon aquatic worms and small crustaceans (Derosier 2004a).

Declines in Michigan populations of eastern sand darters have been attributed to siltation, modification of riparian areas, channel and flow alterations, and nutrient enrichment (Derosier 2004a). In the vicinity of the Fermi project, the eastern sand darter was last observed in Monroe County in 1929 and in Wayne County in 1936; it has not been reported from Washtenaw County (MNFI 2007g). Although suitable habitat for this species could be present in Stony Creek, no eastern sand darters were collected during recent surveys of aquatic habitats on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No eastern sand darter eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b).

Lake Sturgeon (*Acipenser fulvescens*)

The lake sturgeon is listed as threatened by the State of Michigan for Wayne County, although it is not listed for Monroe County (MNFI 2007g). This fish is also listed as endangered by the State of Ohio (ODNR 2009b). Historically, this species has been found in the Hudson Bay watershed, St. Lawrence estuary, and upper and middle Mississippi River and Great Lakes Basins, and scattered throughout Tennessee, Ohio, and lower Mississippi drainages (Goforth 2000a). It has become rare throughout its historic range, and population estimates indicate that about 1 percent of their original numbers remain. Michigan populations are among the largest at the current time and are scattered throughout most counties bordering the Great Lakes, as well as in some inland lakes and rivers (Goforth 2000a). The lake sturgeon is a benthic organism that occurs in large rivers and the shallow areas of large lakes (Goforth 2000a). Lake sturgeon tend to avoid aquatic vegetation and prefer deep run and pool habitats of rivers, although habitat use varies among lakes, depending on what conditions are available (Goforth 2000a).

Lake sturgeon begin spawning migrations in May when the water temperature reaches 10–12°C, but they do not actually begin spawning until the water is between 13 and 18°C. Spawning occurs in areas with swift currents and clean rocky substrates and at depths of 2 to 15 ft. Large females lay hundreds of thousands of adhesive eggs but may spawn only once every 3 to 7 years. The eggs are fertilized as they are laid and hatch in approximately 5 days. Juveniles grow relatively quickly for the first 10 years, but growth slows considerably after that. Males become sexually mature at about 15 years of age, while females reach maturity at about 25 years of age. The lake sturgeon has the greatest life expectancy of any freshwater fish, with some individuals reaching 80 years old. Although a lake sturgeon spawning area was historically recorded along Michigan's Lake Erie shoreline near Stony Point in Monroe County, activity has diminished or ceased in this area since the 1970s. The lake sturgeon forages over gravel, sand, and mud substrates. The lake sturgeon feeds on snails, clams, crustaceans, fish, and aquatic insect larvae and may also prey on eggs of other species of fish during foraging (Goforth 2000a).

Lake Erie was formerly one of the most productive waters for lake sturgeon in North America (EPA 2009e). In the 1860s, the lake sturgeon population was greatly reduced in Lake Erie as a bycatch of the gill net fishery. In subsequent decades, overharvesting, limited reproduction, and destruction of spawning habitats nearly eliminated the lake sturgeon population in the lake (EPA 2009e). Threats to lake sturgeon populations include physical barriers to migration (e.g., construction of dams), loss of spawning and nursery areas, impacts on water quality, parasitism by sea lamprey, colonization of spawning habitats by zebra and quagga mussels, predation of eggs by round gobies, and the introduction of contaminants (Goforth 2000a). In addition, life history attributes, such as the late age at which sexual maturity is attained, infrequent reproduction, and lack of parental care for eggs or young, contribute to the decline of this species by offering a very low potential for population growth (Goforth 2000a).

Given the proximity of a previously documented spawning area for lake sturgeon in the vicinity of Lake Erie near Stony Point (Goforth 2000a), which is located approximately 1 mi south of the southern boundary for the Fermi site, there is a potential for lake sturgeon to occur in waters near the Fermi site. Although this species does not occur in Washtenaw County, it was last reported from Wayne County in 2006 (MNFI 2007g). No lake sturgeon individuals were collected during recent surveys of aquatic habitats in the vicinity of the Fermi site

(AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No lake sturgeon eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b).

Northern Madtom (*Noturus stigmosus*)

The northern madtom is listed as endangered by the State of Michigan for Wayne County and Washtenaw County; it is not listed for Monroe County (MNFI 2007g). This fish species is found in Lake Erie and Ohio River Basins from western Pennsylvania, southern Ontario, and West Virginia, to the Ohio River in southern Illinois (Carman 2001b). The species is uncommon and is disappearing on the edges of its range. It is also protected in Canada as an endangered species. The northern madtom historically occurred in several large rivers in southeastern Michigan. Surveys in the late 1970s found the species to be present in the Detroit and Huron Rivers, although a survey conducted in the Huron River in 1983 found no northern madtom individuals; the species was observed in the St. Clair River as recently as 1995 (Carman 2001b).

The northern madtom inhabits riffles with sand and gravel substrates in swiftly flowing small to large rivers (Carman 2001b). This species is tolerant of elevated turbidity, although it apparently avoids heavily silted areas (Carman 2001b). Although knowledge of the life history characteristic of this species is limited, the northern madtom is probably sexually mature after 2 to 3 years. It spawns in small cavities in the substrate (Carman 2001b) from June to August (MNFI 2007g). It is believed to feed primarily on aquatic insect larvae and other small invertebrates (Carman 2001b).

The northern madtom is not known to occur in Monroe County, although it could be present in appropriate habitats in Wayne County and Washtenaw County (MNFI 2007g). No northern madtoms were collected during recent surveys on the Fermi site, although another madtom species (tadpole madtom, *Noturus gyrinus*) was observed in surveys conducted near the South Lagoon (AECOM 2009b). Similarly, no northern madtoms were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No northern madtom eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b).

Pugnose Minnow (*Opsopoeodus emiliae*)

The pugnose minnow is listed as endangered by the State of Michigan (MNFI 2007g). This fish species has been documented from the southern Great Lakes Basin, through the Mississippi River valley, to the Gulf of Mexico (Carman 2001c). Although common in the southeastern portion of its range, it is becoming rare at the northern edge of its range (Carman 2001c). Historically, the pugnose minnow occurred in Michigan tributaries and nearshore areas of Lake

Erie and Lake St. Clair, located approximately 15 mi northeast of the Fermi site, although there is no recent record of occurrence (Carman 2001c). The pugnose minnow inhabits slow, clear waters of rivers and shallow regions of lakes and is found in greatest abundance in weedy areas over sand or organic substrate (Carman 2001c). Historically, it occurred in turbid areas of the Huron River that lacked aquatic vegetation, although it is believed that such conditions are not preferred (Carman 2001c).

The life history of the pugnose minnow is not well documented. Spawning occurs in June and July (MNFI 2007g). After hatching, the adult length of 2 in. is reached within 2 years (Carman 2001c). The pugnose minnow feeds on small crustaceans, fly larvae, and other aquatic invertebrates, as well as algae and plants (Carman 2001c).

In Michigan, the pugnose minnow has been observed in Monroe and Wayne Counties within the past 15 years (MNFI 2007g). Declines in Michigan populations have been attributed primarily to increased siltation and loss of weedy aquatic habitats (Carman 2001c). Although there is a potential for suitable habitat for the pugnose minnow to be present in the vicinity of the Fermi site, no individuals were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No pugnose minnow eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b).

Pugnose Shiner (*Notropis anogenus*)

The pugnose shiner is listed as endangered by the State of Michigan (MNFI 2007g). The distribution of this fish species historically ranged from the Lake Ontario drainage of eastern Ontario and western New York to southeastern North Dakota and central Illinois (Derosier 2004b). The species is rare and declining in much of its former range (Derosier 2004b). Within Michigan, the pugnose shiner was historically found within at least 18 watersheds, including some within Wayne and Washtenaw Counties (MNFI 2007g). The pugnose shiner usually inhabits clear, vegetated lakes and vegetated pools and runs of low-gradient streams and rivers and appears to be extremely intolerant of increased levels of turbidity (MNFI 2007g). The species feeds on filamentous green algae, plant material, and small crustaceans (Derosier 2004b). There is little other information available about the life history of this species.

In Michigan, the pugnose shiner was last reported from Washtenaw County in 1938 and from Wayne County in 1894; it has not been reported from Monroe County (MNFI 2007g). No individuals were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No pugnose shiner eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b). Suitable habitat for this species does not occur on the Fermi site.

Redside Dace (*Clinostomus elongatus*)

The redside dace is listed as endangered by the State of Michigan (MNFI 2007g). This fish species was historically distributed in the Lake Erie and Lake Ontario drainages in southeastern Michigan, Ontario, Ohio, Pennsylvania, and New York; the upper Mississippi River Basin of Wisconsin and southeastern Minnesota; the upper Susquehanna River drainage of New York and Pennsylvania, and the upper Ohio River Basin (Goforth 2000b). In Michigan, the redside dace occurs in the River Rouge drainage of Oakland and Wayne Counties and in the Huron River drainage in Washtenaw County (Goforth 2000b). Redside dace occur in small headwater streams with moderate to high gradients, overhanging vegetation that provides shade, coarse woody structures, and clean rocky substrates (Goforth 2000b).

The redside dace spawns during late May in clean rocky riffles, and it inhabits pools during other periods of the year (MNFI 2007g). Redside dace generally mature at about 2 or 3 years of age and reach a length of about 3 in. (Goforth 2000b). This species feeds primarily on insects (Goforth 2000b).

The redside dace has not been reported to occur in Monroe County (MNFI 2007g). No individuals were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No redside dace eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b). Suitable habitat for this species does not occur on the Fermi site.

River Darter (*Percina shumardi*)

The river darter is listed as endangered by the State of Michigan (MNFI 2007g). The distribution of this fish species ranges from southern Canada to the Gulf of Mexico, including the Great Lakes Basin (Carman 2001d). The river darter is found in rivers and large streams with deep, fast-flowing riffles and cobble and boulder substrate. This species has also been observed at depths below 15 ft in nearshore areas of the Great Lakes and is tolerant of elevated levels of turbidity (Carman 2001d).

The river darter is believed to move upstream to spawn. Spawning occurs in late winter to early spring in southern areas, from April through May in the Midwest, and as late as June or July in Canada. The female river darter buries eggs in loose gravel or sand substrates during spawning, and neither males nor females provide parental care to the young. River darters grow to be 3 in. long, mostly within the first year of development, and sexual maturity is usually reached after 1 year. As juveniles, river darters primarily feed on small zooplankton; adults prey upon midge and caddisfly larvae, as well as some snail species (Carman 2001d).

Even though the river darter is relatively tolerant of elevated turbidity and other water quality changes, the species generally requires deep and swiftly flowing waters as habitat. Such habitats are becoming more limited as a result of flood control efforts and riverine impoundments. Within the project area, the river darter was last observed in Monroe and Wayne Counties in 1941; there are no reports of this species from Washtenaw County (MNFI 2007g). No suitable stream habitat for the river darter is present on the Fermi site. No river darters were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No river darter eggs or larvae were collected during entrainment and impingement studies in 2008 and 2009 (AECOM 2009b).

River Redhorse (*Moxostoma carinatum*)

The river redhorse is listed as threatened by the State of Michigan (MNFI 2007g). This fish species was historically distributed in rivers of the upper St. Lawrence River to the upper Mississippi River drainages, west to Nebraska, and south to Florida (west of the Appalachians); it is widespread in the central Mississippi Basin, including Missouri, Arkansas, Kentucky, Tennessee, and Alabama (Stagliano 2001a). The species reaches the northern extent of its historic range in Michigan, and few specimens have been documented in the State (Stagliano 2001a). In the vicinity of the Fermi site, the river redhorse has been documented only from the Detroit River in Wayne County. The species prefers medium to large rocky rivers with moderate to strong currents and is most often associated with long, deep run habitats up to 3 m deep (MNFI 2007g). This species is generally considered intolerant of increased levels of silt deposition and turbidity (MNFI 2007g).

Although most individuals average 10 to 20 in. in length, this species can be 30 in. long and weigh more than 10 lb. In Michigan, the river redhorse normally spawns in July or August, with adults often migrating upstream to medium-sized sections of rivers and tributary streams. Spawning occurs over gravel or rubble in nests constructed by males. After hatching, young fish generally remain in the spawning reaches until they are subadults. Sexual maturity is reached at approximately 3 years of age, and adults can live to be approximately 12 years old. River redhorse consume primarily benthic invertebrates, such as clams, crayfish, and aquatic stages of insects (Stagliano 2001a).

In Michigan, the river redhorse was last observed in Wayne County in 1984 and has not been reported from Monroe or Washtenaw Counties (MNFI 2007g). No river redhorse were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No river redhorse eggs or larvae were collected during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b). Suitable habitat for river redhorse is not present on the Fermi site.

Sauger (*Sander canadensis*)

The sauger is listed as threatened by the State of Michigan (MNFI 2007g). The native range for this fish species includes the St. Lawrence, Great Lakes, Hudson Bay, and Mississippi River Basins, as well as the Tennessee River in Alabama and Louisiana; the sauger has also been introduced into the Atlantic, Gulf, and southern Mississippi River drainages (Derosier 2004c). This species was historically abundant in Lake Erie.

The sauger, which is closely related to the walleye, prefers turbid areas of lakes, reservoirs, and large rivers (MNFI 2007g). This species spawns over shallow areas with gravel and rubble substrates in May or June, when temperatures range from 4 to 6°C (Derosier 2004c). The sauger broadcasts demersal, adhesive eggs over shoals during the night. After hatching, young sauger spend up to 9 days on the bottom, absorbing yolk from their egg sacs. Males reach sexual maturity within 3 years, while females take 4 to 6 years to mature (Derosier 2004c). The life expectancy for the sauger is up to 13 years (Derosier 2004c), and it can attain lengths up to approximately 18 in. (NatureServe 2009). Saugers have a specialized structure in their eyes that makes them very sensitive to light, and they prefer to feed at night in clearer waters or during the day in turbid areas (Derosier 2004c). Juvenile sauger prey on zooplankton and aquatic insect larvae, whereas adults feed on fish and larger invertebrates, including gizzard shad, emerald shiner, crappie, bass, freshwater drum, leeches, crayfish, and insects (Derosier 2004c).

Within the project area, the sauger was last reported from Monroe County in 1996 and from Wayne County in 1993; there are no reports of this species from Washtenaw County (MNFI 2007g). Although there is no riverine habitat suitable for sauger on or adjacent to the Fermi site, suitable habitat could be present in Lake Erie near the Fermi site. However, no sauger individuals were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No sauger eggs or larvae were collected during entrainment and impingement studies in 2008 and 2009 (AECOM 2009b).

Silver Shiner (*Notropis photogenis*)

The silver shiner is listed as endangered by the State of Michigan (MNFI 2007g). The distribution for this fish species ranges from the Great Lakes and their tributaries, through the Ohio River Basin and Tennessee drainage, to northern Alabama and Georgia. This shiner is fairly common within most of the Ohio River Basin but occurs more rarely in tributaries of the Great Lakes. Within Michigan, it is locally abundant in the St. Joseph River (Hillsdale County) and in the River Raisin (Washtenaw County). Historically, the silver shiner was also found in the River Raisin in Monroe County (Carman 2001e).

Preferred habitat for the silver shiner is medium to large streams with moderate to high gradients. This species is usually found in deeper water, such as pools or eddies directly below riffles. The species has been documented to prefer a variety of substrates, including gravel and boulder, pebble and cobble, and sand, mud, and clay, and is believed to avoid areas with dense vegetation and substantial siltation. In Michigan, the shiner has been found to inhabit areas of strong current with wooded banks (Carman 2001e).

Reproduction of the silver shiners is not well documented, but it is believed to spawn in June. Juvenile silver shiners exhibit rapid growth, reaching sexual maturity at age 2 and maximum size by age 3. Although the silver shiner primarily feeds at the surface, it will take mid-water prey as well. The majority of the silver shiner's prey are aquatic stages of insects, especially flies (Carman 2001e).

The silver shiner is relatively rare in Michigan, but populations appear to be stable (Carman 2001e). The species is fairly tolerant of human impact and poor water quality (Carman 2001e). The silver shiner prefers stream habitats with moderate to high gradient, and such habitat is not present on the Fermi site. No silver shiners were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) in the vicinity of the Fermi site. No silver shiner eggs or larvae were observed during entrainment or impingement studies in 2008 and 2009 (AECOM 2009b). Suitable habitat for this species does not occur on the Fermi site.

Southern Redbelly Dace (*Phoxinus erythrogaster*)

The southern redbelly dace is listed as endangered by the State of Michigan (MNFI 2007g). The distribution for this fish species ranges from the Lake Erie and Lake Michigan drainages, through the Mississippi River Basin south to Alabama, Arkansas, and Oklahoma. The northern limit of this species' range is in southeastern Michigan in the Huron River and River Raisin drainages that feed Lake Erie (Stagliano 2001b). The southern redbelly dace generally occurs in the clear and cool permanent headwaters of river systems, especially small moderate-gradient spring-fed and wooded streams that contain pools and are shaded (Stagliano 2001b). Preferred substrates include mud bottoms of pools and clean gravel of riffles (Stagliano 2001b).

In the northern portion of its range, the southern redbelly dace usually spawns in May and June. Spawning fish migrate from pools to riffles, where they use nests built by other fishes in the same family (*Cyprinidae*). Females generally release 700 to 1000 eggs during each spawning event. Southern redbelly dace reach sexual maturity within 1 year at a length of less than 2 in. This species is generally herbivorous, feeding on filamentous algae, diatoms, and drifting or benthic detritus; larger fish reportedly feed on chironomid and mayfly larvae, as well as other small invertebrates (Stagliano 2001b).

Within the project area, the southern redbelly dace was last reported from Monroe County in 1930 and from Washtenaw County in 1973; there are no reports of this species from Wayne County (MNFI 2007g). Although there is a potential for suitable habitat to be present in some of the small streams adjacent to the Fermi site or within the ROW for the proposed transmission line, the areas of Lake Erie near the Fermi site are not suitable habitat for this species. No southern redbelly dace were collected during recent surveys on the Fermi site (AECOM 2009b), and none were reported in past biological surveys of Stony Creek (MDEQ 1996, 1998) or the Swan Creek estuary (Francis and Boase 2007) near the Fermi site. No southern redbelly dace eggs or larvae were collected during entrainment and impingement studies in 2008 and 2009 (AECOM 2009b).

Critical Habitats

No critical habitat for aquatic species has been designated by the FWS in the vicinity of the Fermi site.

Non-Native and Nuisance Species

Aquatic nuisance species have the ability to cause large-scale ecological and economic problems when they have been introduced into an ecosystem that does not have the natural controls to keep them in check, such as pathogens, predators, and parasites. When new species are introduced into an area, the lack of natural controls may cause the populations to grow at or near maximum exponential rates. If a nuisance species becomes established, it may disrupt the balance of the existing ecosystem. As a nuisance species proliferates, it may prey upon, out-compete, or cause disease in the existing inhabitants. Aquatic nuisance species that are known to occur on or near the Fermi site are discussed below.

<u>Asian Clam (*Corbicula fluminea*)</u>

The Asian clam was imported in the northwestern United States in 1938 as a food source and subsequently released to the environment. The species has since become widely distributed throughout the United States (Foster et al. 2011). Native to Asia and Africa, the first report of this species from Lake Erie was in 1981, and it has now become established in the Great Lakes. Cold water temperatures limit the potential for survival and reproduction of this species in the Great Lakes Region, where it is often found in areas influenced by the heated water discharged from power plants (French and Schloesser 1991). Asian clams can attach to intake pipes and other man-made structures, causing problems related to the operation and maintenance of power plants and industrial water systems. The cost of removing them from intake systems is estimated at about a billion dollars each year (Foster et al. 2011). Asian clams compete with other species, especially native freshwater mussels, by occupying benthic habitat and filtering phytoplankton and suspended matter from the water column. This species is also eaten by some aquatic species, such as fish and crayfish (Foster et al. 2011).

Fishhook Water Flea (*Cercopagis pengoi*)

The fishhook water flea is an invasive planktonic crustacean that is native to the Caspian Basin in southwest Asia. It is believed to have been introduced to the Great Lakes from the ballast water of a transoceanic ship in the late 1990s. It is now considered established in Lake Ontario and has substantial populations in all of the Great Lakes except Lake Superior and Lake Huron. The fishhook water flea consumes zooplankton and competes with other planktivores for food. Similar to the spiny water flea (described below), this species has a long spine that makes it less palatable to planktivorous fish, and it has a high reproductive rate. As a consequence, it is feared that the establishment of this species could result in substantial changes to plankton communities and could affect survival of planktivorous fish in affected lakes. The current distribution of this species in the vicinity of the Fermi site is unknown, although it was found in Lake Erie in 2002 (Benson et al. 2010a).

Lyngbya (*Lyngbya wollei*)

Lyngbya is an invasive filamentous cyanobacterial (blue-green algae) species that has become established in some areas of the western basin of Lake Erie. Lyngbya, which is common in some areas of the southeastern United States, was first observed in Maumee Bay (approximately 18 mi south-southwest of the Fermi site) in 2006. This species has been observed to form dense benthic and floating mats that can interfere with boating and other lake activities and may negatively affect other aquatic organisms. In addition, when the algal mats wash ashore, they can blanket extensive shoreline areas and become a nuisance as they decompose.

Bridgeman and Penamon (2010) conducted surveys of the western basin in 2008 and found that lyngbya was most prevalent along shorelines in the vicinity of Maumee Bay, becoming less prevalent with increasing distance from Maumee Bay. In addition, the biomass of benthic mats of lyngbya was found to be greatest in Maumee Bay and Bolles Harbor at water depths of 5 to 11 ft on substrates that contained mixtures of sand and fragmented shells from dreissenid mussels (i.e., zebra and quagga mussels). The closest record of occurrence of lyngbya is in the vicinity of Sterling State Park, approximately 5 mi south-southwest of the Fermi site (Bridgeman and Penamon 2010). Bridgeman and Penamon (2010) found no lyngbya in samples collected at Stony Point (approximately 2 mi southwest of the Fermi site) in 2008, and lyngbya has not been documented at the Fermi site. Overall, it appears that the potential for excessive growth of lyngbya is related to the amount of light penetration into the water column (a function of water turbidity), water depth, nutrient availability, and the type of substrate that is present (Bridgeman and Penamon 2010; LaMP Work Group 2008). Bridgeman and Penamon (2010) found that lyngbya in the vicinity of Maumee Bay usually occurred at depths between 6.6 and 9.2 ft. Nutrient concentrations of nitrate, orthophosphate, and total phosphorus reported from Maumee Bay (Moorhead et al. 2008) were higher than those reported by the applicant in Lake Erie near the Fermi site (AECOM 2009a).

A report prepared by Detroit Edison (2012a) documented visual inspections for algae recorded in ship and dive logs during surveys conducted as part of the Fermi 2 Radiological Environmental Monitoring Program. Detroit Edison (2012a) also performed microscopic analyses of algal samples collected near the existing Fermi 2 discharge and the proposed location for the Fermi 3 discharge in 2011. Information from the logs indicated that no mats or stands of algae were observed in the vicinity of the Fermi site. The microscopic analyses confirmed that *Lyngbya wollei* was not present in samples from the Fermi site.

Quagga Mussel (*Dreissena rostriformis bugensis*)

The quagga mussel is a nuisance species believed to have been introduced to the United States through the ballast water discharge of transatlantic shipping vessels. Native to Ukraine, this species was first discovered in the Great Lakes region in 1989 and has now become well-established in Lake Erie. It has been reported in Lake Erie near the mouths of Swan and Stony Creeks (near the Fermi site), and is most likely present in parts of the Detroit River as well. Very similar to the zebra mussel (described below), the quagga mussel attaches to a wide variety of living and nonliving things, including intake pipes and structures, causing problems related to the operation and maintenance of these structures. By filtering phytoplankton and suspended matter from the water column, the quagga mussel consumes a large portion of the zooplankton food source, thus affecting the entire food chain. By clarifying the water, the species augments the natural success of aquatic vegetation and, in turn, alters the entire lake ecosystem (Benson et al. 2010b).

Round Goby (*Neogobius melanostomus*)

The round goby is an invasive species abundant throughout the Great Lakes region, with origins in the Black and Caspian Seas. It is commonly believed that the round goby was introduced to the Great Lakes through ballast water. First encountered in the vicinity of the St. Clair River in 1990, the round goby has now spread to all of the Great Lakes. The largest populations are believed to be in Lake Erie and Lake Ontario. This small fish feeds primarily on bivalves (including zebra mussels), amphipods, small fish, and fish eggs. Thermal tolerance for this species ranges from 39 to 68°F. Known to compete with other fish for food and consume eggs and juvenile fish, the round goby is seen as a detriment to the Lake Erie ecosystem (Fuller et al. 2010a).

The round goby is present in habitats near the Fermi site and is likely present in Swan Creek and Stony Creek. During aquatic surveys conducted at the Fermi site in 2008 and 2009, a total of 22 round gobys were collected along the Lake Erie shoreline near the South Lagoon (AECOM 2009b). Round gobys were also observed in samples collected during impingement and entrainment studies during 2008 and 2009; it was estimated that 123 individuals would be impinged and that more than 1.7 million eggs and larvae would be entrained annually during normal operations of the water intake (AECOM 2009b).

Sea Lamprey (*Petromyzon marinus*)

The sea lamprey is a primitive jawless fish originating in the Atlantic Ocean. The sea lamprey is an invasive species and is larger and far more predacious than the lamprey species that are native to Lake Erie. During the adult stage, sea lampreys parasitize other fish by attaching to them with their suckerlike mouth and penetrate the body wall with sharp teeth in order to feed on body fluids; this often results in the death of the host fish (Great Lakes Fishery Commission 2000). A single sea lamprey can kill as much as 40 lb of fish in its lifetime, and it is estimated that only one in seven fish survive an attack by a sea lamprey (Great Lakes Fishery Commission 2000). They have a strong advantage over the many species of fish native to Lake Erie because they have no natural predators in the lake. The sea lamprey has no economic value, and during its peak abundance, it is estimated that 85 percent of lake trout encountered that have not been killed by the lamprey will have scarring from their attacks (Great Lakes Fishery Commission 2000). Sea lampreys were first observed in Lake Erie (Fuller et al. 2010b). This species typically moves into tributaries to spawn, and many tributaries of Lake Erie are treated with chemicals, called lampricides, that kill the larval stages of sea lampreys in order to prevent further expansion of the species. Although Lake Erie and Swan Creek are the only waterways in the vicinity of the Fermi site where sea lampreys have been found, Stony Creek and the Detroit River could have individuals present during spawning runs.

Spiny Water Flea (*Bythotrephes longimanus*)

The spiny water flea is an invasive planktonic crustacean (cladoceran) that is native to Europe and northern Asia and believed to have arrived in the Great Lakes region via ballast water in the mid 1980s. Because of a preference for cooler waters, the spiny water flea is more abundant in the central basin of Lake Erie than in the western basin; however, it can be found throughout the lake (Berg 1992). There are populations found in inland lakes of the Great Lakes region, and it is presumed that the spiny water flea could also occur in tributaries of Lake Erie, such as Swan Creek, Stony Creek, and the Detroit River as well.

This is a large plankton species, about 0.5 in. long, that has a very high reproductive rate. The spiny water flea consumes small zooplankton, such as small cladocerans, copepods, and rotifers, and it is feared that the introduction of this species could result in changes to the zooplankton community structure in affected lakes. The spiny water flea also competes with juvenile fish, since they share many similar food sources, such as zooplankton, fish larvae, and eggs. This species is not an attractive prey to the native inhabitants of Lake Erie because of the sharp spines located on its tail. It is assumed that there will be few deterrents to the success of its rapidly growing population (Liebig and Benson 2010).

Tubenose Goby (*Proterorhinus semilunaris*)

The tubenose goby is a small fish that was introduced into the St. Clair River, in Michigan, in 1990, and probably originated in ballast water discharged from a foreign tanker that took on water somewhere in the Black Sea (Jude et al. 1992). This species is believed to be established, but rare in the St. Clair River and in Lake St. Clair, in Michigan (Fuller et al. 2012). Since establishment, the distribution of the species has expanded and it now also occurs in the Detroit River and the western basin of Lake Erie (Kocovsky et al. 2011). This species was also found to be present in Swan Creek in 2001, within approximately 2.5 mi of Lake Erie and the Fermi site (Fuller et al. 2012).

In the western basin of Lake Erie, maximum densities of tubenose gobies occurred in sheltered areas with abundant growth of aquatic vegetation, which also is the preferred habitat for the native northern Black Sea populations (Kocovsky et al. 2011). Tubenose gobies were generally absent from sampled areas of the western basin that were dominated by cobble, along windswept shores, or that lacked vegetation (Kocovsky et al. 2011). The diet of tubenose gobies in the western basin consisted almost exclusively of invertebrates, especially midge larvae and amphipods, suggesting that it may compete for food with other bottom-dwelling fishes, such as darters (*Etheostoma* spp. and *Percina* sp.), madtoms (*Noturus* spp.), and sculpins (*Cottus* spp.), and could displace some of these native species (Kocovsky et al. 2011).

Zebra Mussel (*Dreissena polymorpha*)

The zebra mussel is considered a nuisance species throughout the entire Great Lakes region and is known to inhabit the western basin of Lake Erie, near the Fermi site. Zebra mussels have been reported in Swan Creek, Stony Creek, and the Detroit River. Originally found primarily in Russia, it is believed that this species was transported to the Great Lakes region in the ballast water of a transatlantic freighter in 1988. Since that time, it has spread to more than 100 lakes and several major river systems, including the Mississippi River (USGS 2008).

Zebra mussels are very successful invaders because they live and feed in many different aquatic habitats, breed prolifically, and have both a planktonic larval stage and an attached adult stage. Adult zebra mussels attach to a wide variety of living and nonliving things, from boats, docks, piers, and water intake pipes to plants and even slow-moving animals. They can also attach to each other, creating dense blankets of mussels up to 1-ft thick. In 1989, the city of Monroe lost its water supply for 3 days when large amounts of zebra mussels clogged the city's water intake pipeline. The FWS estimates the economic impact of zebra mussels to be in the billions of dollars (over the next 10 years) in the Great Lakes region alone (USGS 2008).

In addition to the economic damage caused by this species, the invasion of the Great Lakes and other areas by this species has had important ecological effects. As identified in previous sections, zebra mussels have contributed to the decline of native freshwater mussels by competing for food and space and by preventing burrowing and other activities when they attach to the shells of freshwater mussels. In addition, the collective water-filtering ability of quagga and zebra mussels is believed to have had lakewide effects on nutrient levels, the abundance and composition of phytoplankton and zooplankton communities, and water clarity, resulting in large-scale ecological changes (USGS 2008).

2.4.2.4 Important Aquatic Species and Habitats – Transmission Lines

As identified in Section 2.4.2.2, aquatic habitats within or adjacent to the new transmission line corridor include several small streams and numerous small drainage ditches. The new transmission line corridor does not cross any lakes, ponds, or reservoirs. Stony Creek, which is located in the developed eastern portion of the assumed route, is the largest stream crossed by the transmission line route and is discussed in Section 2.4.2.1.

There are no known commercial fisheries occurring within surface water habitats that occur within the proposed transmission line corridor. While some species that support fisheries (e.g., largemouth or smallmouth bass, bluegill, or yellow perch) could be present in these habitats in low numbers, there are no important commercial or recreational fisheries present within the assumed 300-ft-wide ROW because of the small sizes of the drainages present.

Federally and State-listed species that have a potential to occur along the new transmission line route, on the basis of county-level records for Monroe, Wayne, and Washtenaw Counties, are identified in Table 2-16. The majority of the transmission line route falls within the Ottawa-Stony Watershed (Hydrologic Unit Code 04100001). However, it is not known whether suitable habitat or populations of species identified in Table 2-16 occur in portions of the drainage that would be crossed by the proposed transmission route. The MDEQ and/or USACE may require surveys of the proposed transmission line corridor to evaluate the presence of important species and habitat.

2.4.2.5 Aquatic Monitoring

No formal monitoring of the aquatic environment on the Fermi site has been conducted or is planned. The current NPDES permit for the Fermi site does not require monitoring of aquatic ecological resources, and there are no requirements in the license for Fermi 2 to conduct monitoring of aquatic resources, including specific aquatic ecological monitoring of the algal community, benthic invertebrates, or fish.

2.5 Socioeconomics

This section describes the socioeconomic baseline of the regional and local area around the Fermi plant site. The proposed Fermi 3 would be built at the site of the existing Fermi 1 and 2 that are owned and operated by Detroit Edison, located in Monroe County, Michigan, on the shore of Lake Erie. Section 2.5.1 describes the regional and local population, and Section 2.5.2 describes community characteristics of the population.

The review team considered the regional area to be the area within a 50-mi radius of Fermi 3, including portions of the metropolitan statistical areas that encompass the Cities of Detroit and Toledo and their surrounding metropolitan areas. Within a 50-mi radius of Fermi 3 are all or a portion of eight counties in Michigan (Jackson, Lenawee, Livingston, Macomb, Monroe, Oakland, Washtenaw, and Wayne); eight counties in Ohio (Erie, Fulton, Henry, Lucas, Ottawa, Sandusky, Seneca, and Wood); and three Canadian census divisions (Essex, Chatham-Kent, and Lamberton). The 2000 and 2010 Census populations of counties and selected municipalities located within or partially within the 50-mi radius are shown in Table 2-17.[(a)]

Also within a 50-mi radius of Fermi 3 are the Cities of Detroit and Toledo and portions of their surrounding metropolitan statistical areas. The City of Detroit is part of the Detroit-Warren-Livonia Metropolitan Statistical Area (MSA), which encompasses 10 principal cities over a six-county area. The City of Toledo is part of an MSA that includes Lucas, Fulton, Ottawa, and Wood Counties. The 2000 and 2010 Census populations of the Detroit-Warren-Livonia MSA and the Toledo MSA are shown in Table 2-18.

The review team expects most socioeconomic impacts to occur within a local area where most of the building and operations workforces for Fermi 3 are expected to reside. This local area would be Monroe and Wayne Counties in Michigan and Lucas County in Ohio, which the review team considers the economic impact area. The review team expects community services there to receive the majority of any benefits and stresses associated with building, maintenance, and operation of Fermi 3.

Table 2-19 shows the county of residence for the 2008 Detroit Edison workforce at the Fermi site. Approximately 57.5 percent of the plant's workforce resides in Monroe County, Michigan, where the plant is located. Approximately 23.1 percent reside within the Detroit-Warren-Livonia MSA, principally in Wayne County (19.0 percent of the workforce). Approximately 12.9 percent reside within the Toledo MSA, principally in Lucas County (10.7 percent of the workforce). The remaining 6.5 percent of the workers is distributed across 13 other counties in Michigan, Ohio,

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(a) This section has been updated for the Final EIS to include the results of the mandated U.S. decadal census for 2010 for the data sets that have been released by the U.S. Census Bureau as of May 2012. For the data sets that have not yet been released, the review team has presented the results of the five-year estimates from the American Community Survey (i.e., 2006–2010).

Table 2-17. Total Population of U.S. Counties and Municipalities and Canadian Census Divisions within or Partially within a 50-mi Radius of the Fermi Site in 2000 and 2010

County or Municipality	2000	2010	Change in Population (percent)
Michigan			
Jackson County	158,422	160,248	1.2
Lenawee County	98,890	99,892	1.0
Livingston County	156,951	180,967	15.3
Macomb County	788,149	840,978	6.7
Monroe County[(a)]	145,945	152,021	4.2
City of Monroe	22,076	20,733	–6.1
Oakland County	1,194,156	1,202,362	0.7
Washtenaw County	322,895	344,791	6.8
Wayne County[(a)]	2,061,162	1,820,584	–11.7
City of Detroit	951,270	713,777	–25.0
Ohio			
Erie County	79,551	77,079	–3.1
Fulton County	42,084	42,698	1.5
Henry County	29,210	28,215	–3.4
Lucas County[(a)]	455,054	441,815	–2.9
City of Toledo	313,619	287,208	–8.4
Ottawa County	40,985	41,428	1.1
Sandusky County	61,792	60,944	–1.4
Seneca County	58,683	56,745	–3.3
Wood County	121,065	125,488	3.7
Ontario, Canada[(b)(c)]			
Essex City	374,975[(d)]	388,782[(e)]	3.7
City of Windsor	209,218[(d)]	319,246[(e)]	52.6
City of Chatham-Kent	107,709[(d)]	104,075[(e)]	–3.4

Sources: USCB 2000a, b, 2010a, b, c; Statistics Canada 2007, 2011a, b, c

(a) Counties that make up the three-county economic impact area.

(b) Canadian census divisions are counties or other legislated areas that are identified by provinces for the planning or provision of community services. Population data from 2000 and 2010 for Canadian census divisions are unavailable. Canadian 2001 and 2011 Census data are provided instead.

(c) The 50-mi radius around Fermi 3 encompasses a small portion of Lamberton County in Ontario; however, because of the small amount of land impacted, population statistics for Lamberton County have not been included in the analysis of the 50-mi radius area.

(d) 2001 data.

(e) 2011 data.

Table 2-18. Total Population of Detroit-Warren-Livonia MSA and Toledo MSA in 2000 and 2010

Metropolitan Statistical Area	2000	2010	Change in Population (percent)
Detroit-Warren-Livonia[a]	4,452,557	4,296,250	–3.5
Toledo[b]	659,188	651,429	–1.2

Source: USCB 2008, 2010d

(a) The Detroit-Warren-Livonia MSA encompasses the principal cities of Detroit, Warren, Livonia, Dearborn, Troy, Farmington Hills, Southfield, Pontiac, Taylor, and Novi. It encompasses Wayne, Lapeer, Livingston, Macomb, Oakland, and St. Clair Counties.

(b) The Toledo MSA encompasses the principal city of Toledo and Lucas, Fulton, Ottawa, and Wood Counties.

and Ontario. No more than 23 employees (3.2 percent of the total workforce) reside in any one county outside Monroe, Wayne, and Lucas Counties. Current employees at the Fermi site represent less than 1 percent of the total population in any of the counties or locations where these employees reside.

The review team determined that, on the basis of the analysis of the residential distribution of the Fermi site workforce, the economic impact area for analysis of the construction and operation of Fermi 3 would include Monroe and Wayne Counties in Michigan and Lucas County in Ohio. These three counties are where more than 87 percent of the current Fermi site workforce resides; therefore, the review team expects that most of the building and operations workforces for Fermi 3 would similarly reside in these three counties. Given the commute distance beyond this three-county area and the residential distribution pattern of the current Fermi site workforce, the review team expects few in-migrating workers to choose to reside outside these three counties, and the impact on any one community is not likely to be noticeable. The review team expects workers already residing in the 50-mi region will have no marginal impact on their communities due to Fermi 3 building or operations.

The scope of the review of demographic and community characteristics is guided by the magnitude and nature of the expected impacts that may result from the building, maintenance, and operation of Fermi 3.

2.5.1 Demographics

This section provides population data within a 50-mi radius of Fermi 3 for two major groups: residents, who live permanently in the area, and transients, who may temporarily work or visit in the area but have a permanent residence elsewhere. Population data for residents are based on the 2000 and 2010 U.S. Census and the 2001 and 2011 Canada Census. Transient populations are not fully characterized by the U.S. Census Bureau (USCB), which generally

Table 2-19. Distribution of Fermi Site Employees in 2008 by County of Residence

County	Workforce in 2008	Percent of Workforce by County	Percent of Workforce Cumulative	Percent of 2010 County Population[(a)]
Monroe	418	57.5	57.5	0.3
Wayne	138	19.0	76.5	<0.1
Lucas	78	10.7	87.2	<0.1
Economic Impact Area	**634**		**87.2**	**0.03**
Washtenaw	23	3.2	90.4	<0.1
Oakland	21	2.9	93.3	<0.1
Lenawee	10	1.4	94.7	<0.1
Wood	8	1.1	95.8	<0.1
Macomb	6	0.8	96.6	<0.1
Ottawa	6	0.8	97.4	<0.1
Sandusky	3	0.4	97.8	<0.1
Livingston	2	0.3	98.1	<0.1
Fulton	2	0.3	98.4	<0.1
Windsor (Ontario)	2	0.3	98.7	<0.1
Jackson	1	0.1	98.8	<0.1
Branch[(b)]	1	0.1	98.9	<0.1
Berrien[(b)]	1	0.1	99.0	<0.1
Saint Clair[(b)]	1	0.1	99.1	<0.1
Van Buren[(b)]	1	0.1	99.2	<0.1
Presque Isle[(b)]	1	0.1	99.3	<0.1
Erie	1	0.1	99.4	<0.1
Seneca	1	0.1	99.5	<0.1
Stark[(b)]	1	0.1	99.6	<0.1
Clare	1	0.1	99.7	<0.1
Total	**727**			

Source: Detroit Edison 2008a
(a) County population data were from USCB 2010a, b; Statistics Canada 2011a.
(b) Outside the 50-mi radius around Fermi 3.

documents only resident populations. Therefore, the transient population within a 50-mi radius of Fermi 3 is estimated as described in Section 2.5.1.2. Regional population projections in 10-year increments are provided through 2060 for the combined resident and transient populations within a 50-mi radius.

Data on the resident population, population change, and selected demographic characteristics also are provided for the local population (i.e., the population within the three-county economic impact area, including Monroe and Wayne Counties, Michigan, and Lucas County, Ohio). Included in this section is information on migrant workers (i.e., workers who reside in an area for a period of time to work and then leave after their jobs are done).

2.5.1.1 Resident Population

The following resident population data is based in part on the sector analysis performed in the FSAR for the Fermi 3 COL application (Detroit Edison 2012b). Following the discussion of the sector analysis, resident population is provided at a county level based on U.S. Census Bureau data.

Data for the resident population within a 50-mi radius of Fermi 3 were estimated by Detroit Edison using LandView® 6 software, developed by the USCB in collaboration with other Federal agencies as a tool to estimate 2000 Census populations at prescribed distances within a specific geographic area. Detroit Edison used ArcGIS software, which can estimate the percentage of a population within a specified geographic area, to estimate the population in Canada.

On the basis of 2000 Census data, approximately 5.4 million persons reside within a 50-mi radius of Fermi 3. Table 2-20 provides the 2000 population as distributed among 10-mi circular segments within a 50-mi radius.

Table 2-20. Resident Population within a 50-mi Radius of Fermi 3 in 2000

0–10 mi	10–20 mi	20–30 mi	30–40 mi	40–50 mi	1–50 mi
89,198	336,170	1,725,503	1,939,797	1,287,597	5,378,266

Source: Detroit Edison 2011a

Figure 2-15 shows the distribution of this population in further detail, as each 10-mi circular segment within a 50-mi radius is subdivided into sectors to show the population distribution by radial direction.

The largest population center within a 50-mi radius of Fermi 3 is the portion of the Detroit-Warren-Livonia MSA within the 50-mi radius. This MSA had a population of more than 4 million persons in 2000. The Detroit-Warren-Livonia MSA encompasses 10 principal cities over a six-county area, the core of which is the City of Detroit, which is located approximately 30 mi northeast of the Fermi site. Toledo, which is approximately 24 mi southwest of the Fermi site, is part of an MSA that includes Lucas, Fulton, Ottawa, and Wood Counties, portions of which are within a 50-mi radius of the site. In 2000, the population of the Toledo MSA was 659,188 persons. To the northeast, approximately 251,563 persons in Canada are within a 50-mi radius of Fermi 3.

An estimated 89,198 permanent residents are located within the emergency evacuation zone, which lies within a 10-mi radius around Fermi 3. The City of Monroe accounts for a large portion of this population. It is the largest city within a 10-mi radius of Fermi 3, with a population of 22,076 persons in 2000. Other population centers (and their corresponding 2000 Census

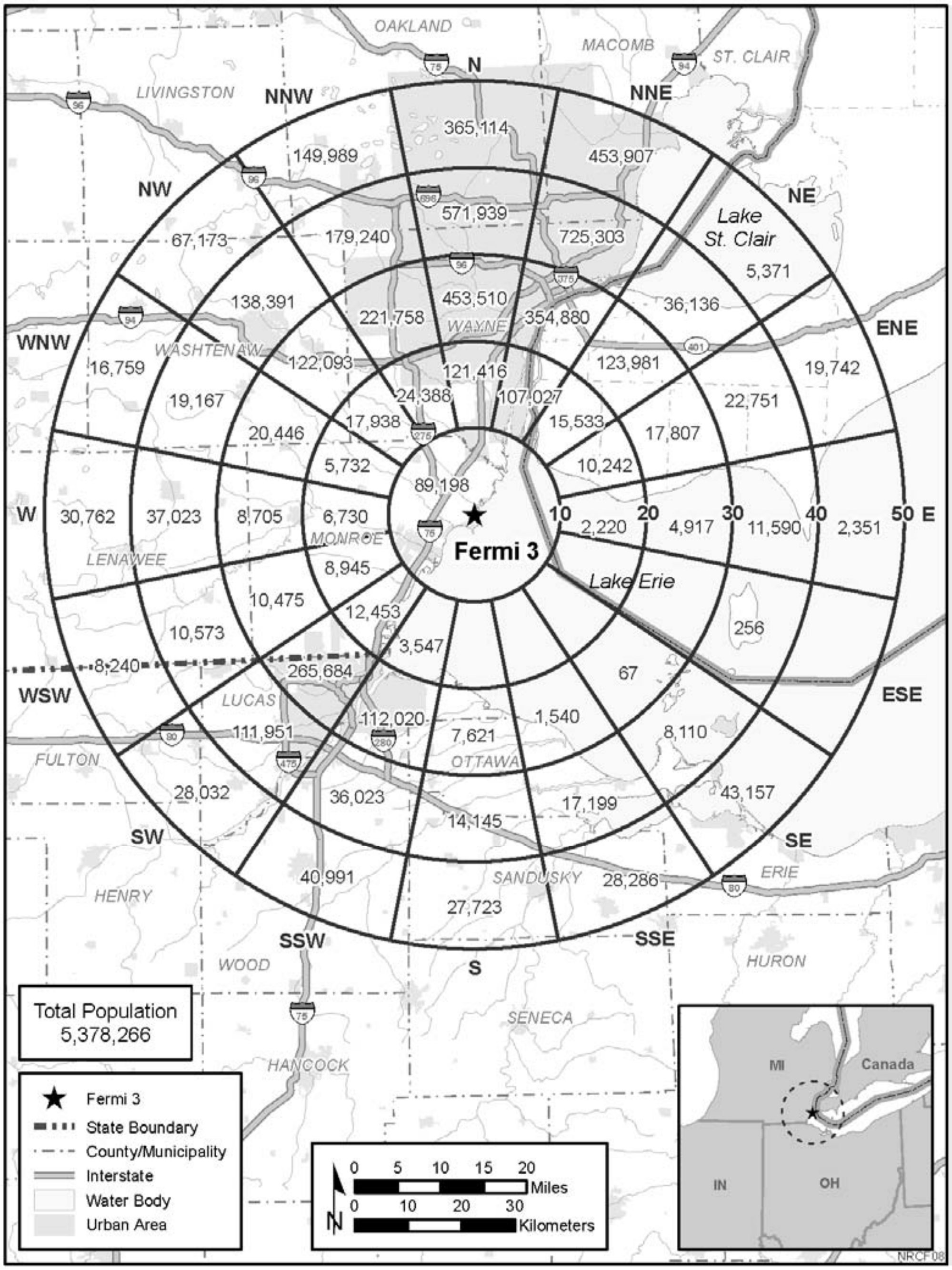

Figure 2-15. Resident Population Distribution in 2000 Located 0 to 50 mi from Fermi 3 as Shown by Segmented Concentric Circles (Detroit Edison 2011a)

populations) within the 10-mi radius include Woodland Beach (2179 persons), Carleton (2561 persons), Detroit Beach (2289 persons), Flat Rock (8488 persons), Gibraltar (4264 persons), Rockwood (4726 persons), and Stony Point (1175 persons). Much of the surrounding land use beyond the population centers is agricultural. Open water also accounts for a large portion of the area within the emergency evacuation zone because of the presence of Lake Erie directly east of the Fermi site.

Tables 2-21 and 2-22 present the historic and projected populations for Monroe, Wayne, and Lucas Counties compared with the respective State totals. In addition to the 1990, 2000, and 2010 Census populations, the USCB provides Statewide population projections. Projections at the county level are provided by SEMCOG for Monroe and Wayne Counties, Michigan, and by the Ohio Department of Development for Lucas County, Ohio.

Monroe County has 24 municipal jurisdictions, including 15 townships, 4 cities, and 5 villages. The county had modest growth between the 1990 and 2010 Census, and the population is expected to continue to grow through 2030, although at a slower rate than has occurred historically (SEMCOG 2008a). Most of the population growth has occurred around the City of Monroe, along the northern boundary toward Detroit and along the southern boundary toward Toledo (Monroe County Planning Department and Commission 2010). Wayne County has 38 municipal jurisdictions. The population in Wayne County has declined between the 1990 and

Table 2-21. Historic and Projected Population Change in Monroe and Wayne Counties, Michigan, 1990–2030

	Michigan					
	Monroe County		Wayne County		State of Michigan	
Year	Population	Average Annual Growth (percent)	Population	Average Annual Growth (percent)	Population	Average Annual Growth (percent)
1990	133,600	–[(a)]	2,111,687	–	9,295,297	–
2000	145,945	0.9	2,061,162	–0.2	9,938,492	0.7
2010	152,021	0.4	1,820,584	–1.2	9,883,640	<–0.1
2020 projected	159,461	0.5	1,812,593	<–0.1	10,695,993	0.8
2030 projected	167,588	0.5	1,824,113	0.1	10,694,172	0.0

Sources: Monroe and Wayne Counties 2020 and 2030 projections are provided by SEMCOG (2008a). 1990, 2000, and 2010 data for all areas are from the 1990, 2000, and 2010 Census of Population and Housing (USCB 1990a, 2000a, 2010a). State projections for 2020 and 2030 are also provided by the USCB via its 2004 Interim Projections (USCB 2004).

(a) – = The average annual growth rate was calculated from 1990 through 2030 and is not presented for 1990 or any years prior to 1990.

Table 2-22. Historic and Projected Population Change in Lucas County, Ohio, 1990–2030

	Lucas County		State of Ohio	
Year	Population	Average Annual Growth (percent)	Population	Average Annual Growth (percent)
1990	462,361	–[(a)]	10,847,115	–
2000	455,054	–0.2	11,353,140	0.5
2010	441,815	–0.4	11,536,504	0.2
2020 projected	434,650	–0.2	11,644,058	0.1
2030 projected	417,870	–0.4	11,550,528	–0.1

Sources: For Lucas County, projections are provided by the Ohio Department of Development (2003). 1990 and 2000 data for all areas are from the 1990, 2000, and 2010 Census of Population and Housing (USCB 1990b, 2000b, 2012b). State projections for 2020 and 2030 are also provided by the USCB via its 2004 Interim Projections (USCB 2004).

(a) – = The average annual growth rate was calculated from 1990 through 2030 and is not presented for 1990 or any years prior to 1990.

2010 Census and is expected to continue to decline through 2020. Some of the population loss in Wayne County has been due to residents moving out of the City of Detroit into suburban communities in adjoining counties. However, SEMCOG forecasts modest growth in Wayne County between 2020 and 2030 (SEMCOG 2008a).

Lucas County has nine municipal jurisdictions, including three townships, three cities, and three villages. The county has experienced, and is projected to continue to experience, modest population loss through 2030 (Ohio Department of Development 2003).

Tables 2-23 and 2-24 present selected demographic characteristics for the resident population within Monroe, Wayne, and Lucas Counties.

2.5.1.2 Transient Population

Transient populations include people who do not reside permanently in the area but work in or visit schools, hospitals and nursing homes, correctional facilities, hotels and motels, and recreational areas or special events on a temporary basis. The transient population within a 50-mi radius of Fermi 3 was estimated by Detroit Edison on the basis of data on the following groups:

- workers who live permanently outside of the 50-mi radius and commute to a worksite within the 50-mi radius, an assumption based on 2000 Census commuter data for each county
- visitors who live outside of the 50-mi radius and travel to destinations within the 50-mi radius (e.g., campers, users of recreational facilities), an assumption based on 2000 Census data on recreational, seasonal, and occasional housing units

Table 2-23. Selected Demographic Characteristics of the Resident Population in Monroe and Wayne Counties, Michigan

Demographic Characteristic	Monroe County	Wayne County	State of Michigan	United States
Population Density				
Population, 2010	152,021	1,820,584	9,883,640	308,745,538
Land area (square miles)	551	614	56,804	3,537,438
Population per square mile, 2010	276	2965	174	87
Ethnic Composition, 2010 (percent of total)				
Caucasians	94.4	52.3	78.9	72.4
African-American	2.4	41.3	14.3	12.8
Hispanic	2.6	4.9	4.0	15.1
Other[(a)]	1.0	2.8	3.0	5.6
Two or more races	1.2	1.5	1.5	1.6
Income Characteristics, 2010				
Median household income	$55,366	$42,241	$48,432	$51,914
Persons below poverty (percent of total)	9.0	21.4	14.8	13.8

Sources: USCB 2000a, 2009, 2010c, e, f, g

(a) Includes American Indian and Alaska Native persons, Asian persons, and Native Hawaiian and Other Pacific Islanders.

Table 2-24. Selected Demographic Characteristics of the Resident Population in Lucas County, Ohio

Demographic Characteristic	Lucas County	State of Ohio	United States
Population Density			
Population, 2010	441,815	11,485,910	308,745,538
Land area	340	40,948	3,537,438
Population per square mile, 2010	1300	277	87
Ethnic Composition, 2010 (percent of total)			
Caucasians	74.0	82.7	72.4
African-American	19.0	12.2	12.6
Hispanic	6.1	3.1	16.3
Other[(a)]	3.8	3.0	12.1
Two or more races	3.1	2.1	2.9
Income Characteristics, 2010			
Median household income	$42,072	$47,358	$51,914
Persons below poverty (percent)	18.0	14.2	13.8

Sources: USCB 2000b, 2009, 2010c, e, f, g

(a) Includes American Indian and Alaska Native persons, Asian persons, and Native Hawaiian and Other Pacific Islanders.

- residents of special facilities (correctional facilities, college dormitories, nursing homes, hospitals, religious group quarters, and others).

Detroit Edison estimated the transient population for the FSAR by using LandView® 6 software based on the 2000 Census population. Table 2-25 provides the estimated total transient population within a 50-mi radius of Fermi 3. An estimated 200,656 transient persons lived or visited within a 50-mi radius of Fermi 3 as of the 2000 Census.

Table 2-25. Transient Population within a 50-mi Radius of Fermi 3 in 2000

0–10 mi[(a)]	10–20 mi	20–30 mi	30–40 mi	40–50 mi	1–50 mi
17,538	10,906	44,433	70,601	57,178	200,656

Source: Detroit Edison 2011a
(a) Transient population within the emergency evacuation zone (e.g., 0–10 mi radius) was derived from KLD Associates, Inc. 2008.

2.5.1.3 Regional Population Projections

Table 2-26 shows the population growth projections for the region in 2020 and for four subsequent decades through the year 2060 by 10-mi increments. Detroit Edison based these projections on the average annual growth rate between the 1990 Census population and the estimated 2005 population of each of the counties within the region and the average annual growth rate for populations in the Canadian census subdivisions between the Canadian 1996 Census and 2006 Census. Average annual growth rates were applied to the 2000 (United States) and 2001 (Canada) resident census population and the estimated transient population to project the growth through 2060. These growth rates were weighted by the applicant for the percentage of the county population within each 10-mi segment around Fermi 3. The review team reviewed the growth rates and concurred with this approach.

2.5.1.4 Agricultural, Seasonal, and Migrant Labor

Agricultural, seasonal, or migrant labor within Monroe, Wayne, and Lucas Counties includes:

- Contract labor employed during outages at Fermi 2 and
- Migrant labor on farms in Monroe, Wayne, and Lucas Counties.

During Fermi 2 scheduled refueling outages, contract labor is hired by Detroit Edison to carry out fuel reloading activities, equipment maintenance, and other projects associated with the outage. Detroit Edison employs approximately 1200 to 1500 workers for 30 days during every refueling outage, which occurs every 18 months for Fermi 2.

Table 2-26. Resident and Transient Population Projections within a 50-mi Radius of Fermi 3 by 10-mi Increments, 2000-2060

Year	Distance					
	0–10 mi	**10–20 mi**	**20–30 mi**	**30–40 mi**	**40–50 mi**	**Total**
2000	106,736	347,077	1,769,937	2,010,398	1,344,775	5,578,923
2008	112,665	348,369	1,791,988	2,081,615	1,449,117	5,783,754
2020	123,378	351,302	1,831,686	2,198,894	1,624,796	6,130,056
2030	133,239	354,711	1,871,367	2,307,607	1,791,234	6,458,158
2040	144,031	359,060	1,917,634	2,427,916	1,978,702	6,827,343
2050	155,853	364,415	1,971,113	2,561,627	2,190,275	7,243,283
2060	168,849	370,858	2,032,503	2,810,898	2,429,542	7,812,650

Source: Detroit Edison 2011a

A migrant worker is defined by the U.S. Department of Agriculture (USDA) as “a farm worker whose employment required travel that prevented the migrant worker from returning to his/place of residence the same day.” In the 2007 Census of Agriculture (USDA 2007), the USDA reports the number of farms with hired labor by county and State as well as the total number of hired workers. Migrant workers are a subset of total hired workers, but the number of migrant workers is not reported.

The review team concluded that the number of migrant workers within Monroe, Wayne, and Lucas Counties is low because the total number of hired workers in the 2007 Census was 3592, and between 7 percent to 15 percent of the farms in Monroe, Wayne, and Lucas Counties reported that migrant workers were employed there (Table 2-27).

Table 2-27. Migrant Labor within the Regional Area of Fermi 3 in 2007

County	Farms with Hired Labor (no. of farms)	Farms with Hired Labor (no. of workers)	Migrant Labor on Farms with Hired Labor (no. of farms)	Percentage of Farms with Migrant Labor
Monroe	222	1854	27	12
Wayne	86	894	6	7
Lucas	91	844	14	15

Source: USDA 2007

2.5.2 Community Characteristics

This section characterizes the communities that may be affected by the building, maintenance, and operation of Fermi 3. As noted in Section 2.5.1, most socioeconomic impacts are expected to occur within a three-county economic impact area, which includes Monroe and Wayne Counties in Michigan and Lucas County in Ohio. These three counties are where more than 87 percent of the current Fermi site workforce resides; therefore, the review team expects that most of the building and operations workforces for Fermi 3 would similarly reside in these three counties.

Since no more than 3.2 percent of the current workforce resides in any one county outside the local area of Monroe, Wayne, and Lucas Counties and since current employees at the Fermi site represent less than 1 percent of the total population in any of the counties or locations where these employees reside, the review team expects impacts beyond the three-county area to be minimal. Therefore, the following discussion focuses on the three-county economic impact area. Community characteristics evaluated in this section include the economy, taxes, transportation, aesthetics and recreation, housing, public services, and education, focusing on the three-county economic impact area of Monroe and Wayne Counties, Michigan, and Lucas County, Ohio.

2.5.2.1 Economy

An overview of the economy of Monroe, Wayne, and Lucas Counties is provided below. Tables 2-28 and 2-29 show employment by industry for 2000 and 2010 within each of the three counties, and Table 2-30 shows the labor force statistics.

Manufacturing, specifically automobile manufacturing, has been the major sector of the economy in southeast Michigan throughout most of the 20th century. This manufacturing base has affected the economies of Wayne and Monroe Counties in Michigan as well as Lucas County, Ohio. Southeast Michigan is 680 percent more concentrated in automobile manufacturing employment than the national economy overall (SEMCOG 2007). Since the 1940s, Lucas County has also supported the automotive industry, primarily as a supplier of automotive glass and automotive parts (Lucas County 2010).

Job growth in manufacturing was strong through the 1990s but has been in decline since 2000. Between 1999 and 2006, the State of Michigan lost 274,000 manufacturing jobs, primarily in the automobile and automobile parts manufacturing industries (Ivacko 2007). SEMCOG estimates that between 2000 and 2009, southeast Michigan lost 210,000 manufacturing jobs (SEMCOG 2009a). Domestic automobile manufacturers, heavily reliant on light trucks and sport utility vehicles (SUVs), were particularly hit by the increase in gasoline prices and loss of market share in light vehicles during this decade. Job losses in auto manufacturing have had a ripple effect in other industries statewide, estimated as a loss of between one to three jobs in other sectors for every job lost in manufacturing (Ivacko 2007; SEMCOG 2009a).

Job losses accelerated with the automobile industry restructuring and the economic downturn of 2009, which affected the construction sector and consumer spending (Michigan Department of Energy, Labor, and Economic Growth 2010a). As the manufacturing sector has declined, the economy of southeast Michigan, including the Fermi 3 economic impact area, has moved

Table 2-28. Area Employment by Industry – Monroe and Wayne Counties, Michigan, in 2000 and 2010

	Monroe County					Wayne County				
	2000		2010			2000		2010		
Occupation	**Persons**	**%**	**Persons**	**%**	**Net Change**	**Persons**	**%**	**Persons**	**%**	**Net Change**
Agriculture; forestry; fishing and hunting; mining	894	1	589	<1	–305	1044	<1	2357	<1	+1313
Construction	5370	7.6	4316	6.2	–1054	39,296	14.6	29,005	4.0	–10,060
Manufacturing	18,120	25.8	14,185	20.4	–3935	185,856	21.8	121,536	16.7	–64,320
Wholesale trade	2307	3.3	2349	3.4	+42	26,904	3.2	19,286	2.7	–7618
Retail trade	8430	12	8006	11.5	–124	90,905	10.7	80,492	11.1	–10,413
Transportation and warehousing; utilities	5112	7.3	4982	7.1	–130	54,387	6.4	42,616	5.9	–11,771
Information	973	1.4	736	1.1	–237	21,231	2.5	15,606	2.1	–5625
Finance and insurance; real estate and rental and leasing	2669	3.8	3102	4.5	+433	50,591	5.9	43,826	6.0	–6765
Professional, scientific, and management; administrative and waste management services	4012	5.7	5024	7.2	+1012	77,890	9.2	71277	9.8	+6613
Educational services; healthcare; social assistance	12,891	18.3	15,139	21.7	+2248	158,342	18.6	162,976	22.4	+4634
Arts, entertainment, and recreation; accommodation and food services	4894	7.0	5749	8.2	+855	68,026	8.0	74,630	10.3	+6604
Other services, except public administration	3054	4.3	3379	4.8	+325	42,366	5.0	33,474	4.6	–8892
Public administration	1618	2.3	2147	3.1	+529	34,272	4.0	28,796	4.0	–5476
Total	**70,344**		**69,703**		**–641 (–0.9%)**	**851,110**		**726,108**		**–60,876 (–7.2%)**

Sources: USCB 2000a, 2010f.

Table 2-29. Area Employment by Industry – Lucas County, Ohio, in 2000 and 2010

	Lucas County				
	2000		2010		
Occupation	Persons	%	Persons	%	Net Change
Agriculture; forestry; fishing and hunting; mining	866	<1	571	<1	–295
Construction	12,230	5.8	10,184	5.1	–2046
Manufacturing	38,774	18.3	29,496	14.7	–9278
Wholesale trade	8411	4.8	5993	3.0	–2418
Retail trade	25,977	12.3	23,891	11.9	–2086
Transportation and warehousing; utilities	11,599	5.5	11,970	5.9	+371
Information	4079	1.9	3502	1.7	–577
Finance and insurance; real estate and rental and leasing	10,258	4.8	10,323	5.1	+65
Professional, scientific, and management; administrative and waste management services	19,036	9.0	17,552	8.7	–1484
Educational services; healthcare; social assistance	46,342	21.9	51,706	25.8	+5364
Arts, entertainment, and recreation; accommodation and food services	17,110	8.1	20,357	10.1	+3247
Other services, except public administration	10,226	4.8	8736	4.4	–1490
Public administration	7111	3.4	6430	3.2	–681
Total	**212,019**		**200,711**		**–11,308 (–5.3%)**

Sources: USCB 2000b; 2010f

toward a health care and services based economy. SEMCOG forecasts continued growth in the health care and services industries (SEMCOG 2008a).

Overall, with the decline in population as discussed in Section 2.5.1 and with the loss of jobs and transition from higher to lower wage and salary rates, the economy in southeast Michigan is in transition. Overall, the State of Michigan, and southeast Michigan in particular, have experienced a decline in average income, housing prices, and income and property tax revenues (Scorzone and Zin 2010). The decline in tax revenues, along with a declining population, has resulted in a lower level of investment in infrastructure (SEMCOG 2010b).

Table 2-30. Labor Force Statistics for Monroe, Wayne, and Lucas Counties in 2000 and 2010

	Monroe County		Wayne County		Lucas County	
	2000	**2010**	**2000**	**2010**	**2000**	**2010**
Total labor force	77,194	70,724	952,300	844,184	227,304	214,733
Employed workers	74,756	61,921	911,069	719,390	217,049	190,514
Unemployed workers	2438	8803	41,231	1124,794	10,255	24,219
Unemployment rate	3.2	12.4	4.3	14.8	4.5	11.3

Source: USBLS 2012

Monroe County

Monroe County employment was nearly 70,724 workers in 2010 (USBLS 2012). Approximately 40 percent of the jobs in Monroe County are in two sectors: manufacturing sector and educational services/healthcare/social assistance sector. The four largest employers in Monroe County in 2007 were Detroit Edison, with approximately 1500 employees; Mercy Memorial Hospital, with approximately 1300 employees; the supermarket chain Meijer Inc., with approximately 1025 employees; and the Monroe Public Schools school district, with approximately 1000 employees (Monroe County Finance Department 2008). In 2007, Ford Motor Company closed Automotive Component Holdings, formerly named Visteon Corporation, causing a loss of 1200 jobs.

Detroit Edison's workforce of approximately 1500 workers is employed at the Fermi plant site and the coal-fired Monroe County Power Plant. During outages, an additional 1200 to 1500 outage workers are also employed at the Fermi plant site for a period of 30 days every 18 months. Between 2009 and 2010, Detroit Edison had a construction workforce at the Monroe County Power Plant to conduct capital improvements of the air emission control equipment (Detroit Edison 2011a). Future projects involving installation of air pollution control equipment will require a workforce ranging from 100 to 550 workers. Detroit Edison expects the work at the Monroe County Power Plant will be completed by 2014 (Detroit Edison 2011c).

Monroe County experienced growth in several sectors, most notably in the professional scientific and management/administrative and waste management services sector and the educational services/healthcare/social assistance sector, but experienced losses in primarily construction and manufacturing for a net loss in jobs between 2000 and 2010 of just under 1 percent. The total labor force declined from 77,000 in 2000 to 70,000 in 2010, and the U.S. Bureau of Labor Statistics (USBLS) reported a rise in unemployment from 3.2 percent in 2000 to 12.4 percent in 2010.

Monroe County's economy benefits from an extensive transportation network, waterfront access, energy supplies, and agricultural production. Three major railroad lines and I-75 traverse Monroe County from north to south. Access to the waterfront of Lake Erie provides industrial, commercial, and recreation-based economic opportunities. The Port of Monroe provides a point of access for Great Lakes shipping and transport through the Great Lakes-Saint Lawrence Seaway. Thirty-seven other marinas are located within Monroe County, and the Lake Erie shoreline, with its beaches, boat launch facilities, and campgrounds, is attractive to tourists. Three major energy facilities are located in Monroe County, including Detroit Edison's Fermi 2 Plant and its coal-fired Monroe Power Plant and Consumer's Energy's J.R. Whiting Power Plant (Monroe County Planning Department and Commission 2010). Approximately 62 percent of Monroe County's land is in farmland. In 2007, the USDA reported that the value of agricultural products sold from Monroe County was $130 million (USDA 2007). Between 2006 and 2016, job growth is expected in the healthcare, service, professional, and farming occupations (Michigan Department of Energy, Labor and Economic Growth 2010a).

Wayne County

Employment in Wayne County was 844,184 workers in 2010 (USBLS 2012). Approximately 40 percent of the jobs in Wayne County are in two sectors: manufacturing sector and educational services/healthcare/social assistance sector. In 2010, Wayne County had 121,536 manufacturing jobs and 162,976 jobs in educational services/healthcare/social assistance. The four largest employers in Wayne County in 2007 were Ford Motor Company, with approximately 42,309 employees; the Detroit School District, with approximately 17,329 employees; the City of Detroit, with approximately 13,593 employees; and the Henry Ford Health System, with approximately 11,475 employees (Wayne County Department of Management and Budget 2008).

Wayne County is part of a large urbanized area within the Detroit-Warren-Livonia MSA, which encompasses 10 principal cities in a six-county area and had a combined estimated population in 2010 of 4.3 million. In addition to Ford Motor Company, other large manufacturing businesses in the metropolitan area as of 2008 included General Motors Corporation (41,861 employees); Chrysler LLC (32,597 employees); Automotive Component Holdings, an automotive supplier (4497 employees); and Johnson Controls Automotive Experience, an automotive supplier (4205 employees). Several healthcare systems were also large employers in the metropolitan area as of 2008, in addition to Henry Ford Health System and including the University of Michigan Health System (16,551 employees), St. John Providence Health System (14,286 employees), Trinity Health (13,012 employees), Beaumont Hospitals (12,638), and Detroit Medical Center (11,003 employees) (Detroit Economic Growth Corporation 2010).

Wayne County is served by major transportation routes, including highway, air transport, rail, and waterway shipping routes, which support the economy of the area. International trade with Canada, which is conducted primarily by truck traffic across the Ambassador Bridge, contributes significantly to the local economy. Wayne County was the destination or origin for 11,987 cross-border trucks and 123,012 tons of cargo in 2006. Passenger trips across the border also contribute toward retail spending and tourism (SEMCOG 2009b). In addition, the Detroit/Wayne County Port Authority maintains freight transportation hubs for rail, trucking, and shipping. In 2005, the Port of Detroit imported and exported 17 million tons of cargo, with revenues of approximately $165 million (Detroit/Wayne County Port Authority 2010). The Detroit Metropolitan Wayne County Airport (DTW), located in Wayne County, served more than 36 million passengers in 2007 (DTW 2009).

Between 2000 and 2010, Wayne County lost approximately 125,000 jobs, primarily in the manufacturing and construction sectors. Some growth occurred in educational services, healthcare and social assistance, the arts, entertainment, recreation, and accommodation and food services, but it did not make up for the jobs lost. In addition to losses in manufacturing and construction, Wayne County also experienced job losses in other employment sectors, including wholesale and retail trade and transportation, indicating that its economy is closely linked to its manufacturing base. During this time period, Wayne County lost members of the labor force as well as population. These trends are attributed to workers leaving the area to pursue jobs elsewhere, production workers taking buyouts and early retirement in the restructuring process, and an aging population (SEMCOG 2007). In 2010, the USBLS reported the unemployment rate for Wayne County was 14.8 percent. Nationally, the unemployment rate in 2010 was 9.6 percent; and in the State of Michigan it was 12.7 percent.

Between 2006 and 2016, job growth is expected in the healthcare, service, professional, and farming occupations (Michigan Department of Energy, Labor, and Economic Growth 2010a).

Lucas County

Lucas County had 214,733 employed workers in 2010 (USBLS 2012). Approximately 26 percent of the workforce is employed in the educational services/healthcare/social assistance sector. Manufacturing and retail trade employ approximately 15 percent and 12 percent, respectively. The four largest employers in Lucas County in 2007 were Promedica Health Systems, with approximately 11,265 employees; Mercy Health Partners, with approximately 6723 employees; the University of Toledo, with approximately 4987 employees; and the Toledo School District, with approximately 4554 employees (Lucas County Auditor's Office 2008).

Lucas County is part of an urbanized area within the Toledo MSA, which encompasses the City of Toledo and three other counties. The economy of Lucas County is integrated with the economy of the City of Toledo and communities within the MSA. The economy has been supported by agricultural and industrial production, transportation, and warehousing (Regional Growth Partnership 2010). Approximately 49 percent of the land area in Lucas County is in farmland. In 2007, the USDA reported that the value of agricultural products sold from Lucas County was $47 million (USDA 2007). Large manufacturing businesses in the Toledo area as of 2009 included General Motors Corporation (2924 employees), Chrysler LLC

(2261 employees), The Andersons (grain storage, process, and retail; 1793 employees), Libbey, Inc. (glass manufacturing; 1047 employees), Owens-Corning (glass manufacturing; 950 employees), and Dana Corporation (automotive parts manufacturing; 850 employees) (Regional Growth Partnership 2010). Other nonmanufacturing employers in the MSA, in addition to the four largest employers listed above, are Bowling Green State University (5400 employees), Lucas County (3934 employees), and Kroger, Inc. (retail grocery; 2747 employees) (Regional Growth Partnership 2010).

Transportation and warehousing also support the economy in Lucas County. The Toledo-Lucas County Port Authority maintains freight transportation hubs for rail, trucking, and shipping. Sixteen terminal operators are located at the Port of Toledo on Lake Erie, providing access to the Great Lakes Saint Lawrence Seaway; they involve grain and food storage (ADM Grain Company, The Andersons, Hansen Mueller), fuel storage (BP-Husky Refining, Seneca Petroleum, and Sunoco MidAmerica M&R), and other operations. Toledo is a major railroad hub for Canadian National (North American), CSX Transportation (CSX), and Norfolk Southern Railway (Regional Growth Partnership 2010).

Between 2000 and 2010, Lucas County lost 11,000 jobs. Job losses occurred primarily in construction, manufacturing, and the wholesale and retail trade sectors, with fewer job losses in other sectors of the economy. The county gained jobs in the educational services/healthcare/social assistance sector and the arts/entertainment/recreation and accommodation/food services sectors. Between 2000 and 2010, the unemployment rate for the county increased from 4.5 percent to 11.3 percent. In the State of Ohio, the unemployment rate in 2010 was 10.1 percent (USBLS 2012).

Heavy Construction Workforce in Economic Impact Area

A portion of the existing construction workforce in Monroe, Wayne, and Lucas Counties is engaged in the type of heavy craft construction work that would be required for building a nuclear power plant facility. Detroit Edison identified the following types of heavy craft construction workers who would be employed for construction of Fermi 3: supervisors, boilermakers, brick and stone masons, carpenters, laborers, paving and surfacing workers, operating engineers, electricians, insulation workers, plumbers and steamfitters, rebar workers, sheet metal workers, and millwrights (Detroit Edison 2011a).

Table 2-31 provides an estimate of the size of the labor pool for the metropolitan areas that include Monroe and Wayne Counties in Michigan and Lucas County, Ohio, for the types of workers that would be needed for construction of Fermi 3. The review team notes that the total estimates do not equal the sum for detailed occupations because total estimates include occupations not shown separately. Included in the total are occupations within the extraction industry (e.g., drilling and mining) and other construction occupations that are not occupations that would be used for constructing Fermi 3. However, also included in the total are

Table 2-31. Construction Industry Occupational Employment Estimates in the Economic Impact Area[(a)] in 2008

Occupation Title[(b)]	**Monroe, Michigan MSA**	**Detroit-Livonia-Dearborn, Michigan Metropolitan Division**	**Toledo, Ohio MSA**
Boilermakers	–[(c)]	120	70
Brickmasons and blockmasons	–	550	160
Carpenters	160	2200	1850
Cement masons and concrete finishers	70	320	340
Stonemasons	–	–	–
Construction laborers	330	2380	1320
Paving, surfacing, and tamping equipment operators	–	120	50
Operating engineers and other construction equipment operators	130	1570	600
Electricians	210	3660	1340
Insulation workers: floor, ceiling, and wall	–	–	–
Insulation workers: mechanical	–	–	–
Painters, construction, and maintenance	–	790	420
Reinforcing iron and rebar workers	–	–	–
Plumbers, pipefitters, and steamfitters	210	1860	1120
Sheet metal workers	–	430	460
Structural iron and steel workers	100	190	150
Millwrights[(d)]	40	1140	–
Total construction and extraction occupations[(e)]	1850	19,430	11,410

Source: USBLS 2008

(a) Data are presented by the USBLS for metropolitan areas that include the counties identified as the economic impact area. The geographical area for the Monroe MSA is Monroe County, and the geographical area for the Detroit-Livonia-Dearborn Metropolitan Division is Wayne County. However, the geographical area for the Toledo MSA includes Fulton, Ottawa, and Wood Counties as well as Lucas County, Ohio.

(b) The occupational titles presented are those occupations that Detroit Edison plans to use for construction of Fermi 3.

(c) – = Data are not reported for this occupation type.

(d) Millwrights are classified by the USBLS under the Installation, Maintenance, and Repair Occupations.

(e) Included in the total are occupations within the extraction industry (e.g., drilling and mining) and other construction occupations, which are not occupations that would be used to construct Fermi 3. However, included in the total are construction occupations that would be used by Detroit Edison to construct Fermi 3 but have not been reported by USBLS by construction type. Therefore, total estimates do not equal the sum for detailed occupations because total estimates include occupations not shown separately. Estimates do not include self-employed workers.

construction occupations that would be used by Detroit Edison to construct Fermi 3, but have not been reported by USBLS by construction type. Estimates do not include self-employed workers.

Table 2-32 provides the 2016 employment projections for the types of heavy craft construction workers who would be employed for building Fermi 3. The State of Michigan forecasts a modest growth in all of the major craft occupations; the State of Ohio also forecasts growth in the major craft occupations, except for sheet metal workers and millwrights (Michigan

Table 2-32. Michigan and Ohio Construction Labor Force by Major Craft Occupation

	Michigan			Ohio		
Construction Category	**2006 Actual**	**2016 Projected**	**Net Change**	**2006 Actual**	**2016 Projected**	**Net Change**
Construction and Extraction Occupations[(a)]	184,180	195,890	+11,710	246,120	263,130	+17,010
Boilermakers	520	580	+60	590	670	+80
Brickmasons and blockmasons	4740	5220	+480	6510	7180	+670
Carpenters	31,710	33,710	+2000	41,220	44,930	+3710
Cement masons and concrete finishers	4140	4490	+350	6610	7340	+730
Stonemasons	260	280	+20	440	490	+50
Construction laborers	27,240	29,330	+2090	32,330	35,270	+2940
Paving, surfacing, and tamping equipment operators	2250	2420	+170	1810	1930	+120
Operating engineers and other construction equipment operators	9090	9680	+590	12,080	12,950	+870
Electricians	24,000	25,070	+1070	30,190	30,400	+210
Insulation workers: floor, ceiling, and wall	480	530	+50	1160	1230	+70
Insulation workers: mechanical	480	510	+30	560	600	+40
Painters, construction, and maintenance	8580	9090	+510	12,620	13,970	+1350
Reinforcing iron and rebar workers	170	200	+30	900	1020	+120
Plumbers, pipefitters, and steamfitters	15,060	15,760	+700	18,120	19,110	+990
Sheet metal workers	4960	5190	+230	5770	5750	–20
Structural iron and steel workers	1600	1650	+50	2690	2780	+90
Millwrights[(b)]	5500	5520	+20	5410	4550	–860

Sources: Michigan Department of Energy, Labor, and Economic Growth 2010b; Ohio Department of Job and Family Services 2008

(a) Total estimates do not equal the sum for detailed occupations because total estimates include occupations not shown separately. Estimates do not include self-employed workers.

(b) Millwrights are classified by the USBLS under the installation, maintenance, and repair occupations.

Department of Energy, Labor and Economic Growth 2010b; Ohio Department of Job and Family Services 2008).

Detroit Edison identified the following occupations specific to the operations workforce for Fermi 3: management, operations, engineering, maintenance, outage and planning, major modification and site support, organizational effectiveness, radiation protection, training, security, supply chain management, and telecommunications (Detroit Edison 2011a).

Table 2-33 lists the 2006 statewide labor force and the 2016 projections for the statewide labor force for occupational categories that correspond to the operations workforce that would be required for Fermi 3. The State of Michigan forecasts growth in most of the occupations that support operations, especially in the occupations with broad applications in multiple industries (Michigan Department of Energy, Labor, and Economic Growth 2010b). The State of Ohio also

Table 2-33. Michigan and Ohio Nuclear Operations Labor Force by Occupation

	Michigan			Ohio		
Occupation	**2006**	**2016 Projected**	**Net Change**	**2006**	**2016 Projected**	**Net Change**
General and operations managers	36,460	35,450	–1010	56,770	54,430	–2340
Accountants and auditors	34,290	38,230	+3940	49,080	54,050	+4970
Computer software engineers Applications and systems software	19,420	24,400	+4980	23,770	31,760	+7990
Network and computer system Administrators	7850	9270	+1420	12,020	14,510	+2490
Chemical engineers	1050	1160	+110	1530	1570	+40
Civil engineers	6190	6870	+680	5990	6460	+470
Electrical engineers	6370	6790	+420	4440	4500	+60
Mechanical engineers	24,730	25,970	+1240	11,350	10,630	–720
Nuclear technicians	90	90	0	400	400	0
Security guards	25,360	27,600	+2240	31,390	33,680	+2290
Office and administration support	699,660	723,590	+23,930	917,670	943,850	+26,180
Nuclear power reactor operators	–[(a)]	–	–	150	160	+10
Power distributors and dispatchers	490	470	–20	160	140	–20
Power plant operators	1640	1680	+40	1260	1220	–40
Stationary engineers and boiler operators	1310	1320	+10	2080	1970	–110

Sources: Michigan Department of Energy, Labor, and Economic Growth 2010b; Ohio Department of Job and Family Services 2008
(a)   – = Data are not reported for this occupation type.

forecasts growth in the occupations with broad applications, but it also forecasts modest declines in general and operations managers, mechanical engineers, power distributors and dispatchers, power plant operators, and stationary engineers and boiler operators (Ohio Department of Job and Family Services 2008).

2.5.2.2 Taxes

This section describes the State and local tax structure and tax revenue for jurisdictions in the area of the proposed Fermi 3.

State

Income and sales taxes are the principal sources of tax revenues for the States of Michigan and Ohio, accounting for more than half of the tax receipts for fiscal year (FY) 2009 in both States (Table 2-34). Corporate taxes account for 12 percent of tax revenues in Michigan and Ohio. Most of the tax revenues go to a general fund that supports various State activities in both Michigan and Ohio, as defined in each State's budget. The State of Michigan also receives a portion of property tax revenue from a State education tax, which is collected at the local level. The State education tax supports the State School Aid Fund, which, along with 2 percent of the sales tax and contributions from other sources, allows the State to provide an equitable redistribution of school aid throughout the State. All local school districts are provided with a minimum allowance per pupil, which has lowered the spending gap between low- and high-spending school districts.

Table 2-34. Tax Revenue for the States of Michigan and Ohio

	FY 2009[a] Net Receipts in 1000s (percent of total)			
	Michigan		Ohio	
Tax Source	**Dollars**	**Percent**	**Dollars**	**Percent**
Individual income	6,071,541	29	8,228,349	39
Sales and Use	7,417,881	35	7,276,288	34
Corporate	2,602,517	12	2,443,059	12
State education	2,145,886	10	–[b]	–
Cigarettes	984,028	5	924,764	4
Motor vehicle fuel	957,202	5	1,743,151	8
Other taxes and fees[c]	890,287	4	648,284	3
Total	**21,069,342**		**21,263,895**	

Sources: Michigan Department of Treasury 2010; Ohio Office of Management and Budget 2009

(a) FY 2009 for the State of Michigan is October 1, 2008, through September 30, 2009. FY 2009 for the State of Ohio is July 1, 2008, through June 30, 2009.

(b) – = The State of Ohio does not collect a State education tax.

(c) Includes real estate transfer tax, airport parking tax, convention center utility tax, and others.

Tax rates for income, sales and use, corporate, and State education in the States of Michigan and Ohio are shown in Table 2-35.

Table 2-35. Tax Rates in the States of Michigan and Ohio

Tax Source	2009 Tax Rates	
	Michigan	Ohio
Individual income	4.35 percent[(a)]	0.618 percent on the first $5000 of income to 6.24 percent on the amount in excess of $200,000[(b)]
Sales and Use[(c)]	6 percent[(d) (e)]	5.5 percent
Corporate [(f)]	Income: 4.95 percent Modified gross receipts: 0.8 percent	Gross receipts: 0.26 percent
State education	$6 per $1000 of assessed value	–[(g)]

Sources: Citizen Research Council of Michigan 2011; Ohio Department of Taxation 2009

(a) Rate applies from 2007 through 2011, decreasing annually thereafter through 2015, at which time the rate is set at 3.9 percent.

(b) The State of Ohio enacted a 4.2 percent annual across-the-board tax rate reduction between 2005 and 2009. In 2010, the State Tax Commission is required to adjust the tax rate for each income bracket based on inflation.

(c) Michigan has no city, local, or county sales tax. The county sales tax rate for Lucas County, Ohio, is 1.25 percent, which is in addition to the 5.5 percent State sales tax.

(d) 2 percent of the sales and use tax is dedicated to the School State Aid Fund.

(e) Sales of electricity, natural gas, and home heating fuels for residential use are taxed at a rate of 4 percent; commercial and industrial users are taxed at a rate of 6 percent.

(f) For Michigan, this is the Michigan business tax. For Ohio, this is the commercial activity tax, which replaced the corporation franchise tax as of 2009.

(g) – = The State of Ohio does not collect a State education tax.

Local

Table 2-36 presents the total revenue, property tax revenue, percent of total revenues, and millage rate for property taxes (property tax rate per $1000) for each county in Monroe, Wayne, and Lucas Counties.

In the State of Michigan, local jurisdictions have taxing authority for income (cities only), selected sales revenue (i.e., hotel accommodations and stadium and convention facilities), and various property taxes.

Under the Michigan Uniform City Income Tax Act, individual cities in Michigan may adopt a city uniform income tax. Generally, the rate is 1 percent for residents and corporations and 0.5 percent for nonresidents with earnings in the imposing city. Cities with populations larger than 750,000 may impose rates up to 2.5 percent on residents, 1.0 percent on corporations, and 1.25 percent on nonresidents (Citizen Research Council of Michigan 2011). Cities with income taxes in Wayne County include Detroit (2.5 percent for residents, 1.0 percent for corporations,

Table 2-36. Property Tax Revenue and Millage Rates for Monroe, Wayne, and Lucas Counties (FY 2009)

Rates and Revenues	Monroe County	Wayne County	Lucas County
Tax revenues			
Total revenue[(a)]	$64,974,874	$522,088,000	$248,270,000
Total property tax revenue	$32,028,207	$364,895,000	$102,305,000
Percent of total revenues	49	70	41
Millage rates			
Direct county millage rate[(a)]	4.8	6.6	2.0
Overlapping rates[(b)]			
Cities and village	10.33 to 18.96	11.43 to 38.95	0.80 to 7.00
Townships	0.70 to 9.66	2.36 to 14.04	4.80 to 24.25
School districts[(c)]	28.95 to 37.99	18.00 to 33.50	46.85 to 125.85
Intermediate school districts	3.46 to 7.28	3.37 to 4.75	–[(d)]

Sources: Monroe County Finance Department 2009; Wayne County Department of Management and Budget 2009; Lucas County Auditor's Office 2009

(a) General Fund only.

(b) Millage rates for special districts, special authorities, and other community facilities (e.g., libraries, community colleges) are not shown.

(c) Millage rates for school districts in Monroe and Wayne Counties includes 6 mills for the State School Aid Fund.

(d) – = Lucas County does not have a separate tax rate for intermediate school districts.

and 1.25 percent for nonresidents); Hamtramck (1.0 percent for residents, 1.0 percent for corporations, and 0.5 percent for nonresidents); and Highland Park (2.0 percent for residents, 2.0 percent for corporations, and 1.0 percent for nonresidents). None of the cities in Monroe County impose income taxes (Citizen Research Council of Michigan 2011).

Property taxes are the primary source of revenue in Monroe and Wayne Counties. As shown in Table 2-36, property taxes represent 49 percent of total revenue in Monroe County. In Wayne County, property tax revenue represents 70 percent of total county revenue (Monroe County Finance Department 2009; Wayne County Department of Management and Budget 2009).

Millage for local school districts in Michigan is limited to the lesser of 18 mills or the 1993 millage rate (when the State School Aid Fund was established) because the State funds most of the operating expenses for schools. In addition, principal residences, industrial personal property, and qualified agricultural property are entirely exempt from school millages, and commercial personal property is partially exempt. However, if the per-pupil foundation allowance falls below the State minimum allowance, school districts may reduce the exemption on principal residence and qualified agricultural property or may levy additional mills on all property to generate the per-pupil allowance. School districts may also levy taxes to fund capital expenditures. In 2009, the State average millage rate, including the 6-mill State education tax, was 39.13 mills (Citizen Research Council of Michigan 2011).

Millage rates for county property tax revenue and revenue of overlapping jurisdictions in Monroe and Wayne Counties are shown in Table 2-36.

In the State of Ohio, only the State and counties may levy a general sales tax; however, cities, villages, and townships may also levy sales taxes on accommodations and admissions. In addition to the State, cities and villages in Ohio may levy income taxes. All local jurisdictions may levy property taxes, including schools and other special districts (i.e., fire, water, and sewer). Property taxes are the primary source of revenue in Lucas County.

As of 2006, 566 municipalities (235 cities and 331 villages) in the State of Ohio levied an income tax. The tax rates are flat rates, and the maximum rate allowed under State law is 1 percent without voter approval. In 2006, municipal income tax rates ranged from 0.30 percent to 3 percent (Ohio Department of Taxation 2009).

As shown in Table 2-36, property taxes represent 41 percent of total revenue in Lucas County (Lucas County Auditor's Office 2009).

Fermi 2

The major State and local taxes paid by Detroit Edison are the Michigan business tax, property tax, and sales tax on purchases of goods and services for operation and maintenance of the plant. In addition, consumers of electricity pay a State sales tax on the electricity used, which is collected by Detroit Edison and paid to the State of Michigan.

Detroit Edison paid $149 million in combined Federal and State income tax in 2007 (Detroit Edison 2010e). Detroit Edison estimates that it paid, on average, $1.154 million per year in direct sales taxes (those taxes generated by direct expenditures for operation and maintenance of the plant site and capital expenditures) during the years 2002 through 2007. An additional $4.44 million in indirect sales tax revenues was generated, benefitting the States of both Michigan and Ohio (Detroit Edison 2011a). Indirect sales tax revenue is based on expenditures by workers as a portion of their take-home salary.

Table 2-37 shows the estimated State sales tax revenue based on electrical usage by consumers within the Detroit Edison service area in 2009.

Detroit Edison is also assessed property tax by local jurisdictions within Monroe County. Detroit Edison is the leading taxpayer in Monroe County. In 2009, its assessed value was $820 million, or 13.3 percent of the total county taxable assessed value, which includes the coal-fired Monroe Power Plant as well as Fermi 2. Over the past 9 years, Detroit Edison's assessed value has declined. In 2000, the assessed value of the Fermi plant was $1,146 million, or 25.4 percent of the total county taxable assessed value (Monroe County Finance Department 2009). In 2009, Detroit Edison paid a millage rate of approximately 47.33 mills, dispersed to the local

Table 2-37. Estimated Sales Tax Revenue from Electrical Usage by Consumers within the Detroit Edison Service Area in 2009[(a)]

Consumers	Usage[(b)] (MWh)	Total Revenue (in millions of $)	Sales Tax Rate[(c)]	Total Sales Tax Revenue (in millions of $)
Residential	14,625,206	1754	0.04	70
Commercial	18,190,402	1617	0.06	97
Industrial	9,932,275	687	0.06	41
Total				208

Source: DOE/EIA 2009

(a) Detroit Edison owns and operates eight fossil-fuel plants, one hydroelectric plant, and various oil or gas-fueled peaking units as well as Fermi 2 within the State of Michigan (Detroit Edison 2010e).

(b) Detroit Edison reports that approximately 14 percent of its power generation is nuclear (Detroit Edison 2010e).

(c) Detroit Edison reports that most of its customers are located within the State of Michigan (Detroit Edison 2010e). Therefore, the estimated sales tax revenue is based on the State of Michigan sales tax rate.

jurisdictions outlined in Table 2-38. Total property taxes paid by Detroit Edison for the Fermi 2 plant site are shown in Table 2-38.

Table 2-38. Estimated 2009 Property Tax for Detroit Edison

Jurisdiction	Millage in 2009	Total Estimated Tax in 2009 (in millions of $)
Monroe County – Operation	4.8	3.9
Monroe County – Senior Citizens	0.5	0.4
Monroe County Community College	2.18	1.8
Monroe County Library	1.0	0.8
Monroe Intermediate School District	4.75	3.9
Frenchtown Charter Township	6.8	5.6
Jefferson Schools	18.5	15.2
State Education Tax	6.0	4.9
Resort Authority	2.8	2.3
Total	47.33	38.8

Source: Monroe County Finance Department 2009

2.5.2.3 Transportation

This section provides an overview of the regional transportation facilities in the local area, including air, rail, and barge, that could provide service for the Fermi plant site. The discussion of the roads and highways in the local area focuses on the immediate vicinity of the Fermi site, where traffic impacts associated with the commute of the preconstruction, construction, and operational workforce to and from the Fermi site are more likely to occur. Commuter traffic beyond the immediate vicinity of the site would be dispersed and would not be expected to affect traffic patterns or level of service on more distant roadways.

Air

The largest commercial airport in the Fermi site region is DTW, located approximately 19 mi north of the Fermi plant site. DTW serves domestic and international passenger carriers and air cargo flights. In 2007, more than 467,000 annual flight operations went through DTW, serving more than 36 million passengers. In 2007, it was the 10th largest airport in the country, based on number of passengers served (DTW 2009).

Willow Run Airport is located 7 mi west of DTW and serves cargo, corporate, and general aviation flights. It is one of the country's largest airports for handling cargo air freight. DTW and the Willow Run Airport are operated by the Wayne County Airport Authority. There are numerous other cargo, passenger, and private airports in the Fermi site region. Table 2-39 lists the public airports in the vicinity of the Fermi plant site.

Table 2-39. Public Use Airports in the Local Area

Name	Location	Type of Operation	Distance from Fermi Site (mi)	Direction from Fermi Site
Wickenheiser Airport	Carleton, Michigan	General aviation	7	NW
Custer Airport	Monroe, Michigan	General aviation	9	W
Grosse Ile Municipal Airport	Detroit/Grosse Ile, Michigan	General aviation	11	NNW
Erie Aerodrome	Erie, Michigan	General aviation	18	SW
Detroit Metropolitan Wayne County Airport	Detroit, Michigan	Commercial, air taxi, general aviation	19	NNW
Willow Run Airport	Ypsilanti, Michigan	Commercial, air taxi, general aviation	24	NNW
Toledo Suburban Airport	Lambertville, Michigan	General aviation	25	SW
Gradolph Field Airport	Petersburg, Michigan	General aviation	25	W
Toledo Express Airport	Toledo, Ohio	Commercial, air taxi, general aviation	>40	SW
Coleman A. Young Municipal Airport	Detroit, Michigan	General aviation, air taxi	33	NNE

Source: AirNav.com 2009

Rail

Three major railway systems provide service to or at stations near the Fermi site because it is centrally located between Detroit and Toledo: Canadian National (CN), CSX, and Norfolk

Southern Railway (NS) (Monroe County Planning Department and Commission 2010). A rail spur from the main line CN railway extends into the Fermi site parallel to Enrico Fermi Drive. This rail spur allows large and heavy equipment to be transported to the plant site (Detroit Edison 2011a).

Shipping

Barges, freighters, and bulk cargo ships use Lake Erie in the vicinity of the Fermi site. Most of the barge traffic on Lake Erie near the Fermi site occurs to and from the Ports of Toledo, Detroit, and Monroe, which are part of the Great Lakes-St. Lawrence Seaway system, which connects shipments from the Atlantic Ocean to the Midwest. In 2008, 4232 vessels traveled through the seaway. During that same year, the Toledo port received 138 shipments and exported 126 shipments, and the Port of Detroit received 140 shipments and exported 49 shipments (St. Lawrence Seaway Management Corporation 2009). The Port of Monroe is not considered a major port but has received heavy equipment for the Fermi 2 power plant in the past. A barge slip and offloading area is located at the Fermi plant site; it was used to offload equipment during Fermi 2 construction, but is no longer in use (Detroit Edison 2011a).

Roads/Highways

The region within a 50-mi radius surrounding the Fermi site has a highly developed roadway network. I-75, which extends through Monroe County and Frenchtown Charter Township, is 2 mi east of the Fermi plant site and provides access from the Fermi site north to Detroit and south to Toledo. I-275 splits from I-75 north of the Fermi plant site and continues in a northwesterly direction, providing a western bypass around the Detroit metropolitan area, and access to the DTW, western Wayne County, and Oakland County. It connects to I-94 and I-96, which are the primary Michigan east-west interstates.

The main entrance to the site is at Enrico Fermi Drive, which connects to N. Dixie Highway after crossing Toll Road and Leroux Road. N. Dixie Highway links the site to local communities north and south and connects to many other key local and regional highways. To the south, N. Dixie Highway provides access to I-75 at an interchange approximately 6.2 mi southwest of the site. It also intersects Nadeau Road south of the site, which provides another interchange with I-75 approximately 6 mi west of the site. To the north, N. Dixie Highway intersects with Swan Creek Road, which has an interchange with I-75 approximately 6 mi to the northwest of the Fermi site.

Existing roadways in the vicinity of the Fermi site are shown on Figure 2-16. The average daily traffic (ADT) volume for these roadways is shown on Table 2-40. Most of the roads in the area, excluding I-75 and N. Dixie Highway, are low-volume roads, with an ADT of fewer than 5000 vehicles per day. These traffic volumes are generally below the capacity of the roads (Mannik & Smith Group, Inc. 2009).

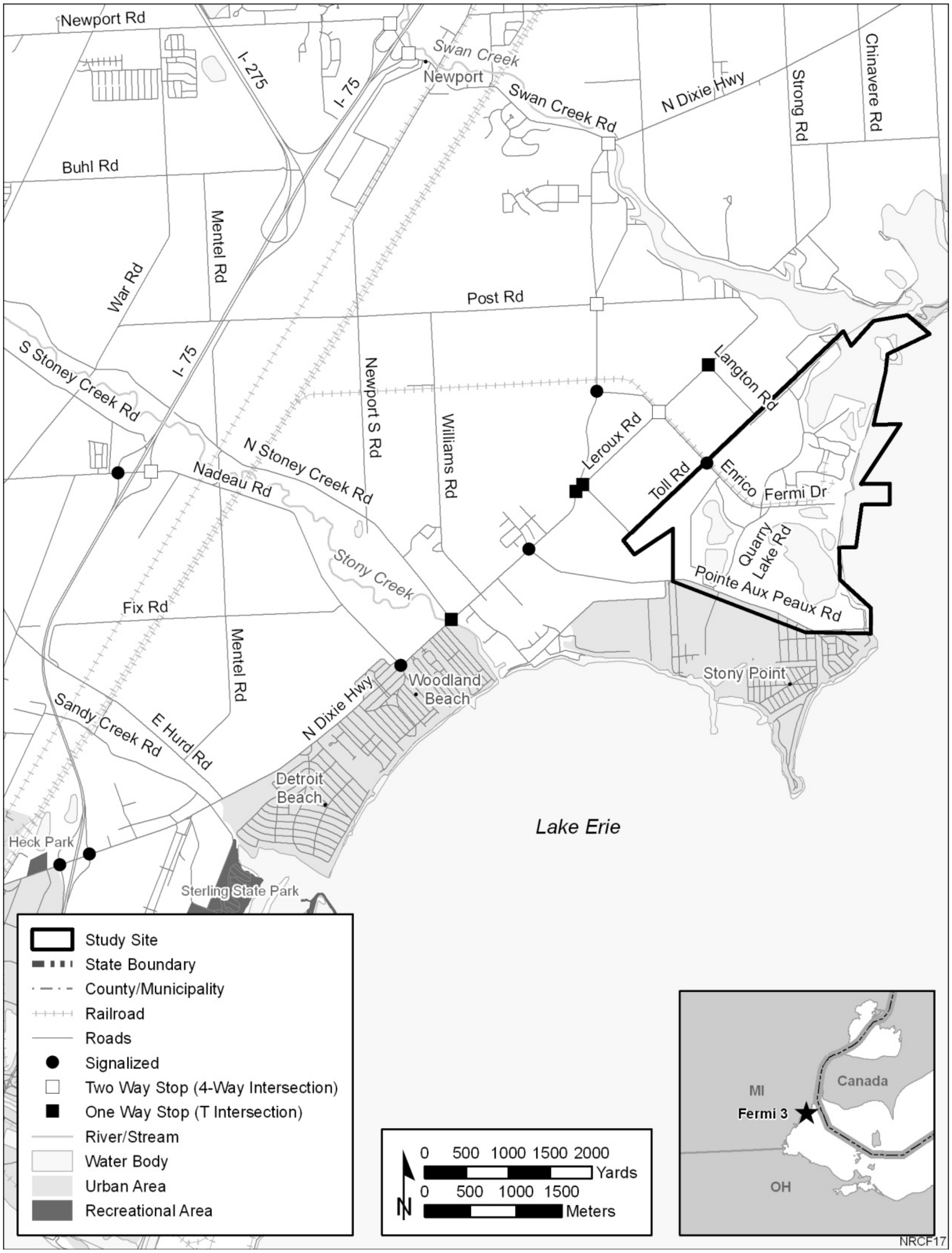

Figure 2-16. Local Roadways near the Fermi Site (Mannik & Smith Group, Inc. 2009)

Table 2-40. Existing Average Daily Traffic Volumes on Local Roadways

Roadway	Weekday ADT	Weekend ADT
I-75, N. Dixie Highway to Nadeau Road	16,800	–[(a)]
I-75, I-275 to Newport/Swan Creek Road	31,200	–
N. Dixie Highway, I-75 to Nadeau Road	12,700	–
N. Dixie Highway, Stony Creek to Pointe Aux Peaux Road	8494	7219
N. Dixie Highway, south of Enrico Fermi Drive	4307	–
Nadeau Road	5300	–
Pointe Aux Peaux Road	4110	3766
Swan Creek Road	4300	–
Enrico Fermi Drive	2378	611
Post Road, east of N. Dixie Highway	275	260
Leroux Road	124	125

Source: Mannik & Smith Group, Inc. 2009
(a) – = ADT volumes were not collected during the weekend for these roadways.

In May 2009, Detroit Edison performed a level of service (LOS) analysis for the intersections of these roadways during the peak traffic periods associated with the arrival and departure of Fermi plant employees during normal operations. LOS is a designation of operational conditions on a roadway or intersection, ranging from A (best) to F (worst). LOS categories as defined in the *Highway Capacity Manual* are listed on Table 2-41. The LOS analysis was conducted in accordance with the Transportation Research Board's *Highway Capacity Manual* to evaluate the operational efficiency at each intersection and its approaching roadway(s). This analysis was conducted to determine the baseline conditions from which the traffic impacts associated with construction and operation of Fermi 3 could be compared. Table 2-42 provides the LOS at local intersections during the morning and afternoon commutes to and from the Fermi plant site. All intersections in the immediate vicinity of the Fermi plant site operated at acceptable LOSs. The Mannik & Smith Group identified deficiencies at three intersections associated with the I-75 interchanges (Mannik & Smith Group, Inc. 2009):

- Northbound I-75 ramp, left turn to westbound Nadeau Road
- Northbound I-75 ramp, left turn to westbound Swan Creek Road
- Southbound I-75 ramp, northbound approach at Swan Creek Road.

Mannik & Smith Group, Inc. determined that beyond the immediate vicinity of Fermi 2, the traffic associated with the Fermi workforce would not be distinguishable from the ADT volumes on major commuting routes, such as I-75. Therefore, the traffic analysis did not encompass the entire economic impact area. The review team reviewed the traffic analysis prepared by The Mannik & Smith Group, Inc., and concurred with the findings.

Table 2-41. Level of Service Categories

Level of Service	Definition
Intersections with signals	
A	Acceptable: little or no delay, few vehicles stopped at intersection
B	Acceptable: short traffic delays, progression is still good
C	Acceptable: average traffic delays, many vehicles go through intersection without stopping, but a significant amount are stopped
D	Acceptable (marginal): long traffic delays, unfavorable progression, more vehicles stopped at intersection, individual cycles may fail
E	Moderately deficient: very long traffic delays, individual cycles frequently fail
F	Deficient: extreme traffic delays, over-saturation
Intersections with no signals	
A	Acceptable: primarily free flow
B	Acceptable: reasonably free flow
C	Acceptable: stable flow
D	Acceptable (marginal): marginal congestion
E	Moderately deficient: unstable congestion
F	Deficient: very congested

SEMCOG is the region's designated metropolitan planning organization for regional transportation planning. Short-range (e.g., 2008 to 2011) priorities for funding by cities, county road commissions, transit agencies, and the Michigan Department of Transportation are included on a list called the Transportation Improvement Program (TIP), which is regularly updated (SEMCOG 2009c). Projects funded under the TIP are drawn from the long-range RTP, the latest version of which is the *Direction 2035 Regional Transportation Plan for Southeast Michigan* (SEMCOG 2009d). Included in the RTP are more than 1500 projects throughout southeast Michigan that address roadway congestion and safety, bridges, bicycling/walking, public transit, and freight transport.

Specific transportation projects in the vicinity of the Fermi site that are included in either the TIP or the RTP include adding a center left-turn lane on N. Dixie Highway. Improvements between Grand Boulevard and Stony Creek Road were completed in 2008; improvements between Stony Creek Road and Swan Creek Road are still pending (Brudzinski 2011). Other projects identified in the TIP were roadway resurfacing projects on some of the roadways in the vicinity of the Fermi site. None of the deficiencies identified in the LOS analysis are currently addressed by roadway improvements in the TIP or the RTP (SEMCOG 2009c, d).

Public transportation in Monroe County is provided by the Lake Erie Transportation Commission. The Lake Erie Transportation Commission operates a bus service called the Lake Erie Transit (LET). It has eight fixed routes serving the City of Monroe and Monroe Charter and Frenchtown Charter Townships. The Lake Erie Transportation Commission also provides a

Table 2-42. Existing Level of Service in 2009 on Area Roadway Intersections during Peak Morning and Afternoon Workforce Commutes

Intersection	Approach/Movement	LOS Peak Morning	LOS Peak Afternoon
Northbound I-75 ramps and Dixie Hwy.	Northbound ramp	C	C
	N. Dixie Hwy./eastbound	A	A
	N. Dixie Hwy./westbound	A	A
Northbound I-75 ramps and Nadeau Rd.	Northbound ramp/left turn	F	D
	Northbound ramp/right turn	Free	Free
	Nadeau Rd./eastbound/thru/left turn	A	A
	Nadeau Rd./westbound	Free	Free
Northbound I-75 ramps and Swan Creek Rd.	Northbound ramp/left turn	D	E
	Northbound ramp/right turn	B	B
	Swan Creek Rd./southeast-bound	Free	Free
	Swan Creek Rd./northwest-bound	A	A
Southbound I-75 ramps and Swan Creek Rd./ Newport Rd.	Southbound ramp (northbound approach)	C	E
	Newport Rd./northwest-bound	A	A
	Newport Rd./southeast-bound	A	A
	Swan Creek Rd./southbound	A	D
N. Dixie Hwy. and Stony Creek Rd.	Stony Creek Rd./eastbound	C	C
	North Dixie Hwy./northbound	A	A
	North Dixie Hwy./southbound	Free	Free
N. Dixie Hwy. and Pointe Aux Peaux Rd.	N. Dixie Hwy./northeast-bound	B	B
	North Dixie Hwy./southwest-bound	A	C
	Pointe Aux Peaux Rd./northwest-bound	B	B
N. Dixie Hwy. and Leroux Rd.	Leroux Rd./southwest-bound	B	B
	North Dixie Hwy./northbound	Free	Free
	North Dixie Hwy./southbound	A	A
N. Dixie Hwy. and Enrico Fermi Dr.	N. Dixie Hwy./northbound	A	A
	N. Dixie Hwy./southbound	A	B
	Enrico Fermi Dr./westbound	C	B
N. Dixie Hwy. and Post Rd.	Post Rd./eastbound	C	C
	Post Rd./westbound	B	B
	North Dixie Hwy./northbound	A	A
	North Dixie Hwy./southbound	B	A
Enrico Fermi Dr. and Leroux Rd.	Leroux Rd./northeast-bound	B	A
	Leroux Rd./southwest-bound	A	A
	Enrico Fermi Dr./southeast/northwest	Free	Free

Dial-a-Ride program for residents in Frenchtown Charter and Bedford Townships; residents are transported from their homes to any destination within the township or to one of the LET fixed lines. Ridership is approximately 400,000 persons annually (LET undated). For the 2007 fiscal year, LET served 358,196 passengers (Michigan Department of Transportation 2009). None of the routes provided by LET directly access the Fermi plant site.

2.5.2.4 Aesthetics

The location of Fermi 3 would be within the existing Fermi site along the Lake Erie shoreline. Elevations at the site range from lake level to 25 ft above lake level. Existing plant structures include the decommissioned Fermi 1, Fermi 2 (operating), and two 400-ft-tall cooling towers. The cooling towers, neutral gray concrete in color, are the predominant visible structures on the site and are visible from outside the site property boundaries in all directions. Topography in the vicinity of the plant site is fairly flat, with some lower elevation wetland areas along the Lake Erie shoreline, including the Fermi site and the surrounding DRIWR.

Surrounding land use is predominantly agricultural, with some residential areas that are within the viewshed of the plant site. Several small beach communities are located along the Lake Erie shore within 5 mi of the Fermi plant site, including Estral Beach, Stony Point, Detroit Beach, and Woodland Beach. Several public and private beaches are located along the Lake Erie shoreline in Monroe and Wayne Counties. Many small marinas and docks are also located along the Lake Erie shoreline within the vicinity and viewshed of the Fermi site. Lake Erie provides a wide variety of water-related recreational opportunities, and recreational boating on Lake Erie is an important resource to the State. The Fermi site and buildings are easily viewed by boaters in Lake Erie.

Recreational facilities and areas in Monroe, Wayne, and Lucas Counties offer a wide variety of active and passive recreational opportunities such as boating, swimming, hiking, camping, picnicking, and bird watching. The following discussion focuses on major parks and recreational facilities in the local area and their management and highlights prominent park features.

The DRIWR is one of the largest Federally managed recreational and conservation lands in the local area. It encompasses 656 ac of the Fermi site and is managed by the FWS. The DRIWR's acquisition boundary extends 48 mi along the Lake Erie shoreline from the Detroit River to the River Raisin, with lands that can be acquired as they become available. Although the portion of the DRIWR that is within the Fermi site is not open to the public, other portions are open and provide opportunities for hunting, fishing, and wildlife observation. The River Raisin National Battlefield Park, located in Monroe County, is also under Federal control. Located approximately 7 mi from the Fermi site, it is a recent addition to the National Park System. The park and visitor center had been operated previously by the Monroe County Historical Society and the Monroe County Historical Commission.

State recreational areas in Monroe County total 7413 ac and include Sterling State Park and three game areas – Point Mouillee State, Petersburg State, and Erie State – as well as several boat access sites and road rest areas. The two Fermi 2 cooling towers are visible from Point Mouillee State Game Area (3.1 mi to the northeast) and Sterling State Park (4.8 mi to the south-southwest). Point Mouillee State Game Area (3466 ac) is one of the largest freshwater marsh restoration projects in the world. Waterfowl, shorebirds, and other wetland wildlife are the primary attraction at this site. Sterling State Park (1300 ac) is the only State Park on the Lake Erie shoreline of Michigan. It has campgrounds, beach access, a boat launch, a playground, and nature trails.

The Huron-Clinton Metropolitan Authority (HCMA) is a regional special park district encompassing Wayne, Oakland, Macomb, Washtenaw, and Livingston Counties. The HCMA operates 13 Metroparks totaling 23,630 ac. These Metroparks are located along the Huron and Clinton Rivers, providing a greenbelt around the Detroit metropolitan area. The parks are generally more than 1000 ac each, with Stony Creek and Kensington being more than 4300 ac.

Monroe County, Wayne County, and the City of Detroit also manage a number of parks and recreational facilities. Several regional recreational trail and greenway initiatives include the Detroit Heritage River Water Trail, Downriver Linked Greenways Initiative, and Southeast Michigan Greenways Initiative.

Lucas County contains many Federal, State, and local park and conservation lands. Along Lake Erie is the Ottawa National Wildlife Refuge (NWR) Complex, which consists of three NWRs and a waterfowl production area. The Cedar Point NWR, West Sister Island NWR, and a portion of the Ottawa NWR are located in Lucas County. State lands include the 2202-ac Magee Marsh Wildlife Refuge, the 3101-ac Maumee State Forest, and the 1336-ac Maumee Bay State Park (ODNR 2009a).

The Metroparks in and around the Toledo area encompass 11 parks, totaling 10,500 ac. These parks provide a variety of passive and active recreational opportunities and preserve the natural and cultural features of the area.

2.5.2.5 Housing

This section provides an overview of the housing market in Monroe, Wayne, and Lucas Counties, including information on the housing stock, vacancy rates, house values, rental costs, and basic services. Also included is information about short-term accommodations, including hotels and motels, and sites for recreational vehicles (RVs), which could support the temporary construction workers as well as outage workers.

As shown in Table 2-43, the USCB identified more than 1 million housing units in Monroe, Wayne, and Lucas Counties in 2010. The vacancy rate within the three counties ranged

Table 2-43. Selected Housing Characteristics for Monroe, Wayne, and Lucas Counties, 2010

Characteristics	Monroe County	Wayne County	Lucas County
Total Housing Units	62,930	826,328	202,659
Occupied	58,298	690,943	179,000
Owner-occupied (number of units)	47,048	464,603	116,420
Owner-occupied (percent)	80.7	67.2	65.0
Renter-occupied (number of units)	11,250	226,340	62,580
Renter-occupied (percent)	19.3	32.8	35.0
Vacant	4632	135,385	23,659
Vacancy Rate			
Homeowner (percent)	2.4	4.4	3.8
Rental (percent)	9.1	11.3	10.6
Units in Structure for Total Housing Units			
1 unit (number of units)	48,546	619,739	144,020
1 unit (percent)	77.0	75.0	71.1
2–4 units (number of units)	2749	67,387	18,355
2–4 units (percent)	4.4	8.2	9.1
5 or more units (number of units)	5764	124,878	34,860
5 or more units (percent)	9.2	15.1	17.2
Mobile homes (number of units)	5864	14,207	5401
Mobile homes (percent)	9.3	1.7	2.7
Other (boat, RV, van, etc.) (number of units)	7	117	23
Other (boat, RV, van, etc.) (percent)	<1	<1	<1
Lack of Services within Occupied Housing Units			
Lacking complete plumbing facilities (number of units)	209	4909	327
Lacking complete plumbing facilities (percent)	<1	<1	<1
Lacking complete kitchen facilities (number of units)	220	6617	1204
Lacking complete kitchen facilities (percent)	<1	1.0	<1
No telephone service available (number of units)	3060	36,793	6213
No telephone service available (percent)	5.2	5.3	3.5
>1 occupant/room (number of units)	545	15,135	1400
>1 occupant/room (percent)	<1	2.2	<1

Source: USCB 2010h

between 2.4 and 2.9 percent for owner-occupied housing and 11.3 and 14.4 percent for rental units, with Wayne County having the highest vacancy rates. Most of the housing units are owner-occupied single-family units, with owner occupancy highest in Monroe County. Occupied units generally offer basic services, including plumbing, kitchens, and telephone service.

Median housing costs for Monroe, Wayne, and Lucas Counties in 2010 are provided in Table 2-44. Housing costs are comparable throughout the area, although the median housing values tend to be higher in Monroe County, whereas the rental cost is slightly higher in Wayne County.

Table 2-44. Housing Costs for Monroe, Wayne, and Lucas Counties, 2010

Parameter	Monroe	Wayne	Lucas
Median Housing Value	$161,800	$121,100	$122,400
Median Monthly Cost			
Housing units with a mortgage	$1451	$1397	$1243
Housing units without a mortgage	$451	$486	$463
Median Monthly Rent	$733	$759	$631
Sources: USCB 2010h			

SEMCOG provides regional housing information and trends for counties in southeast Michigan, including Monroe and Wayne Counties. SEMCOG reported that the number of mobile home parks and sites and amount of building permit activity in southeast Michigan as of 2008 indicated that Wayne County had 68 mobile home parks and 15,835 mobile home sites.

Monroe County had 29 mobile home parks and 7452 mobile home sites (SEMCOG 2008b). Monroe County reported that 17.2 percent of the surveyed sites were vacant in 2006 (Detroit Edison 2011a).

In 2008, Monroe County approved permits for the construction of 118 new housing units and the demolition of 44 housing units, resulting in a net increase of 74 new units. During the same year, permits for construction of 1062 new housing units and the demolition of 3498 housing units were approved in Detroit and the remainder of Wayne County, resulting in a net loss of 2436 units. Permits for residential construction have declined over the past few years in southeast Michigan. Data on building permit activity between 2005 and 2008 are provided in Table 2-45. These trends continued in 2009, with a net of 40 units approved in Monroe County and a loss of 101 units in Wayne County (SEMCOG 2010b).

The housing market has also been affected by foreclosures in southeast Michigan and in other areas of the country. The U.S. Department of Housing and Urban Development (HUD) has estimated housing foreclosures for each county in the country under its new Neighborhood

Table 2-45. Housing Construction Trends in Monroe and Wayne Counties, 2005–2008

Parameter	Wayne County				Monroe County			
	2005	**2006**	**2007**	**2008**	**2005**	**2006**	**2007**	**2008**
New building units	4864	2789	1422	1062	919	583	351	118
Demolitions	2419	1897	1976	3498	43	64	59	44
Net units	**2445**	**892**	**–554**	**–2436**	**876**	**519**	**292**	**74**

Source: SEMCOG 2010b

Stabilization Program, which provides grants for State and local governments and nonprofit organizations to acquire and redevelop foreclosed properties that may otherwise lead to abandonment and neighborhood decline (HUD 2008). HUD estimated the number of housing foreclosures in 2007 and the first six months of 2008 throughout the country. In Monroe County, HUD estimated that 2398 properties were in foreclosure, representing a rate of 6.5 percent of the housing units with a mortgage. In Wayne County, HUD estimated that 48,944 properties were in foreclosure, a rate of 11.2 percent of the housing units with a mortgage (HUD 2008).

SEMCOG forecasts a slow increase in the number of occupied units in Monroe County through 2035 (see Table 2-46). Wayne County experienced a decline in the number of occupied units between 1990 and 2008, with growth occurring in the next decade and through 2035.

Table 2-46. Historic and Forecasted Number of Occupied Units, 2020–2035

	Historical			Forecast Period		
County	**1990**	**2000**	**2010**	**2020**	**2030**	**2035**
Monroe	46,508	53,772	58,298	63,307	67,709	69,388
Wayne	780,535	768,440	690,943	717,116	738,524	747,632

Source: SEMCOG 2008a; USCB 2010h

Assuming that the average vacancy rate for Monroe and Wayne Counties remains constant, an estimated 4495 units would be vacant in 2020 in Monroe County and an estimated 62,389 units would be vacant in 2020 in Wayne County.

An estimated 375 short-term accommodation establishments are located within 50 mi of the City of Monroe; they include hotels and motels, bed and breakfast inns, cabins, cottages, condos, historic inns, and campgrounds (Detroit Edison 2011a). Table 2-47 provides an estimate of the number of RV sites within Wayne, Monroe, and Lucas Counties. Although the number of units in other short-term accommodation establishments has not been estimated, the review team assumes that some units would be available during construction of Fermi 3.

Table 2-47. Campground/Recreational Vehicle Sites near Fermi Plant Site

Name	Location	Number of Sites
Monroe County		
Covered Wagon Camp Resort	Ottawa Lake	140
Harbortown RV Resort	Monroe Township	250
Monroe County/Toledo North KOA	Summerfield	NR[(a)]
River Raisin Canoe Livery Campground	Dundee	19
River Raisin Marine and Campground	Monroe	
Totem Pole Park LLC	Summerfield	130
Camp Lord Willing Management RV Park and Campground	Frenchtown Township	110
KC Campground	Milan	100
Pirolli Park Campground	Summerfield	NR

Sources: Michigan Association of RV Parks and Campgrounds 2011; Pure Michigan 2011; Monroe County Parks Commission 2008
(a) NR = Not reported.

2.5.2.6 Public Services

This section provides information about water supply and wastewater treatment and police, fire response, and healthcare services available to the residents of Monroe, Wayne, and Lucas Counties. Educational services are discussed in Section 2.5.2.7.

Water Supply Services

Residents of Monroe, Wayne, and Lucas Counties obtain potable water through wells or municipal water supplies. The capacities of the major water suppliers servicing the local area are provided below.

<u>Monroe County</u>

Several municipal water suppliers provide water to residents of Monroe County, including the City of Monroe; Frenchtown Charter Township; City of Toledo, Ohio; and the DWSD. Table 2-48 shows the total treatment capacity, average daily flow, and maximum daily flow for these municipal water suppliers. Residents outside areas supported by these municipal suppliers obtain water through private wells (Monroe County Planning Department and Commission 2010).

The City of Monroe pumps and treats water from Lake Erie. It operates a joint intake and pumping facility with Frenchtown Charter Township. The city's water treatment and distribution system serves the City of Monroe and portions of the surrounding townships, including Monroe Charter, Raisinville, Exeter, Ida, and London. In addition, the City of Monroe supplies water in

Table 2-48. Capacity of Municipal Water Suppliers in Monroe, Wayne, and Lucas Counties

Municipal Water Supplier	Treatment Capacity (MGD)	Average Daily Flow (MGD)	Maximum Daily Flow (MGD)
City of Monroe[(a)]	18	7.8	10.9
Frenchtown Charter Township[(a)]	8	2.1	3.9
City of Milan[(a)]	2	1.2	NR[(b)]
Detroit Water and Sewage District[(c)]	1720	622	794
City of Toledo [(c)]	120	73	104

Sources: Monroe County Planning Department and Commission 2010; Ellenwood 2010; Leffler 2010
(a) 2005 data.
(b) NR = not reported.
(c) 2009 data.

bulk to the Village of Dundee and the City of Petersburg, serving an estimated population of 53,000 residents. The City of Monroe treatment plant has an 18 MGD treatment capacity. The average daily and maximum daily water demands for the service area provided by the City of Monroe treatment plant were 7.8 MGD and 10.9 MGD, respectively, in 2005 (Monroe County Planning Department and Commission 2010).

Frenchtown Charter Township shares the water intake with the City of Monroe and operates a water treatment plant that services approximately 20,000 residents and other nonresidential customers within the township. Frenchtown Charter Township also provides the potable water supply for the Fermi plant site. The average daily and maximum daily water demands for Frenchtown Charter Township in 2005 were 2.1 MGD and 3.9 MGD, respectively. The plant doubled its capacity from 4 to 8 MGD in 2006, which was projected to be sufficient for a minimum of 20 years (Monroe County Planning Department and Commission 2010).

The southern portion of Monroe County, including Bedford, Erie, and LaSalle Townships, and the City of Luna Pier receive water supplies through the City of Toledo, Ohio, water treatment and distribution system. Northern portions of Monroe County, including Ash Township, Berlin Township, and the Villages of Carleton, Estral Beach, and South Rockwood, receive water supplies either directly through the DWSD treatment and distribution system via the township, which then distributes the water to the villages, or wholesale from DWSD.

The City of Milan in Monroe County has its own water treatment plant, drawing from groundwater wells located within the city limits. The plant has a 2.0 MGD capacity and treats an average daily demand of 1.2 MGD (Monroe County Planning Department and Commission 2010).

Wayne County

Residents of Wayne County receive water from the Detroit Water and Sewerage Department (DWSD), which also supplies water to residents in the City of Detroit and 126 neighboring communities in all or portions of Oakland, Macomb, St. Clair, Lapeer, Genesee, Washtenaw, and Monroe Counties. The DWSD maintains three intake facilities that draw water from Lake Huron and the Detroit River and five water treatment plants. The total capacity of the treatment plants is approximately 1720 MGD. The average daily and maximum daily water demands in 2009 were 622 MGD and 794 MGD, respectively (DWSD 2004; Ellenwood 2010).

Lucas County

Residents in Lucas County are served by two municipal water suppliers. Toledo's water treatment and distribution system serves the city residents and portions of Lucas County, including the Cities of Maumee, Sylvania, and Perrysburg, and portions of Monroe County, Michigan, and Wood County, Ohio. Within the Collins Park Treatment Plant are two facilities, one with an 80-MGD treatment capacity and a second with a 40-MGD treatment capacity. In 2009, the average daily demand was 73 MGD, and the maximum daily demand was 104 MGD (Leffler 2010).

The City of Oregon's water treatment and distribution system serves city residents and portions of eastern Lucas County. Because of its distance from the Fermi 3 site, this public facility is not expected to be impacted and is not discussed further.

Wastewater Treatment Services

Monroe County

Wastewater treatment services are provided by a number of townships and municipalities in Monroe County, which service residential, commercial, and industrial customers within the City of Monroe; in Frenchtown Charter, Monroe Charter, Raisinville, Bedford, Berlin, Ida, York, LaSalle and Ash Townships; in the Cities of Milan, Petersburg, and Luna Pier; and in the Villages of Dundee, Carleton, and Maybee. Other residents within the county are served by private, onsite wastewater disposal systems (Monroe County Planning Department and Commission 2010). Table 2-49 shows the design flow, average daily flow, and maximum daily flow for the municipal wastewater treatment facilities that service these areas.

The following discussion focuses on wastewater treatment system for the City of Monroe, where the largest concentration of the construction and operation workforces associated with Fermi 3 would be expected to reside.

Table 2-49. Flows in Major Public Wastewater Treatment Facilities in Monroe, Wayne, and Lucas Counties

Municipal Wastewater Treatment Plant (WWTP)	NPDES Permit Date	Design Flow (MGD)[a]	Avg. Daily Flow (MGD)[b]	Max. Daily Flow (MGD)[b]
Monroe County				
City of Monroe (including Frenchtown Charter, Monroe Charter, and Raisinville Townships)	2010	24	15.9	67
Bedford Township	2007	6	–[c]	–
Berlin Township	2006	1.8	–	–
Ida and Raisinville Townships	2009	0.14	–	–
City of Milan (including York and Milan Townships)	2010	2.5	1.3	3.5
City of Petersburg	2010	0.2	0.12	0.85
City of Luna Pier (including LaSalle Township)	2011	0.35	0.24	0.58
Village of Dundee	2011	1.5	–	–
Village of Carlton (including Ash Township)	2010	0.74	0.39	0.95
Village of Maybee	2009	0.08	–	–
Wayne County				
Detroit Water and Sewage District	2008	930		
Grosse Ile Township	2008	2.5	2.5	10.5
City of Rockwood	2009	1.0	0.4	2.4
City of Trenton	2008	6.5	4.5	10.8
Wayne County Downriver WWTP	2008	125		
Lucas County				
Bayview WWTP		195	71	160

Sources: MDEQ 2011; McGibbeny 2010
(a) Basis of effluent limitations in NPDES permit.
(b) As reported in the NPDES application.
(c) – = Not available.

The Monroe Metropolitan Water Pollution Control System serves approximately 52,000 residents within the City of Monroe, large portions of Monroe Charter and Frenchtown Charter Townships, and a small portion of Raisinville Township. The plant has a design capacity of 24 MGD and average daily flow of 16 MGD, for an available capacity of about 34 percent during normal flow periods. During heavy rain events, the treatment plant can be overloaded from excessive stormwater and groundwater. The maximum daily flow that has occurred is 67 MGD (MDEQ 2011).

Wayne County

Residents of Wayne County are served by two large municipal wastewater treatment systems (WWTPs) (DSWD and the Wayne County Downriver WWTP) and by three small municipal systems (Grosse Ile Township, and the Cities of Rockwood and Trenton).

The DWSD owns and operates one of the largest single-site WWTPs in the United States. It serves the northern portion of Wayne County, including Detroit and portions of Macomb and Oakland Counties, a service area covering 946 mi^2 and 76 communities. The system includes four principal regional interceptors, 14 pumping stations, 3383 mi of sewers in Detroit, and an estimated 8770 mi in the suburban communities served by DWSD. Currently, DWSD's WWTP has a design flow of 930 MGD. The plant currently treats an average of 727 MGD (DWSD 2003; Ellenwood 2010).

Wayne County operates the Downriver WWTP located in Wyandotte, Michigan, which serves 13 communities in the remaining portions of Wayne County that are not served by the DWSD. It has a design flow of 125 MGD and treats an average daily flow of 52 MGD (MDEQ 2011; Hubbell, Roth, and Clark, Inc. 2009).

Lucas County

Lucas County residents are served by various wastewater treatment systems. The City of Toledo's Bayview WWTP is one of the largest wastewater treatment facilities in northwest Ohio. It provides treatment services to an area of approximately 120 mi^2 with a population of approximately 398,000 residents within the City of Toledo, City of Rossford, Villages of Walbridge and Ottawa Hills, and portions of Wood County, Lucas County, and the Village of Northwood. The total capacity of the system is 195 MGD. The average daily and maximum daily water demands in 2009 were 71 MGD and 160 MGD, respectively, for an available capacity of about 64 percent (Toledo Waterways Initiative 2009; McGibbeny 2010).

Police Services

Police jurisdictions operating in Monroe County include the City of Monroe Police Department, Monroe County Sheriff, and Michigan State Police. Municipal jurisdictions, including the Cities of Luna Pier and Milan, the Villages of Carleton and South Rockwood, and Erie Township also maintain police departments.

Police jurisdictions operating in Wayne County include the City of Detroit Police Department, the Wayne County Sheriff, and the Michigan State Police. More than 40 other jurisdictions within Wayne County also maintain police departments.

Police jurisdictions in Lucas County include the Lucas County Sheriff, the City of Toledo, the City of Oregon, and the City of Maumee. The Villages of Holland and Waterville and Sylvania Township also maintain police departments.

The number of law enforcement personnel employed in county and municipal governments in Ohio and Michigan is provided in Table 2-50. The ratio of law enforcement personnel per 1000 residents throughout the county (county and municipal jurisdictions combined) is provided in Table 2-51.

State Police also serve populations within Monroe, Lucas, and Wayne Counties. The Michigan State Police organization is divided into seven districts. Monroe and Wayne Counties are within District 2, which also includes Washtenaw, Macomb, St. Clair, and Oakland Counties. In 2008, the total number of law enforcement personnel employed by the Michigan State Police was 2907 full-time employees, which included 1830 officers and1077 civilians (FBI 2009). In March 2011, the Michigan State Police announced a regional restructuring plan involving a reduction in the number of posts from 62 to 29 and the redesignation of 12 posts as detachments. Although the plan results in fewer facilities, the number of State Police overall does not decrease (Michigan State Police 2011).

The Ohio State Highway Patrol is organized into nine districts. Lucas County is within District 1, which also includes Wood, Fulton, Henry, Defiance, Williams, Paulding, Putnam, Van Wert, Allen, and Hardin Counties. In 2008, the total number of law enforcement personnel employed by the Ohio State Highway Patrol was 2630 full-time employees, which included 1556 officers and 1074 civilians (FBI 2009).

Fire Response Services

Twenty-one jurisdictions within Monroe County have fire response services, primarily staffed by volunteer firefighters. Career firefighters staff the City of Monroe Fire Department and the Frenchtown Charter Township, with staffs of 37 and 33, respectively. Forty-five jurisdictions have fire response services within Wayne County, and 15 jurisdictions within Lucas County have fire response services. The largest fire departments within the economic impact area are in the City of Detroit, which has 48 stations and a staff of 1738, and in the City of Toledo, which has 17 stations and a staff of 508. Townships, cities, and villages in Monroe, Wayne, and

Table 2-50. Law Enforcement Personnel in Monroe, Wayne, and Lucas Counties

Jurisdiction[a]	Law Enforcement Personnel		
	Civilians[b]	Officers[c]	Total
County Sheriffs			
Monroe County	96	106	202
Wayne County	166	1064	1230
Lucas County	229	289	518
Municipal Police Departments			
Monroe County			
Carleton	1	3	4
Erie Township	1	5	6
Luna Pier	0	4	4
Milan	3	9	12
Monroe	5	40	45
South Rockwood	0	4	4
Wayne County			
Allen Park	4	44	48
Belleville	2	9	11
Brownstown Township	11	38	49
Canton Township	37	87	124
Dearborn	32	198	230
Dearborn Heights	25	85	110
Detroit	369	3032	3401
Ecorse	5	26	31
Flat Rock	3	24	27
Garden City	8	38	46
Gibralter	1	10	11
Grosse Ile Township	7	17	24
Grosse Pointe	2	25	27
Grosse Pointe Farms	13	35	48
Grosse Pointe Park	6	43	49
Grosse Pointe Shores	3	18	21
Grosse Pointe Woods	6	40	46
Hamtramck	0	44	44
Harper Woods	3	35	38
Huron Township	5	20	25
Inkster	10	58	68
Lincoln Park	10	51	61
Livonia	35	148	183
Melvindale	3	23	26
Northville	1	16	17

Table 2-50. (contd)

Jurisdiction(a)	Law Enforcement Personnel		
	Civilians(b)	Officers(c)	Total
Northville Township	12	34	46
Plymouth	1	15	16
Plymouth Township	15	31	46
Redford Township	17	64	81
River Rouge	1	19	20
Riverview	3	29	32
Rockwood	1	8	9
Romulus	18	55	73
Southgate	9	38	47
Sumpter Township	7	15	22
Taylor	15	92	107
Trenton	1	37	38
Van Buren Township	16	44	60
Wayne	10	39	49
Westland	25	100	125
Woodhaven	3	31	34
Wyandotte	10	38	48
Lucas County			
Holland	0	9	9
Maumee	15	45	60
Oregon	14	46	60
Sylvania Township	15	43	58
Toledo	134	639	773
Waterville	1	12	13
Total County Sheriff and Municipal Law Enforcement Personnel			
Monroe County			277
Wayne County			6957
Lucas County			973

Source: FBI 2009

(a) State police also serve populations within Monroe, Lucas, and Wayne Counties, but they are not included in these totals because they serve multiple jurisdictions.

(b) Civilians include personnel, such as clerks, radio dispatchers, meter attendants, jailers, correctional officers, and mechanics, who are full-time employees of the agency.

(c) Officers are individuals who ordinarily carry a firearm and a badge, have full arrest powers, and are paid from governmental funds set aside specifically for sworn law enforcement representatives.

Table 2-51. Population Served by Law Enforcement Personnel in Monroe, Wayne, and Lucas Counties

County	Law Enforcement Personnel	Population Served[(a)]	Law Enforcement Personnel per 1000 Residents (2010)
Monroe	277	152,021	1.8
Wayne	6822	1,820,584	3.7
Lucas	973	441,815	2.2

Source: FBI 2009
(a) 2010 population from the USCB (USCB 2010a, b).

Lucas Counties that maintain fire protection services are listed in Table 2-52. The number of fire response personnel per 1000 residents is provided in Table 2-53.

Healthcare Services

Mercy Memorial Hospital is staffed by 235 full-time physicians and 1100 full-time equivalent staff members and is the primary healthcare facility in Monroe County. It is also the primary treatment facility for any injury at the Fermi plant. There are 238 licensed beds in the hospital, and the daily average number of inpatients in 2010 was about 169. Mercy Memorial Hospital has recently undergone a major, $34 million renovation, which doubled the capacity of the emergency center from 25,000 to 60,000 patient visits per year and increased its capability to respond to higher-level traumas (Kreiger 2011). In 2007, the emergency center accommodated 42,040 patient visits (Mercy Memorial Hospital 2009).

Thirty-two hospitals are located in Wayne County, 17 of which are located in Detroit (Wayne County 2009). The largest healthcare providers, which operate multiple facilities, include the Henry Ford Health System (11,475 employees), the Detroit Medical Center (10,150 employees), and Oakwood Healthcare, Inc. (7510 employees) (Wayne County Department of Management and Budget 2008).

The Toledo/Lucas County area has 12 hospitals. The largest healthcare provider is Promedica Health Systems (11,265 employees), which operates several of the hospitals in the Toledo area, including the Toledo Hospital, Toledo Children's Hospital, and Bay Park Community Hospital (City of Oregon). Another large healthcare provider in the Toledo area is Mercy Health Partners (6723), which operates the Mercy St. Vincent Medical Center, Mercy St. Charles Hospital (City of Oregon), Mercy St. Anne's Hospital, and Mercy Children's Hospital. The University of Toledo Medical Center is also located in Toledo.

Data on the number of healthcare workers employed in Monroe, Wayne, and Lucas Counties and the ratio of healthcare workers per 1000 residents are provided in Table 2-54. Healthcare workers are workers within the "healthcare practitioner and technical occupations," and "healthcare support occupations" as defined by the U.S. Bureau of Labor Statistics, Standard Occupational Classification System.

Table 2-52. Fire Response Personnel in Monroe, Wayne, and Lucas Counties

Fire Department Name	Department Type	Number of Stations	Number of Personnel: Firefighters: Active (career)	Number of Personnel: Firefighters: Active (volunteer)	Number of Personnel: Firefighters: Active (paid per call)	Number of Personnel: Non-firefighting (civilian)	Number of Personnel: Non-firefighting (volunteer)	Total
Monroe County								
Ash Township Volunteer Fire Department	Volunteer	2	0	40	0	0	0	40
Bedford Fire Department	Volunteer	3	0	0	64	0	0	64
Bedford Fire Department 2	Volunteer	1	0	30	0	0	0	30
Berlin Charter Township Fire Department 1	Volunteer	1	0	0	28	0	0	28
Berlin Charter Township Fire Department 2	Volunteer	1	0	0	23	0	0	23
Dundee Township Fire Department	Volunteer	1	0	30	0	0	0	30
Erie Township Fire Department	Volunteer	1	0	22	0	0	0	22
Estral Beach Fire Department	Volunteer	1	0	8	0	0	6	14
Exeter Township Fire Department	Volunteer	1	0	0	26	0	0	26
Frenchtown Charter Township Fire Department	Mostly career	4	18	0	14	1	0	33
Ida Township Volunteer Fire Department	Volunteer	1	0	26	0	0	1	27
La Salle Volunteer Fire Department	Volunteer	1	0	24	0	0	0	24
London-Maybee-Raisinville	Volunteer	1	0	21	0	0	0	21
Luna Pier Volunteer Fire Department	Volunteer	1	0	0	21	0	2	23
Milan Area Fire Department	Volunteer	1	0	0	36	1	0	37
Monroe Charter Township Fire Department	Volunteer	3	0	0	25	0	0	25
Monroe Fire Department	Career	3	37	0	0	0	0	37
Morin Point Fire Department	Volunteer	1	0	29	0	0	3	32
Ottawa Lake Volunteer Fire Department	Volunteer	1	0	22	0	0	0	22
Summerfield TWP Volunteer Fire Department	Volunteer	1	0	0	26	0	0	26
Whiteford Township Volunteer Fire Department	Volunteer	1	0	22	0	0	0	22
Wayne County								
Allen Park Fire Department	Career	1	32	0	0	1	0	33
Belleville Fire Department	Volunteer	1	0	0	16	0	0	16
Brownstown Fire Department	Career	4	30	0	0	1	0	31
Canton Fire Department	Career	2	53	0	0	2	0	55
Charter Township of Redford Fire Department	Career	3	39	0	0	1	0	40
City of Detroit Fire Department	Career	48	1260	0	0	478	0	1738

Table 2-52. (contd)

Fire Department Name	Department Type	Number of Stations	Number of Personnel: Firefighters: Active (career)	Number of Personnel: Firefighters: Active (volunteer)	Number of Personnel: Firefighters: Active (paid per call)	Number of Personnel: Non-firefighting (civilian)	Number of Personnel: Non-firefighting (volunteer)	Total
City of Harper Woods Fire Department	Career	1	12	0	0	0	0	12
City of Inkster Fire Department	Career	1	18	0	0	6	0	24
City of Northville Fire Department	Mostly volunteer	1	1	0	28	0	0	29
Dearborn Fire Department	Career	4	121	0	0	2	0	123
Dearborn Heights Fire Department	Career	2	54	0	0	1	0	55
Ecorse Fire Department	Mostly career	1	14	0	10	0	0	24
Flat Rock Fire Department	Mostly volunteer	1	7	0	25	0	0	32
Garden City Fire Department	Career	1	20	0	0	1	0	21
Gibraltar Fire Department	Volunteer	1	0	0	30	0	0	30
Great Lakes Operations Fire Department	Career	2	15	0	0	0	0	15
Grosse Ile Fire Department	Mostly volunteer	1	2	32	0	1	0	35
Grosse Pointe City Fire Department	Career	1	25	0	0	6	0	31
Grosse Pointe Farms Public Safety	Career	1	35	0	0	0	0	35
Grosse Pointe Park Department of Public Safety	Career	1	44	0	0	8	0	52
Grosse Pointe Shores Department of Public Safety	Mostly career	1	19	8	0	0	0	27
Grosse Pointe Woods Department of Public Safety	Career	1	47	0	0	6	0	53
Hamtramck Fire Department	Career	1	25	0	0	0	0	25
Highland Park Department of Public Safety	Career	1	43	0	0	0	0	43
Huron Township Fire Department	Mostly volunteer	3	6	0	30	0	0	36
Lincoln Park Fire Department	Career	1	32	0	0	1	0	33
Livonia Fire and Rescue	Career	5	91	0	0	5	0	96
Melvindale Fire Department	Career	1	14	0	0	1	0	15
Metro Fire Department, Ltd.	Volunteer	2	0	5	2	0	10	17
Northville Township Fire/Rescue Department	Career	2	15	0	0	0	0	15
Plymouth Community Fire Department	Mostly career	3	31	0	7	1	0	39
River Rouge Fire Department	Career	1	27	0	0	0	0	27
Riverview Fire Department	Mostly volunteer	1	2	0	50	8	0	60
Rockwood Fire Department	Volunteer	1	0	0	21	5	0	26

Table 2-52. (contd)

Fire Department Name	Department Type	Number of Stations	Number of Personnel: Firefighters: Active (career)	Number of Personnel: Firefighters: Active (volunteer)	Number of Personnel: Firefighters: Active (paid per call)	Number of Personnel: Non-firefighting (civilian)	Number of Personnel: Non-firefighting (volunteer)	Total
Romulus Fire Department	Mostly volunteer	4	8	0	32	1	0	41
Southgate Fire Department	Career	1	27	0	0	1	0	28
Sumpter Township Fire Department	Volunteer	2	0	0	30	0	0	30
Taylor Fire Department	Career	3	66	0	0	3	0	69
Trenton Fire Department	Career	2	33	0	0	1	0	34
Van Buren Fire Department	Mostly volunteer	2	2	0	32	0	0	34
Wayne County Department of Airports	Career	3	65	0	0	2	0	67
Wayne Fire Department	Career	1	21	0	0	2	0	23
Westland Fire Department	Career	5	78	0	0	2	0	80
Woodhaven Fire Department	Mostly volunteer	2	7	0	20	0	1	28
Wyandotte Fire Department	Career	2	29	0	0	1	0	30
Lucas County								
180th Ohio Air National Guard Fire Department	Career	1	40	0	0	0	0	40
Jerusalem Township Fire Department	Volunteer	1	0	28	0	0	0	28
Maumee Fire Station 1	Mostly volunteer	2	20	0	55	1	0	76
Monclova Township Fire-Rescue Department	Mostly volunteer	1	2	0	33	0	0	35
Oregon Fire Department	Mostly volunteer	3	12	0	95	1	0	108
Ottawa Hills Fire Department	Career	1	10	0	0	0	0	10
Providence Township Fire and Rescue	Mostly volunteer	1	1	32	32	0	6	71
Richfield Township Fire Department	Volunteer	1	0	33	0	0	1	34
Spencer Township Fire-Rescue	Volunteer	1	0	26	0	0	0	26
Springfield Township Fire Department	Mostly career	3	40	0	36	5	0	81
Sylvania Township Fire Department	Mostly career	4	55	0	8	1	0	64
Toledo Fire Department	Career	17	494	0	0	14	0	508
Washington Township Fire Department	Volunteer	1	0	0	40	0	0	40
Waterville Fire Department	Mostly volunteer	1	6	0	26	1	0	33
Whitehouse Department	Mostly volunteer	1	11	0	30	0	0	41

Table 2-52. (contd)

Fire Department Name	Department Type	Number of Stations	Number of Personnel					
			Firefighters					
			Active (career)	Active (volunteer)	Active (paid per call)	Non-firefighting (civilian)	Non-firefighting (volunteer)	Total
Total Municipal Fire Department Personnel								
Monroe County		31	55	274	263	2	12	606
Wayne County		129	2470	45	333	548	11	3407
Lucas County		39	691	119	355	23	7	1195

Source: FEMA 2010

Table 2-53. Population Served by Firefighters in Monroe, Wayne, and Lucas Counties

County	Fire Protection Service Personnel	Population Served[(a)]	Firefighters per 1000 Residents (2008 estimate)
Monroe	606	152,021	4.0
Wayne	3407	1,820,584	1.9
Lucas	1195	441,815	2.7

Source: FEMA 2010
(a) 2010 population from the USCB (USCB 2010a, b).

Table 2-54. Population Served by Healthcare Workers in Economic Impact Area

Jurisdiction[(a)]	Number of Healthcare Workers	2010 Population Served[(b)]	Healthcare Workers per 1000 Residents (2010)
Monroe, Michigan MSA			
Healthcare practitioner and technical occupations[(c)]	1750		
Healthcare support occupations [(d)]	1020		
Total	2770	152,021	18.2
Warren-Livonia, Michigan MSA			
Healthcare practitioner and technical occupations	45,640		
Healthcare support occupations	23,390		
Total	69,030	4,296,250	16.1
Toledo, Ohio MSA			
Healthcare practitioner and technical occupations	22,140		
Healthcare support occupations	12,460		
Total	34,600	651,429	53.1

Source: USBLS 2008; USCB 2010d
(a) Occupational employment is provided for the metropolitan area in which the county is located.
(b) 2010 population from the USCB for metropolitan areas (USCB 2010d).
(c) Includes physicians, dentists, registered nurses, therapists, medical and clinical laboratory technicians, emergency medical technicians and paramedics, and others as defined by the USBLS (2008).
(d) Includes home health aides; nursing aides, orderlies and attendants; and other healthcare assistants as defined by the USBLS (2008).

2.5.2.7 Education

Tables 2-55 through 2-57 list selected characteristics, including the number of schools, district enrollment, and the student-to-teacher ratio for the 2008–2009 school year for all public school districts in Monroe, Wayne, and Lucas Counties. Michigan does not mandate a student-to-

Table 2-55. Monroe County Public School Districts

School District	Location	Grades	Number of Schools	Students	Teachers	Student-Teacher Ratio
Public School District						
Airport Community School District	Carleton	K-12	6	2935	157	18.6
Bedford Public Schools	Temperance	K-12	8	5223	280	18.7
Dundee Community Schools	Dundee	K-12	4	1687	88	19.1
Ida Public School District	Ida	K-12	3	1674	100	16.7
Jefferson Schools (Monroe)	Monroe	K-12	7	2177	121	18.0
Mason Consolidated Schools (Monroe)	Erie	K-12	3	1374	86	15.9
Monroe Public Schools	Monroe	K-12	14	6683	334	20.0
Summerfield School District	Petersburg	K-12	3	790	43	18.6
Whiteford Agricultural Schools	Ottawa Lake	K-12	3	740	45	16.6
Total Public School District Enrollment				23,283		
Regional District						
Monroe ISD	Monroe	K-12	6	1006	101	10.0

Source: U.S. Department of Education 2010

teacher ratio, but some of the local school districts have adopted a standard student-to-teacher ratio. The student-to-teacher ratio in Ohio is prescribed under the Ohio Administrative Code as a districtwide average of 25 students to one full time equivalent (FTE) teacher for regular classrooms.

There are 9 public school districts (Table 2-55), 14 private or parochial schools, and 2 charter schools in Monroe County. Monroe County is also served by the Monroe County Intermediate School District (ISD), which provides specialized education services and resources to the schools. The Monroe County ISD operates specialized education facilities, including the Monroe County Educational Center for children with developmental disabilities, the Monroe County Transition Center for secondary students with disabilities, the Monroe County Hearing Impaired Program, the Holiday Camp, and academic programming for students in the juvenile justice system at the Monroe County Youth Center.

The total enrollment within the Monroe County public school districts during the 2008–2009 school year was 23,283 students. The Monroe public schools district is the largest district in Monroe County; it includes the City of Monroe and all or part of the five surrounding townships. School enrollment for the Monroe County public school district was 6683 students during the 2008–2009 school year.

Table 2-56. Wayne County Public School Districts

School District	Location	Grades	Number of Schools	Students	Teachers	Student-Teacher Ratio
Allen Park Public Schools	Allen Park	K-12	6	3737	175	21.3
City of Harper Woods Schools	Harper Woods	K-12	4	1264	60	21.1
Clarenceville School District	Livonia	K-12	4	1884	98	19.2
Crestwood School District	Dearborn Heights	K-12	5	3458	176	19.7
Dearborn City School District	Dearborn	K-12	36	18,478	1090	17.0
Dearborn Heights School District #7	Dearborn Heights	K-12	6	2859	146	19.5
Detroit School District	Detroit	PK-12	199	97,577	5953	16.4
Ecorse Public School District	Ecorse	K-12	4	1057	54	19.6
Flat Rock Community Schools	Flat Rock	PK-12	5	1917	90	21.3
Garden City School District	Garden City	K-12	10	5256	354	14.9
Gibraltar School District	Woodhaven	K-12	8	3705	190	19.5
Grosse Ile Township Schools	Grosse Ile	K-12	4	1875	104	18.0
Grosse Point Public Schools	Grosse Point	K-12	16	8606	540	16.0
Hamtramck Public Schools	Hamtramck	K-12	7	2936	159	18.5
Highland Park City Schools	Highland Park	K-12	5	3032	154	19.7
Huron School District	New Boston	K-12	5	287	126	19.8
Lincoln Park Public Schools	Lincoln Park	PK-12	13	4891	275	17.8
Livonia Public Schools	Livonia	K-12	28	16,864	931	18.1
Melvindale-North Allen Park Schools	Melvindale	K-12	4	2801	134	20.9
Northville Public Schools	Northville	K-12	12	7275	437	16.7
Plymouth-Canton Community Schools	Plymouth	PK-12	27	19,235	948	20.3
Redford Union School District	Redford	K-12	9	3565	218	16.4
River Rouge School District	River Rouge	K-12	4	1206	57	21.1
Riverview Community School District	Riverview	K-12	5	2631	127	20.7
Romulus Community Schools	Romulus	K-12	10	4090	201	20.4
School District of the City of Inkster	Inkster	K-12	5	3218	112	28.9
South Redford School District	Redford	K-12	7	3381	178	19.0
Southgate Community School District	Southgate	K-12	12	5689	297	19.2
Taylor School District	Taylor	K-12	17	9226	500	18.4
Trenton Public Schools	Trenton	K-12	5	2877	173	16.6
Van Buren Public Schools	Belleville	K-12	12	5944	352	16.9
Wayne-Westland Community School District	Westland	PK-12	27	13,654	741	18.4
Westwood Community Schools	Dearborn Heights	K-12	8	2013	129	15.6
Woodhaven-Brownstown School District	Brownstown	K-12	9	5390	289	18.7

Table 2-56. (contd)

School District	Location	Grades	Number of Schools	Students	Teachers	Student-Teacher Ratio
Wyandotte City School District	Wyandotte	K-12	11	4984	285	17.5
Total Public School District Enrollment				276,862		
Regional District						
Wayne Regional District	Wayne	–[(a)]	2	107	NA[(b)]	

Source: U.S. Department of Education 2010
(a) – Data were not reported.
(b) NA = Not applicable.

Table 2-57. Lucas County Public School Districts

School District/ Charter School/ Regional District	Location	Grades	Number of Schools	Students	Teachers	Student-Teacher Ratio
School District						
Anthony Wayne Local	Whitehouse	PK-12	6	4631	210	22.1
Maumee City	Maumee	PK-12	6	2844	171	16.7
Oregon City	Oregon	PK-12	7	3870	249	15.5
Ottawa Hills Local	Toledo	PK-12	2	996	71	14.0
Springfield Local	Holland	PK-12	6	4030	219	18.4
Sylvania City	Sylvania	PK-12	12	7640	489	15.6
Toledo City	Toledo	PK-12	67	26,516	1888	14.0
Washington Local	Toledo	PK-12	12	6736	419	16.1
Total Public School District Enrollment				57,263		
Regional District						
Lucas Regional District	Toledo	–[(a)]	5	NA[(b)]	54	

Source: U.S. Department of Education 2010
(a) – = Data were not reported.
(b) NA = Not applicable.

The student-to-teacher ratio within the Monroe County public school districts ranged from 15.9:1 (Mason Consolidated Schools) to 20.0:1 (Monroe Public Schools); the nationwide ratio was 15.3 students to one teacher, and the statewide ratio was 17.5 students to one teacher. Most of the districts were equal to or exceeded the State average student-to-teacher ratio, with the Monroe County public school district having the highest student-to-teacher ratio.

Wayne County has 35 school districts and 74 public school academies or charter schools. The county is also served by the Wayne County Regional Educational Service Agency (RESA), which provides specialized education services and resources to the schools. The total enrollment within the Wayne County public school districts was 276,862 students during the 2008–2009 school year. The largest district in Wayne County is the Detroit school district, with more than 97,000 students. Other large school districts include the Dearborn City school district, Plymouth-Canton community schools, Wayne Westland community schools, and Livonia public schools.

In March 2010, the Detroit school district announced plans to reduce approximately 4 million ft^2 of excess capacity (55 schools) to address declining enrollment. In 1994, kindergarten enrollment was 16,046 students; it declined to 6039 in 2009 (Detroit Public Schools 2010). In February 2011, the State mandated that with a budget deficit of $327 million, the Detroit Public Schools needed to close 70 schools between 2011 and 2012. After a series of town hall meetings, the Detroit Public Schools announced in May 2011 that it could reduce operating costs by $75 to $99 million by transferring 45 of the schools proposed for closure to local and national groups and charter school operators. In its Renaissance Plan 2012, 18 schools would close during the summer of 2011 if a charter operator is not identified (Detroit Public Schools 2010).

The student-to-teacher ratio within the Wayne County public school districts ranged from 14.9 students per teacher (Garden City schools) to 28.9 students per teacher (City of Inkster schools); the nationwide ratio was 15.3 students per teacher, and the statewide ratio was 17.5 students per teacher. All but one school exceeded the national student-to-teacher ratio, and approximately 71 percent of the schools exceeded the State student-to-teacher ratio.

Lucas County has 8 school districts and 38 academies and alternative schools. The total enrollment within the Lucas County public school districts during the 2008–2009 school year was 57,263 students. The Toledo City School District is the largest district in Lucas County, with 26,516 students attending during the 2008–2009 school year.

The student-to-teacher ratio within the Lucas County public school districts ranged from 14.0 students per teacher (Ottawa Hills Local schools and Toledo City School District) to 22.1 students per teacher (Anthony Wayne Local schools); nationally, the ratio was 15.3 students per teacher, and within the State of Ohio, the ratio was 16.1 students per teacher. Fifty percent of the districts have fewer students per teacher than the statewide ratio, and all the school districts are below the State-mandated ratio of one teacher to 25 students.

Numerous colleges and universities are within the local area, including Monroe County Community College (MCCC), Wayne State University, University of Detroit, University of Michigan-Dearborn, and University of Toledo. Over the past few years, MCCC and Lakeland Community College, in Kirkland, Ohio, have developed a nuclear engineering technology program in anticipation of a forecasted need for workers in the nuclear energy industry. MCCC has also recently developed a new heavy and industrial construction technology certificate program that is designed to support the anticipated building workforce needed for Fermi 3.

2.6 Environmental Justice

Environmental justice refers to a Federal policy established by Executive Order 12898 (59 FR 7629) under which each Federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations.[(a)] The Council on Environmental Quality (CEQ) has provided guidance for addressing environmental justice (CEQ 1997). Although it is not subject to the Executive Order, the Commission has voluntarily committed to undertake environmental justice reviews. On August 24, 2004, the Commission issued its policy statement on the treatment of environmental justice matters in licensing actions (69 FR 52040).

This section provides a general description of the minority and low-income populations within a 50-mi radius of the proposed Fermi 3 site. This geographic area covers all or a portion of eight counties in Michigan (Jackson, Lenawee, Livingston, Macomb, Monroe, Oakland, Washtenaw, and Wayne) and eight counties in Ohio (Erie, Fulton, Henry, Lucas, Ottawa, Sandusky, Seneca, Wood). Two Canadian census divisions (Essex, Chatham-Kent) are also located within a 50-mi radius of the Fermi 3 site.

The characterization of minority and low-income populations in this section forms the analytical baseline from which potential environmental justice effects would be determined. The characterization of populations of interest includes an assessment of "populations of particular interest or unusual circumstances" (e.g., minority or low-income communities exceptionally dependent on subsistence resources or identifiable in compact locations such as Native American settlements).

2.6.1 Methodology

The review team first examined the geographic distribution of minority and low-income populations within a 50-mi radius of Fermi 3 by using the ArcGIS 10 geographical information system (GIS) software. This software allows the user to map and analyze demographic information from the U.S. Census Bureau at the census block group level[(b)] for a defined geographic area. The review team verified its analysis by field inquiries to numerous agencies and groups (Appendix B).

(a) Minority categories are defined as American Indian or Alaskan Native, Asian, Native Hawaiian or other Pacific Islander, Black races, or Hispanic ethnicity. "Other" may be considered a separate minority category. Low income refers to individuals living in households meeting the official poverty definition. To see the USCB definition and values for poverty visit the USCB Web site at http://www.census.gov.

(b) A census block is the smallest geographic area for which the USCB collects and tabulates sample data. A block group is the next level above census blocks in the geographic hierarchy and is a subdivision of a census tract or block numbering area.

The first step in the review team's environmental justice methodology is to examine each census block group that was fully or partially included within a 50-mi radius of Fermi 3 in order to determine for each block group whether the percentage of any minority or low-income population is great enough to identify that block group as a minority or low-income population of interest. If either of the two criteria discussed below are met for a census block group, that census block group is considered a minority or low-income population of interest warranting further investigation. The two criteria are whether:

- The minority or low-income population exceeds 50 percent of the total population for the census block group, or
- The percentage of the minority or low-income population is at least 20 percentage points greater than the same minority or low-income population's percentage in the respective State.

The populations of minority groups in Michigan and Ohio are shown on Table 2-58.

Table 2-58. Population by Race in Michigan and Ohio, 2010

	Population by Race			
	Michigan		**Ohio**	
Category	**Persons**	**%[(a)]**	**Persons**	**%**
White	7,895,340	79.3	9,598,726	83.4
Black or African American	1,401,616	14.1	1,391,240	12.1
American Indian and Alaska Native	54,502	0.5	22,785	0.2
Asian	242,886	2.4	186,464	1.6
Native Hawaiian and other Pacific Islander	2722	<0.1	2162	<0.1
Hispanic or Latino (of any race)	423,412	4.3	333,019	2.9
Some other race/two or more races	355,621	3.6	311,054	2.7
Total population	**9,952,687**		**11,512,431**	
Aggregate minority (percent)		23.1		18.4

Source: USCB 2010i
(a) Note: percentages may not add to 100 percent due to rounding.

The identification of census block groups that met one or both of the two criteria noted above is not sufficient for the review team to conclude that a disproportionately high and adverse impact exists. Likewise, the lack of census block groups meeting the above criteria cannot be construed as evidence of no disproportionately high and adverse impacts upon minority or low-income populations. The review team must also conduct an active public outreach and on-the-ground investigation in the region of the plant to determine whether minority or low-income populations in the region that were not identified in the census mapping exercise may exist. To reach an environmental justice conclusion, the review team investigated all populations in greater detail to identify pathways by which environmental impacts could have disproportionately high and adverse effects on minority or low-income communities. To identify pathways to disproportionately high and adverse effects, the review team considered the following:

- Health considerations:
  - Are the radiological or other health effects significant or above generally accepted norms?
  - Is the risk or rate of hazard significant and appreciably in excess of the general population's?
  - Do the radiological or other health effects occur in groups that are affected by cumulative or multiple adverse exposure from environmental hazards?
- Environmental considerations:
  - Is there an impact on the natural or physical environment that significantly and adversely affects a particular group?
  - Are there any significant adverse impacts on a group that appreciably exceed or are likely to appreciably exceed those on the general population?
  - Do the environmental effects occur in groups affected by cumulative or multiple adverse exposure to environmental hazards?

Under NRC's methodology, if this more detailed investigation does not yield any potentially disproportionately high and adverse impacts on populations of interest, the review team could conclude that there are no environmental justice impacts from the proposed action. If, however, the review team found any potential disproportionately high and adverse effects and potential pathways by which those impacts could occur, the review team would then (1) determine there was the potential for a disproportionately high and adverse impact on minority or low-income populations, (2) fully characterize the nature and extent of that impact, and (3) identify possible mitigation measures that may be used to lessen that impact.

The remainder of this section discusses the results of the search for potentially affected populations of interest.

2.6.1.1 Minority Populations

The review team assessed the populations for each minority group, as well as for an "aggregate" minority population, which is calculated as the "Total Population" minus all persons identified as "White—Not Hispanic or Latino.". For each of the 4281 census block groups fully or partially within a 50-mi radius of Fermi 3, the percent of the census block group's population represented by each minority population was calculated separately and in aggregate and compared with the two criteria listed above. Table 2-59 displays the results of that Census search, indicating that:

- 1221 census block groups within the 50-mi radius met the criteria and are considered to have a Black or African-American population of interest.
- No census block groups within the 50-mi radius met the criteria for, and none is considered to have, an American Indian or Alaskan Native population of interest.
- 100 census block groups within the 50-mi radius met the criteria and are considered to have an Asian population of interest.
- No census block groups within the 50-mi radius met the criteria for, and none is considered to have, a Native Hawaiian or other Pacific Islander population of interest.
- 320 census block groups within the 50-mi radius met the criteria and are considered to have a Hispanic or Latino population of interest.
- 1352 census block groups within the 50-mi radius met the criteria and are considered to have an aggregate minority population of interest.

Most of the census block groups classified as minority populations of interest lie to the north and south of the Fermi plant site in Wayne and Lucas Counties, respectively (Figures 2-17, 2-18, and 2-19). One census block group within Monroe County qualifies as a minority population of interest. This census block group is the closest minority population of interest to the proposed site, located in the City of Monroe, approximately 5 mi southwest of the Fermi 3.

Table 2-59 shows the results of the analysis to identify minority populations of interest within a 50-mi radius of Fermi 3. Figures 2-17, 2-18, and 2-19 show the geographic locations of the minority populations of interest within the 50-mi radius.

There is one Native American population within a 50-mi radius of the proposed Fermi 3 plant site, located on Walpole Island, Canada, approximately 50 mi northeast of the site. The island is inhabited by the Chippewa, Potawatomi, and Ottawa peoples. In 2006, the population was 1878 persons (Statistics Canada 2012). Because this Native American population of interest is at the limit of the 50-mi region, and because it is in Canada, the review team did not include it in its environmental justice investigation.

2.6.1.2 Low-Income Populations

The review team calculated the percent of households in each of the 4281 census block groups within a 50-mi radius of Fermi 3 and identified 579 census block groups that met the low-income measurement for being populations of interest (Table 2-60).

Table 2-59. Results of the Census Block Group Analysis for Minority Populations of Interest within the Region (50-mi radius)[(a)]

State/County	Total Census Block Groups	Number of Census Block Groups with Minority Populations of Interest					
		Black	American Indian	Asian	Pacific Islander	Hispanic	Aggregate
Michigan							
Jackson	6	0	0	0	0	0	0
Lenawee	69	1	0	0	0	6	1
Livingston	58	0	0	0	0	0	0
Macomb	530	35	0	5	0	4	36
Monroe	123	1	0	0	0	1	1
Oakland	770	138	0	41	0	25	170
St. Clair	1	0	0	0	0	0	0
Washtenaw	251	28	0	22	0	0	51
Wayne	1822	916	0	30	0	72	974
Ohio							
Erie	47	8	0	0	0	19	10
Fulton	18	0	0	0	0	0	0
Henry	3	0	0	0	0	0	0
Lucas	398	94	0	2	0	175	106
Ottawa	43	0	0	0	0	2	0
Sandusky	55	0	0	0	0	11	3
Seneca	6	0	0	0	0	0	0
Wood	81	0	0	0	0	5	0
Total	**4281**	**1221**	**0**	**100**	**0**	**320**	**1352**

Source: USCB 2010i
(a) Shaded rows indicate counties in the economic impact area.

Most of the census block groups classified as low-income populations of interest lie to the north and to the south of the Fermi site in Wayne and Lucas Counties, respectively (Figure 2-20).

One census block group within Monroe County also qualifies as a low-income population of interest. This census block group is the same minority population identified above as being the population of interest closest to the Fermi plant site (approximately 5 mi away).

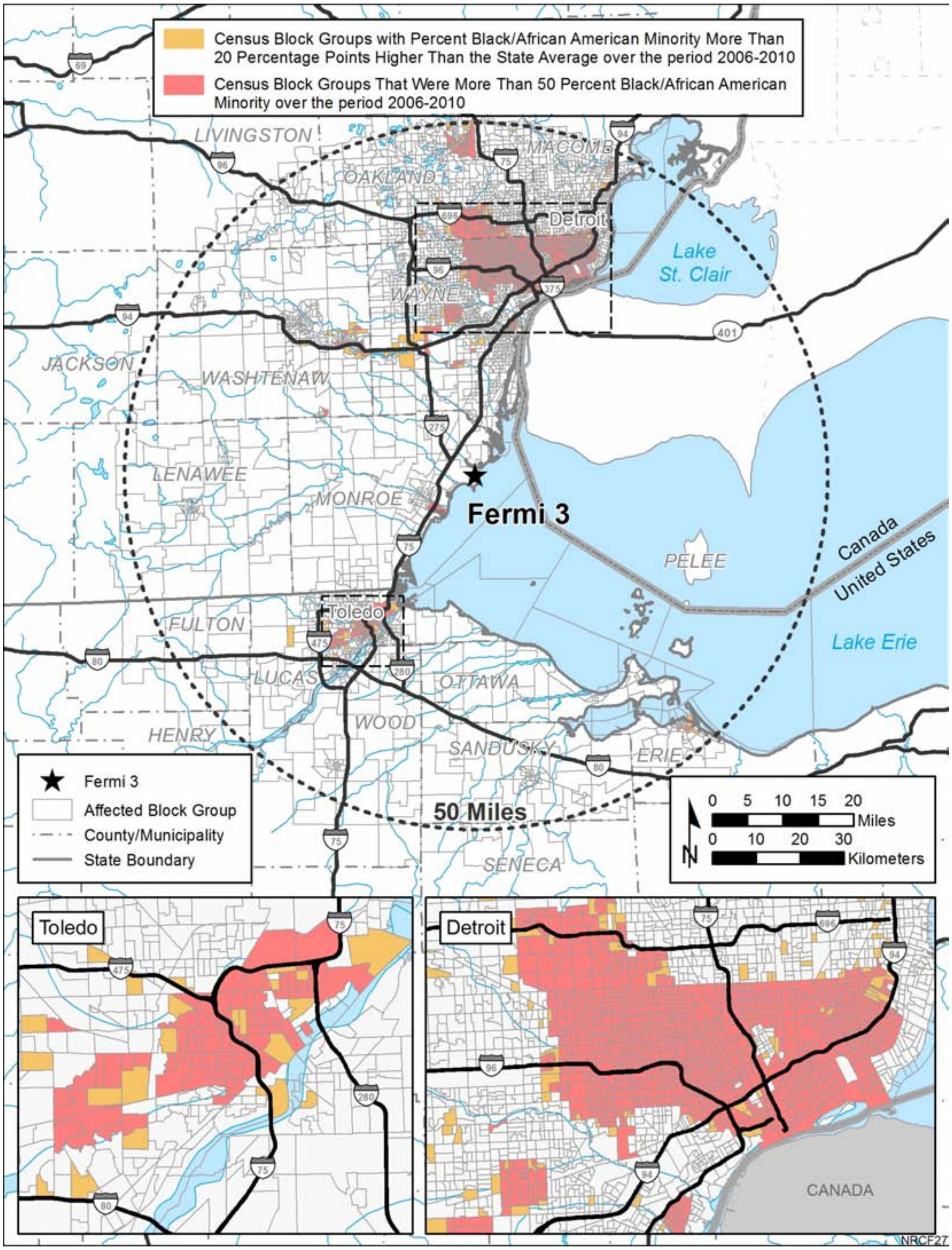

Figure 2-17. Black and African-American Minority Census Block Group Populations of Interest within a 50-mi Radius of Fermi 3 (USCB 2010i)

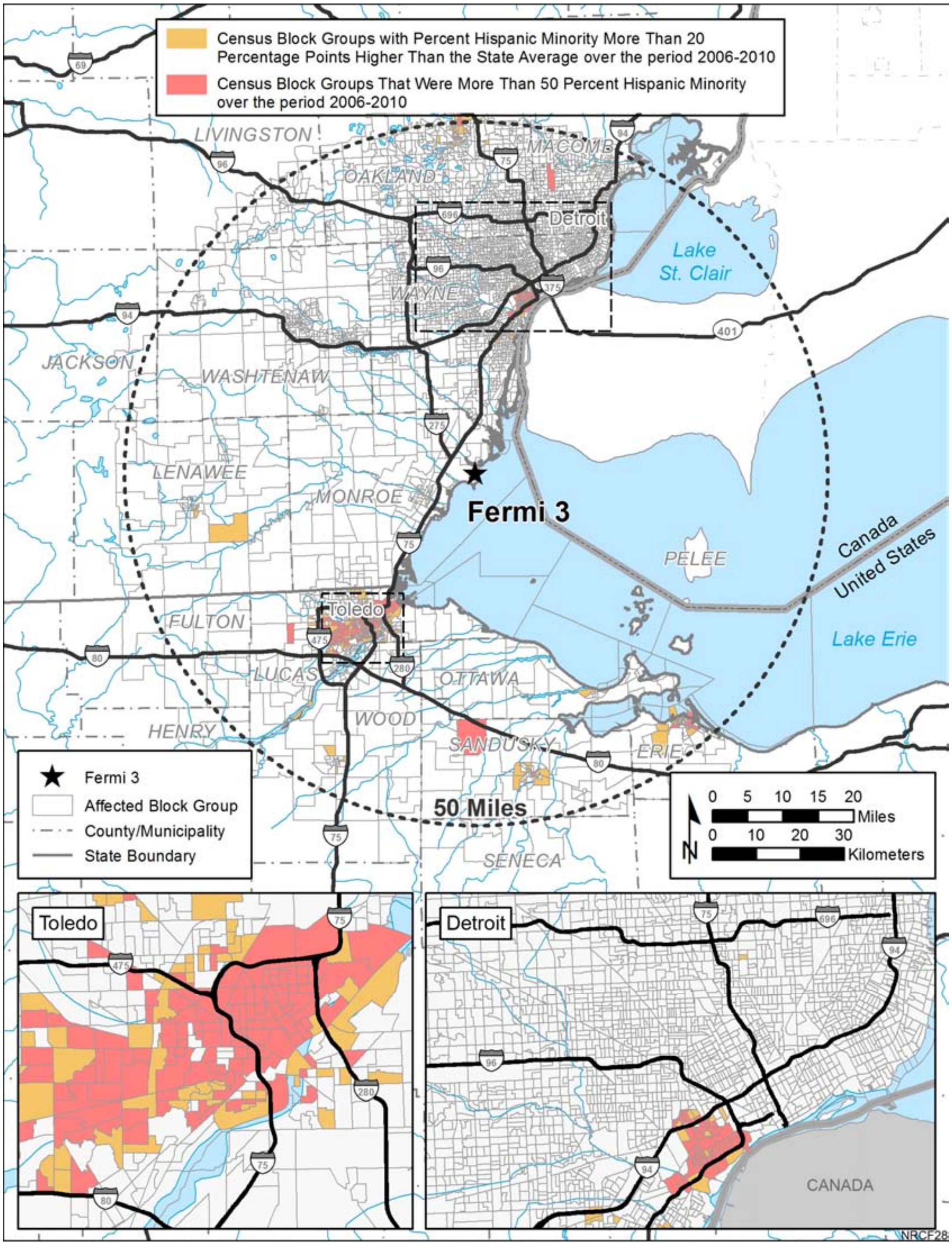

Figure 2-18. Hispanic Minority Census Block Group Populations of Interest within a 50-mi Radius of Fermi 3 (USCB 2010i)

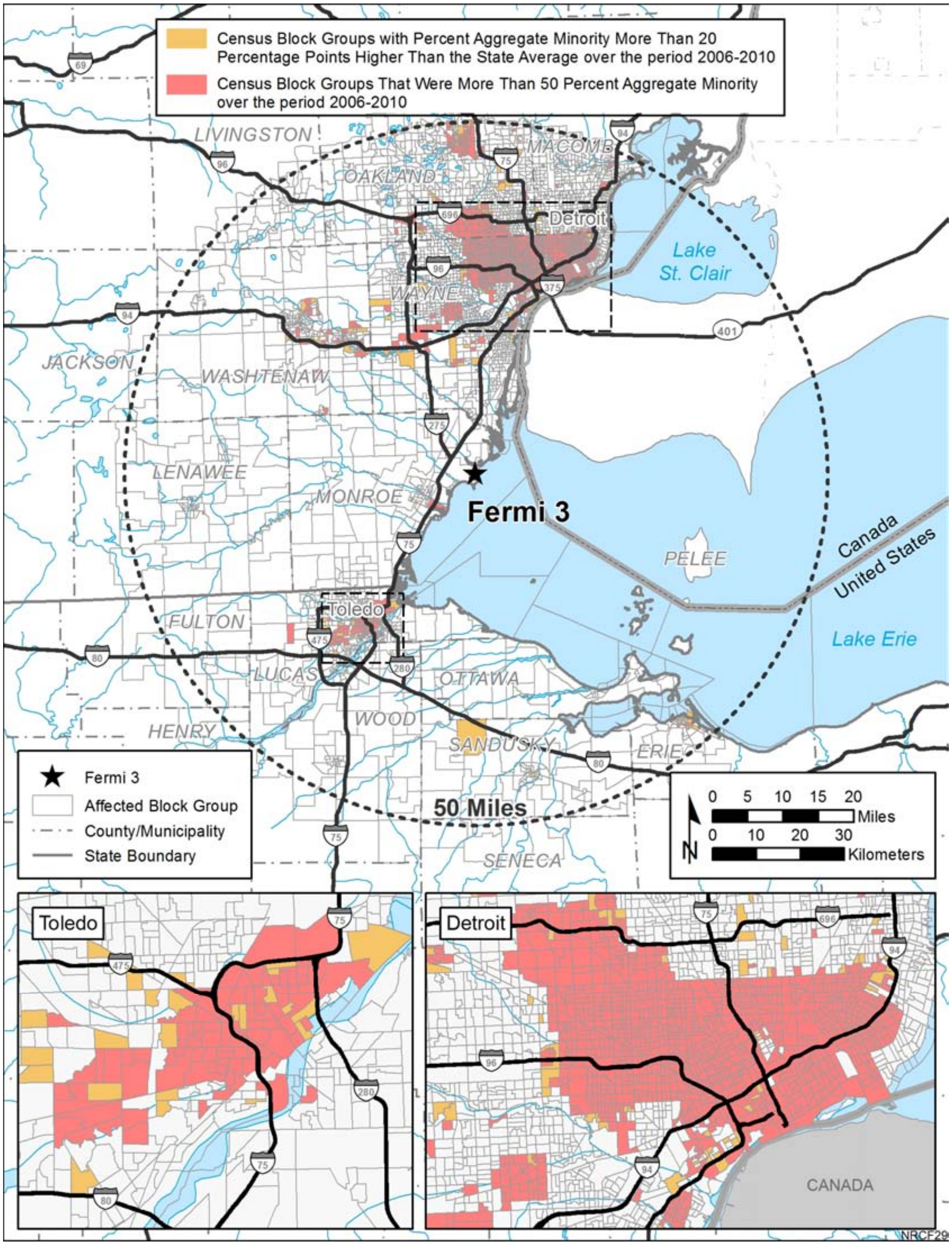

Figure 2-19. Aggregate Minority Census Block Group Populations of Interest within a 50-mi Radius of Fermi 3 (USCB 2010i)

Table 2-60. Results of the Census Block Group Analysis for Low-Income Populations of Interest within the Region (50-mi radius)[(a)]

State and County	Total Number of Census Block Groups	Number of Census Block Groups with Low-Income Populations of Interest	Percent of Census Block Groups with Low-Income Populations of Interest
Michigan			
Jackson	6	0	0
Lenawee	69	4	5.8
Livingston	58	0	0
Macomb	530	25	4.7
Monroe	123	1	0.8
Oakland	770	40	5.2
St. Clair	1	0	0
Washtenaw	251	34	13.5
Wayne	1822	479	26.3
Ohio			
Erie	47	5	10.6
Fulton	18	0	0
Henry	3	0	0
Lucas	398	81	20.4
Ottawa	43	0	0
Sandusky	55	1	1.8
Seneca	6	0	0
Wood	81	9	11.1
Total	**4281**	**679**	**15.9**

Source: USCB 2010j
(a) Shaded rows indicate counties in the economic impact area.

2.6.2 Scoping and Outreach

The review team conducted interviews with community leaders within the 50-mi region to verify and supplement the list of populations of interest and to identify pathways by which a disproportionately high and adverse environmental or socioeconomic effect could be experienced by minority or low-income communities. The review team provided the region with an advanced notice of public scoping meeting in accordance with NRC guidance. In these scoping and outreach activities, the review team did not identify any additional groups of minority or low-income persons not already identified in the GIS analysis of census data.

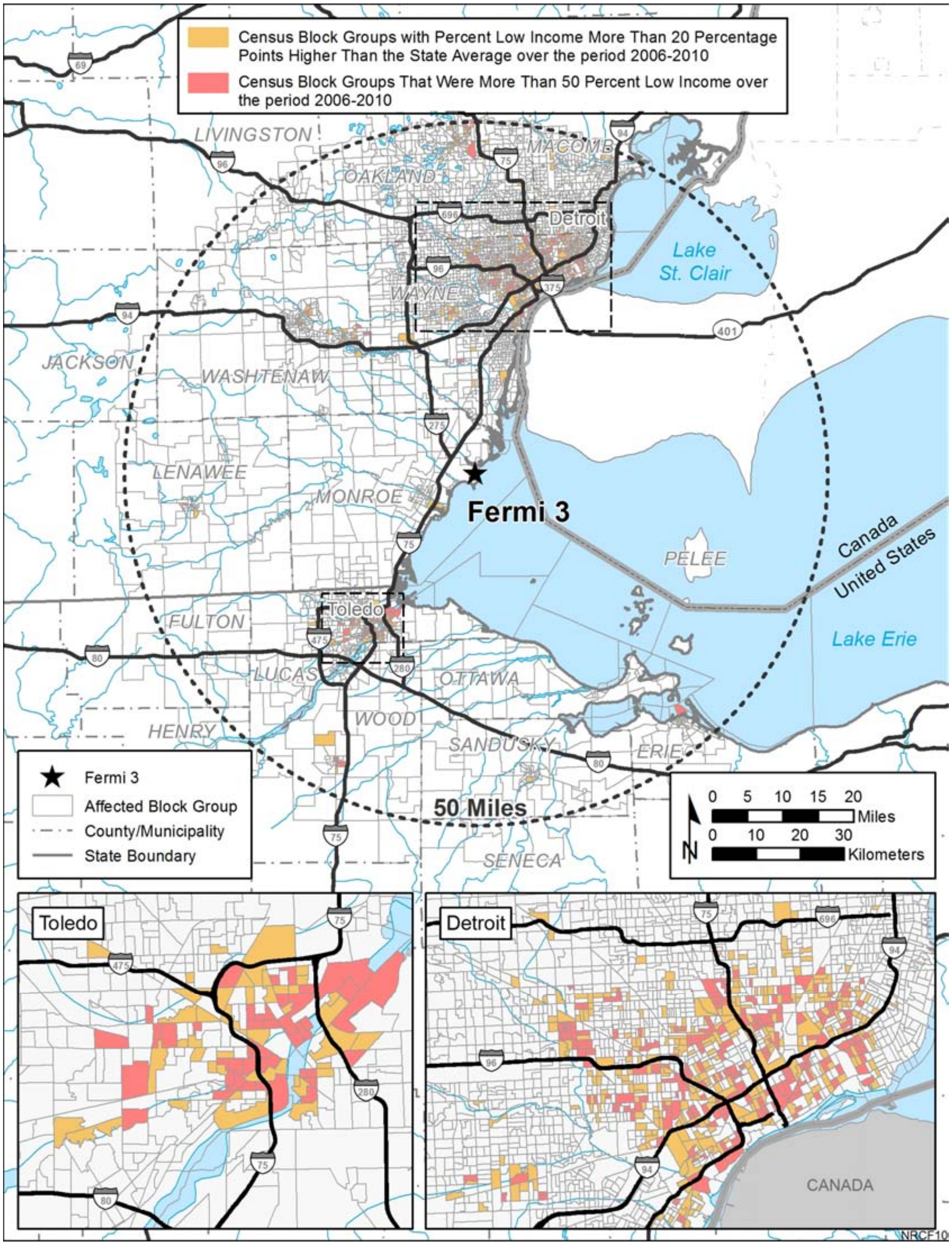

Figure 2-20. Low-Income Census Block Group Populations of Interest within a 50-mi Radius of Fermi 3 (USCB 2010j)

2.6.3 Subsistence and Communities with Unique Characteristics

The next step in the review team's methodology is to examine whether or not any of the identified minority or low-income populations appear to have a unique characteristic that could lead to a disproportionately high and adverse effect. Examples of unique characteristics include lack of vehicles, sensitivity to noise, close proximity to the plant, or subsistence activities. Such unique characteristics must be demonstrably present in the population and relevant to the potential environmental impacts of the plant. If the impacts from the proposed action appear to adversely affect an identified minority or low-income population through a unique characteristic, then the review team makes a determination whether the adverse impact is disproportionately high when compared with that in the general population.

Subsistence uses of natural resources are often intended to supplement income by providing food or other resources that free up actual earnings for additional purchases. Common categories of subsistence uses include gathering plants, fishing, and hunting. Some subsistence use is undertaken for ceremonial and traditional cultural purposes. Subsistence use often involves using publicly held resources, such as rivers (subsistence fishing) or forests (hunting or gathering of vegetation), but it also includes the use of privately owned resources such as home vegetable gardens. Subsistence information is often site-specific and difficult to differentiate from the recreational uses of natural resources. Therefore, the review team presents subsistence information in a more qualitative manner on the basis of diverse sources of published and anecdotal information.

Approximately 206 ac of the 1260-ac Fermi site are currently developed. The general public is not allowed uncontrolled access to the site for safety and security reasons; thus, no ceremonial, culturally significant, or subsistence gathering of vegetation occurs on the site. In addition, the DRIWR encompasses a 656-ac portion of the Fermi plant site that is not open to the public. The public is also prohibited from using the waters of Lake Erie for fishing, swimming, or boating within a 1-mi exclusion zone around the plant site.

During the development of the ER, Detroit Edison contacted several local persons with knowledge of the potential for subsistence activities in Monroe County. These persons included the Monroe County Sheriff, the Superintendent of the Monroe County Intermediate School District, two local church officials, and a landowner who has farmed more than 200 ac approximately 2 mi from the site for more than 30 years. The review team concluded from discussions with these contacts that no subsistence activities are occurring on or near the site.

2.6.4 Migrant Populations

Migrant labor or a migrant worker is defined by the USDA as a "farm worker whose employment required travel that prevented the migrant worker from returning to his/her place of residence the same day." From an environmental justice perspective, there is a potential for such groups in some circumstances to be disproportionately affected by emissions in the environment. However, as discussed in Section 2.5, only 27 of 222 farms employing hired labor reported that they use migrant labor (USDA 2007). Even if all of the migrant workers were minority or low-income individuals, on the basis of the average number of hired workers per farm in Monroe County, the review team estimated that the total number of migrant workers is about 216 in the Monroe County. No information was available on their actual location of employment within the county.

2.6.5 Environmental Justice Summary

The review team found census block groups with aggregate minority or low-income populations that exceed the percentage criteria established for environmental justice analyses. Consequently, the review team performed additional analyses before making a final environmental justice determination. On the basis of the information in the Detroit Edison ER, public input, and its own outreach and analysis, the review team determined that because there are minority and low-income populations of interest in the region, impacts on these communities must be considered in greater detail, as discussed in Section 2.6.1. The result of the review team analyses of construction impacts can be found in Section 4.5 of this EIS. Analyses of operation impacts can be found in Section 5.5.

2.7 Historic and Cultural Resources

In accordance with 36 CFR 800.8(c), the NRC and the USACE have elected to use the National Environmental Policy Act of 1969, as amended (NEPA), process to comply with the obligations found under Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA). As a cooperating agency, the USACE is part of the NRC review team, involved in all aspects of the environmental review. The USACE is the primary Federal agency that will review and authorize regulated activities in waters of the United States, including wetlands. The NRC will determine whether or not to issue a COL for Fermi 3. For the purposes of Section 106, the NRC is the lead Federal agency consulting with the State Historic Preservation Office/Officer (SHPO) for the COL permit.

This section discusses the cultural background of the Fermi 3 site region, including prehistoric and historic resources (Section 2.7.1). It also details the efforts that have been taken to identify cultural resources within the area of potential effects (APE) and the cultural resources and historic properties that were identified (Section 2.7.2). A description of the NHPA Section 106 consultation efforts accomplished to date is also provided (Section 2.7.4). The assessments of impacts of the proposed building and operation of Fermi 3 and its associated facilities on historic properties identified within the APE, pursuant to Section 106 of the NHPA, are found in Sections 4.6 and 5.6, respectively.

2.7.1 Cultural Background

The cultural background for the proposed Fermi 3 project location and the surrounding region was developed as part of the Phase I cultural resources investigations and the submerged sites sensitivity assessment that were conducted for the Fermi 3 project in support of the COL application ER (Demeter et al. 2008; Weir 2008a; Taylor 2009) and is summarized here.

The proposed Fermi 3 project location and the surrounding region show evidence of both prehistoric and historic occupation and/or settlement by Native Americans and Euroamericans that has continued through to the present. Archaeological records suggest that the Fermi 3 project location and the surrounding area have had the potential for occupation from the Paleo-Indian period (ca. 10,000 BC to 8000 BC), the Archaic Period (ca. 8000 BC to 550 BC), and the Woodland Period (ca. 600 BC to AD 1600). Native American groups that lived in the region at the time of contact with early European explorers and settlers were identified from historic written accounts, which indicated that these contact-period Native American groups were associated with the Erie, an Iroquoian group, and with the Wendat/Huron, Ottawa, Miami, and the allied Fox and Mouscatine, which are all Algonquian groups (Demeter et al. 2008).

According to the Michigan Department of Human Services and the Bureau of Indian Affairs, there are currently 12 Federally recognized Indian Tribes in the State of Michigan primarily associated with the Chippewa, Ottawa, and Potawatomi. None of these 12 Federally recognized Indian Tribes are located within the proposed Fermi 3 project area or its surrounding region in southeastern Michigan. However, the closest of these 12 Federally recognized Indian Tribes are three groups of Potawatomi Indians in southwestern Michigan and one group of Chippewa Indians in central Michigan: the Nottawaseppi Huron Band of Potawatomi Indians in Calhoun County; the Pokagon Band of Potawatomi Indians in Cass County; the Gun Lake Potawatomi Tribe (also known as the Match-e-be-nash-she-wish Band of Potawatomi Indians of Michigan) in Allegan County; and the Saginaw Chippewa Indian Tribe, located on the Isabella Indian Reservation in Isabella County (Michigan Department of Human Services 2010; Michigan Department of Human Services undated; 73 FR 18553).

The National Park Service (NPS) Native American Consultation Database (NACD), developed as part of NPS's national program for compliance with the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA), identified three Federally recognized Indian Tribes with judicially established land claims within Monroe County, Michigan. One is the Hannahville Indian Community in Menominee County, Michigan (northern Michigan). The other two are located outside the State of Michigan: the Forest County Potawatomi Community in Forest County, Wisconsin (northeastern Wisconsin), and the Ottawa Tribe of Oklahoma in Ottawa County, Oklahoma (northeastern Oklahoma) (NPS 2010b). Because judicially established land claims are based on proven ancestral or historic ties to lands (USGS 1993; NPS 2010a), these three Federally recognized Indian Tribes may also have been prehistorically or historically associated with the Fermi 3 project location or its surrounding region.

The regional historic cultural background begins with European exploration and settlement by the French in the 17th century, followed by British control of the area in the mid to late 18th century. After the War of 1812, the region came under American control and was reorganized into counties, including the establishment of Monroe County and the Village of Monroe in 1817. With the opening of a Federal Land Office in the area in 1824, increasing settlement occurred in the region through the remainder of the 19th century. However, because the Fermi 3 project area was historically a wetland environment, little settlement occurred in the project area in the 19th century, although the shoreline areas have been used for commercial fishing purposes and upland areas were used for vineyards and silica sand mining. By the early 20th century, wealthy Detroit residents began to purchase lots and build summer cottage communities or resorts to the south of the Fermi 3 project area, along the Lake Erie shoreline. These seasonal communities have been converted since the mid 20th century to year-round communities that are still occupied today, including the Stony Point, Woodland Beach, and Detroit Beach communities located south/southwest of the Fermi 3 project area (Demeter et al. 2008).

Shoreline and offshore areas in the vicinity of the Fermi site may have been used prehistorically and historically by Native Americans for fishing, hunting, and gathering plant resources. Historic Euroamerican activities along the shoreline and in offshore areas in the region also have been associated with fishing, including the development of commercial fishing industries associated with lake herring (*Coregonus artedii*), lake sturgeon (*Acipenser fulvescens*), lake whitefish (*Coregonus clupeaformis*), and common carp (*Cyprinus carpio*) in the region from the mid-19th to the early 20th centuries (Demeter et al. 2008; Weir 2008a; University of Wisconsin Sea Grant Institute 2002). The local commercial fishing industry was subsequently replaced in the early 20th century by the development of shoreline areas as seasonal (summer) communities or resorts, as described above. Currently, shoreline areas in the vicinity of the Fermi site support the Fermi 1 and 2 plant facilities and the year-round beach communities to the northeast and southwest of the Fermi 3 project area.

2.7.2 Historic and Cultural Resources at the Site

To identify the historic properties and cultural resources at the Fermi 3 site and along associated transmission line corridors, the review team reviewed the following information:

- Fermi 3 ER (Detroit Edison 2011a) – Detroit Edison's contractor, Black & Veatch Corporation (Black & Veatch), summarized the conclusions of investigations undertaken to identify and evaluate cultural resources and historic properties in the APE for the Fermi 3 project.
- NRC site audit, February 2009 – NRC review team consulted with the Michigan SHPO and also conducted an on-the-ground visit of the Fermi 3 site and the direct and indirect APEs for the Fermi 3 project.

- Detroit Edison's RAI responses – letters dated July 31, 2009; September 30, 2009; and November 23, 2009 (Detroit Edison 2009f, d, and e, respectively).
- Detroit Edison technical report – Fermi 3 Phase I cultural resources investigation, July 2008 (Demeter et al. 2008).
- Detroit Edison technical report – Fermi 3 submerged sites sensitivity study, December 2008 (Weir 2008a).
- Detroit Edison technical report – Fermi 1 preliminary *National Register of Historic Places* evaluation, March 2009 (Kuranda et al. 2009).
- Detroit Edison technical report – Fermi 3 archaeological survey, November 2009 (Taylor 2009).
- Detroit Edison technical report – Fermi 3 cultural resources review, March 2011 (Taylor 2011).

Determination of APE

The NRC has determined that the APE for the environmental review consists of the area containing the proposed Fermi 3 power plant site where ground-disturbing activities could potentially occur (the direct APE) and surrounding areas that may be indirectly (visually) affected by the building and operation of Fermi 3 and associated facilities (the indirect APE) (see Figure 2-21). Historic and cultural resources identified within the direct APE are considered onsite resources. Historic and cultural resources identified within the indirect APE are considered offsite resources.

The direct and indirect APEs identified by the NRC for the environmental review correspond to three APEs identified by Detroit Edison and Commonwealth Cultural Resources Group, Inc. (CCRG), in consultation with the Michigan SHPO for the Phase I cultural resources investigation, as follows: the direct APE, which corresponds to the archaeological APE discussed in Phase I reports; the indirect APE, which corresponds to that portion of the aboveground resources APE that is discussed in Phase I reports that is outside the archaeological APE; and a submerged sites APE, which the NRC considers in the offshore (aquatic) portions of the direct APE.

The direct APE consists of an area that is approximately 520 ac within which Fermi 3 and associated facilities would be constructed and that would include the area at the site that will be impacted by ground-disturbing activities associated with building and operating Fermi 3. Areas within the direct APE include the existing Fermi 1 and Fermi 2 plant sites, a series of interconnected roadway grades, a stone quarry, two spoils-disposal zones, and areas possibly affected by building the Fermi 3 cooling tower, laydown areas, and a new access road (Demeter et al. 2008). Additional areas were subsequently determined to be potentially affected

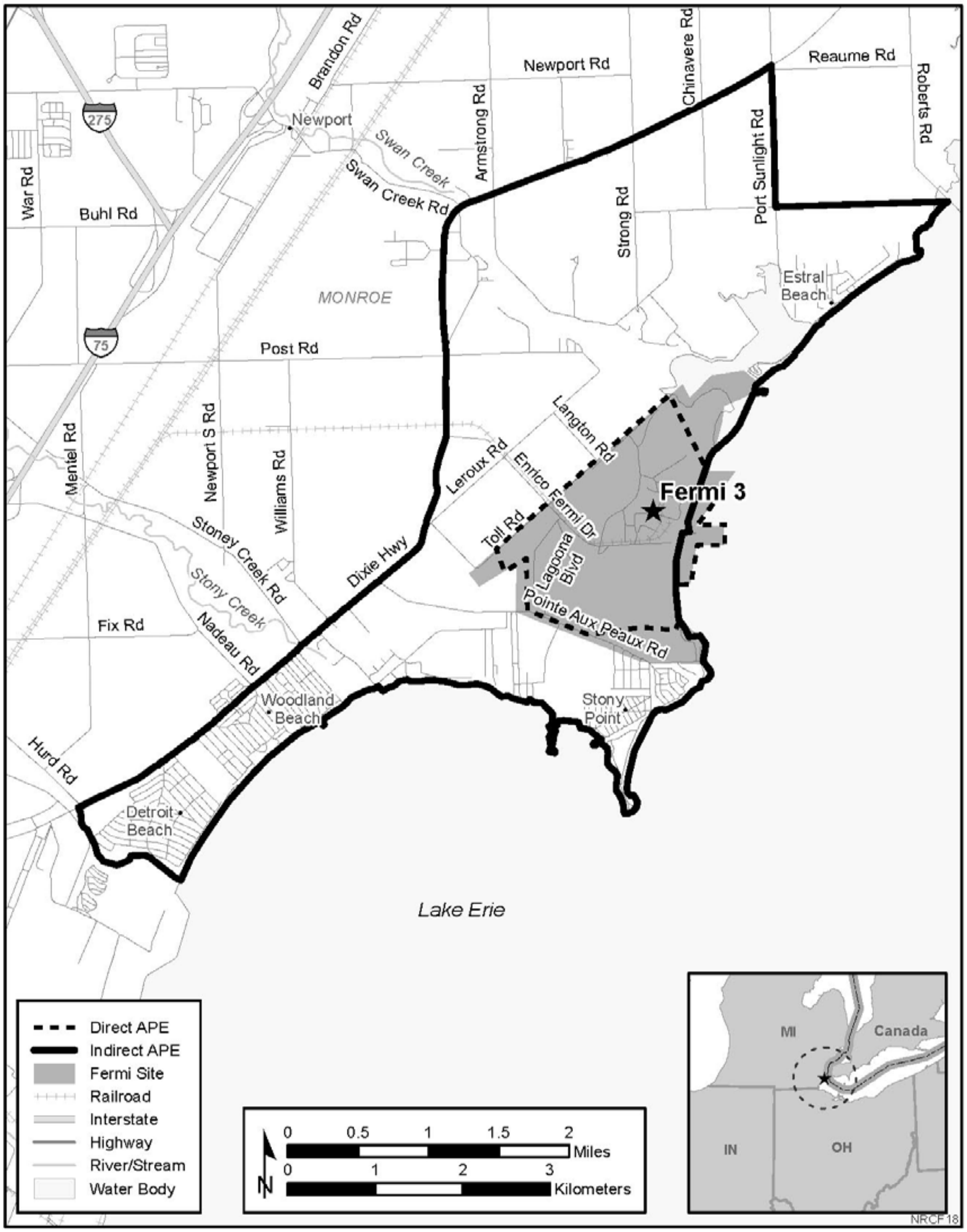

Figure 2-21. Fermi 3 Cultural Resources Area of Potential Effects

by ground-disturbing activities associated with the use of a laydown area during the building phase and building of a meteorological tower and its associated access road, and they are considered part of the direct APE by the NRC review team. These additional areas, totaling 28.5 ac, were also subjected to additional Phase I archaeological investigations (Taylor 2009, 2011). One previously recorded cultural resource, an archaeological site, is located in the direct APE (Demeter et al. 2008) and is discussed in greater detail below.

The indirect APE consists of offsite areas surrounding the proposed Fermi 3 power plant site to address the potential for indirect visual impacts or effects on cultural resources and historic properties (buildings or structures) that may result from building and operating Fermi 3. The indirect APE consists of an area of about 6680 ac that extends approximately parallel to the shoreline of Lake Erie and includes the nearest shoreline settlements of Estral Beach to the northeast and Woodland Beach and Detroit Beach to the southwest of the Fermi 3 site (Detroit Edison 2011a; Conway 2007; Weir 2008b).

The indirect APE does not include the direct APE. One previously recorded *National Register of Historic Places* (NRHP)-eligible historic property, a building at 5046 Williams Road, is located offsite in the indirect APE (Demeter et al. 2008) and is discussed in greater detail below. Two other previously recorded cultural resources, both archaeological sites that have not been evaluated for NRHP-eligibility, are also located in the indirect APE (Demeter et al. 2008).

The submerged sites APE was identified by CCRG to address the potential for impacts on offshore cultural resources or historic properties that might result from building and operating Fermi 3 and its water intake and discharge structures. This approximately 130-ac area includes the existing discharge conduit and cooling water intake channel for the Fermi 1 and 2 units, as well as the existing barge dock and channel for the Fermi plant property (Weir 2008a). No previously identified shipwrecks or archaeological sites are located within the submerged sites APE (Weir 2008a; Demeter et al. 2008).

Phase I Cultural Resources Investigations

CCRG conducted Phase I cultural resources investigations within the terrestrial portions of the Fermi 3 APE between November 2007 and April 2008 and in October 2009 (Detroit Edison 2011a; Demeter et al. 2008; Taylor 2009). The purpose of these Phase I cultural resources investigations was to identify cultural resources and historic properties within the direct and indirect APEs and to evaluate the NRHP-eligibility of any newly identified cultural resources and any previously identified cultural resources that had not been evaluated for NRHP eligibility.

The archaeological survey conducted as part of the Phase I cultural resources investigation resulted in the identification of eight archaeological resources within the direct APE (one previously recorded prehistoric site location; four newly identified prehistoric find spots or isolated artifacts; two newly identified historic sites; and one newly identified multicomponent site [prehistoric and historic]). None of these eight archaeological resources were recommended eligible for listing in the NRHP (see Table 2-61). The aboveground resources survey conducted as part of the Phase I cultural resources investigation identified a total of 84 architectural resources within the direct and indirect APE (consisting of buildings or structures). Twenty-two of these architectural resources have been determined or recommended eligible for listing in the NRHP; the remaining architectural resources have been recommended not eligible for listing in the NRHP (see Table 2-62).

Archaeological Resources

Ten archaeological resources have been identified within the direct and indirect APEs: eight in the direct APE and two in the indirect APE. The eight archaeological resources identified in the direct APE consist of one previously recorded archaeological site location, four newly identified prehistoric archaeological find spots or isolated artifacts, two newly identified historic archaeological sites, and one newly identified multicomponent (prehistoric and historic) archaeological site (Detroit Edison 2011a). The one previously recorded onsite archaeological site location was revisited during the Phase I cultural resources investigation, but no evidence of this previously recorded site was observed. The site appears to have been destroyed by natural shoreline erosion due to wave action and/or landfilling and installation of riprap for erosion control, and no further archaeological investigations have been recommended for this previously recorded site.

The remaining seven newly identified archaeological resources within the direct APE were evaluated for NRHP eligibility under Criterion D. The four prehistoric archaeological find spots or isolated artifacts and the single prehistoric artifact identified at the multicomponent archaeological site are nondiagnostic (i.e., the artifact cannot be interpreted for function and/or cannot be dated to a specific prehistoric cultural period), are not associated with any other prehistoric materials or features, and would not contribute information beyond what is already known of the prehistoric context for the Fermi 3 site. The lack of diagnostic information renders these prehistoric archaeological resources minimally important with regard to their research value. The two newly identified historic archaeological sites and the historic component of the one multicomponent archaeological site have been evaluated as possessing limited interpretive value such that none are likely to contribute significant information relative to past regional historic land use patterns (Demeter et al. 2008). As such, none of the seven newly identified archaeological resources in the direct APE have been recommended as being eligible for listing in the NRHP under Criterion D, and no further archaeological investigations have been recommended for any of these seven onsite archaeological resources (Detroit Edison 2011a; Demeter et al. 2008; Taylor 2009).

Table 2-61. Fermi 3 Archaeological Resources Identified – Phase I Investigations

Site Number	Site Description	Site Age or Cultural Period	NRHP–Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
20MR702	Onsite Previously Recorded Prehistoric Archaeological Site	Unidentified Prehistoric	Not Eligible[(a)] – Site destroyed by natural erosion and/or installation of rip-rap for erosion control	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
20MR818	Onsite Multi-component (Prehistoric and Historic) Surface Artifact Scatter	Unidentified Prehistoric and Late 19th to Early 20th Century	Recommended Not Eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
20MR819	Onsite Isolated Prehistoric Find Spot	Unidentified Prehistoric	Recommended Not Eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
20MR820	Onsite Isolated Prehistoric Find Spot	Unidentified Prehistoric	Recommended Not Eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
20MR821	Onsite Isolated Prehistoric Find Spot	Unidentified Prehistoric	Recommended Not Eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
20MR822	Onsite Isolated Prehistoric Find Spot	Unidentified Prehistoric	Recommended Not Eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
20MR823	Onsite Historic Archaeological Site	Early to mid 20th Century	Recommended Not Eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
20MR825	Onsite Historic Surface Artifact Scatter and Pet Cemetery	20th Century	Recommended Not Eligible[(b)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]

Sources: Demeter et al. 2008; Taylor 2009

(a) Demeter et al. 2008.

(b) Taylor 2009.

(c) Conway 2011.

Table 2-62. Fermi 3 Aboveground Resources Identified – Phase I Investigations

Resource Address/Name	Resource Description	Construction Date	NRHP-Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
Fermi Drive (Enrico Fermi Atomic Power Plant [Fermi 1])	Onsite Nuclear Power Plant	1956	Recommended NRHP-eligible (Criterion A and C)[b]	Evaluation of NRHP-eligibility[a] [b]	Concurrence indicated in May 9, 2011, letter[c]
5046 Williams Rd.	Offsite Previously Recorded Front-Gabled-Style House	c. 1840	Determined NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
2381 Hurd Rd.	Offsite New England One-and-a-Half-Style House	c. 1850	Recommended NRHP-eligible (Criteria A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
2122 N. Dixie Hwy.	Offsite Gabled-Ell-Style House	c. 1875	Recommended NRHP-eligible (Criteria A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
2430 N. Dixie Hwy. (St. Anne's Catholic Church Grotto)	Offsite Vernacular-style Ecclesiastical Structure (Grotto)	1956	Recommended NRHP-eligible (Criterion C, Exception A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Near 4973 N. Dixie Hwy.	Offsite Greek Revival-Style House	c. 1840	Recommended NRHP-eligible (Criterion A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
5179 N. Dixie Hwy. (Dixie Skateland)	Offsite Vernacular-Style Skating Rink	1958	Recommended NRHP-eligible (Criterion A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6068 N. Dixie Hwy.	Offsite Farmstead Complex: Side-Gabled House and Vernacular-Style Barn and Other Outbuildings[d]	c. 1885	Recommended NRHP-eligible (Criterion A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
N. Dixie Hwy. (St. Charles Cemetery)	Offsite Late 19th Century Cemetery	1882	Recommended NRHP-eligible (Criterion A and Exception D)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
N. Dixie Hwy. (Old St. Charles [White or LaDue] Cemetery)	Offsite Mid 19th Century Cemetery	1851	Recommended NRHP-eligible (Criterion A and Exception D)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8109 Swan Creek Rd. (St. Charles [Borromeo] Church Complex)	Offsite Victorian Gothic-Style Church and Outbuildings[d]	1882-1886	Recommended NRHP-eligible (Criterion C and Exception A)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6344 Trombley Road (Jacob Masserant Farmstead Complex)	Offsite Farmstead Complex: Hall-and-Parlor-style House, Three-Bay Threshing Barn and Associated Outbuildings[d]	c. 1853	Recommended NRHP-eligible (Criterion A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6511 Leroux Road (Joseph Fix Farmstead Complex)	Offsite Farmstead Complex: Gabled-Ell-style House, Three-Bay Threshing Barn and Associated Outbuildings[d]	1878	Recommended NRHP-eligible (Criterion A and C)[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]

Table 2-62. (contd)

Resource Address/Name	Resource Description	Construction Date	NRHP-Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
3684 Brest Rd. (Frenchtown Township District No. 13 School)	Offsite Standardized School Plan-Style School	1926-1927	Recommended NRHP-eligible (Criterion A and C)[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
3738 Brest Rd. (Dewey House)	Offsite Greek Revival-Style House	c. 1840	Recommended NRHP-eligible (Criterion A, B and C)[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
Pearl Drive Historic District			Recommended NRHP-eligible (Criterion A and C)[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
3535 Pearl Dr.	Offsite Prairie-Colonial Revival-Style House	c. 1927	Contributing element[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
3555 Pearl Dr.	Offsite Prairie-Colonial Revival-Style House	c. 1927	Contributing element[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
3575 Pearl Dr.	Offsite Prairie-Colonial Revival-Style House	c. 1927	Contributing element[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
3595 Pearl Dr.	Offsite Prairie-Colonial Revival-Style House	c. 1927	Contributing element[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
2983 Third St.	Offsite Tudor Revival-Style House (Cotswold Cottage/ Storybook substyle)	c. 1940	Recommended NRHP-eligible (Criterion C)[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
3677 Lakeview Dr.	Offsite Contemporary Folk-Style House	c. 1945	Recommended NRHP-eligible (Criterion C)[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
3360 Elmwood St.	Offsite Mediterranean-Style House	c. 1940	Recommended NRHP-eligible (Criterion C)[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
3390 Lawndale St.	Offsite Queen Anne-style House	c. 1910	Recommended NRHP-eligible (Criterion A)[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
3518 Nippising St. (Indian Trails Clubhouse)	Offsite Vernacular-style Civic Building	c. 1930-1940	Recommended NRHP-eligible (Criterion A and C)[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
3606 Lakeshore Dr.	Offsite Mediterranean-Style House	c. 1940	Recommended NRHP-eligible (Criterion C)[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
3351 N. Dixie Hwy. (Joey's Frenchtown Bar)	Offsite Commercial Building with American Foursquare-Style Base	c. 1910	Recommended Not NRHP-eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
3979 N. Dixie Hwy.	Offsite T-Plan-Style Farmstead[(d)]	c. 1885	Recommended Not NRHP-eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
5163 N. Dixie Hwy.	Offsite Gabled-Ell-Style House	c. 1885	Recommended Not NRHP-eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]
5795 N. Dixie Hwy.	Offsite T-Plan-Style House and Farmstead Complex[(d)]	c. 1870	Recommended Not NRHP-eligible[(a)]	No Further Work Needed[(a)]	Concurrence indicated in May 9, 2011, letter[(c)]

Table 2-62. (contd)

Resource Address/Name	Resource Description	Construction Date	NRHP-Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
6175 N. Dixie Hwy.	Offsite Gabled-Ell-Style House	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7180 N. Dixie Hwy.	Offsite Upright and Wing-Style House	c. 1850	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7858 N. Dixie Hwy.	Offsite Vernacular-Style Commercial Building	c. 1920	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8106 N. Dixie Hwy.	Offsite Gabled-Ell-style House	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8145 N. Dixie Hwy.	Offsite Cross-gabled-style House and Farmstead Complex[d]	c. 1870	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8207 N. Dixie Hwy. (F. Bondy or Masserant House)	Offsite Gabled-ell-style House	1887	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8527 N. Dixie Hwy.	Offsite Vernacular Side-Gabled-Style House	c. 1840	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8563 N. Dixie Hwy.	Offsite Upright and Wing-Style House	c. 1850	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8570 N. Dixie Hwy.	Gabled-Ell-Style House	c. 1900	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7781 Swan Creek Rd.	Offsite Foursquare-Style House	c. 1910	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8038 Swan Creek Rd.	Offsite Side-Gabled-Style House	c. 1850	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7705 Strong Rd.	Offsite Gabled-Ell-Style House and Farmstead Complex[d]	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7831 Strong Rd.	Offsite Gabled-Ell-Style House and Farmstead Complex[d]	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8180 Chinaware Rd.	Offsite Gabled-Ell-Style House and Farmstead Complex[d]	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
8594 Port Sunlight Rd.	Offsite Cross-Gabled-Style House and Farmstead Complex[d]	c. 1890	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Lakeshore Dr.	Offsite Art Moderne-Style House	c. 1925	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]

Table 2-62. (contd)

Resource Address/Name	Resource Description	Construction Date	NRHP-Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
6771 Lakeshore Dr.	Offsite Minimal Traditional-style House	c. 1940	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6771 Lakeshore Dr.	Offsite Vernacular-Style Fire Pit	c. 1945	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6708 Lakeshore Dr.	Offsite Vernacular-Style House	c. 1920	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7497 Lakeshore Dr. (Estral Beach Hotel)	Offsite Neoclassical Revival-Style Commercial Building	1922	Recommended Not NRHP-Eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
7194 Lakeview Blvd. (Estral Beach Fire Station 58 and Village Hall)	Offsite Vernacular Civic Buildings[d]	1968	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
5603 Post Rd.	Offsite Foursquare-Style House	c. 1910	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
5701 Post Rd.	Offsite Queen Anne-Style House	c. 1895	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
6994 Post Rd.	Offsite Gabled-ell House	c. 1885	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
4610 Burke Rd.	Offsite Colonial Revival-Style House	c. 1915	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3880 Lakeshore Dr.	Offsite Tudor Revival-Style House	c. 1942	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3195 Brest Rd.	Offsite Foursquare-Style House	c. 1910	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Lakeshore Dr. (between 6771 and 3689)	Offsite Vernacular-Style House	c. 1930	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3704 Lakeshore Dr.	Offsite Contemporary Folk-Style House	c. 1925	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3019 Second St.	Offsite Tudor Revival-Style House	c. 1940	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3013 Tenth St.	Offsite Side-gabled Vernacular-style House	c. 1930	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3260 Eleventh St.	Offsite Side-Gabled Vernacular-Style House	c. 1930	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
3028 Harborview (Detroit Beach Boat Club)	Offsite Side-Gabled Vernacular-Style Civic Building	Mid 20th Century	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Harborview (Substation)	Offsite Vernacular-Style Industrial Building	c. 1960	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]

Table 2-62. (contd)

Resource Address/Name	Resource Description	Construction Date	NRHP-Eligibility Status	CCRG/Detroit Edison Recommendations	SHPO Comments/ Concurrence
2112 Grand Blvd.	Offsite Foursquare-Style House	c. 1920	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]
Grand Blvd. (next to 2015)	Offsite Front-Gabled (clipped) Vernacular-Style House	c. 1930	Recommended Not NRHP-eligible[a]	No Further Work Needed[a]	Concurrence indicated in May 9, 2011, letter[c]

Sources: Demeter et al. 2008; Kuranda et al. 2009
(a) Demeter et al. 2008.
(b) Kuranda et al. 2009.
(c) Conway 2011.
(d) Two or more architectural resources were evaluated at this location.

The two previously recorded archaeological resources identified within the indirect APE consist of a prehistoric site and a historic (19th century) site. Neither of these offsite archaeological resources has been evaluated for NRHP eligibility (Demeter et al. 2008).

Architectural Resources

The 84 architectural resources identified within the direct and indirect APEs consist of historic buildings or structures. The NRHP-eligibility status of the 84 architectural resources is as follows:

- One offsite previously recorded historic property, a house at 5046 Williams Road in the indirect APE, was determined NRHP-eligible by the Michigan SHPO in 1995 (Detroit Edison 2011a; Demeter et al. 2008).
- One onsite architectural resource, the Enrico Fermi Atomic Power Plant Unit 1 (Fermi 1), is located within the direct APE. Fermi 1 was evaluated for NRHP eligibility as part of a separate project and appears to meet the criteria for NRHP eligibility (Detroit Edison 2011a; Kuranda et al. 2009; Conway 2011). Fermi 1 was also designated a Nuclear Historic Landmark by the American Nuclear Society in October 1986 (American Nuclear Society 2010).
- One offsite proposed historic district, the Pearl Drive Historic District in the indirect APE, composed of four houses, has been recommended as NRHP eligible as a result of cultural resource investigations for this project (Detroit Edison 2011a; Demeter et al. 2008).
- Nineteen offsite individual buildings or structures in the indirect APE (consisting of houses, farmstead complexes, cemeteries, ecclesiastical complexes or structures, civic buildings, and miscellaneous community or recreational buildings) have been recommended as NRHP eligible as a result of cultural resource investigations for this project (Detroit Edison 2011a; Demeter et al. 2008).
- Sixty-two offsite architectural resources in the indirect APE (consisting of individual houses, farmstead complexes, ecclesiastical complexes or structures, civic buildings, industrial and commercial buildings, and miscellaneous community or recreational buildings) have been recommended as not eligible for listing in the NRHP as a result of cultural resources investigations for this project (Detroit Edison 2011a; Demeter et al. 2008).

Historic Properties

One offsite previously recorded historic property is located within the indirect APE: a house at 5046 Williams Road, which was determined to be NRHP eligible by the Michigan SHPO in 1995 (Detroit Edison 2011a; Demeter et al. 2008).

One onsite property is located within the direct APE: Fermi 1, which was evaluated for NRHP eligibility as part of a separate project and appears to meet the criteria for NRHP eligibility. The Michigan SHPO indicated concurrence with this finding per the letter dated May 9, 2011 (Detroit Edison 2011a; Kuranda et al. 2009; Conway 2011).

Twenty additional offsite properties within the indirect APE have been recommended to be NRHP eligible. These resources include:

- The proposed Pearl Drive Historic District, composed of four houses (Detroit Edison 2011a; Demeter et al. 2008), and
- Nineteen individual buildings or structures (Detroit Edison 2011a; Demeter et al. 2008).

The Phase I cultural resources investigations did not discover any human remains in the terrestrial portions of the APE (Demeter et al. 2008; Taylor 2009).

The proposed new approximately 11-mi transmission line route from the Sumpter-Post Road junction to the Milan Substation has been assessed as having a moderate to high potential for identifying archaeological resources; however, no Phase I cultural resource investigations were conducted (Detroit Edison 2011a).

Submerged Sites Sensitivity Study

CCRG reported the results of the submerged sites sensitivity study in December 2008 (Weir 2008a). The purpose of the submerged sites sensitivity study was to identify previously recorded submerged sites and maritime-related resources within the submerged sites APE and to determine the likelihood that previously unidentified submerged sites and maritime-related resources would be located within the submerged sites APE. On the basis of the presence of known resources in areas outside the submerged sites APE, the lack of research on submerged sites within the general project area, and the shallow water environment within the submerged sites APE, CCRG concluded that the submerged sites APE has a moderate to high sensitivity for containing previously unidentified maritime-related resources. However, no previously recorded submerged sites or maritime-related resources (including archaeological sites, structures such as docks, or shipwrecks) were identified within the submerged sites APE and portions of the APE along the shoreline and in the vicinity of the current outfall pipes, water intake pipes, dock, and channel were assessed as having been previously disturbed by landfilling and dredging during the building and operation of Fermi 1 and 2 (Weir 2008a).

The results of the Phase I cultural resource investigations conducted for the Fermi 3 project (Demeter et al. 2008; Taylor 2009, 2011), including the results of the submerged sites sensitivity assessment (Weir 2008a), have been submitted to the Michigan SHPO for review and comment under Section 106 of the NHPA.

Traditional Cultural Properties

Detroit Edison contacted six Native American groups in an effort to identify any traditional cultural properties in the area of the Fermi 3 site and/or to determine whether the Fermi 3 site is an area that is otherwise sensitive to these groups with respect to cultural resources. Five of the six Native American groups are Federally recognized Indian Tribes: the Match-e-be-nash-she-wish Band of Potawatomi Indians of Michigan; the Huron Potawatomi, Inc.; the Forest County Potawatomi Community of Wisconsin; the Hannahville Indian Community; and the Saginaw Chippewa Indian Tribe of Michigan (Detroit Edison 2009d). The NRC also contacted these five Federally recognized Indian Tribes as part of consultation under NEPA and Section 106 of the NHPA (see Section 2.7.4). The remaining Native American group contacted by Detroit Edison was the non-Federally recognized Native American group (the Wyandot of Anderdon Nation) (Detroit Edison 2009d).

None of the five Federally recognized Indian Tribes responded to Detroit Edison. The non-Federally recognized Native American group responded to Detroit Edison’s contact but did not identify any traditional cultural properties in the area of the Fermi 3 site or indicate that the Fermi 3 site is an area that is sensitive to this group with respect to cultural resources (Detroit Edison 2011a; Gronda 2008). Responses from Federally recognized Indian Tribes that the NRC has received to date are discussed in Section 2.7.4.

2.7.3 Historic and Cultural Resources within the Transmission Line Corridor

The proposed transmission line route will extend from the Fermi 3 site in Monroe County north and west to the existing Milan Substation in Washtenaw County. The majority of the proposed transmission line route, from the Fermi 3 project area in Monroe County north to the Sumpter-Post Road junction in Wayne County, will utilize an existing transmission line route. The remaining portion of the proposed transmission line route, from the Sumpter-Post Road junction in Wayne County west to the existing Milan substation in Washtenaw County, will utilize a new, undeveloped transmission line route.

Efforts to identify cultural resources along the proposed transmission line route consisted of site file research for the entire proposed transmission line route and a field view of the proposed new portion of the route. The APE for the site file search for the entire proposed transmission line route was defined as a 1.5-mi area around the proposed route from the Fermi 3 site in Monroe County to the existing Milan Substation in Washtenaw County. Site file searches identified a total of 77 previously recorded archaeological resources within the proposed transmission line route APE; no previously recorded architectural resources or NRHP-listed or NRHP-eligible historic properties were identified (Detroit Edison Corporation 2011a). Six of the 77 archaeological resources would be crossed by that portion of the proposed transmission line route that would require a new corridor. These six archaeological resources, which consist of five prehistoric archaeological sites and one historic archaeological site, were previously determined to not be NRHP eligible (see Table 2-63).

Table 2-63. Identified Transmission Line Corridor Archaeological Resources

Site Number	Site Description	Site Age or Cultural Period	NRHP–Eligibility Status
20WN928	Previously Recorded Prehistoric Archaeological Site	Unidentified Prehistoric	Determined Not Eligible
20WN927	Previously Recorded Prehistoric Archaeological Site	Woodland	Determined Not Eligible
20WN972	Previously Recorded Prehistoric Archaeological Site	Late Woodland	Determined Not Eligible
20WN 973	Previously Recorded Prehistoric	Unidentified Prehistoric	Determined Not Eligible
20WN976	Previously Recorded Prehistoric	Late Woodland	Determined Not Eligible
20WN1043	Historic Archaeological Site	19th and 20th Century	Determined Not Eligible

Source: Detroit Edison 2011a

The preliminary field view of the APE for both archaeological and aboveground resources was limited to the portion of the proposed transmission line route that would require a new corridor, and it extended 1.5 mi on either side of an assumed 300-ft-wide corridor centerline (Detroit Edison 2011a). Results of this field view of the proposed new transmission line route indicated a moderate to high potential for identifying archaeological resources and the few aboveground resources that meet the minimum age requirement or retain sufficient integrity to be considered for NRHP eligibility (Detroit Edison 2011a).

Cultural resources impacts related to construction of the proposed transmission lines are discussed in Sections 4.6, 10.2.1, and 10.4.1.5. Operational impacts of the proposed transmission lines on cultural resources are discussed in Sections 5.6 and 10.2.2, and cumulative transmission line cultural resource impacts are discussed in Section 7.5.

2.7.4 Section 106 Consultation

In December 2008, the NRC initiated Section 106 consultation for the proposed Fermi 3 project with the Michigan SHPO and the Advisory Council on Historic Preservation (ACHP) as part of the scoping process for the review of the Fermi 3 COL application under NEPA, consistent with 36 CFR 800.8(c) (NRC 2008a, b) (see Appendix C). In December 2008, the NRC also initiated Section 106 consultation for the proposed Fermi 3 project with a total of 17 Federally recognized Indian Tribes, in accordance with 36 CFR 800.2(c)(2)(ii) and 36 CFR 800.3(c), (see Appendix C for complete listing). Twelve of the Indian Tribes contacted as part of the scoping process are located in the State of Michigan. The remaining five Indian Tribes are located outside the State of Michigan but are either within a 50-mi radius of the Fermi 3 project or have a judicially established land claim in Monroe County, Michigan, or in lands within a 50-mi radius of Fermi 3. In these letters, the NRC provided information about the proposed action and indicated that Section 106 consultation would be integrated with the NEPA process in accordance with 36 CFR 800.8 and would include participation in the scoping process; the identification of cultural resources and historic properties, including those historic properties of traditional religious or cultural importance to Federally recognized Indian Tribes; the assessment of effects of the proposed action on any historic properties; and the resolution of any adverse effects on historic properties.

The USACE issued Public Notice LRE-2008-00443-1-S11 (USACE 2011c) to solicit comments from the public; Federal, State, and local agencies and officials; Indian Tribes; and other interested parties in order to consider and evaluate the impacts of regulated activities associated with the Fermi 3 project. The comments received are under review and are being considered by the USACE to determine whether to issue, modify, condition, or deny a permit and to assess impacts on endangered species, historic properties, water quality, general environmental effects, and the other public interest factors.

The ACHP responded to the NRC, indicating that the NRC must notify the Michigan SHPO and meet the standards in 36 CFR 800.8(c)(1)(i) through (v); and that it should notify the ACHP in the event that the NRC determines, in consultation with the SHPO/Tribal Historic Preservation Office (THPO) and other consulting parties, that the proposed undertaking may adversely affect properties listed, or eligible for listing, on the NRHP, and submit to the ACHP any EIS that is prepared pursuant to 36 CFR 800.8(c)(2)(i) (Vaughn 2009). The NRC notified the ACHP of the finding of adverse effects on Fermi 1 and invited the ACHP to participate in the consultation to resolve the adverse effects, in accordance with 36 CFR 800.6 (NRC 2011).

In a December 21, 2009, phone conversation, Mr. Brian Grennell of the Michigan SHPO suggested that the NRC provide him with a completed Michigan SHPO's *Application for Section 106 Review* form to facilitate his Section 106 review of the Fermi 3 COL application. This form was further discussed in a phone conference with Mr. Grennell on August 5, 2010. The NRC sent the completed form to the Michigan SHPO in a letter dated December 17, 2010. In a response letter dated May 9, 2011 (that was received on May 10, 2011), the Michigan SHPO stated that Fermi 1 appeared to meet the criteria for listing in the NRHP and that it concurred with the NRC's determination that demolition would have an adverse effect on Fermi 1 (Conway 2011).

To date, one of the 17 Federally recognized Indian Tribes, the Delaware Nation, Oklahoma, has responded to the NRC (Smith 2011). In a letter dated December 30, 2011, the Delaware Nation requested to be a consulting party on the project and requested that all surveys, reports, and information pertaining to the project be forwarded to the Delaware Nation Cultural Preservation Director for review. NRC forwarded the requested surveys, reports, and information to the Delaware Nation on February 21, 2012 (NRC 2012a). To date, the Delaware Nation has not provided any comments or identified any concerns regarding the surveys, reports, and information pertaining to the project and did not participate in the development of the Memorandum of Agreement (MOA) to resolve adverse effects of the Fermi 3 project on Fermi 1.

The NRC review team conducted consultation to resolve the adverse effect of Fermi 3 on historic properties (specifically, Fermi 1) in accordance with 36 CFR 800.6. NRC, the Michigan SHPO, Detroit Edison, and the Monroe County Community College were the consulting parties. As a result of this consultation, an MOA between NRC and the Michigan SHPO was developed, stipulating measures for Detroit Edison to implement to resolve the adverse effects of Fermi 3 on Fermi 1. These measures will consist of recordation of the Fermi 1 structure and development of a public exhibit on the history of Fermi 1.

The MOA's first (recordation) stipulation states that Detroit Edison will conduct recordation documentation of the Fermi 1 structure in accordance with Michigan SHPO *Documentation Guidelines,* submit original documentation packages to the Michigan SHPO for review and approval, and submit original documentation packages to the State Archives of Michigan and the Monroe County Library within one year of the date of the executed MOA. The MOA's first stipulation has been met because the Michigan SHPO stated in a letter dated May 7, 2012, that it had reviewed and accepted the recordation materials submitted by DTE (MacFarlane-Faes 2012), and DTE has submitted original documentation packages to the State Archives of Michigan and the Monroe County Library and Reference Center.

The MOA's second stipulation states that Detroit Edison will develop and establish a permanent public exhibit on the history of Fermi 1 in consultation with Monroe County Community College and other interested parties and the Michigan SHPO within two years of the signed MOA. The MOA states that Detroit Edison will coordinate with the various parties to develop a mutually acceptable plan for the scope, location, and design of this exhibit and, at the conclusion of the exhibit, will offer any remaining archival items pertaining to the history of Fermi 1 to local, State, and Federal agencies and nonprofit organizations potentially interested in the permanent retention or display of these items (NRC 2012b). Per the direction of the Michigan SHPO, the NRC requested comments from seven interested parties on the draft MOA, six of which replied stating they had no comments (see Appendix C). (The seventh did not reply.) The MOA was thus finalized and signed on March 20, 2012, by the Michigan SHPO after being signed by the NRC, DTE, and Monroe County Community College. A copy of the executed MOA was forwarded to the ACHP for filing (NRC 2012c). The MOA's first stipulation has been met because the Michigan SHPO stated in a letter dated May 7, 2012, that it had reviewed and accepted the recordation materials submitted by DTE (MacFarlane-Faes 2012), and DTE has submitted original documentation packages to the State Archives of Michigan and the Monroe County Library and Reference Center.

On January 14, 2009, the NRC conducted two public scoping meetings (an afternoon session and an evening session), with USACE participation, in Monroe, Michigan, at the Monroe County

Community College's La-Z-Boy Center Meyer Theater. Comments made during the scoping meetings identified five additional historic or cultural resources in the vicinity of the Fermi 3 site (NRC 2009a). The five historic or cultural resources identified during the scoping meetings are as follows:

- Monroe Harbor.
- River Raisin Battlefield, an NRHP-listed historic property and a congressionally authorized addition to the NPS.
- A portion of the existing Motor Cities National Heritage Area, a Congressionally designated area that is collaboratively managed by Federal, State, and local public and private agencies and groups to promote natural, cultural, historic, and scenic resources that combine to form a cohesive, nationally important landscape arising from patterns of human activity shaped by geography (in this case, the development of the automotive industry and the relationship between labor and industry).
- A proposed War of 1812 Bicentennial Legacy Commission project, developed under the auspices of the Michigan Commission on the Commemoration of the Bicentennial of the War of 1812 by the Experiential Tourism Task Group, War of 1812 Bicentennial Steering Committee in Monroe County, and consisting of the proposed reestablishment of wild rice (*Zizania aquatica*), with the help of the Native American Community, in unspecified areas suitable for its propagation.
- A proposed War of 1812 Bicentennial Legacy Commission project consisting of the proposed development of a nonmotorized trail, Hull's Road Coastal Heritage Trail along North Dixie Highway, in part in the vicinity of the Fermi 3 site, as part of the Downriver Greenways Initiative (NRC 2009a).

Two of the five historic or cultural resources identified during the scoping meetings, Monroe Harbor and the River Raisin Battlefield, are outside the Fermi 3 APE. Another two of the five resources, the Motor Cities National Heritage Area and the proposed reestablishment of wild rice as a proposed War of 1812 Bicentennial Legacy Commission project, overlap but do not have specific or identified locations within the Fermi 3 APE. The fifth resource, the proposed development of Hull's Road Coastal Heritage Trail along North Dixie Highway, would be located along or immediately adjacent to the western boundary of the indirect APE. No other comments or concerns regarding historic and cultural resources were made at the scoping meetings.

According to 10 CFR 50.10(a)(2)(vii) the building of transmission lines is not considered an NRC-authorized activity. Therefore, the NRC considers the offsite proposed transmission lines to be outside the NRC's APE and therefore not part of the NRC's consultation.

2.8 Geology

The geology and associated seismological and geotechnical conditions at the proposed Fermi Unit 3 site are described in Section 2.5 of the FSAR, which is part of the COL application (Detroit Edison 2012b). A summary of the geology of the Fermi site is provided in Section 2.6 of the ER (Detroit Edison 2011a). Both the FSAR and the ER were informed by the characterization conducted for the now decommissioned Fermi 1 and the operating Fermi 2 and the results of subsurface investigations performed recently to support the COL application. The staff's descriptions of the geological features of the site and the vicinity and its detailed analyses and evaluations of geological, seismological, and geotechnical data, as required for an assessment of the site-safety issues related to Fermi 3, are, or will be, included in the staff's Safety Evaluation Report.

The Fermi site is in the Eastern Lake section of the Central Lowland physiographic province (USGS 2010a). The geologic setting is described in detail in the FSAR (Detroit Edison 2012b). In summary, the site is in a relatively tectonically stable region, with glacial and glaciolacustrine Pleistocene deposits underlain by a thick succession of Paleozoic sedimentary bedrock. The near-surface units are summarized in Table 2-64. Excavation for some site buildings extends through the surficial unconsolidated materials and into the Bass Islands Group bedrock.

Table 2-64. Geologic Units at the Fermi 3 Site

Formation	Geologic Age	Description	Approx. Thickness (ft)	Approx. Depth to Upper Contact (ft)
Fill	Recent	Various gravel-cobble fill and fine-grained fill	Up to 15	0
Lacustrine deposits	Pleistocene	Mainly clay and silty clay	0 to 8.7	Up to 15
Glacial deposits	Pleistocene	Clay with sand or gravel, silt with sand or gravel, clayey gravel	6 to 19	15 to 20
Bass Islands Group	Silurian	Dolomite	Up to 99	28
Salina Group	Silurian	Shale, halite, dolomite, anhydrite	Hundreds	119

Source: Detroit Edison 2012b

The Fermi site is fairly flat, with site elevations mainly in a range of approximately 575 to 595 ft. Most existing Fermi facilities, including Fermi 2, are located at elevation 583.0 ft plant grade datum (581.8 ft NAVD 88), and Fermi 3 would be located on an area elevated to 590.0 ft plant grade datum (587.8 NAVD 88), with safety-related facilities at a minimum of 590.5 ft plant grade datum (589.3 NAVD 88).

The average water elevation for Lake Erie is estimated to be 571.6 ft NAVD 88 (NOAA 2009a). A rock barrier is present east of Fermi 2 at the shoreline to protect against high water levels of

Lake Erie. The rock barrier crest elevation is at 581.8 ft NAVD 88. Over the past 30 years, the Lake Erie shoreline at the Fermi site has remained fairly stable. Additional hydrologic information, including information on lake level and site drainage, is in Section 2.3.1.1.

Soils adjacent to the developed portion of the Fermi site are primarily Lenawee silty clay loam, a very poorly drained soil developed on till-floored lake plains (USDA 2010).

Mineral resources in Monroe County are summarized in a USGS (2010b) database of locations and deposit types. The resources include active and inactive quarries, sand and gravel pits, and clay pits. The nearest extraction site to the Fermi property is a clay pit 6 mi to the north. Several additional quarries in the county, including the Fermi quarries that were used to support the building of Fermi 2, are described by Reeves et al. (2004) and Detroit Edison (2011a). The nearest offsite quarry is about 3 mi north-northwest of the Fermi site. In Monroe County, bedrock aquifers are the main groundwater resource; glacial drift generally provides water only in small to moderate quantities (Reeves et al. 2004). Further hydrogeologic information is in Section 2.3.1.2.

2.9 Meteorology and Air Quality

The following sections describe the climate and air quality of the Fermi 3 site. Section 2.9.1 describes the climate of the region and area in the immediate vicinity of the Fermi 3 site, Section 2.9.2 describes the air quality of the region, Section 2.9.3 describes atmospheric dispersion at the site, and Section 2.9.4 describes the meteorological monitoring program at the site.

2.9.1 Climate

The Fermi 3 site is located in Monroe County in the southeastern corner of Michigan. Its climate is influenced by Lake Erie and its location with respect to major storm tracks. The Fermi 3 site has a humid continental climate that is marked by variable weather patterns and that features cold winters with frequent snowfalls and warm and humid summers with frequent thunderstorms. Because of its proximity to Lake Erie, the site experiences relatively small diurnal and seasonal temperature ranges compared with those at comparable latitudes. Air masses approach the region mostly from the southwest, except when they come from the northwest during spring months. The closest first-order weather stations with long periods of record are Detroit Metropolitan Airport, about 17 mi north-northwest of the site; Toledo Express Airport, about 38 mi southwest of the site; and Flint Bishop International Airport, about 74 mi north-northwest of the site. These stations provide a good indication of the general climate at the site because of their proximity. The general area surrounding the site is relatively flat, with no topographic features that would cause the local climate to deviate significantly from the regional climate.

The following statistics are derived from local climatological data for Detroit Metropolitan Airport (NCDC 2010a). Temperatures are more variable in the winter than in the summer because of the differences in air mass source regions. Mean daytime maximum temperatures range from about 31.1°F in January to about 83.1°F in July, while mean nighttime minimum temperatures range from about 17.0°F in January to about 62.1°F in July. Monthly average wind speeds range from about 7.6 miles per hour (mph) in August to about 11.4 mph in January. Precipitation varies slightly from season to season, with the highest of 9.81 in. in summer and the lowest of 6.30 in. in winter. Snow generally occurs from October to April, with an annual total of 44.0 in., of which about 90 percent falls from December to March.

On a larger scale, climate change is a subject of national and international interest. The recent compilation of the state of knowledge in this area by the U.S. Global Change Research Program (USGCRP), a Federal Advisory Committee (USGCRP 2009) has been considered in preparation of this EIS. The USGCRP has provided valuable insights regarding the state of knowledge of climate change. The projected change in temperature from the "recent past" (1961–1979) over the period encompassing the licensing action (i.e., to the period 2040 to 2059 in the USGCRP report) in the vicinity of the Fermi site is an increase of between 3 to 5°F. While the USGCRP has not incrementally forecast the change in precipitation by decade to align with the licensing action, the projected change in precipitation from the "recent past" (1961–1979) to the period 2080 to 2099 was presented. The USGCRP report forecasts that northern areas will become wetter as a result of more northward incursions of storm tracks: about a 15 to 20 percent increase in winter and spring, a 5 to 10 percent decrease in summer, and a 0 to 5 percent increase in fall around the Fermi site (USGCRP 2009).

On the basis of the assessments of the USGCRP and the National Academy of Sciences' National Research Council, the EPA determined that potential changes in climate caused by greenhouse gas (GHG) emissions endanger public health and welfare (74 FR 66496). The EPA indicated that although ambient concentrations of GHGs do not cause direct adverse health effects (such as respiratory or toxic effects), public health risks and impacts can result indirectly from changes in climate. As a result of the determination by the EPA and the recognition that mitigative actions are necessary to reduce impacts, the review team concludes that the effect of GHG emissions on climate and the environment is already noticeable but not yet destabilizing. The Commission has provided guidance to the NRC staff to consider carbon dioxide and other GHG emissions in its NEPA reviews and has directed that such considerations should encompass emissions from constructing and operating a facility as well as from the fuel cycle (NRC 2009b). The review team characterized the affected environment and the potential GHG impacts of the proposed action and alternatives in this EIS. Consideration of GHG emissions was treated as an element of the existing air quality assessment that is essential in a NEPA analysis. In addition, in situations in which it was important to do so, the review team considered the effects of the changing environment during the period of the proposed action on other resource assessments.

2.9.1.1 Wind

To examine regional wind patterns around the Fermi site, the staff reviewed wind roses from the three nearby first-order weather stations (Detroit, Toledo, and Flint) for the years 2005 through 2009 (NCDC 2010b). Overall wind patterns among the three nearby first-order weather stations show some similarity, but monthly wind patterns are somewhat different, and these differences are primarily attributable to the position of storm tracks. The wind rose from the closest first-order weather station, Detroit Metropolitan Airport, is presented in Figure 2-22.

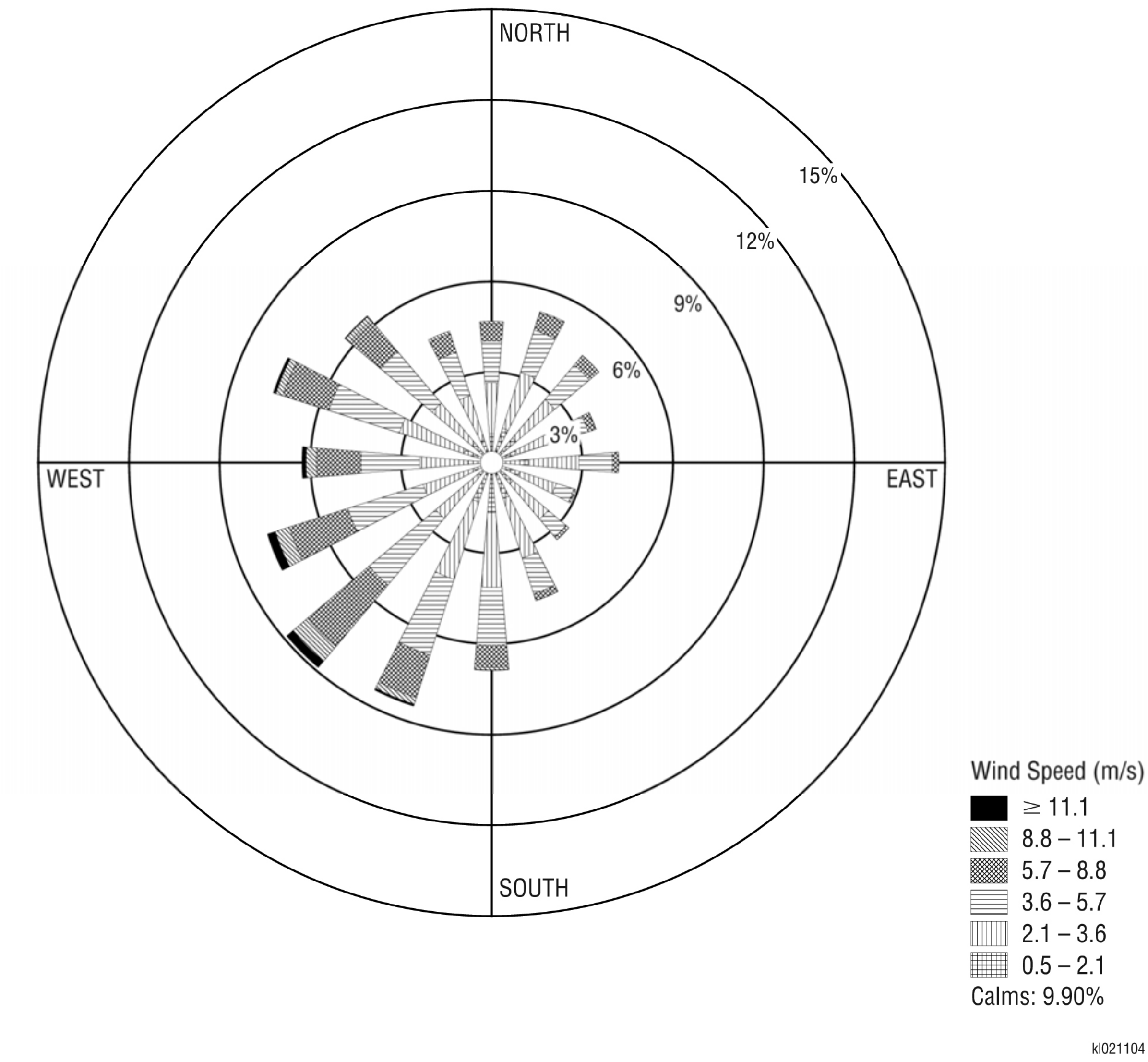

Figure 2-22. Wind Rose at 33-ft Height at the Detroit Metropolitan Airport, Detroit, Michigan, 2005 to 2009 (Data source: NCDC 2010b)

As shown in Figure 2-22, the average annual wind speed at Detroit Metropolitan Airport is about 8.6 mph. For the same period, average annual wind speeds at Toledo (8.1 mph) are lower than those at Flint and Detroit, both of which are 8.6 mph. The Detroit seasonal lowest wind speed of 7.2 mph occurs in summer, while the Detroit seasonal highest wind speed of 10.0 mph occurs in winter. Although not prominent, the prevailing wind direction is from the southwest (about 8.9 percent of the time). Prevailing winds are from the west-southwest for Toledo and from the south-southwest for Flint. About 25 percent of the time, winds at Detroit blow from southwesterly directions, including south-southwest, southwest, and west-southwest. Typically, when the Bermuda High sits over the southeastern United States and storm tracks move north of the Fermi site, southwesterly winds dominate. During winter months when a storm track is situated near the Fermi site, westerly and northwesterly winds become more frequent.

Figure 2-23 presents the 33-ft height wind rose at the Fermi site based on 2001 to 2007 onsite wind data (Detroit Edison 2010c). Average annual wind speed is about 6.6 mph, which is approximately three-fourths of that at the Detroit Metropolitan Airport. The reason for differences in wind speeds is that the meteorological tower at the Fermi site is surrounded by forest and existing Fermi 2 facilities, while the tower at the airport is exposed to open areas. The prevailing wind direction is from the southwest (about 11.2 percent of the time). Similar to Detroit, winds blow from southwesterly directions, including south-southwest, southwest, and west-southwest, about 30.2 percent of the time. Overall, annual and monthly wind direction patterns of the two stations are quite similar. The exception is higher frequencies of occurrence of the southeast components for the Fermi site, which are attributable to onshore lake breezes that develop most often during late spring through early fall.

2.9.1.2 Temperature

The temperature measured at the 33-ft level of the Fermi meteorological tower is considered to be representative of the Fermi 3 site. Temperature data from the tower for the 2001 through 2007 time period show that the annual average temperature is 50.6°F, with the lowest monthly average temperature of 27.3°F occurring in January and the highest monthly average temperature of 73.5°F occurring in July. During this 7-year period, the absolute minimum temperature was –3.8°F, and the absolute maximum temperature was 94.3°F. These temperatures are consistent with long-term values for Detroit Metropolitan Airport, with a monthly minimum of 24.5°F in January and a monthly maximum of 73.5°F in July during climate normal years (1971–2000). About 12.0 days per year have a maximum temperature that is higher than or equal to 90°F, while about 130 days per year have a minimum temperature that is lower than or equal to 32°F (NCDC 2010a).

2.9.1.3 Atmospheric Moisture

The moisture content of the atmosphere can be represented in a variety of ways. The most common are in terms of relative humidity, precipitation, and fog. The atmospheric moisture

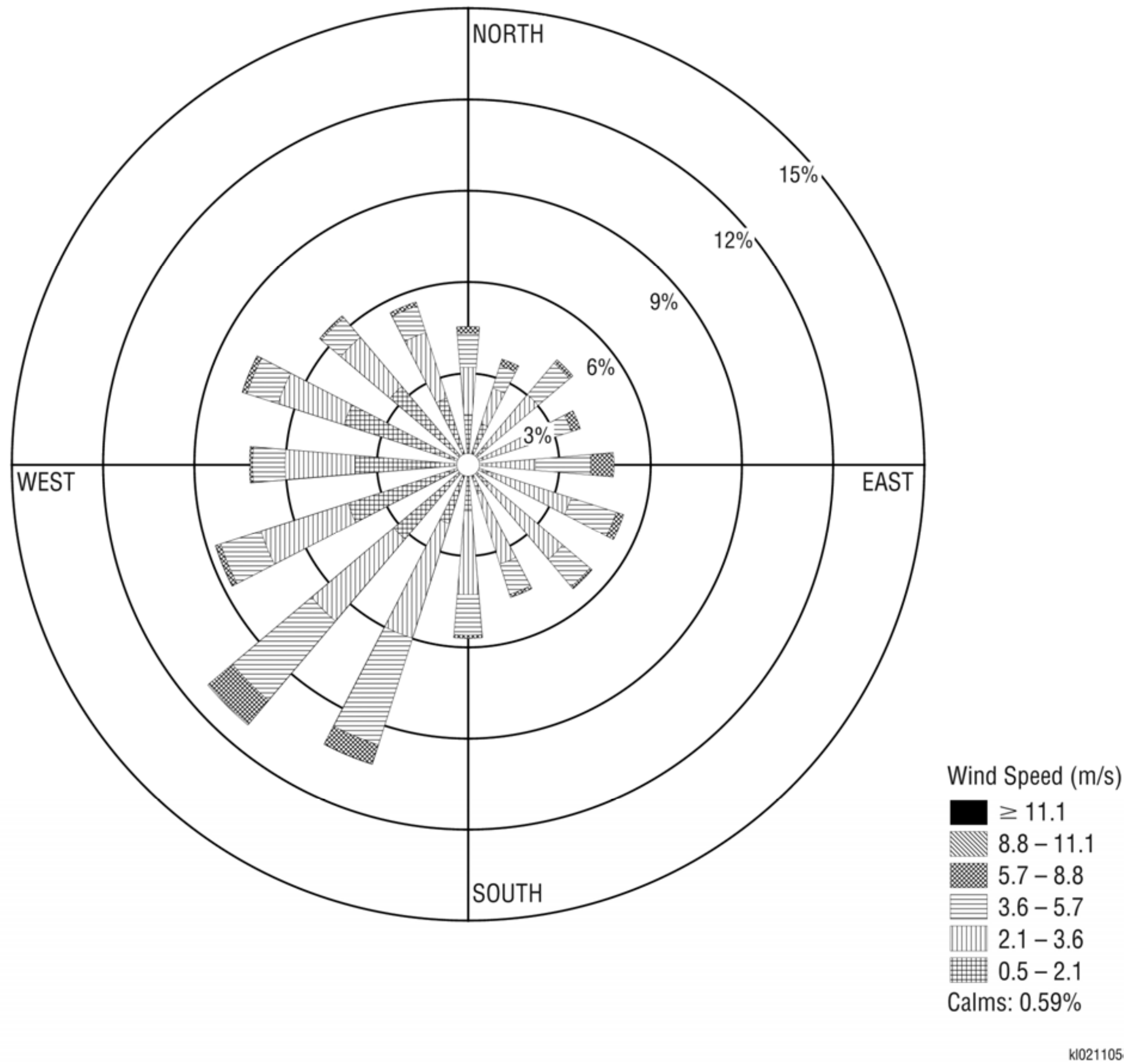

Figure 2-23. Wind Rose at 33-ft Height at the Fermi Site, Monroe County, Michigan, 2001 to 2007 (Data source: Detroit Edison 2010c)

measurements at the Fermi site include precipitation and dew-point temperature. Wet-bulb temperature, relative humidity, fog, and visibility data are not collected at the Fermi site.

For precipitation, historic measurement data at the Detroit Metropolitan Airport are presented because of frequent malfunctions of the precipitation sensor at the Fermi site during the 2003–2007 period. Annual precipitation averaged about 32.9 in. during climate normal years

(1971–2000) (NCDC 2010a). Measurable precipitation of 0.01 in. or more occurred about 137 days per year. Wintertime storm tracks are typically positioned south of Detroit, which could bring combinations of rain, snow, freezing rain, and sleet, along with heavy snowfall accumulations on occasion.

The area surrounding the Fermi site experiences abundant precipitation, and about 38 percent of the days have precipitation levels of at least 0.01 in., but droughts still occur at times. According to the Palmer Drought Index (NCDC 2010c), which determines the severity of drought conditions, more than 10 droughts have occurred in Michigan since 1900, and a recent drought was recorded in the late 1990s. Overall, the frequency of extreme drought conditions has been decreasing, and more wet years have been prevalent since 1940.

The annual average relative humidity at the Detroit Metropolitan Airport is about 71 percent. Relative humidity remains relatively uniform throughout the year, with the lowest monthly average of 65 percent occurring in April and May and the highest monthly average of 77 percent occurring in December (NCDC 2010a). Relative humidity is lowest during the day (the annual average relative humidity at 1 p.m. local standard time is 60 percent) and highest during early morning (the annual average relative humidity at 7 a.m. local standard time is 81 percent). Because of its proximity to Lake Erie, the Fermi site is expected to experience higher relative humidity and smaller monthly variations than locations that are farther inland but at a comparable latitude (e.g., Detroit Metropolitan Airport).

Fog occurs when horizontal visibility is less than or equal to 7 mi. On the basis of this criterion, fog occurred about 12.7 percent of the time (1114 hours per year) at the Detroit Metropolitan Airport during the period 1961–1995 (NCDC 1993; NCDC 1997). Fog occurs more frequently in winter than in summer, with the highest frequency of 17.5 percent of the time occurring in December and the lowest frequency of 9.0 percent of the time occurring in June. For the same period, heavy fog that restricts visibility to less than or equal to 0.25 mi is reported about 0.7 percent of the time (62.4 hours per year) on an annual basis. Monthly variations for heavy fog are almost the same as those for fog. Heavy fog occurred about 17.8 days per year, with about 2 to 3 days occurring in winter and less than 1 day occurring in summer (NCDC 2010a).

2.9.1.4 Atmospheric Stability

Atmospheric stability is a meteorological parameter that describes the dispersion characteristics of the atmosphere. It can be determined by the difference in temperature between two heights. A seven-category atmospheric stability classification scheme (ranging from A for extremely unstable to G for extremely stable) based on temperature differences is set forth in NRC's Regulatory Guide 1.23, Revision 1 (NRC 2007). When the temperature decreases rapidly with height (typically during the day, when the sun is heating the ground), the atmosphere is unstable, and atmospheric dispersion is greater. Conversely, when temperature increases with height (typically during the night as a result of the radiative cooling of the ground), the atmosphere is stable, and dispersion is more limited. The stability category between unstable and stable conditions is D (neutral), which would occur typically with higher wind speeds and/or higher cloud cover, irrespective of day or night.

Onsite temperature measurement data at the 10-m and 60-m levels of the Fermi meteorological tower for the years 2001 through 2007 are used to determine the stability classes for the site. On an annual basis, D stability (neutral) is the most prevalent single stability class, accounting for about 31.6 percent of the time. The unstable conditions (A to C) occur approximately 28.2 percent of the time, while the stable conditions (E to G) occur about 40.2 percent of the time. Stability patterns vary from season to season. Stabilities A (extremely unstable), D (neutral), and E (slightly stable) are most frequent and can occur throughout the year. Stability A occurs more frequently from mid-spring to early fall when solar radiation is the strongest, and Stability D peaks in winter months. However, frequencies of Stability E remain fairly constant throughout the year.

The temperature contrast at the coastal boundary, due to uneven heating rates of land and water, can cause local lake/land breeze circulation. Around the Fermi site, a lake/land breeze occurs primarily in the warmer months (May to October), with its peak strength happening in the summer. When cooler air over a large water body (i.e., Lake Erie) advances inland during lake breeze conditions, a thermal internal boundary layer begins to develop because of the mechanical and thermal effects at the land-water interface. Typically, a lake breeze begins around late morning and peaks around mid-afternoon. As the sun sets, the land-lake temperature difference decreases and the lake breeze disappears. At night, the land cools off more quickly than the water, and this temperature contrast causes a land breeze, blowing from land to water. The strength of the land breeze is usually weaker than that of its daytime counterpart, the lake breeze.

On the basis of 2001–2007 onsite hourly temperature difference data, extremely unstable conditions (Stability A) occurred about 29 percent of the time when onshore winds blew from Lake Erie, in wind directions ranging from east-northeast to south. These wind conditions can occur during onshore flow conditions, either as local lake breezes or synoptic winds blowing from Lake Erie toward the land. In particular, an autoconvective condition with a lapse rate of –3.4°C per 100 m was frequently exceeded with onshore wind flows (the autoconvective lapse rate represents severe extremely unstable conditions when the density of the atmosphere increases with height). Autoconvective conditions account for about 31 percent of extremely unstable conditions under onshore wind flow conditions. Colder lake air affects temperatures at the 60-m height more than those at the 10-m height because the lower portion of the onshore flow is heated first by the land surface as it comes ashore. The existing meteorological tower is located about 0.5 mi from Lake Erie. At night, the Fermi site has air with relatively more moisture than the air at an inland site at a comparable latitude, and less radiative cooling occurs, which can lead to more neutral conditions than stable conditions. About 70 percent of extremely stable conditions (Stability G) occurred when offshore winds with drier air prevailed (i.e., blowing from the land toward Lake Erie). As a consequence, atmospheric stability and its attendant dispersion characteristics are affected considerably by Lake Erie.

2.9.1.5 Severe Weather

The site can experience severe weather in the form of thunderstorms, lightning, hail, ice storms, waterspouts, and tornadoes.

Thunderstorms occur about 32 days per year at the Detroit Metropolitan Airport (NCDC 2010a). Thunderstorms are most active during the summer months: on about 1 of 5 days from June through August. The Detroit area experiences about 5 days per year of damaging severe thunderstorms with straight winds greater than 50 knots (57.5 mph) (NSSL 2009). Another hazard of thunderstorms is lightning, which can strike up to 10 mi away from the rain. Some lightning strikes have caused injuries, including fatalities, or property damage, including that from disruptions of electrical circuits and wildfires. The Detroit area experienced about two to four flashes of lightning per square kilometer per year from 1996 through 2005 (NOAA 2009b).

On the basis of 1955–2002 data, the 1°-latitude-by-1°-longitude area around the Fermi site experienced about 16.5 hail events per year when hail diameters were 0.75 in. or more and fewer than one hail event per year when hail diameters were 2 in. or more (Schaefer et al. 2004). Seventy-two hail events have been reported for Monroe County (which encompasses the Fermi site) since 1963, eleven of which involved hail diameters of 1.75 in. or more (NCDC 2010d). The event with the largest hail diameter reported for Monroe County occurred on March 27, 1991; the diameter was 4 in. The majority of hail events occurred in April through July, and no hail was reported from November through February.

The Fermi site and surrounding region can experience wintry precipitation such as ice storms mostly during winter and early spring. Data for 1976 to 1990 indicate that freezing rain occurred on about 5 days/year around the Fermi site, while ice pellets occurred on about 4 days/year (Cortinas et al. 2004). Freezing rain and ice pellets occur mostly from November through April, peaking during the winter months. Thirty-seven snow and ice storms have been reported in Monroe County since 1993 (NCDC 2010d). A total of nine freezing rain events were reported in Monroe County, and ice accumulation during most events was 0.5 in. or lower. The highest ice accumulation, ranging from 1.5 to 2.5 in., occurred on March 13 and 14, 1997, when a major ice storm hit southeastern Michigan.

On occasion, tornadoes occur in the area surrounding the Fermi site, but they are less frequent and destructive than those in the “tornado alley” of the central United States. For the period 1950 to 2009, 28 tornadoes were reported in Monroe County, with an average frequency of one every two years (NCDC 2010d). More than 75 percent of the tornadoes occurring in Monroe

County were relatively weak (less than or equal to F2 on the Fujita tornado scale). However, two F3 and four F4 tornadoes were reported in Monroe County; the combined F4 tornadoes caused 17 fatalities, 57 injuries, and considerable property damage. On the basis of tornado statistics for the Fermi site vicinity, the review team estimates the probability of a tornado striking the proposed Fermi 3 reactor building to be about 5 in 10,000 (5×10^{-4}) per year (Ramsdell and Rishel 2007).

Around 2:30 a.m. on June 6, 2010, a tornado touched down in Detroit Beach, Michigan, traveled about 5 mi northeast, and entered Lake Erie at Estral Beach six minutes later (AnnArbor.com 2010). On the basis of the observed damage, the tornado can be classified as an EF1 tornado. The tornado's track had a width of 500 yd and an estimated top wind speed of 90 mph. Fermi 2, which was along the tornado's path, automatically shut down as a precaution. Although the reactor building was undamaged, the storm tore a 20- by 30-ft hole in the roof of the building housing the steam turbines, blew off siding from the auxiliary building, and damaged the cooling fins at the twin natural draft cooling towers (MonroeNews.com 2010). The Fermi 2 reactor was safely shut down and kept in standby mode for more than a week as repairs to associated facilities were made.

Waterspouts, which are considered to be tornadoes on water but with weaker strength, were reported twice in 1997 and 1998 along Monroe County's shoreline (NCDC 2010d). On July 26, 1998, one waterspout was reported off the shoreline of Stony Point, which is located a couple of miles south of the Fermi site.

2.9.2 Air Quality

The discussion on air quality includes six common criteria air pollutants for which the EPA has established National Ambient Air Quality Standards (NAAQS): sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$; particles with an aerodynamic diameter of less than or equal to 10 micrometers (μm) and 2.5 μm, respectively), and lead (Pb). The air quality discussion also covers heat-trapping GHGs (primarily carbon dioxide [CO_2]), which have been the principal factor causing climate change over the last 50 years (USGCRP 2009).

The Fermi 3 site is in Monroe County, Michigan, which, with Lucas and Wood Counties in Ohio, is in the Metropolitan Toledo Interstate Air Quality Control Region (AQCR) (40 CFR 81.43). However, nonattainment status for $PM_{2.5}$ is reported as a part of the Detroit-Ann Arbor Designated Area in 40 CFR 81.323. Surrounding AQCRs include the Metropolitan Detroit-Port Huron Intrastate AQCR to the north and the South Central Michigan Intrastate AQCR to the west. Monroe County and its neighboring counties are designated as an attainment area for all criteria pollutants except $PM_{2.5}$ (EPA 2010b). Monroe County is designated as a nonattainment area for $PM_{2.5}$, as are six other southeastern counties, including the Detroit metropolitan area and its downwind areas. In July 2011, the MDEQ submitted a request asking the EPA to redesignate southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011). In July 2012, the EPA issued a proposed rule designating southeastern Michigan as having attained both the 1997 annual $PM_{2.5}$ NAAQS and the 2006 24-hour $PM_{2.5}$ NAAQS, based on 2009–2011 ambient air monitoring data (77 FR 39659, dated July 5, 2012) but the final determination has yet to be made. On June 29, 2009, Monroe County, with seven other southeastern counties including the Detroit metropolitan area, was redesignated from a nonattainment area to a maintenance area for the 8-hour ozone standard, and, on August 9, 2007, Lucas and Wood Counties in Ohio were redesignated (EPA 2010b).

Class I Areas as defined by the Clean Air Act are national parks larger than 6000 ac, wilderness areas, national memorial parks larger than 5000 ac, and international parks that have stringent protection from air pollution damage. There are no mandatory Class I Federal areas where visibility is an important value in the lower peninsula of Michigan. The nearest Class I area is Otter Creek Wilderness Area in West Virginia, which is located about 275 mi southeast of the Fermi site.

Air emission sources from the Fermi 3 site would include standby diesel generators and diesel fire pumps operating on an intermittent basis, an auxiliary boiler, and cooling towers. Only small amounts of air pollutant emissions from the Fermi 3 site would be released, because there is no primary combustion involved in generating power from nuclear energy. Considering the distance to the Class I areas and the minor nature of air emissions from the Fermi 3 site, there is little likelihood that activities at the Fermi 3 site could adversely affect air quality and air-quality-related values (e.g., visibility or acid deposition) in any of the Class I areas. However, a new air operating permit would be required for the proposed Fermi 3 site.

Climate changes are under way in the United States and globally, and their extent is projected to continue to grow substantially over next several decades unless intense concerted measures are taken to reverse this trend. Climate-related changes include rising temperatures and sea levels; increased frequency and intensity of extreme weather (e.g., heavy downpours, floods, and droughts); earlier snowmelts and associated frequent wildfires; and reduced snow cover, glaciers, permafrost, and sea ice. Climate changes are closely linked to increases in GHGs (USGCRP 2009). GHGs are transparent to incoming short-wave radiation from the sun but opaque to outgoing long-wave (infrared) radiation from the earth’s surface. The net effect over time is a trapping of absorbed radiation and a tendency to warm the earth’s atmosphere, which together constitute the “greenhouse effect.” Since the onset of the Industrial Revolution in the mid 1700s, human activities have contributed to the production of GHGs, primarily through deforestation and the combustion of fossil fuels such as coal, oil, and natural gas. The principal GHGs that enter the atmosphere due to human activities include CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). However, some GHGs such as CO_2, CH_4, and N_2O are emitted to the atmosphere through natural processes as well.

2.9.3 Atmospheric Dispersion

Atmospheric dispersion factors (χ/Q values) are used to evaluate the potential consequences of accidental and routine releases at the Fermi 3 site. Onsite meteorological data from the 6-year period 2002–2007 were used by Detroit Edison to develop the atmospheric dispersion factors presented in the ER (Detroit Edison 2011a).

Detroit Edison provided the review team with hourly meteorological data recorded for the 6-year period from January 2002 through December 2007 (Detroit Edison 2011a). The staff viewed the meteorological site and instrumentation, reviewed the available information on the meteorological measurement program, and evaluated data collected by the program.

Visual inspection during a site audit conducted on February 2 to 6, 2009, indicated that the distance from the meteorological tower to the nearest obstruction (i.e., the wooded area located west of the tower) was less than 10 obstruction heights. This distance is not consistent with Revision1 of Regulatory Guide 1.23 (NRC 2007), which states wind sensors should be located over level, open terrain at a distance of at least 10 times the height of any nearby obstruction, if the height of the obstruction exceeds one-half of the height of the wind measurement. In a response to a series of Requests for Additional Information (RAIs) from the staff, Detroit Edison performed a review of wind data ranging from 1975 through 2003 and concluded that the nearby trees could be affecting the 10-m wind speed measurements during the period 2002–2007; that is, the potential exists for the wind measurements at the 10-m elevation to be lower than the actual wind speed at the 10-m elevation. Detroit Edison assessed the effect of lower measured wind speeds at the 10-m level on its short-term (accident) atmospheric dispersion estimates (χ/Q values) and concluded that it was conservative to determine these dispersion estimates by using the lower measured wind speed at the 10-m elevation. Detroit Edison also assessed the effects of lower measured wind speed at the 10-m level on its long-term (routine) atmospheric dispersion estimates and concluded that the higher (more conservative) χ/Q and deposition (D/Q) values from either the 1985–1989 period (when trees to the west of the meteorological tower were lower) or 2002–2007 period should be used in the routine release dose analysis.

2.9.3.1 Short-Term Dispersion Estimates

Acceptable methods of calculating short-term (accident) χ/Q values for design-basis accidents (DBAs) from meteorological data are set forth in Regulatory Guide 1.145, *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants* (NRC 1983). The short-term χ/Q values were estimated using the PAVAN computer program (Bander 1982), which implements the methodology of Regulatory Guide 1.145.

For environmental reviews, Section 7.1 of NUREG-1555 (NRC 2000) states that DBA consequences should be evaluated by assuming realistic meteorological conditions (i.e., 50-percentile χ/Q values) at the Exclusion Area Boundary (EAB) and outer boundary of the

Low Population Zone (LPZ). The EAB and LPZ at the Fermi 3 site are circles centered at the Reactor Building with radii of 2928 ft and 3 mi, respectively. For conservatism, Detroit Edison defined dose calculation EAB and LPZ distances of 2428 ft and 2.9 mi, respectively, which were derived by using the distance from the outer edge of a circle centered on the Reactor Building that encompassed all possible release points. A 6-year (2002–2007) composite joint frequency distribution of wind speed, wind direction, and atmospheric stability was used to evaluate a ground-level (10-m level) release. The PAVAN model estimates 50-percentile overall site (i.e., non-direction-specific) 1-hour χ/Q values (which are assumed to persist for 2 hours) at the dose calculation EAB and LPZ distances. Atmospheric dispersion factors for intermediate periods at the dose calculation LPZ distance were estimated by logarithmic interpolation between the 50-percentile 1-hour χ/Q value and the corresponding annual average χ/Q value. Table 2-65 presents χ/Q results at dose calculation EAB and LPZ distances as a function of averaging time.

Table 2-65. Atmospheric Dispersion Factors for Design Basis Accidents at Fermi 3 Site

	χ/Q (s/m^3) by Averaging Time					
Location	**0–2 Hours**	**0–8 Hours**	**8–24 Hours**	**1–4 Days**	**4–30 Days**	**Annual Average**
Dose Calculation EAB	5.675×10^{-5}	–[(a)]	–	–	–	4.09×10^{-5}
Dose Calculation LPZ	4.026×10^{-6}	3.057×10^{-6}	2.664×10^{-6}	1.977×10^{-6}	1.287×10^{-6}	7.62×10^{-7}

Source: Detroit Edison 2011a

(a) A dash denotes “not applicable.”

The review team independently ran the PAVAN model by using the 2002–2007 meteorological data and obtained results similar to those of Detroit Edison. The team also independently ran the PAVAN model by using a composite joint frequency distribution derived from the 1985–1989 Fermi 2 onsite meteorological database submitted by Detroit Edison in response to a staff RAI.

Detroit Edison stated that aerial photographs of the area surrounding the Fermi meteorological tower during this time period confirmed the absence of significant air flow obstructions to wind measurements at the 10-m elevation. The staff found that its short-term atmospheric dispersion estimates that resulted from using the 1985–1989 composite joint frequency distribution were less conservative than Detroit Edison’s values from using the 2002–2007 composite joint frequency distribution. The staff therefore concluded that Detroit Edison has identified a conservative set of 50-percentile EAB and LPZ short-term atmospheric dispersion factors by using the 2002–2007 composite joint frequency distribution.

2.9.3.2 Long-Term Dispersion Estimates

Long-term dispersion estimates for use in evaluation of the radiological impacts of normal operations were calculated by Detroit Edison by using the XOQDOQ computer code (Sagendorf et al. 1982). This code implements the guidance set forth in Regulatory Guide 1.111 (NRC 1977) for estimation of atmospheric dispersion (χ/Q) and deposition factors (D/Q) for use in evaluation of the consequences of normal reactor operations.

Three release pathways were considered: ground-level releases from the Radwaste Building stack and mixed-mode releases (part-time elevated and part-time ground-level) from the Reactor Building/Fuel Building stack and the Turbine Building stack. As it did with PAVAN, Detroit Edison initially used a 6-year (2002–2007) composite joint frequency distribution of wind speed, wind direction, and atmospheric stability to evaluate potential impacts from routine releases at the Fermi 3 site. Distances from the release point to the site boundary, nearest residence, garden, sheep, goat, meat cow, and milk cow for all sectors were considered. These distances were computed by using distances from the outer edge of a circle, centered on the Reactor Building, which encompassed all three release pathways. Dry deposition and site and regional topography were considered for the dispersion analysis.

The NRC staff independently ran the XOQDOQ model by using the 2002–2007 meteorological data and obtained results similar to those of the Detroit Edison. The staff also independently ran the XOQDOQ model by using a composite joint frequency distribution derived from the 1985–1989 Fermi 2 onsite meteorological database submitted in Detroit Edison's response to an RAI. The staff found that in several cases, its long-term atmospheric dispersion estimates that resulted from using the 1985–1989 composite joint frequency distribution were more conservative than Detroit Edison's values from using the 2002–2007 composite joint frequency distribution. Accordingly, the applicant eventually used the higher χ/Q and D/Q values from either the 1985–1989 period or the 2002–2007 period in its routine release dose analyses. The maximum annual average χ/Q values for three plume depletion scenarios (i.e., no decay and the default half-life decay periods of 2.26 and 8 days) and annual average relative D/Q values are presented in Table 2-66. The long-term atmospheric dispersion and deposition estimates presented in the Table 2-66 are the higher values from either the 1985–1989 period or the 2002–2007 period.

2.9.4 Meteorological Monitoring

There has been a meteorological monitoring program at the Fermi site since June 1975. The initial instrumentation was installed to provide the onsite meteorological information required for licensing of Fermi 2. The Fermi 2 meteorological monitoring program provides the basis for the Fermi 3 preapplication meteorological monitoring program. The instrumentation is described briefly in the Fermi 3 ER (Detroit Edison 2011a). However, the natural draft cooling tower for Fermi 3 would be built prior to the building of Fermi 3 in the approximate location of the current

Table 2-66. Maximum Annual Average Atmospheric Dispersion and Deposition Factors from Routine Releases at Selected Receptors

					χ/Q (s/m^{-3})[a]			
Receptor	**Downwind Sector**	**Distance (mi)**	**Emission Source Stack**	**Mode of Release**	**No Decay Undepleted**	**2.26-Day Decay Undepleted**	**8-Day Decay Depleted**	**D/Q (m^{-2})**
Site boundary	SSE	0.61	Radwaste Bldg.	Ground level	1.1×10^{-5}	1.1×10^{-5}	1.0×10^{-5}	–[b]
Site boundary	NW	0.48	Radwaste Bldg.	Ground level	–	–	–	4.9×10^{-8}
Site boundary	WNW	0.48	Reactor Bldg./ Fuel Bldg.	Mixed	–	–	–	1.7×10^{-8}
Site boundary	NW	0.48	Reactor Bldg. Fuel Bldg.	Mixed	8.7×10^{-7}	8.7×10^{-7}	8.1×10^{-7}	–
Site boundary	WNW	0.48	Turbine Bldg.	Mixed	–	–	–	1.5×10^{-8}
Site boundary	NW	0.48	Turbine Bldg.	Mixed	9.6×10^{-7}	9.6×10^{-7}	8.9×10^{-7}	1.5×10^{-8}
Residence	NW	059	Radwaste Bldg.	Ground level	7.0×10^{-6}	7.0×10^{-6}	6.3×10^{-6}	3.4×10^{-8}
Residence	NW	0.59	Reactor Bldg./ Fuel Bldg.	Mixed	6.8×10^{-7}	6.8×10^{-7}	6.3×10^{-7}	1.2×10^{-8}
Residence	NW	0.59	Turbine Bldg.	Mixed	7.2×10^{-7}	7.2×10^{-7}	6.6×10^{-7}	1.2×10^{-8}
Vegetable garden	NW	0.60	Radwaste Bldg.	Ground level	7.0×10^{-6}	7.0×10^{-6}	6.3×10^{-6}	3.4×10^{-8}
Vegetable garden	NW	0.60	Reactor Bldg./ Fuel Bldg.	Mixed	6.8×10^{-7}	6.8×10^{-7}	6.3×10^{-7}	1.2×10^{-8}
Vegetable garden	NW	0.60	Turbine Bldg.	Mixed	7.1×10^{-7}	7.1×10^{-7}	6.5×10^{-7}	1.1×10^{-8}
Sheep	NNE	4.41	Radwaste Bldg.	Ground level	1.9×10^{-7}	1.8×10^{-7}	1.4×10^{-7}	5.7×10^{-10}
Sheep	NNE	4.41	Reactor Bldg./ Fuel Bldg.	Mixed	4.8×10^{-8}	4.8×10^{-8}	4.3×10^{-8}	2.8×10^{-10}
Sheep	NNE	4.41	Turbine Bldg.	Mixed	4.3×10^{-8}	4.3×10^{-8}	3.8×10^{-8}	2.8×10^{-10}
Goat	WNW	2.21	Radwaste Bldg.	Ground level	3.0×10^{-7}	3.0×10^{-7}	2.4×10^{-7}	1.5×10^{-9}
Goat	WNW	2.21	Reactor Bldg./ Fuel Bldg.	Mixed	7.7×10^{-8}	7.7×10^{-8}	7.0×10^{-8}	8.4×10^{-10}
Goat	WNW	2.21	Turbine Bldg.	Mixed	6.9×10^{-8}	6.9×10^{-8}	6.1×10^{-8}	7.9×10^{-10}

Table 2-66. (contd)

Receptor	Downwind Sector	Distance (mi)	Emission Source Stack	Mode of Release	χ/Q (s/m^{-3})[a] No Decay Undepleted	χ/Q (s/m^{-3})[a] 2.26-Day Decay Undepleted	χ/Q (s/m^{-3})[a] 8-Day Decay Depleted	D/Q (m^{-2})
Meat cow	NNE	4.41	Radwaste Bldg.	Ground level	1.9×10^{-7}	1.8×10^{-7}	1.4×10^{-7}	–
Meat cow	NNW	2.95	Radwaste Bldg.	Ground level	–	1.8×10^{-7}	1.4×10^{-7}	6.4×10^{-10}
Meat cow	NNE	4.41	Reactor Bldg./ Fuel Bldg.	Mixed	4.8×10^{-8}	4.8×10^{-8}	4.3×10^{-8}	–
Meat cow	NNW	2.95	Reactor Bldg./ Fuel Bldg.	Mixed	4.8×10^{-8}	–	4.3×10^{-8}	3.4×10^{-10}
Meat cow	NNE	4.41	Turbine Bldg.	Mixed	4.3×10^{-8}	4.3×10^{-8}	3.8×10^{-8}	–
Meat cow	NNW	2.95	Turbine Bldg.	Mixed	4.3×10^{-8}	–	3.8×10^{-8}	3.3×10^{-10}
Milk cow	WNW	2.09	Radwaste Bldg.	Ground level	3.4×10^{-7}	3.3×10^{-7}	2.8×10^{-7}	1.7×10^{-9}
Milk cow	WNW	2.09	Reactor Bldg./ Fuel Bldg.	Mixed	8.4×10^{-8}	8.4×10^{-8}	7.7×10^{-8}	9.5×10^{-10}
Milk cow	WNW	2.09	Turbine Bldg.	Mixed	7.6×10^{-8}	7.5×10^{-8}	6.8×10^{-8}	8.9×10^{-10}

Source: Detroit Edison 2011a
(a) Atmospheric dispersion and deposition factors presented in the table are the higher values from either the 1985–1989 period or the 2002–2007 period.
(b) A dash denotes “not applicable.”

meteorological tower; thus, the meteorological tower would be relocated to the southeast corner of the Fermi site, which is located about 0.9 mi south-southeast of the current meteorological tower.

The current meteorological tower is located about 1113 ft west-southwest of the proposed location of the Fermi 3 containment building and has a height of 197 ft above plant grade. The primary instrumentation on the open-latticed tower consists of 10-m and 60-m wind speed and direction sensors; a 10-m vertical wind speed sensor; a 10-m air temperature sensor; a 10- to 60-m vertical air temperature difference system; a 10-m dew point sensor; and a 1.5-m (ground level) heated tipping bucket rain gauge. The sensor types, heights, and locations relative to buildings conform to *Proposed Revision 1 to Regulatory Guide 1.23, Meteorological Programs in Support of Nuclear Power Plants* (NRC 1980), except for the proximity of the trees to the meteorological tower, as discussed below. There are secondary sensors for all parameters except dew point and precipitation.

Data from the sensors are routed through signal conditioning equipment and then sent to digital data recorders. An analog backup record of the outputs is also maintained. Sensors, electronics, and recording equipment are calibrated on a six-month basis or more frequently if indicated by operating history. Visits are made to the tower twice a week for collection of data and visual inspection of the sensors and recording equipment.

Data from the primary and secondary sensors are fed independently to data acquisition equipment of the Integrated Plant Computer System (IPCS) in the Fermi 2 Control Room. The IPCS screens data for validity and quality, performs meteorological calculations, updates archives, and displays data. The data are available in five formats: instantaneous values, 1-minute blocked averages, 15-minute rolling averages, 15-minute blocked averages, and 1-hour blocked averages. Routine data summaries are generated for each day, calendar month, and calendar year. In addition, joint frequency distributions of wind speed and direction by Pasquill stability class are created from the 1-hour blocked averages.

The new meteorological tower will be located about 4750 ft south-southeast of the Fermi 3 reactor building; it will be a guyed open-latticed tower that is 197 ft high. The site is wooded, and trees will need to be trimmed to heights less than 16 ft out to a distance satisfying the 10 times building-height distance specified in Revision 1 of Regulatory Guide 1.23 (NRC 2007). A climate-controlled instrument shelter will be installed at the base of the tower. Primary and secondary sensors on the new tower will monitor the same parameters as do those on the existing Fermi 2 tower. The new tower will be operational for at least one and possibly two years prior to decommissioning of the existing tower.

The data recording process for the new program will mirror the process for the existing tower, except for the replacement of signal conditioning equipment that is no longer available.

Instrument calibration, service, and maintenance procedures currently in use will be continued for the new program. Data reduction, transmission, acquisition, and processing used in the preapplication program will continue to be used for the construction, preoperational, and operational programs.

Detroit Edison provided the review team with meteorological data for the 6-year period from January 2002 through December 2007 (Detroit Edison 2010c). The staff used these data to independently estimate atmospheric dispersion factors for the site. The staff viewed the meteorological site and instrumentation, reviewed the available information on the meteorological measurement program, and evaluated data collected by the program.

As stated previously, visual inspection during the site audit in February 2009 indicated that the distance from the meteorological tower to the nearest obstruction (i.e., the wooded area located west of the tower) is less than the guidance provided in the proposed Revision 1 of Regulatory Guide 1.23 (NRC 1980), which states that the height of natural or man-made obstructions to air movement should ideally be lower than the measuring level to a horizontal distance of ten times the measuring level height. Revision 1 of Regulatory Guide 1.23 (NRC 2007) provides further guidance regarding the tower's proximity to obstructions to air movement, stating that wind sensors should be located over level, open terrain at a distance of at least 10 times the height of any nearby obstruction, if the height of the obstruction exceeds one-half of the height of the wind measurement. In a response to a series of RAIs from the staff, Detroit Edison performed a review of wind data ranging from 1975 through 2003 and concluded that the nearby trees could be affecting the 10-m wind speed measurements during the period 2002–2007; that is, the potential exists for the wind measurements at the 10-m elevation to be lower than the actual wind speed at the 10-m elevation. Detroit Edison provided a copy of the 1985–1989 data from the Fermi 2 meteorological tower in a response to a staff RAI. The staff found that the 1985–1989 data had a lower frequency of (1) low wind speeds at the 10-m elevation and (2) extremely unstable (stability class A) conditions. Discrepancies in wind speed and stability class frequency distributions between the two databases create uncertainty as to which one of the two datasets (1985–1989 versus 2002–2007) is most representative of site conditions for the purposes of performing atmospheric dispersion analyses. Given the uncertainty in the data, the short-term dispersion estimates discussed in Section 2.9.3.1 and the long-term dispersion estimates discussed in Section 2.9.3.2 were evaluated by using both sets of data, and the more conservative (bounding) dispersion estimates were used. These evaluations are discussed in more detail in Section 2.9.3.

The staff found that the lower 10-m wind speed measurements associated with the 2002–2007 meteorological data produced higher (more conservative) atmospheric dispersion factors for the short-term dispersion estimates used to support the design-basis accident assessments discussed in Section 5.11.1. This is because the design-basis accident assessments are based on ground-level releases and the algorithms used to estimate dispersion for ground-level releases predict decreasing atmospheric dispersion factors (i.e., more favorable dispersion conditions) for higher wind speeds. Because the severe accident assessments discussed in Section 5.11.2 are also based on ground-level releases, the use of the 2002–2007 meteorological data should produce bounding atmospheric dispersion estimates for the severe accident assessments as well. Given that the severe accident consequence calculations using the 2002–2007 meteorological data are significantly below the relevant safety goals, any changes in results from the use of a new set of meteorological data would not be expected to change the final conclusions.

2.10 Nonradiological Health

This section describes aspects of the environment at the Fermi site and vicinity associated with nonradiological human health impacts. The section provides the basis for evaluating impacts to human health from building and operating the proposed Fermi 3. Building activities have the potential to affect public and occupational health, create impacts from noise, and impact the health of the public and workers from the transportation of construction materials and personnel to the Fermi site. Operation of Fermi 3 has the potential to impact the public and workers at the Fermi site from operation of the cooling system, noise generated by operations, electromagnetic fields (EMFs) generated by transmission systems, and transportation of operations and outage workers to and from the Fermi site.

2.10.1 Public and Occupational Health

This section describes public and occupational health at the Fermi site and vicinity associated with air quality, occupational injuries, and etiological agents (i.e., disease-causing microorganisms).

2.10.1.1 Air Quality

Public and occupational health can be affected by changes in air quality from activities that contribute to fugitive dust, vehicle and equipment exhaust emissions, and automobile exhaust from commuter traffic (NRC 1996). Air quality for Monroe County and the Fermi site vicinity is discussed in Section 2.9.2. As discussed in that section, this area is designated as an attainment area for all criteria pollutants except $PM_{2.5}$ (EPA 2010b). Monroe County, as well as six other southeastern counties including the Detroit metropolitan area, are designated as nonattainment areas for the $PM_{2.5}$ standard. In July 2011, the MDEQ submitted a request asking the EPA to redesignate southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011). In July 2012, the EPA issued a proposed rule designating southeastern Michigan as having attained both the 1997 annual $PM_{2.5}$ NAAQS and the 2006 24-hour $PM_{2.5}$ NAAQS, based on 2009–2011 ambient air monitoring data (77 FR 39659, dated July 5, 2012) but the final determination has yet to be made. Recently, Monroe County, as well as seven other southeastern counties in Michigan and Lucas and Wood Counties in Ohio, were redesignated from nonattainment areas to maintenance areas for the 8-hour ozone standard (EPA 2010b).

2.10.1.2 Occupational Injuries

In general, occupational health risks to workers and onsite personnel engaged in activities such as building, maintenance, testing, excavation, and modifications are expected to be dominated by occupational injuries (e.g., falls, electric shock, asphyxiation) or occupational illnesses. Historically, actual injury and fatality rates at nuclear reactor facilities have been lower than the average U.S. industrial rates, with a 2008 average incidence rate of 0.7 per 100 workers (USBLS 2009a). The annual incidence rates (the number of injuries and illnesses per 100 full-time workers) for the State of Michigan and the United States for electrical power generation, transmission, and distribution workers are 3.7 and 3.2, respectively (USBLS 2009a, b). These statistics are used to estimate the likely number of occupational injuries and illnesses for operation of the existing Fermi 2 and predict the likely number of cases for the proposed Fermi 3.

Occupational injury and fatality risks are reduced by strict adherence to NRC and Occupational Safety and Health Administration (OSHA) safety standards, practices, and procedures to minimize worker exposures. Appropriate State and local statutes also must be considered when assessing the occupational hazards and health risks associated with the Fermi site. Currently, the Fermi site has programs and personnel to promote safe work practices and respond to occupational injuries and illnesses for Fermi 2. Procedures are in place with the objective of providing personnel who work at the Fermi site with an effective means of preventing accidents due to unsafe conditions and unsafe acts. They include safe work practices to address: hearing protection; personal protective equipment; electrical safety; chemical handling, storage, and use; and other industrial hazards. Personnel are provided with training on safety procedures (Detroit Edison 2011a).

2.10.1.3 Etiological Agents

Public and occupational health can be compromised by activities at the Fermi site that encourage the growth of disease-causing microorganisms (etiological agents). Thermal discharges from Fermi 2 into the circulating water system and Lake Erie (Detroit Edison 2011a) have the potential to increase the growth of thermophilic microorganisms. The types of organisms of concern for public and occupational health include enteric pathogens (such as *Salmonella* spp., *Shigella* spp., and *Pseudomonas aeruginosa*), thermophilic fungi, bacteria (such as *Legionella* spp.), and free-living amoeba (such as *Naegleria fowleri* and *Acanthamoeba* spp.). These microorganisms could give rise to potentially serious human health concerns, particularly at high exposure levels.

Available data assembled by the Centers for Disease Control and Prevention (CDC) for the years 2000 to 2008 (CDC 2002, 2003, 2004, 2005, 2006, 2007, 2008a, 2009, 2010) were reviewed for outbreaks of *Legionellosis*, *Salmonellosis*, or *Shigellosis*. Outbreaks that occurred in Michigan from 2000 to 2008 were within the range of national trends in terms of cases per 100,000 population or total cases per year, and the outbreaks were associated with pools, spas, or lakes. According to the Detroit Edison correspondence with Michigan Department of Community Health (MDCH) in April 2008, it was noted that the department did not record any major waterborne disease outbreaks within Michigan in the last 10 years (Detroit Edison 2010a). The CDC Council of State Territorial Epidemiologists Naegleria Work Group, after reviewing the data from different sources, identified 121 fatal cases of primary amebic meningoencephalitis (a disease caused by *Naegleria fowleri*) in the United States from 1937 to 2007; most cases occurred in southern States during the months of July and September (CDC 2008b).

2.10.2 Noise

Any pressure variation that the human ear can detect is considered as sound, and noise is defined as unwanted sound. Sound is described in terms of amplitude (perceived as loudness) and frequency (perceived as pitch). Sound pressure levels are typically measured by using the logarithmic decibel (dB) scale. A-weighting (denoted by dBA) (Acoustical Society of America 1983, 1985) is widely used to account for human sensitivity to frequencies of sound (i.e., less sensitive to lower and higher frequencies and most sensitive to sounds between 1 and 5 kHz), which correlates well with a human's subjective reaction to sound. Several sound descriptors have been developed to account for variations of sound with time. L_{90} is the sound level exceeded 90 percent of the time, called the residual sound level (or background level) or fairly steady lower sound level on which discrete single sound events are superimposed. The equivalent continuous sound level (L_{eq}) is a sound level that, if it were continuous during a specific time period, would contain the same total energy as a time-varying sound. (Unless designated otherwise, all sound levels are instantaneous or L_{eq} values measured over short [e.g., 1-minute] time periods.) In addition, human responses to noise differ depending on the time of the day (e.g., higher sensitivity to noise during nighttime hours because of lower background noise levels). The day-night average sound level (L_{dn} or DNL) is a single dBA value calculated from hourly L_{eq} over a 24-hour period, with the addition of 10 dBA to sound levels from 10 p.m. to 7 a.m. to account for the greater sensitivity of most people to nighttime noise. Generally, a 3-dBA change over existing noise levels is considered to be a "just noticeable" difference, and a 10-dBA increase is subjectively perceived as a doubling in loudness and almost always causes an adverse community response.

There are no State or county noise regulations for Michigan or Monroe County. The only local noise regulation applicable to the Fermi site is Frenchtown Charter Township Noise Ordinance No. 184, which generally prohibits construction noise "unreasonably annoying to other persons, other than between the hours of 7:00 a.m. and 7:00 p.m." Section 5.3.4 of NUREG-1555

(NRC 2000) states that noise levels are acceptable if the L_{dn} outside a residence is less than 65 dBA, which is consistent with HUD regulations for exterior noise standards (24 CFR 51.101(a)(8)). For context, the sound level of a quiet office is 50 dBA, a normal conversation (at about 3 ft) is 60 dBA, busy traffic is 70 dBA, and a noisy office with machines or an average factory is 80 dBA (Tipler 1991).

An ambient sound level survey was conducted November 26–28, 2007, with Fermi 2 in operation, at seven noise monitoring locations (NMLs) that were selected on the basis of the locations of the nearest noise-sensitive receptors in various directions within 1.5 mi of the Fermi 2 site (Detroit Edison 2011a). Weather conditions were conducive to the measurement of sound levels except during a period with a high average wind speed (10 a.m. to 3 p.m. on November 27, 2007). The noises observed were typical of suburban locations and included local and distant traffic, trains, birds, and dogs barking. Some intermittent gunshot noise from the Fermi firing range was heard at three of the seven NMLs and noise from the Fermi cooling towers were faintly audible at five of the seven NMLs. At two NMLs, noise related to transmission lines was heard. Manned 10-minute L_{eq} measurements were collected at all seven NMLs, and continuous 24-hour noise monitoring was conducted at three NMLs. L_{dn} values were derived on the basis of 10-minute L_{eq} values measured every hour over a 24-hour period.

The highest and lowest sound levels occurred between 10 a.m. and 2 p.m. and between 11 p.m. and 3 a.m., respectively, which are typical times for suburban areas due to local and highway traffic volume. Measured L_{90} values at all NMLs ranged from 32 to 42 dBA, which are typical of suburban areas (Bishop and Schomer 1991). Measured L_{dn} values at three NMLs ranged from 54 to 63 dBA. Even including the period of higher wind speed, which could increase sound levels by several dB, the measured L_{dn} values were below 65 dBA.

2.10.3 Transportation

The Fermi site is accessible by roadways, water, and rail for transport of equipment, materials, and supplies. Construction, operations, and outage workers would access the site by roadway. No public transportation system to the site is available. The regional transportation system is described in Section 2.5.2.3. Existing roadways in the vicinity of the Fermi site are shown on Figure 2-16.

The main entrance to the site is at Enrico Fermi Drive, which connects to N. Dixie Highway after crossing Toll Road and Leroux Road. Enrico Fermi Drive is primarily a private drive for Fermi plant site ingress and egress. There is a signalized intersection at N. Dixie Highway, a four-way stop at Leroux Road, and a one-way stop (T-intersection) at Toll Road (Mannik & Smith Group, Inc. 2009). Most of the roads in the area, excluding I-75 and N. Dixie Highway, are low-volume roads, with an average daily traffic (ADT) volume of less than 5000 vehicles per day. These traffic volumes are generally below the capacity of the roads (Mannik & Smith Group, Inc. 2009).

Roadway accident data for roadway segments and intersections in southeast Michigan are maintained by the SEMCOG. In Monroe County, 3689 accidents occurred in 2009 (SEMCOG 2010c). Approximately 79 percent of the accidents involved property damage only. Approximately 20 percent involved injury, of which 2.5 percent were considered incapacitating injuries. Less than 1 percent of the accidents involved a fatality (SEMCOG 2010c).

Table 2-67 provides the intersections and roadway segments near the Fermi plant site that have a high frequency of accidents. Accident data are evaluated by local jurisdictions, SEMCOG, and the Michigan Department of Transportation to identify problem areas and to develop solutions – such as signalization, roadway improvements, public education, or enforcement – to reduce the number of accidents.

Table 2-67. High-Frequency Accident Intersections and Roadway Segments in Frenchtown Charter Township, 2005–2009

Roadway	Intersection or Roadway Segment	2008 Average Daily Traffic Volume	Total No. of Accidents (2005–2009)	Average Annual No. of Accidents (2005–2009)
Intersection				
N. Dixie Hwy.	Southbound I-75 ramp	NA[(a)]	25	5
Roadway Segments				
N. Dixie Hwy.	Sandy Creek Rd. to Nadeau Rd.	12,700	99	20
Southbound I-75	I-75/Nadeau Rd. ramp to southbound I-275 and northbound I-75 split	21,200	62	12
Nadeau Rd.	I-75/Nadeau Rd. ramp and N. Dixie Hwy.	5300	56	11
Northbound I-75	Sandy Creek Rd. to I-75/Nadeau Rd. ramp	16,800	55	11
Northbound I-75	I-75/N. Dixie Hwy. ramp to Sandy Creek Rd.	16,800	55	10
Southbound I-75	N. Dixie Hwy. to I-75/N. Dixie Hwy. ramp	16,800	48	10

Source: SEMCOG 2010d, e
(a) NA = Not applicable.

SEMCOG is the region's designated metropolitan planning organization for regional transportation planning. The latest version of SEMCOG's long-range RTP is *Direction 2035 Regional Transportation Plan for Southeast Michigan* (SEMCOG 2009d). Short-range (e.g., 2008 to 2011) priorities for funding by cities, county road commissions, transit agencies, and the Michigan Department of Transportation are included on a list called the TIP, which is regularly updated. Projects funded under the TIP are drawn from the long-range RTP. Included in the RTP are more than 1500 projects throughout southeast Michigan that address roadway congestion and safety, as well as bridges, bicycling/walking, public transit, and freight transport.

2.10.4 Electromagnetic Fields

Transmission lines generate both electric and magnetic fields, referred to collectively as EMFs. Public and worker health can be compromised by acute and chronic exposure to EMFs from power transmission systems, including switching stations (or substations) onsite and transmission lines connecting the plant to the regional electrical distribution grid. Transmission lines operate at a frequency of 60 Hz (60 cycles per second), which is considered to be extremely low frequency (ELF). In comparison, television transmitters have frequencies of 55 to 890 MHz, and microwaves have frequencies of 1000 MHz and greater (NRC 1996).

Electric shock resulting from direct access to energized conductors or from induced charges in metallic structures is an example of an acute effect from EMFs associated with transmission lines (NRC 1996). Objects near transmission lines can become electrically charged by close proximity to the electric field of the line. An induced current can be generated in such cases; it can flow from the line through the object into the ground. Capacitive charges can occur in objects that are in the electric field of a line, storing the electric charge while they are electrically isolated from the ground. A person standing on the ground can receive an electric shock by coming into contact with such an object because of the sudden discharge of the capacitive charge through the person’s body to the ground. Such acute effects are controlled and minimized by conformance with National Electrical Safety Code (NESC) criteria.

Onsite transmission lines that would connect Fermi 3 to the proposed new Fermi 3 switchyard would be constructed and owned by Detroit Edison (Detroit Edison 2011a). Transmission lines that serve Fermi 3 offsite would be created and operated by ITC*Transmission* (Detroit Edison 2011a), which also operates and manages the transmission system of existing Fermi 2 at the Fermi site (Detroit Edison 2011a). The existing ITC*Transmission* system meets NESC criteria for induced currents (Detroit Edison 2011a). Detroit Edison stated that all transmission lines would comply with applicable regulatory standards and that the design and construction of the proposed Fermi 3 substation and transmission circuits would comply with NESC provisions (Detroit Edison 2011a). ITC*Transmission* would ensure that the electric field strength under the new transmission lines would conform to NESC guidelines (maximum of less than 7.5 kV/m within the ROW and maximum of less than 2.6 kV/m at the edge of the ROW) (Detroit Edison 2011a).

Long-term or chronic exposure to power transmission lines has been studied for a number of years. These health effects were evaluated in NUREG 1437 (NRC 1996) and are discussed in the ER (Detroit Edison 2011a). NUREG 1437 reviewed human health and EMFs and concluded:

The chronic effects of electromagnetic fields (EMFs) associated with nuclear plants and associated transmission lines are uncertain. Studies of 60-Hz EMFs have not uncovered consistent evidence linking harmful effects with field exposures. EMFs are unlike other agents that have a toxic effect (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be forced and longer-term effects, if real, are subtle. Because the state of the science is currently inadequate, no generic conclusion on human health impacts is possible.

2.11 Radiological Environment

A REMP has been conducted around the Fermi site since 1978. This program measures radiation and radioactive materials from all sources, including the existing units at the Fermi site. The REMP includes the following pathways: direct radiation; atmospheric, aquatic, and terrestrial environments; groundwater; and surface water. A preoperational surveillance program was established to determine baseline conditions and quantify the radioactivity, and its variability, in the area prior to the operation of Fermi 2. After routine operation of Fermi 2 started in 1985, the monitoring program continued to assess the radiological impacts to workers, the public, and the environment.

The results of this monitoring are documented in annual reports entitled *Fermi 2 – [Year] Radioactive Effluent Release and Radiological Environmental Operating Report for the Period January 1, [Year], through December 31, [Year]*. The NRC staff reviewed these annual reports for calendar years 2004 through 2010 (Detroit Edison 2005, 2006, 2007, 2008b, 2009g, 2010d, 2011b). These reports show that exposures or concentrations in air, water, and vegetation are comparable to, if not statistically indiscernible from, preoperational levels, with the exception of tritium, as described below.

NRC's Lessons Learned Task Force Report (NRC 2006) made recommendations regarding potential unmonitored groundwater contamination at U.S. nuclear plants. In response to that report, the Nuclear Energy Institute (NEI) developed the Ground Water Protection Initiative (NEI 2007). Detroit Edison implemented the initiative and began additional groundwater sampling in various locations that may be a source of groundwater contamination around the Fermi site in the fourth quarter of 2007. The changes to the groundwater monitoring program based on the NEI initiative and results of this additional groundwater sampling are summarized in Appendix B of the Radioactive Effluent Release Report for 2008 (Detroit Edison 2009g). The sporadic and variable trace quantities of tritium (maximum concentration observed was 1950 pCi/L) were detected in the few shallow groundwater wells downwind from the Fermi 2 stack. Detroit Edison attributed this to the recapture of tritium in precipitation from the plant's gaseous effluent (Detroit Edison 2009a). The detected tritium concentrations were far below the EPA drinking water standard of 20,000 pCi/L (41 FR 28402).

2.12 Related Federal Projects and Consultations

The staff reviewed the possibility that activities of other Federal agencies might affect the issuance of a COL to Detroit Edison for the proposed Fermi 3. Any such activities could result in cumulative environmental impacts and the possible need for another Federal agency to become a cooperating agency for preparation of the EIS (10 CFR 51.10(b)(2)).

Fermi 3 would be sited on existing land owned by Detroit Edison. Approximately 656 ac of undeveloped lands on the Fermi site are managed as part of the DRIWR. Detroit Edison has had a cooperative agreement with FWS since 2003 that allows the FWS to assist in managing the refuge areas while Detroit Edison retains ownership and control of the entire site. Under the agreement, Detroit Edison and the FWS may end the agreement either in whole or in part, meaning that lands currently included as part of the DRIWR could be removed from the refuge. While approximately 2 ac would be removed during the construction of Fermi 3, Detroit Edison has stated that it intends to return all undisturbed wetlands to the DRIWR after construction of Fermi 3 is complete (Detroit Edison 2011a).

The 345-kV transmission system and associated corridors are currently owned and operated by ITC*Transmission*. The majority of the length of the three new transmission lines required for Fermi 3 would be located within existing transmission corridors. Although construction of the new transmission lines may require the acquisition of new ROWs (Detroit Edison 2011a), it is not expected that these activities will require any Federal action.

There is very little Federal land within 50 mi of the site. The majority of a 480-ac former U.S. Department of Defense (DOD) property about 4 mi northwest of the Fermi site was sold to a private owner in the mid-1980s. A portion of the site is currently owned by the State of Michigan and is used by the Michigan Army National Guard (Detroit Edison 2011a). No plans for future use of this site have been specified by the DOD. The River Raisin National Battlefield Park, located in Monroe County 7 mi to the southwest of Fermi site, is under Federal control. The Cedar Point National Wildlife Refuge and the Ottawa National Wildlife Refuge, both located to the east of Toledo, Ohio, are approximately 25 mi and 30 mi from the site, respectively (National Atlas.gov 2010). There are no wilderness areas or rivers included in the national wild and scenic rivers system within 50 mi of the site, and the closest Native American Tribal reservations are more than 50 mi from the site (National Atlas.gov 2010).

After reviewing the Federal activities in the region surrounding the Fermi site, particularly with regard to their potential of having impacts on wetlands associated with the construction and operation of the Fermi 3 intake and discharge structures and other related facilities that are not under NRC's jurisdictional authority, the staff determined that it would be advantageous for USACE to become a cooperating agency for preparation of the EIS.

The NRC is required under Section 102(2)(C) of NEPA to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in the subject matter of the EIS. During the course of preparing this EIS, the NRC consulted with the USACE, FWS, EPA, and the NOAA Fisheries Service. Related correspondence is included in Appendix F.

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3.0 Site Layout and Plant Description

The proposed Enrico Fermi Unit 3 (Fermi 3) would be located in Monroe County in rural southeastern Michigan. Detroit Edison Company (Detroit Edison) applied to the U.S. Nuclear Regulatory Commission (NRC) for a combined license (COL) for Fermi 3. The proposed new unit would be situated wholly within the existing Enrico Fermi Atomic Power Plant (Fermi) site and adjacent to the existing Enrico Fermi Unit 2 (Fermi 2). Enrico Fermi Unit 1 (Fermi 1), also located on the Fermi site, is in the process of being decommissioned. The Fermi site is located on the western shore of Lake Erie approximately 30 mi southwest of Detroit, Michigan, and 7 mi from the United States–Canada international border.

In addition to the COL application, Detroit Edison must obtain a Department of Army permit from the U.S. Army Corps of Engineers (USACE) to conduct activities that affect waters of the United States, including wetlands. As a first step, Detroit Edison initiated coordination with USACE through preapplication and jurisdictional determination meetings. Then, on June 17, 2011, Detroit Edison submitted a Joint Permit Application (Detroit Edison 2011a) to the Michigan Department of Environmental Quality (MDEQ) for activities associated with the proposed Fermi 3 project. On September 9, 2011, Detroit Edison subsequently submitted a permit application to the USACE.

This chapter describes the key characteristics of the proposed plant that must be understood to assess the environmental impacts of the proposed action; the characteristics are drawn primarily from Detroit Edison's Environmental Report (ER) (Detroit Edison 2011b), its Final Safety Analysis Report (FSAR) (Detroit Edison 2012), and supplemental information provided by Detroit Edison in response to requests for additional information (Detroit Edison 2011d).

Whereas Chapter 2 of this environmental impact statement (EIS) describes the existing environment at the proposed site and its vicinity, this chapter describes the physical layout of the proposed plant. This chapter also describes the physical activities involved in building and operating the plant and associated transmission lines. The environmental impacts of constructing and operating the plant are discussed in Chapters 4 and 5, respectively. This chapter is divided into four sections: Section 3.1 describes the external appearance and layout of the proposed plant; Section 3.2 describes the major plant structures and distinguishes structures that interface with the environment from those that do not interface with the environment, or that interface with the environment temporarily; Section 3.3 describes the activities involved in building or installing each of the plant structures; and Section 3.4 describes the operational activities of the plant that interface with the environment. Full citations for references are listed in Section 3.5.

3.1 External Appearance and Plant Layout

The 1260-acre (ac) Fermi site is located on the western shore of Lake Erie at a grade of approximately 581.8 ft North American Vertical Datum of 1988 (NAVD 88). The grade at the power block area where seismic Category I structures[(a)] are located is approximately 589.3 ft NAVD 88. The site contains one operating boiling water reactor (BWR), Fermi 2, and one fast breeder reactor, Fermi 1, and their associated facilities. Fermi 1 is no longer operational, and the unit has been defueled in preparation for dismantling. Full decommissioning of Fermi 1 is expected to be complete prior to initiation of Fermi 3 construction. Fermi 2 currently is in operation and, if its license is renewed, the unit will continue to operate when Fermi 3 comes online in 2021.

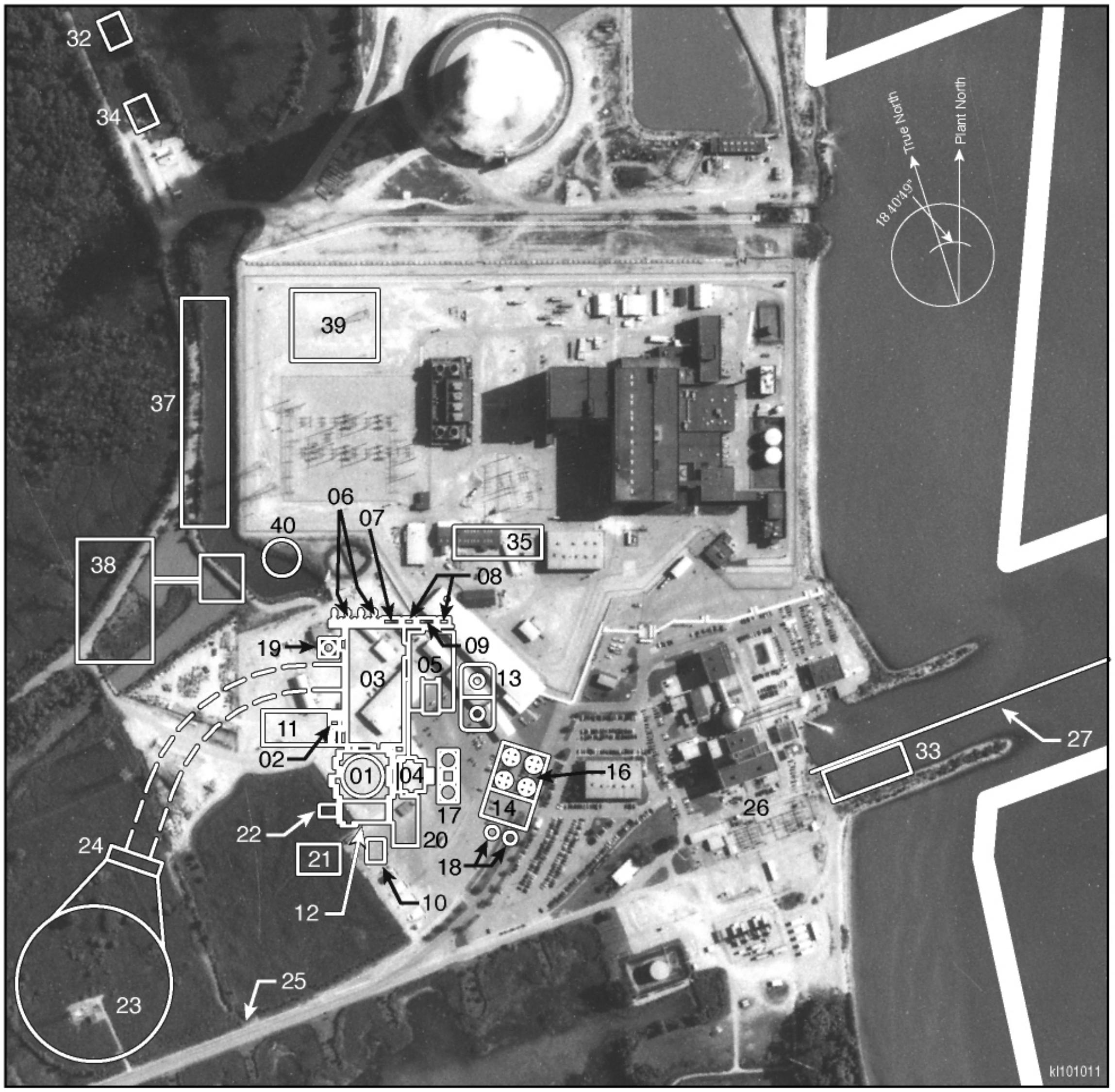
Figures 3-1 and 3-2 show aerial views of the Fermi site layout, including the location of existing and proposed buildings, and the site property boundary. Fermi 1 is shown in these figures, although, as discussed above, Detroit Edison plans to remove this unit as part of a separate action prior to construction of Fermi 3. Figure 3-3 is an aerial view of the current configuration of the Fermi site; Figure 3-4 is an aerial view with the proposed site layout and Fermi 3 structures superimposed.

Fermi 2 uses two 400-ft-tall concrete natural draft cooling towers for heat dissipation (Figure 3-3). Each tower is approximately 450 ft in diameter at the base. As can be seen in Figure 3-3, the natural draft cooling towers for Fermi 2 are the dominant visible structures on the site and are visible from outside the site property boundaries.

The normal power heat sink (NPHS) for Fermi 3 would be provided by an additional concrete natural draft cooling tower. Water from Lake Erie would be used for makeup water for the Circulating Water System (CIRC), the Plant Service Water System (PSWS), and the Fire Protection System (FPS). The intake for Fermi 3 would be adjacent to the existing intake for Fermi 2, which is located between the two groins that project into Lake Erie (Figure 3-1). An offshore underwater discharge pipe would serve as the outfall from the Fermi 3 CIRC and PSWS. The proposed natural draft cooling tower for Fermi 3 would be located to the southwest of the two existing Fermi 2 cooling towers (Figure 3-4).

Fermi 3 would share some facilities with Fermi 2, including office buildings, potable water supply, and sanitary discharge structures (Detroit Edison 2011b). Paved onsite roadways would connect Fermi 3 to the remainder of the Fermi site, providing routine and nonroutine access.

(a) The seismic Category I structures in the GE-Hitachi Nuclear Energy Americas, LLC, Economic Simplified Boiling Water Reactor (GEH ESBWR) design for Fermi 3 include the Concrete Containment, Reactor Building, Control Building, Fuel Building, and Firewater Service Complex.



01 Reactor Building
02 Auxiliary Boiler
03 Turbine Building
04 Control Room
05 Electrical Bldg/Tech Support Center
06 Main Transformers
07 Unit Auxiliary Transformer
08 Reserve Auxiliary Transformer
09 Spare Transformer
10 ADB
11 Radwaste Building
12 Fuel Building
13 Diesel Fuel Oil Storage Tank
14 Water Treatment/Service Water Bldg
16 Service Water Cooling Tower
17 Fire Water Tank and Pumps
18 Water Storage Tanks
19 Condensate Storage Tank
20 Service Building/Operation Support Center
21 Hot Machine Shop and Storage
22 Wash Down Bays
23 NPHS Cooling Tower
24 Pumphouse
25 Security Boundary
26 Station Water Intake
27 CIRC Water Outfall
32 EF2/EF3 Hazardous Waste Warehouse
33 Barge Slip
34 RAD Material Warehouse
35 EF2/EF3 Maintenance Shops
37 EF2/EF3 Common Warehouse
38 Parking Garage and EF2 Shops
39 Fermi 2 ISFSI
40 PAP/VIB

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Figure 3-1. Fermi Site Layout Showing Existing and Proposed Facilities: Power Block and Adjacent Facilities (Detroit Edison 2011b)

Figure 3-2. Fermi Site Layout Showing Existing and Proposed Facilities: Ancillary Facilities (Detroit Edison 2011b)

Figure 3-3. Aerial View of the Existing Fermi Site Looking North (Detroit Edison 2011b)

Some of the existing infrastructure on the Fermi site would be modified to integrate Fermi 3 with Fermi 2. None of the Fermi 2 structures or facilities that directly support power generation at that unit would be shared. The electrical switchyard for Fermi 3 would be separate from the existing Fermi 2 switchyard, but the transmission lines from the two switchyards would share common transmission towers as the lines leave the site. The existing Fermi 2 protected area would be expanded to include Fermi 3. Existing administrative buildings, warehouses, and other minor support facilities would be used, expanded, or replaced, based on economic considerations and operational requirements.

As shown in Figures 3-1 and 3-2, Fermi 3 would be located in close proximity to Fermi 2. Major proposed plant structures would be located, for the most part, on areas that were disturbed during construction and operation of Fermi 1 and Fermi 2. In designing the site layout for Fermi 3, Detroit Edison attempted to minimize offsite visual intrusion and other impacts by locating major plant structures away from the Lake Erie shoreline, placing new structures in relatively close proximity to Fermi 2 facilities, and placing the intake structure in the existing developed section of shoreline (Detroit Edison 2011b).

Figure 3-4. Aerial View of the Fermi Site Looking North with Proposed Fermi 3 Structures Superimposed (Detroit Edison 2011b)

Land use within 5 mi of the Fermi site is primarily for agriculture, although there are several small beach communities (Estral Beach, Stony Point, Detroit Beach, and Woodland Beach) and the small Newport-Oldport residential area to the northwest. The nearest of these communities is Stony Point, located about 2 mi south of the Fermi site. Visual impacts from the site are limited to the closest residents and traffic on the Dixie Highway and other nearby roads. The site is not visible from any nearby recreational areas or other areas that have frequent visitor use.

Figure 3-5 provides a view of the Fermi site from outside the site boundary. As can be seen, the most obviously visible existing structures are the natural draft cooling towers. Although vegetation blocks public view of many of the power plant structures, the cooling towers and their plumes are prominently visible from all directions. Because Fermi 3 would be located in the same general vicinity as Fermi 2, the same vegetation would block views of some Fermi 3

Figure 3-5. View of the Fermi Site from Post Road Looking Southeast: Existing Fermi 2 Cooling Towers Are Shown on the Left; the Proposed Fermi 3 Cooling Tower Is on the Right (Detroit Edison 2011b)

facilities. However, similar to Fermi 2, the proposed natural draft cooling tower and its plume would be visible from offsite (Figure 3-5), including by recreational boaters on Lake Erie. The height of the proposed Fermi 3 natural draft cooling tower would be approximately 600 ft.

3.2 Plant Structures

This section describes each of the major plant structures and is divided into three categories: the reactor power system, structures that would have an interface with the environment during operation, and the balance of plant structures. All of these structures are relevant in the discussion of building impacts in Chapter 4. Only those structures that interface with the environment are relevant to the operational impacts discussed in Chapter 5.

3.2.1 Reactor Power Conversion System

Detroit Edison has proposed the construction and operation of an Economic Simplified Boiling Water Reactor (ESBWR) designed by GE-Hitachi Nuclear Energy Americas, LLC (GEH), at the Fermi site. GEH submitted the Standard Design Certification Application for the ESBWR to the NRC on August 24, 2005, and it was accepted for review on December 1, 2005 (Detroit Edison 2011b). The NRC staff is performing a detailed review of that certification application.

The ESBWR design is a single-cycle, natural circulation BWR with passive safety features. The reactor is rated at 4500 megawatt thermal (MW(t)), with a design gross electrical output of approximately 1605 megawatt electrical (MW(e)) and a net output of 1535 MW(e) (Detroit Edison 2011b). Figure 3-6 provides an illustration of the reactor power conversion system. Steam generated in the reactor vessel drives high-pressure and low-pressure turbines to create electricity. Steam that has passed through the low-pressure turbines is condensed and pumped back to the reactor vessel as water. The heat rejected from the plant to the environment, principally the atmosphere, is calculated to be 9.883×10^9 British thermal units per hour (Btu/hr) (Detroit Edison 2011b).

3.2.2 Structures with Major Plant-Environment Interfaces

For assessment purposes, the review team divided the plant structures into two primary groups: (1) those that interface with the environment and (2) those that are internal to the reactor and associated facilities but without environmental intakes or releases. Examples of environmental interfaces are withdrawal of water from the environment at the intake structures, release of water to the environment at the discharge structure, and release of excess heat to the atmosphere. Structures with environmental interfaces are those that the review team considers in its environmental review of the operational impacts of the facility in Chapter 5. The processes that occur within the plant itself and that do not affect the environment are not relevant to a National Environmental Policy Act (NEPA) review and are not discussed further in this EIS. However, such internal processes are considered in the ESBWR design certification documentation and in NRC plant safety reviews. This section discusses the plant structures that would interface with the environment. The remaining structures are discussed in Section 3.2.3, inasmuch as they may alter the landscape and are relevant in the review team's consideration of construction impacts, which are discussed in Chapter 4 of this EIS.

3.2.2.1 Landscape and Stormwater Drainage

Landscapes and stormwater drainage systems affect the rates and routing of rainfall-generated runoff and affect the infiltration of rainfall into the groundwater as recharge. Impervious areas eliminate recharge to aquifers beneath the site. Pervious areas managed to reduce runoff and maintained free of vegetation will experience considerably higher recharge rates than adjacent areas with local vegetation. Landscaping at the Fermi site would be managed to reduce runoff and erosion. The Fermi 3 power block area would be mostly impervious. The proposed Fermi 3 stormwater drainage patterns are discussed in the FSAR (Detroit Edison 2012), because the stormwater drainage system performs a safety-related function by preventing flooding of the safety structures. The grading of the surface topography would direct water away from the safety structures and into drop inlets, and stormwater runoff would be routed through storm drains to the North Lagoon. If the storm drains were blocked, stormwater would drain off the power block area in all directions and drain to the North Lagoon, the South Lagoon, or directly to Lake Erie (Detroit Edison 2012). The land surrounding the Fermi 3 power block

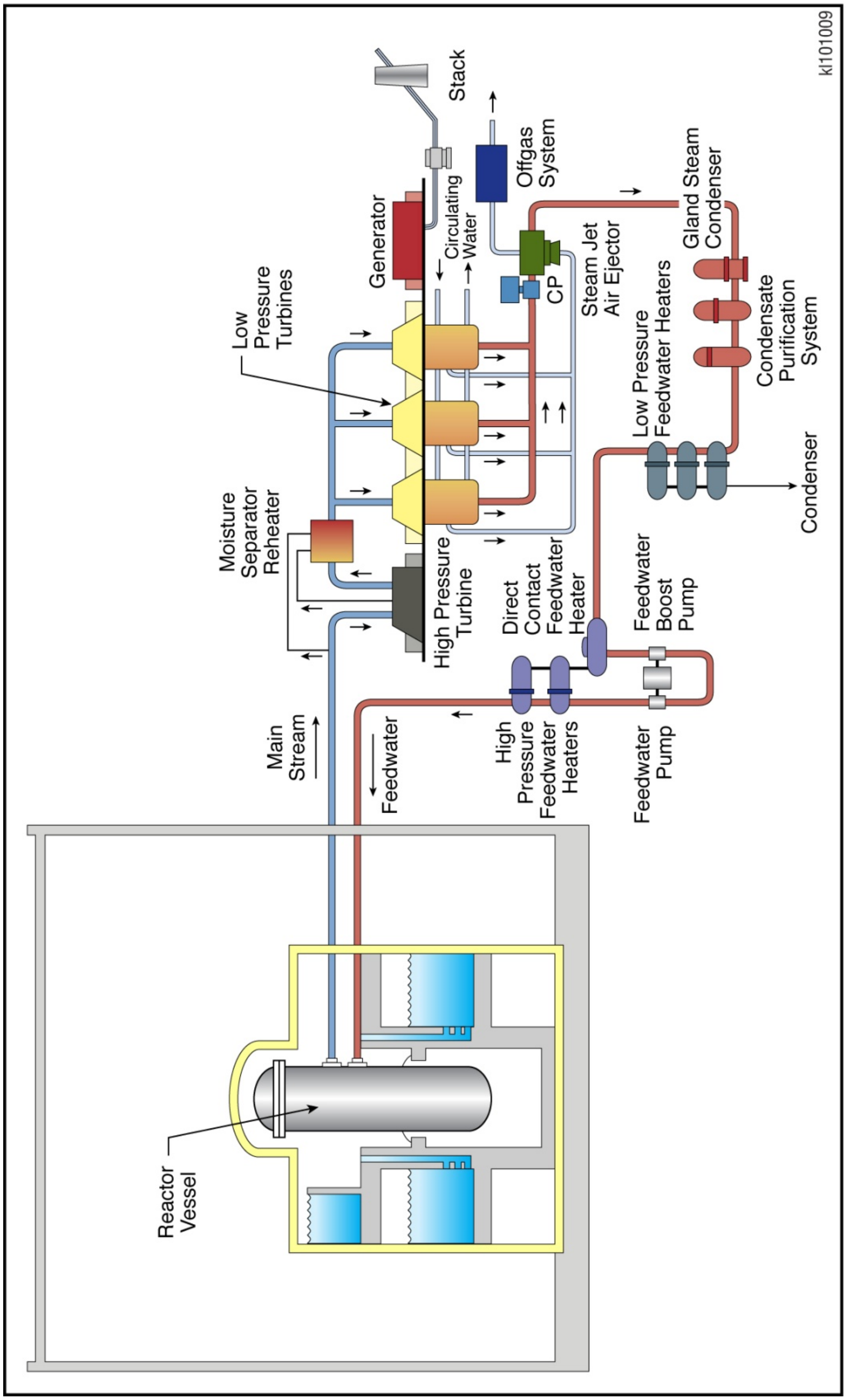

Figure 3-6. Simplified Flow Diagram of the ESBWR Power Conversion System (Detroit Edison 2011b)

would be gently sloped away to allow drainage of stormwater runoff toward the North Lagoon, the South Lagoon, or Lake Erie.

3.2.2.2 Cooling System

The following sections provide detailed descriptions of the components of the cooling water systems for the proposed Fermi 3. These descriptions were determined from the *Economic Simplified Boiling Water Reactor Design Control Document* (GEH 2010) and include site-specific characteristics as described in the Fermi 3 ER (Detroit Edison 2011b).

The cooling system would represent the largest interface between the plant and the environment. Makeup water would be provided to Fermi 3 through the intake structure on Lake Erie. A portion of this makeup water would be returned to Lake Erie as blowdown via the discharge pipe. The remaining portion of this water would be lost to the atmosphere through evaporation or drift from the natural draft cooling tower. These three components represent interfaces between the plant and the environment, and are described next.

Cooling-Water Intake Structures

Water would be withdrawn from Lake Erie for use in Fermi 3 systems through an intake bay. The intake from Lake Erie for Fermi 3 would be located near the intake for Fermi 2, between the two rock groins that extend into Lake Erie. The proposed location of the intake for Fermi 3 is shown in Figure 3-1. Section 3.4.2.1 of the ER (Detroit Edison 2011b) describes the intake system for Fermi 3 in detail.

The intake structure would provide water for the nonsafety-related cooling for the Station Water System (SWS), which would supply makeup water for both the CIRC and the PSWS. The cooling water in the CIRC provides heat dissipation from the main condensers to the normal plant heat sink (NPHS). The NPHS for Fermi 3 would be a natural draft cooling tower. The cooling water in the PSWS would provide head dissipation from the heat exchangers of both the Turbine Component Cooling Water System and the Reactor Component Cooling Water System. The heat from the PSWS would be dissipated to the NPHS and/or the Auxiliary Heat Sink (AHS). The AHS would consist of two mechanical draft cooling towers and would be housed adjacent to the Water Treatment/Service Water on the southeast side of the Fermi 3 power block. The SWS would supply makeup water to the NPHS and AHS cooling tower basins and would consist of two subsystems: the Plant Cooling Tower Makeup System (PCTMS) and the Pretreated Water Supply System (PWSS). The PCTMS would provide makeup water from Lake Erie for evaporation, drift, and blowdown losses. The PWSS would provide water for the FPS and would serve as an alternate to the PCTMS for supplying PSWS makeup water to the cooling towers. The FPS would consist of onsite storage tanks and would be available for fire protection needs for Fermi 3.

At the interface with Lake Erie, there would be a pump house equipped with trash racks to screen out large objects from the pump system and three traveling screens with a 3/8-in. mesh arranged side by side to further screen out litter from the water entering the pump house. Trash collected on the rack and screens would then be disposed of. After water entered the pump house, it would be treated using sodium hypochlorite, a biocide/algaecide, before it entered the pumps at the location of the biocide injection diffuser. There would be two groups of pumps in the intake bay: three PCTMS pumps, each equipped to pump at 50 percent capacity for makeup water to the cooling tower basins, and two PWSS pumps, each designed to pump at 100 percent capacity for makeup water to the AHS and FPS during shutdown.[a]

The maximum flow rate at the intake would be 34,264 gallons per minute (gpm) (Figure 3-7, Table 3-1; Detroit Edison 2011b). Detroit Edison (2011b) stated that the water velocity at the intake would be no more than 0.5 feet per second (ft/s) under all operating conditions to minimize the number of fish being impinged onto the screens.

The cooling water intake for Fermi 3 would include a trash rack, traveling screens, and a fish return system. The trash rack, equipped with a trash rake, would be positioned at the inlet to the pump house structure to capture larger debris; trash collected from the trash racks would be disposed of. Three dual-flow traveling screens (mesh size 3/8 in.) would be arranged side-by-side behind the trash rack to further prevent debris from entering the pump house and to collect aquatic organisms large enough to be caught on the screens. Aquatic organisms would first be washed from the traveling screens using a low-pressure water spray followed by a high-pressure wash to remove remaining debris. Strainers would be in place to collect the organisms washed from the screens, and a strainer backwash would then be used to direct those organisms back to Lake Erie via a fish return system in a manner compatible with the limits of the applicable NPDES permit (Detroit Edison 2011b). With such a system in operation, most impinged fish would be returned alive to Lake Erie. The point of return for the fish return system would be outside the zone of influence of the intake bay (Detroit Edison 2011b).

The elevation of the bottom of the planned intake bay is 559.0 ft NAVD 88, and the location of pump suction would be at 553.0 ft NAVD 88 inside the pump house. The record low water elevation of Lake Erie at the Fermi site (National Oceanic and Atmospheric Administration [NOAA] gage 9063090) is 563.9 ft NAVD 88. Low water levels in Lake Erie should not affect pump suction because the suction would be located at over 10 ft below the lowest recorded water level (Detroit Edison 2011b).

(a) Shutdown is defined as a decrease in the rate of fission (and heat/energy production) in a reactor (usually by the insertion of control rods into the core).

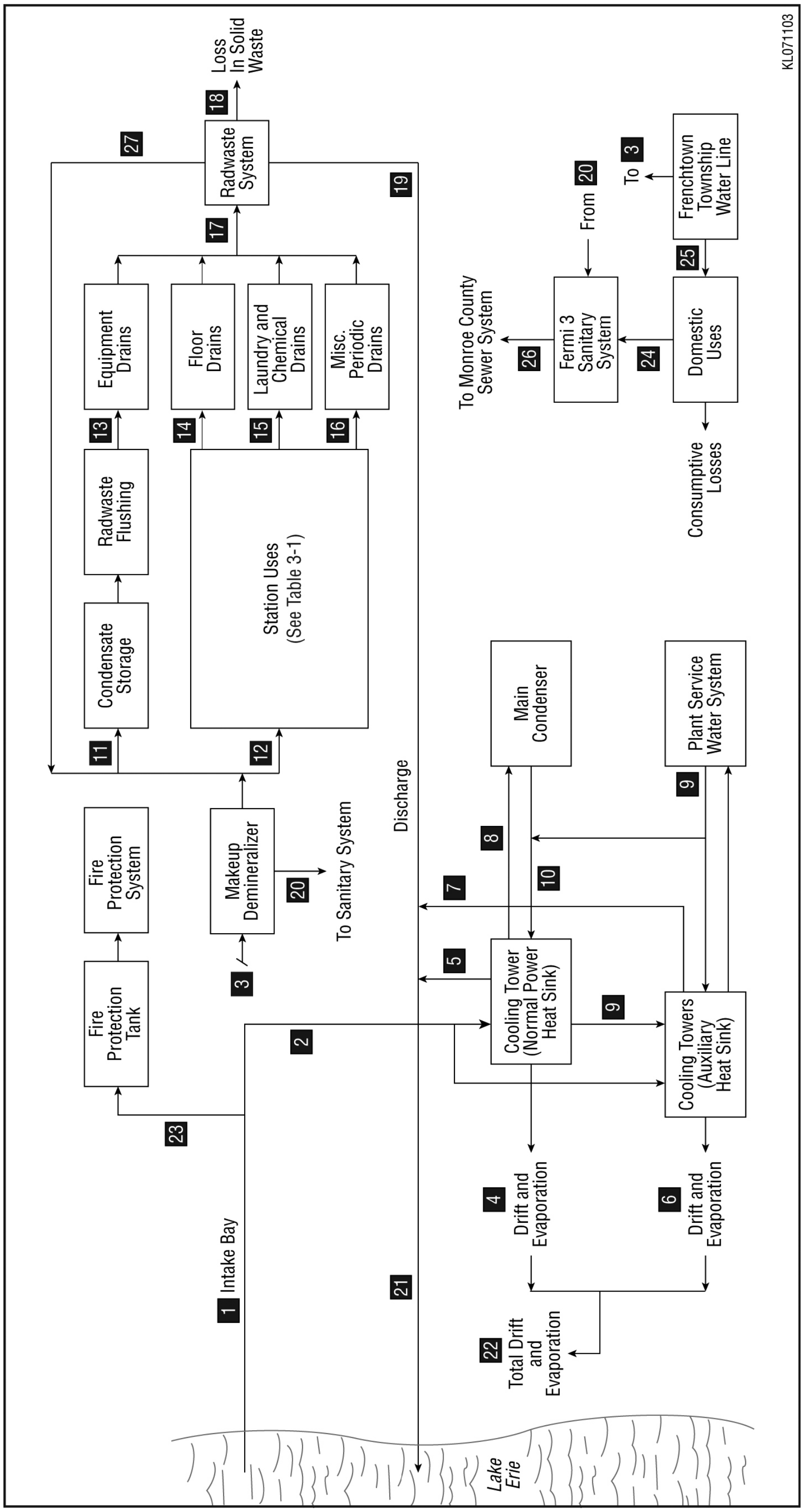

Figure 3-7. Water Use Flow Diagram for Fermi 3 Operations (flow values that correspond to the numbers shown in the figure are provided in Table 3-1) (Detroit Edison 2011b)

Table 3-1. Water Use during Fermi 3 Operations

Flow[a]	Description	Value (gpm) Maximum Normal Power Operation[b]	Value (gpm) Minimum Normal Power Operation[c]	Value (gpm) Average Normal Power Operation[d]	Value (gpm) Average Shutdown Operation
1	Total makeup water intake	34,264	23,780	28,993	1,166
2	Cooling tower makeup water	34,234	23,750	28,963	1,136
3	Demineralizer makeup water	160	160	160	639
4	Normal power heat sink drift and evaporation	17,124	11,882	14,488	0
5	Normal power heat sink discharge (blowdown)	17,110	11,868	14,474	0
6	Auxiliary heat sink drift and evaporation	0	0	0	569
7	Auxiliary heat sink discharge	0	0	0	567
8	Inflow to main condenser	684,000	684,000	684,000	0
9	Total plant service water system flow	40,000	40,000	40,000	40,000
10	Total circulating water system flow	724,000	724,000	724,000	0
11	Inflow to condensate storage	58	58	58	232
12	Inflow to station uses[e]	49	49	49	196
13	Outflow to equipment drains	58	58	58	232
14	Outflow to floor drains	8	8	8	30
15	Outflow to laundry and chemical drains	24	24	24	95
16	Outflow to miscellaneous periodic drains	18	18	18	71
17	Inflow to the radwaste system	107	107	107	428
18	Solid radwaste	2	2	2	9
19	Liquid radwaste discharge[f]	105 (0)	105 (0)	105 (0)	419 (0)
20	Makeup demineralizer blowdown	53	53	53	211
21	Total discharge	17,215	11,973	14,579	987
22	Total drift and evaporation	17,124	11,882	14,488	569
23	Fire protection uses	30	30	30	30
24	Potable water discharge to sewer	200	35	35	47
25	Domestic uses	200	35	35	47
26	Total discharge to Monroe County sewer system	253	88	88	258
27	Liquid radwaste recycled[e]	0 (105)	0 (105)	0 (105)	0 (419)

Source: Detroit Edison 2011b

(a) Numbers correspond to flow arrows shown in Figure 3-7.

(b) Summer months (design/maximum).

(c) Winter months (January/minimum).

(d) Spring and fall months (average).

(e) Station uses include: Standby Liquid Control System, Reactor Component Cooling Water System, Process Sampling System process use, HVAC System, Liquid Waste System chemical addition and line flushing, Turbine Component Cooling Water System, Auxiliary Boiler System, Isolation Condenser/Passive Containment Cooling Pool, Solid Waste System for line flushing, Chilled Water System, and Post Accident Sampling station flushing.

(f) 105 gpm of liquid radwaste is normally recycled for station uses, but system design allows for discharge to Lake Erie.

Cooling Towers

A natural draft cooling tower (NDCT) would be built for the proposed Fermi 3 as the NPHS. The location of the cooling tower is shown in Figure 3-1. The concrete cooling tower would be approximately 600 ft tall and 480 ft in diameter at the base. The cooling tower would be a part of the CIRC, and the cooling water in the CIRC would provide heat dissipation from the main condensers to the NPHS. The CIRC would have four pumps that circulate water from the intake to the condenser during startup,[a] shutdown, and normal operation of Fermi 3. The four CIRC pumps (each 25 percent capacity) would be able to pump a total of 744,000 gpm. The NPHS would be located 2200 ft from the intake structure on Lake Erie and 1100 ft from the main condenser. Consumptive use of water (NDCT drift and evaporation) for cooling would average 14,488 gpm and vary between 11,882 and 17,124 gpm (Figure 3-7 and Table 3-1). Blowdown water from the NDCT would be transported to the discharge pipe to be discharged to Lake Erie at an annual average rate of 14,474 gpm (range 11,868 and 17,110 gpm) (Figure 3-7 and Table 3-1). The NDCT would be designed to dissipate heat at a rate of 1.07×10^{10} Btu/hr to the atmosphere.

The heat from the PSWS would be dissipated to the NPHS and/or the AHS. Two mechanical draft cooling towers would serve as the AHS and would be located adjacent to the Water Treatment/Service Water Building (Figure 3-1). The AHS would have the capacity to dissipate heat at a rate of 2.98×10^{8} Btu/hr (Detroit Edison 2011b).

Discharge Structure

After the water is cooled in the cooling towers, some water would be discharged to Lake Erie. Additional discharges to Lake Erie could include treated liquid radwaste. The proposed location of the discharge pipe is shown on Figure 3-1 as the CIRC water outfall (shown as “27” in figure). The discharge pipe would extend approximately 1300 ft into Lake Erie and would be 4 ft in diameter. For thermal plume simulations (see Section 5.3), Detroit Edison (2011b) assumed that the discharge pipe would be buried in the Lake Erie lake bed and consist of a 3-port diffuser system. This preliminary design assumed that ports would be elevated 1.6 ft above the lake bed and be angled at 20 degrees above horizontal, pointing to the east (away from the shore).

3.2.2.3 Other Permanent Structures that Interface with the Environment

Roads, rail lines, and buildings are additional permanent plant-environment interfacing structures that would be built on the proposed site. These are discussed in this section.

(a) Startup is defined as an increase in the rate of fission (and heat production) in a reactor (usually by the removal of control rods from the core).

Roads

Enrico Fermi Drive is the main existing site access point from North Dixie Highway into the Fermi site. Fermi Drive crosses Leroux Road and Toll Road before reaching the main entrance. Pointe Aux Peaux Road parallels the southern boundary of the site. Onsite roads include Quarry Lake Road, Fox Road, Boomerang Road, Doxy Road, and Bullit Road. Construction traffic would use existing onsite roads, but a new access road (new Fermi Drive) would be constructed parallel to and just north of the existing Fermi Drive from Dixie Highway to the west Fermi property boundary, and would continue through the site to the new personnel access gate (Detroit Edison 2011b). The new Fermi Drive would provide separation between Fermi 2 operations traffic and Fermi 3 construction traffic. Construction of the new Fermi Drive would occur during the early stages of Fermi 3 construction. After construction of Fermi 3 is complete, the new Fermi Drive would be used as the main access to the site, and the existing Fermi Drive might be retained as a secondary access road or abandoned (Detroit Edison 2011b).

To reduce the potential for erosion and siltation from road use by heavy construction vehicles, existing paved roads may be widened or additional surface layers added to roads to support construction traffic (Detroit Edison 2011b). Otherwise, roads are not expected to need reconditioning to handle the loads from Fermi 3 construction.

Rail Lines

Four rail lines occur in the immediate vicinity of the Fermi site, and there are no plans to expand the current level of rail service in the area (Detroit Edison 2011b). Rail transport is available for the construction of Fermi 3 as needed, and no construction or modification of rail lines is anticipated. A single spur track off the Canadian National main rail line crosses the Fermi site parallel to the route of Fermi Drive.

Excavation Water Infiltration Barriers

During construction of Fermi 3, Detroit Edison would use barriers to minimize the flow of water entering the excavation. Water in the shallow fill layer would be excluded from the excavation by barriers such as reinforced diaphragm concrete walls, sheet piles, grout curtains, or freeze walls extending through the fill to the top of the glacial till. The approach to be used has not yet been determined by Detroit Edison. If diaphragm concrete walls, sheet piles, or grout curtains are used, they would remain in place and continue to reduce the permeability of the affected areas.

Spoils Disposal Area

Excavated material from the power block and circulating water pipe runs would be used as backfill and structural fill for the cooling tower and circulating water pipe run area

(Detroit Edison 2011b). No onsite borrow pit is anticipated to be used for Fermi 3 construction. About 500,000 cubic yards (yd^3) of excess excavated material will be disposed of in an onsite area. This onsite disposal area may be an expansion of one of the areas used for Fermi 2 spoils disposal (Figure 3-2), or a new spoils disposal area may be designated onsite. A new Fermi 3 construction material disposal site, if located in waters of the United States including wetlands, would require USACE authorization. The use of an onsite construction landfill is not anticipated.

Diesel Generators, Ancillary Diesel Generators, Auxiliary Boiler, Diesel Fire Pumps

Two 17.1-megawatt (MW) standby diesel generators, two 1.65-MW ancillary diesel generators, a 33-MW auxiliary boiler, and two 200-kilowatt (kW) diesel fire pumps will be installed on the site to provide auxiliary and backup systems. Infrequent testing and operations of these units would result in combustion emissions to the atmosphere. Standby diesel generators would operate about 4 hours per month, ancillary diesel generators are expected to operate 2 hours every three months (8 hours annually), the auxiliary boiler is expected to operate a maximum of 30 days each year, and the fire pumps would operate approximately 48 hours annually.

Barge Slip

Dredging of a barge slip within the existing Lake Erie intake embayment may be conducted to allow delivery of heavy construction equipment and building materials during Fermi 3 construction and for removal of construction debris (shown as “33” in Figure 3-1) (Detroit Edison 2011b). No new roads or other transportation facilities would be required to accommodate Fermi 3 barge traffic. Dredge spoils would be placed in the Spoils Disposal Pond that drains to Lake Erie through Outfall 013, as designated in the Fermi 2 National Pollutant Discharge Elimination System (NPDES) permit.

Based on an evaluation of the size and draft of the barge that would be needed to transport the reactor vessel and other heavy equipment to the site, dredging to the navigation channel in Lake Erie does not appear to be necessary (Detroit Edison 2011a). If it is later determined that dredging to the navigation channel is needed, Detroit Edison would apply for USACE and MDEQ permits, impacts would be assessed, and any necessary mitigative measures determined through the respective permit evaluation processes.

Radwaste Facility

Liquid, gaseous, and solid radioactive waste-management systems collect the radioactive materials produced as byproducts of operating the proposed Fermi 3. The radioactive waste management systems are designed to maintain releases of radioactive materials in effluents to “as low as reasonably achievable” levels in conformance with 10 Code of Federal Regulations (CFR) Parts 20 and 50, including the design objectives of 10 CFR 50, Appendix I

(Detroit Edison 2011b). These systems would process radioactive liquid, gaseous, and solid effluents to maintain releases within regulatory limits, as described in Section 3.4.3. The Radwaste Building would be located adjacent to the Turbine Building (shown as “03” in Figure 3-1). The Radwaste Building source terms are discussed in Chapter 12 of the ESBWR Design Control Document (DCD) (GEH 2010).

Sanitary Waste Treatment Plant

Sanitary waste systems needed at Fermi 3 during construction activities would consist of portable toilets supplied and serviced by an offsite vendor; there would be no sanitary waste system discharge into the effluent stream. During operations, the Fermi 3 wastewater treatment system would collect sewage and wastewater generated from portions of the plant that are outside radiological control areas. The system would use mechanical, chemical, and biological treatment processes. Sanitary effluent would be gathered and discharged to the Monroe Metropolitan Wastewater Treatment Facility and would be required to meet applicable NPDES permit requirements, health standards, regulations, and total maximum daily loads (TMDLs) set by the MDEQ and the U.S. Environmental Protection Agency (EPA) (EPA 2009).

Wastewater treatment operations for Fermi 3 would be similar to those for the existing Fermi 2 and those that are commonly used in wastewater treatment plants throughout the United States. Components of the Fermi 3 sanitary wastewater treatment system include waste basin, wet well, septic tank, settling tank, wet well pumps, sewage discharge pumps, and associated valves, piping, and controls. Chemical treatments applied to the waste would be those within the Monroe Metropolitan Wastewater Treatment Facility, in keeping with municipal sewage treatment standards.

Power Transmission System

Transmission lines and corridors are considered to interface with the environment during operation, because there are potential continuing impacts from electric fields, noise, and corridor maintenance.

A system impact study conducted for Fermi 3 identified the need for a new onsite 345-kilovolt (kV) switchyard and three new 345-kV transmission lines to connect Fermi 3 to the regional electrical grid (Detroit Edison 2011b). The new switchyard would be separate from the existing Fermi 2 switchyard and the onsite 120-kV transmission system.

A new 170-ft-wide transmission corridor (Figure 3-2) is planned on the Fermi site to service Fermi 3 (Detroit Edison 2011b). This transmission corridor would include two sets of towers that would carry both rerouted 345-kV lines that serve Fermi 2 and the new 345-kV lines that serve Fermi 3. The new transmission lines would transmit power from the Fermi 3 generator to the

Fermi 3 switchyard at the intersection of Toll Road and Fermi Drive (Figure 3-2). Onsite 120-kV support for Fermi 2 would be routed underground along the Fermi Drive corridor.

The offsite route for the new lines will traverse approximately 30 mi within a 300-ft transmission line corridor along mostly existing corridors to the Milan Substation (Figure 3-8). The first 18.6 mi of transmission lines (going west and north from Fermi) would be installed alongside the 345-kV lines that are already in place (Figure 3-8). By reconfiguring conductors, new lines in this portion of the route could use existing towers, but placement of additional transmission infrastructure may be necessary. The remaining 10.8 mi of transmission lines to the Milan Substation would be located in an undeveloped portion of the transmission line corridor that was previously authorized for transmission use (Figure 3-8). Some transmission tower footings were installed as part of the original Fermi 3 plan, but the corridor has been minimally maintained. The 350-ft-by-500-ft Milan Substation may be expanded to an area about 1000 ft by 1000 ft to accommodate the Fermi 3 expansion (Detroit Edison 2011b).

Most of the 18.6-mi portion of the route crosses agricultural land, but the undeveloped 10.8-mi portion crosses a variety of land cover types including forest, agricultural lands, rural residential areas, and a golf course.

ITC*Transmission* owns and operates the transmission system in southeastern Michigan. This system transfers power from regional power plants to local distribution systems, and carries power transfers from power plants to loads across the Eastern Interconnection (Detroit Edison 2011b). The offsite portions of the proposed Fermi 3 transmission system and associated corridors would be owned and operated by ITC*Transmission*. Detroit Edison has no control over the construction or operation of the transmission system and is not involved in the evaluation or decision making for proposed changes to or design of the transmission system. The two 345-kV transmission lines that would exit Fermi 3 would be owned by Detroit Edison up to the proposed new Fermi 3 switchyard. Detroit Edison would continue to own the onsite transmission corridor, but expects to contract with ITC*Transmission* to maintain these transmission lines and towers (Detroit Edison 2011b).

In addition to the new transmission lines and switchyard, upgrades to existing transmission lines would be needed to facilitate the new generation on the system (Detroit Edison 2011b). Transmission line and switchyard design would meet or exceed the requirements established in the National Electrical Safety Code (NESC) (IEEE 2007), which provides standards for electrical safety, electrical clearances, structural design loadings, and material strength factors. Modifications to the existing system would comply with relevant local, State, and industry standards, including NESC and various American National Standards Institute/Institute of Electrical and Electronic Engineers, Inc. (ANSI/IEEE) standards.

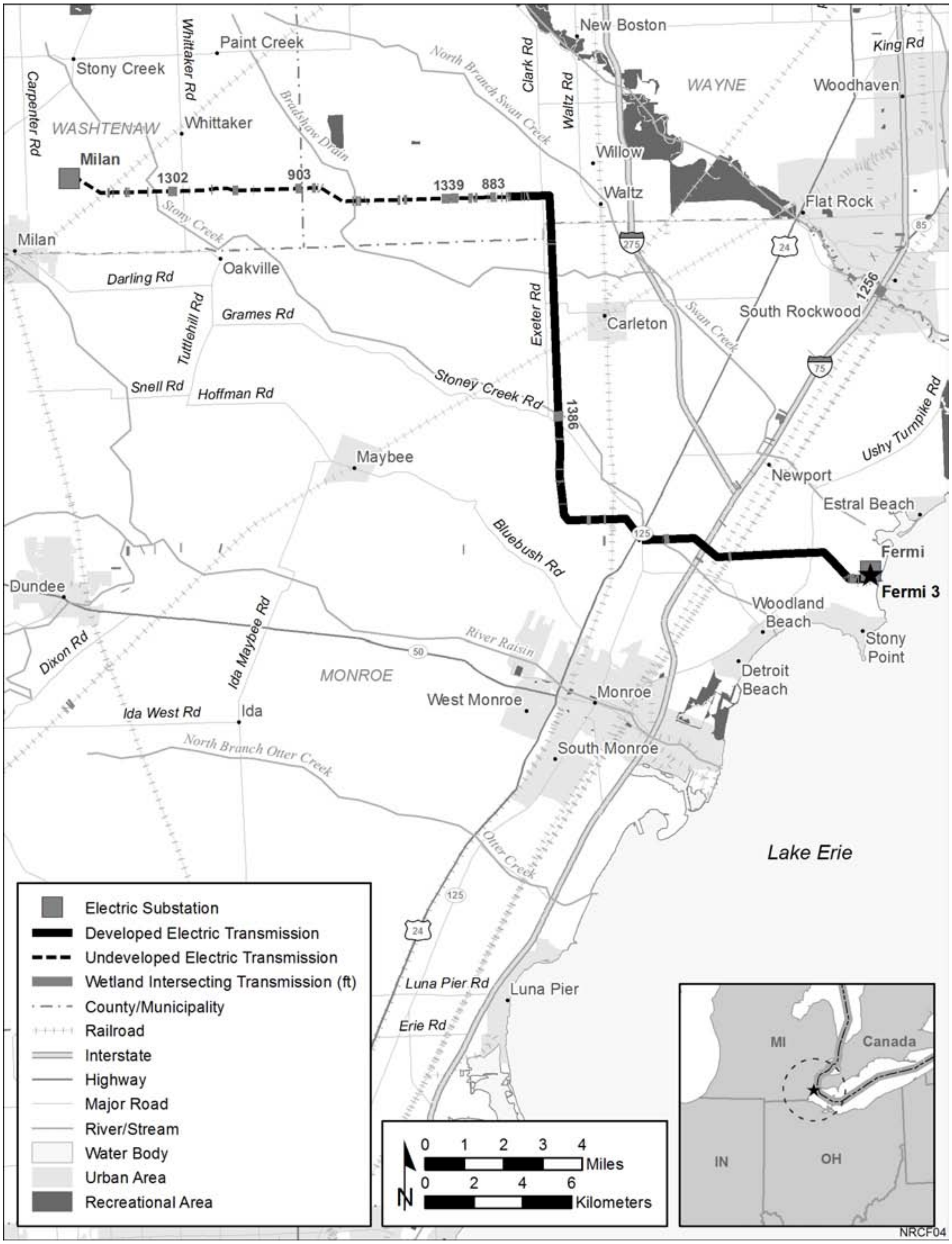

Figure 3-8. Proposed Transmission Line Corridor from Fermi 3 to Milan Substation (Detroit Edison 2011b)

3.2.2.4 Other Temporary Plant-Environment Interfacing Structures

Temporary plant–environment interfacing structures include a concrete batch plant, construction laydown, a construction parking area, and groundwater dewatering systems.

Concrete Batch Plant

An onsite concrete batch plant would be used to produce concrete during Fermi 3 construction. Lake Erie water would be used for concrete production. The plant would be equipped with a dust-control system that would be checked and maintained on a routine basis. The location of the concrete batch plant onsite is expected to result in fewer offsite dust impacts than if concrete were produced offsite and trucked to the construction area.

Construction Laydown Areas and Temporary Parking

Portions of the Fermi site would be used for temporary construction parking and construction laydown (Figure 4-1). These areas would occupy a total of 143 ac (Detroit Edison 2011b). On completion of construction, these areas would be rehabilitated by removing gravel, replacing stocked topsoil, regrading, and revegetating.

Groundwater Wells and Dewatering Systems

Groundwater is not used for Fermi 2 operations, and has not been proposed for use during construction or operation of Fermi 3. However, it is possible that groundwater may be supplied to certain outbuildings as potable water during the construction period (Detroit Edison 2011b). This water use would be expected to be minimal. Groundwater wells or sumps are planned to dewater deep excavations during construction; however, no permanent dewatering systems would be required for Fermi 3.

3.2.3 Structures with Minimal Plant-Environmental Interface

The structures described in the following sections would have minimal interface with the environment during plant operation.

3.2.3.1 Power Block

Buildings and facilities within the power block would include the Reactor Building, Fuel Building, Control Building, Turbine Building, Radwaste Building, and several service buildings (e.g., Electrical Building, Service Water Building) (Figure 3-1).

The Reactor Building (shown as “01” in Figure 3-1) would house the reactor system, reactor support and safety systems, concrete containment, safety-related power supplies and equipment, steam tunnel, and refueling[a] area (GEH 2010). The Fuel Building (shown as "12" in Figure 3-1) would house the spent fuel pool, cask loading area, fuel equipment and storage areas, lower connection to the inclined fuel transfer system, and other plant systems and equipment. The Reactor and Fuel Buildings would share a common wall and a large common foundation mat. The radioactive sources in the spent fuel pool are discussed in Chapter 12 of the ESBWR Design Control Document (DCD) (GEH 2010).

The Control Building (shown as "04" in Figure 3-1) would house safety-related electrical, control, and instrumentation equipment and the control room for the Reactor and Turbine Buildings (GEH 2010). The Turbine Building (shown as "03" in Figure 3-1) would be the tallest building within the power block (171 ft tall and with a 234 ft ventilation stack) and would house the turbine generator, main condenser, condensate and feedwater systems, condensate purification system, offgas system, turbine-generator support systems, and bridge crane.

The Radwaste Building (shown as "10" in Figure 3-1) would house the equipment and floor drain tank(s), sludge phase separator(s), resin hold-up tank(s), detergent drain collection tank(s), concentrated waste tank(s), chemical drain collection tank(s), and associated pumps and systems for the radioactive liquid and solid waste treatment systems (GEH 2010). Tunnels would connect the Radwaste Building to the reactor and Fuel and Turbine Buildings. The radwaste facility is discussed in Section 3.2.2.

3.2.3.2 Cranes and Crane Footings

Mobile cranes and a stationary crane would be used to facilitate the construction of the Fermi 3 power block. The stationary crane would require that footings be fabricated and cranes be erected on the site.

3.2.3.3 Ultimate Heat Sink

The ESBWR design has no separate emergency water cooling system. The ultimate heat sink function would be provided by safety systems integral and interior to the reactor plant. These systems would ultimately use the atmosphere as the heat sink. The ultimate heat sink would not rely on cooling towers, basins, or cooling water intake/discharge structures external to the reactor plant. In the event of an accident, the ultimate heat sink would be provided by the Isolation Condenser/Passive Containment Cooling Pools, which would provide the heat transfer mechanism for the reactor and containment to the atmosphere.

(a) Refueling is a process (one mode of plant operation) of replacing older fuel that can no longer produce electricity effectively from nuclear fission reactions with new fuel.

3.2.3.4 Pipelines

New pipelines would be needed to provide makeup water from Lake Erie for the CIRC, PSWS, and FPS. Cooling tower blowdown water would be discharged via a new pipeline and discharge structure within Lake Erie. The review team assumed that pipelines would follow existing roads or roads created when building Fermi 3. Therefore, the installation of pipelines would be limited to areas already disturbed.

3.2.3.5 Permanent Parking

Two new multiple-level parking garages would be built to accommodate Fermi 2 and 3 operational workers (shown as “38” on Figure 3-1 and “31” on Figure 3-2). The two parking garages are sized to accommodate Fermi 2 and Fermi 3 operational parking.

3.2.3.6 New Meteorological Tower

A new meteorological tower would be built for the Fermi site and would be located near the southeastern boundary of the property (shown as “42” in Figure 3-2) (Detroit Edison 2011b). Relocating the existing meteorological tower would be necessary because the Fermi 3 cooling tower would interfere with the current meteorological tower location. The new meteorological tower would be a guyed open-latticed tower and would have a height of 197 ft.

3.2.3.7 Miscellaneous Buildings

Several small buildings would be built on the site to support worker, construction, and operational needs (e.g., shop buildings, construction support offices, warehouses, guard houses). Some buildings may be temporary and would be removed after the plant begins operation.

3.3 Preconstruction and Construction Activities

Although nuclear-plant construction activities are similar to those for other large industrial facilities, the NRC’s authority is limited to only those construction activities that have a “reasonable nexus to radiological health and safety or common defense and security” (72 *Federal Register* [FR] 57432). This definition of “construction” includes placement of fill, mud mat, concrete, or permanent retaining walls within an excavation for safety-related structures, systems, or components (SSCs) (but not the excavation activity itself); installation of foundations; or in-place assembly, erection, fabrication, or testing of any safety-related SSC. This definition also extends to SSCs needed to mitigate accidents that are used in plant emergency operating procedures or whose failure could cause a safety-related problem. Activities fitting this definition of “construction” can only occur after the NRC issues a COL or a Limited Work Authorization.

Construction activities associated with structures that do not provide a safety function are called "preconstruction" by the NRC in 10 CFR 51.45(c). Preconstruction activities are not within the NRC's regulatory authority; they are typically regulated by other local, State, and Federal agencies. Preconstruction includes activities such as clearing and grading, excavating, and erection of buildings or facilities that do not support the reactor or associated safety structures. Examples of such facilities are parking lots, rail spurs, potable water systems, and sanitary waste treatment facilities. Activities associated with transmission line corridors are also considered preconstruction. Preconstruction activities can occur before, during, or after the construction of safety-related structures, but require the appropriate permits and authorizations from regulating agencies. Further information about the delineation of construction and preconstruction activities in this EIS is presented in Section 4.0.

In this section, those structures and activities that are associated with building a nuclear power plant are described without distinguishing whether those structures and activities are construction or preconstruction. Table 3-2 provides general definitions and examples of construction and preconstruction activities that would be performed in building the new unit. This section is not a comprehensive discussion of all activities or a detailed engineering plan for construction and preconstruction activities. Rather, this section provides an overall characterization of the major activities for the major structures to provide a framework for the activities involved in building the proposed nuclear power plants.

Land would be graded and stormwater pipes would be installed to facilitate stormwater drainage from Fermi 3. The existing site grade would be raised to 589.3 ft NAVD 88 in the vicinity of safety-related structures, approximately 7.5 ft above the current Fermi plant grade. The power block would contain drop inlets connected to a stormwater collection system that would route stormwater to the North Lagoon, which drains to Swan Creek.

3.3.1 Power Block and Cooling Tower

Building the Fermi 3 power block is anticipated to affect 87 ac, including the natural draft cooling tower, fabrication area, construction offices, and the concrete batch plant (Detroit Edison 2011b). Deep excavations would be required for certain Fermi 3 building foundations, including approximately 50 ft for the Reactor Building, 46 ft for the Radwaste Building, 43 ft for the Control Building, and 31 ft for the Turbine Building. Dewatering would be necessary during excavation and foundation-building and could be accomplished using sumps within the excavation and, if necessary, groundwater extraction wells. Portions of the subsurface could be injected with grout to reduce inflow of groundwater to the excavation areas (Detroit Edison 2011b). Grouting was done during construction of Fermi 2, resulting in a reduction in hydraulic conductivity and less inflow of water into the excavation area (Detroit Edison 2011b).

Table 3-2. Definitions and Examples of Activities Associated with Building Fermi 3

Activity	Definition	Examples
Clearing	Removing vegetation or existing structures from the land surface.	Cutting trees from an area to be used for construction laydown.
Grubbing	Removing roots and stumps by digging.	Removing stumps and roots of trees logged from the construction laydown area.
Grading	Reforming the elevation of the land surface to facilitate operation of the plant and drainage of precipitation.	Leveling the site of the reactors and cooling towers.
Hauling	Transporting material and workforce along established roadways.	Construction workers driving on new access road.
Paving	Laying impervious surfaces, such as asphalt and concrete, to provide roadways, walkways, parking areas, and site drainage.	Paving the new Fermi Drive.
Shallow excavation	Digging holes or trenches to a depth reachable with a backhoe. Shallow excavation may not require dewatering.	Pipelines; foundations for small buildings.
Deep excavation	Digging an open hole in the ground. Deep excavation requires equipment with greater vertical reach than a backhoe. Deep excavation generally requires dewatering systems to keep the hole from flooding.	Excavation of the basemat for the reactor.
Excavation dewatering	Pumping water from wells or pumping water directly to keep excavations from flooding with groundwater or surface runoff.	Pumping water from deep excavation for reactor building.
Dredging	Removing substrates and sediment in navigable waters or wetlands.	Enlargement of the barge slip.
Spoils placement	Placing construction (earthwork) or dredged material in an upland location.	Placing dredge spoils into a designated spoils disposal area.
Structure erection	Assembling structures into their final positions, including all connections between structures.	Using a crane to assemble structures.
Fabrication	Creating an engineered material from the assembly of a variety of standardized parts. Fabrication can include conforming native soils to some engineered specification (e.g., compacting soil to meet some engineered fill specification).	Preparing concrete for pouring; laying rebar for basemat.
Well drilling	Drilling and completing wells.	Drilling wells for dewatering or water supply.
Vegetation management	Thinning, planting, trimming, and clearing vegetation.	Maintaining the construction parking lots and laydown areas free of vegetation.
Filling a wetland or waterbody	Discharging dredge and/or fill material into waters of the United States, including wetlands.	Placing fill material into wetlands to bring it to grade with the adjacent land surface.

3.3.2 Intake Structure

The new intake structure would involve building a pump house near the intake structure for Fermi 2. The intake structure itself would be built on previously developed portions of the Lake Erie shore. Additional hydraulic dredging of the intake bay would be required for building of the intake structure. Material that is dredged from the intake bay would be disposed of in the Fermi Spoils Disposal Pond.

3.3.3 Discharge Structures

A portion of Lake Erie would be affected by building the Fermi 3 cooling water discharge pipe. Flow would exit to Lake Erie through three ports in a multi-port diffuser approximately 1300 ft east of the Lake Erie shoreline at the Fermi site. The ports would be at an elevation of approximately 1.6 ft above the lake bed. A 1300-ft line at least 5 ft deep and 5 ft wide at the bottom would be mechanically dredged into Lake Erie for the discharge pipe. The pipe would be installed within the bottom of Lake Erie in a bed of structural fill. Installation of the discharge structure would require USACE and MDEQ permits. Material that is dredged for the discharge pipe installation would be disposed of in the Fermi Spoils Disposal Pond (Figure 3-2).

3.3.4 Barge Slip

The barge slip that was used to offload equipment during Fermi 2 construction would be reconfigured to allow delivery of certain equipment and supplies during construction of Fermi 3. The barge slip and offloading area are cleared gravel with some trees and weedy vegetation along a sandy inlet area having no permanent structures. The facility would require substantial dredging and other preparation work before it could be used for equipment delivery, but dredging activities are expected to be similar to those associated with ongoing operations and maintenance dredging of the existing intake embayment.

3.3.5 Roads

New onsite roads would be graded and paved. Temporary access roads may need to be constructed. A road is planned to be constructed parallel to the current Fermi Drive, to accommodate construction traffic associated with Fermi 3 (Detroit Edison 2011b).

3.3.6 Pipelines

Pipelines would be installed for the CIRC, stormwater collection systems, intake structures, and discharge structures. Shallow excavation (trenching) would be necessary to install the subsurface pipelines, with the exception of the aforementioned discharge pipeline, which would require permitted dredging as mentioned in Section 3.3.1.

3.3.7 Transmission Line Corridors

Installing transmission lines would require the removal of trees and shrubs along portions of the transmission line corridor, movement of construction equipment, and shallow excavation for the foundations of the transmission line towers. It is assumed that development of the first 18.6 mi of transmission line from the Fermi 3 switchyard would require minimal land disturbance because the lines would be placed in an existing developed corridor. The 10.8 mi corridor to the Milan substation is currently undeveloped, and building this portion of the line could disturb 393 ac of mostly forested and agricultural lands. A total of 1069 ac of land would be occupied by the 29.4-mi-long transmission line corridor.

A new 170-ft-wide transmission corridor (Figure 3-2) is planned on the Fermi site to service Fermi 3 (Detroit Edison 2011b). This transmission corridor would include two sets of towers that would carry both rerouted 345-kV lines that serve Fermi 2 and the new 345-kV lines that serve Fermi 3. Clearing of vegetation and land disturbance for this transmission line would be limited to the location of transmission towers because the wetland area traversed by the line could be spanned without clearing.

3.3.8 Switchyard

Detroit Edison would build a new switchyard containing three 345-kV transmission lines to transport to power generated by Fermi 3. The Fermi 3 switchyard would be constructed on 10 ac of the prairie restoration area at the intersection of Fermi Drive and Toll Road (shown as "28" on Figure 3-2). The offsite Milan Substation may be expanded in size, and this expansion would affect an additional 19 ac.

3.3.9 Construction Support and Laydown Areas

A total of 143 ac have been identified for possible construction laydown areas (Detroit Edison 2011b): 60 ac in an agricultural field next to the proposed Fermi 3 switchyard, 20.5 ac north and west of the intersection of Fermi Drive and Doxy Road, and 61 ac located in separate parcels around the Quarry Lakes (Figure 3-2). Existing topsoil would be removed, geofabric would be laid down, and the areas would be surfaced with rock. It is anticipated that construction laydown areas would be used during construction and then restored following project completion.

3.3.10 Parking and Warehouse

A parking structure and a warehouse would be built in the area to the west and north of the Fermi 3 power block, and about 7 ac of open water (the entire central canal and parts of the north and south canals) would be filled in to facilitate building a parking structure and a warehouse on a total of 5 ac (Figure 3-1).

3.3.11 Miscellaneous Buildings

The construction of the meteorological tower and its access road is anticipated to affect approximately 6 ac in the southeast portion of the Fermi site (Figure 3-2). In the southeast corner of the site, the Fermi 3 Simulator, the EF2/EF3 Administrative Building, and the parking garage would affect approximately 7 ac in an area that was previously impacted by construction activities. Shallow excavation and land clearing would likely be required prior to building activities.

3.3.12 Cranes and Crane Footings

Mobile cranes and a stationary crane would be used during building installation. The impact of these cranes is included in the area of impact within the Fermi 3 power block.

3.3.13 Summary of Resource Commitments Resulting from the Building of Fermi 3

Table 3-3 provides a list of the resource commitments resulting from the building of Fermi 3. The values in the table combined with the affected environment described in Chapter 2 provide the basis for the construction and preconstruction impacts assessed in Chapter 4. The sources of the values are provided, and the review team has confirmed that each of the values is not unreasonable.

3.4 Operational Activities

The operational activities considered in the review team's environmental review are those associated with structures that interface with the environment, as described in Section 3.2.2. Examples of operational activities are withdrawing water for the cooling system, discharging blowdown water and sanitary effluent, and discharging waste heat to the atmosphere. Activities within the proposed ESBWR plant are discussed by Detroit Edison in the Fermi 3 FSAR (Detroit Edison 2012) and are reviewed by the NRC in its Safety Evaluation Report (final expected in May 2013). Structures that interface with the environment and related operational activities are listed in Table 3-4.

The following sections describe the operational activities, including operational modes (Section 3.4.1), plant-environment interfaces during operations (Section 3.4.2), and the radioactive and nonradioactive waste management systems (Sections 3.4.3 and 3.4.4); the values of resource parameters likely to be experienced during operations are summarized in Section 3.4.5.

Table 3-3. Summary of Parameters and Resource Commitments Associated with Building the Proposed Fermi 3

Resource	Value	Description and References
Disturbed land area footprint onsite	Approximately 301 ac total; of that approximately 154 ac would be permanently occupied; of the 301 ac, approximately 189 ac consists of currently undeveloped land	ER Section 4.1.1.1, p. 4-5 and Table 10.1-2, p. 10-8
Length of new transmission line corridors	Onsite: Less than 1 mi from Fermi 3 to switchyard	ER Section 2.2.2.2, p. 2-22
	Offsite: Approximately 29.4 mi (18.6 mi of currently developed corridor; 10.8 mi of undeveloped corridor)	ER Section 2.2.2.2, p. 2-23
Width of new transmission line corridors	Onsite: 170 ft	ER Section 2.2.2.2, p. 2-22
	Offsite: 300 ft	ER Section 2.2.2.2, p. 2-23
Disturbed land area in new onsite transmission corridor	Approximately 20 ac	Calculated from information in ER Section 2.2.2.2, p. 2-22
Disturbed land area for Milan Substation expansion	Approximately 19 ac	ER Section 2.2.2.2, p. 2-23
Land area permanently occupied by 29.4 mi offsite transmission corridor	Approximately 1069 ac; Approximately 393 ac in new corridor	ER Section 2.2.2.2, p. 2-23; Table 4.1-1, p. 4-23
Excavation depth to which dewatering would be required	40 ft to 50 ft below grade	Design Control Document, Rev. 6, Section 1.2.2.16; ER Section 4.2.1.5
Water use	350,000 to 600,000 gpd	Obtained from Lake Erie; ER Section 4.2.1.3, p. 4-26
Water discharge	200 gpm (288,000 gpd) dredge effluent discharge; no discharge of sanitary waste	Permitted discharge to Spoils Disposal Pond; ER Section 4.2.1.4, p. 4-24
Workforce	Increase from 150 workers in first 2 years to maximum 2900 workers	ER Section 4.4.2, p. 4-71
Duration of preconstruction and construction activities	9 to 12 years	ER Section 4.4.2, p. 4-71
Noise	89 dBA maximum construction noise level at 50 ft from activity; 63 dBA 1000 ft from activity	ER Section 4.4.1.1.3, Table 4.4-1, p. 4-90

Table 3-4. Operational Activities Associated with Major Structures

Structure Interfacing with Environment	Water Withdrawal from Lake Erie	Traveling Screen Operations	Cooling Tower Blowdown	Heat Dissipation to Atmosphere	Electricity Generation	Solid or Liquid Nonradioactive Waste Export	Gaseous Nonradioactive Effluent Discharge	Liquid Nonradioactive Effluent Discharge	Solid Radioactive Waste Export	Gaseous Radioactive Effluent Discharge	Liquid Radwaste Discharge	Stormwater Discharge	Personnel into and out of Site	Maintenance Dredging Spoils	Vegetation Management
Stormwater management system												x			x
Intake structure	x	x													
Discharge structure			x					x			x				
Cooling towers				x											
Diesel generators, auxiliary boiler, diesel fire pumps					x		x								
Roads						x	x						x		x
Rail lines						x	x								x
Barge slip														x	
Radwaste facility						x	x			x	x				
Sanitary waste treatment plant								x							
Power transmission system					x										x

3.4.1 Description of Operational Modes

The following sections describe the operational systems for the proposed Fermi 3 under normal operating conditions and under emergency shutdown conditions. Design basis accidents and severe accidents are not considered to be normal plant operations. Modes of operation can be divided into six categories: power operation, startup, hot shutdown,[(a)] safe

(a) Hot shutdown is a mode of operation in which the average reactor coolant temperature is greater than 420°F following a safe shutdown.

shutdown,[a] cold shutdown,[b] and refueling. Lake Erie would be the water source for all normal cooling and shutdown conditions. There is no separate emergency cooling water system. Fermi 3 would have its own supply of cooling water for safety-related cooling in the ultimate heat sink. Effluent discharges during normal plant operations at full capacity would be at their highest levels.

Therefore, impacts discussed in subsequent sections exclusively consider discharges during normal operations at full capacity.

3.4.2 Plant-Environment Interfaces during Operations

Fermi 3 operational activities as they relate to structures or systems with an interface to the environment are discussed in this section.

3.4.2.1 Station Water System – Intakes, Discharges, Cooling Towers

Lake Erie would supply the nonsafety-related cooling at Fermi 3 for the SWS, which would supply the CIRC and the PSWS. The cooling water in the CIRC provides heat dissipation from the main condensers to the NPHS. The NPHS for Fermi 3 would be a natural draft cooling tower as shown in Figures 3-1 and 3-3. The cooling water in the PSWS would provide heat dissipation from the heat exchangers of both the Turbine Component Cooling Water System and the Reactor Component Cooling Water System.

The SWS would supply makeup water to the NPHS and AHS cooling tower basins and would consist of two subsystems: the PCTMS and the PWSS. The PCTMS would provide makeup water from Lake Erie for evaporation, drift, and blowdown losses. During normal power operations, the NPHS would reject heat from the plant at a rate of 1.07×10^{10} Btu/hr (Detroit Edison 2011b). It is anticipated that Fermi 3 will be in normal mode 96 percent of the time and will shut down for refueling every 2 years for 30 days (Detroit Edison 2011b).

The heat from the PSWS would be dissipated to the NPHS and/or the AHS. The AHS would reject heat during startup, hot shutdown, stable shutdown,[c] cold shutdown, and refueling at a rate of 2.98×10^{8} Btu/hr (Detroit Edison 2011b). The AHS could also be used during normal

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(a) Safe shutdown is a shutdown in which (1) the reactivity of the reactor is kept to a margin below criticality consistent with technical specifications; (2) the core decay heat is being removed at a controlled rate sufficient to prevent core or reactor coolant system thermal design limits from being exceeded; (3) components and systems necessary to maintain these conditions are operating within their design limits; and (4) components and systems necessary to keep doses within prescribed limits are operating properly.

(b) Cold shutdown is a mode of reactor operation in which the reactor coolant system is at atmospheric pressure and at a temperature below 200°F after shutdown.

(c) Stable shutdown is a mode of operation in which the average reactor coolant temperature is less than or equal to 420°F following a safe shutdown.

power operations. The AHS would consist of mechanical draft cooling towers and would be housed in the Water Treatment/Service Water Building (Figure 3-1) on the southeast side of the Fermi 3 power block. The PWSS would provide water for the FPS and serve as an alternate to the PCTMS for supplying PSWS makeup water to the cooling towers.

During normal plant operations, the only variable quantity of water use would be the amount of water that would be consumed by evaporation and drift from the cooling towers, which would vary based on the ambient temperature conditions (Detroit Edison 2011b). The monthly average anticipated water intake from Lake Erie would vary between approximately 23,750 and 33,500 gpm (Table 3-5). Monthly average consumptive use of water for cooling (drift plus evaporation) would vary between 11,882 and 16,757 gpm, and monthly discharge to Lake Erie (blowdown) would vary between 11,868 and 16,743 gpm.

Table 3-5. Monthly Fermi 3 Cooling Water Discharge Temperature and Flow Rates

Month	Discharge Temperature (°F)	Blowdown Flow Rate (gpm)	Drift Flow Rate (gpm)	Evaporation Flow Rate (gpm)	Makeup Flow Rate (gpm)
January	53.8	11,868	7.2	11,875	23,750
February	55.3	12,193	7.2	12,200	24,400
March	59.4	13,093	7.2	13,100	26,200
April	66.0	14,293	7.2	14,300	28,600
May	72.7	15,393	7.2	15,400	30,800
June	78.4	16,293	7.2	16,300	32,600
July	81.5	16,743	7.2	16,750	33,500
August	80.8	16,693	7.2	16,700	33,400
September	76.3	16,093	7.2	16,100	32,200
October	68.8	14,793	7.2	14,800	29,600
November	62.7	13,743	7.2	13,750	27,500
December	56.6	12,493	7.2	12,500	25,000

Source: Detroit Edison 2011b

- The maximum discharge to Lake Erie would be 17,110 gpm (Table 3-1).
- The maximum consumptive water use rate (evaporation and drift) would be 17,124 gpm (Table 3-1).
- The maximum makeup water flow rate would be 34,264 gpm (Table 3-1).

During shutdown conditions, less than 1166 gpm would be needed for makeup water to the plant (Table 3-1). Approximately 639 gpm of water would be consumed by evaporation and drift from cooling, and 569 gpm would be discharged back to Lake Erie. Periodic dredging of the intake canal would be required. Potential radwaste discharges from the plant are discussed in Section 3.4.2.3. Any discharges from Fermi 3 would require an NPDES permit, similar to the one already regulating Fermi 2 discharges.

The atmosphere would receive heat and water in the form of cooling tower vapor and drift.

3.4.2.2 Power Transmission System

During operation of Fermi 3, vegetation along the power transmission line system would need to be maintained by ITC*Transmission*. Vegetation removal activities would include trimming and application of herbicides periodically and on an as-needed basis along the transmission line corridor.

3.4.2.3 Radioactive Waste-Management Systems

Liquid, gaseous, and solid radioactive waste management systems would be used to collect and treat the radioactive materials produced as byproducts of operating Fermi 3. These systems would process radioactive liquid, gaseous, and solid effluents to maintain releases within regulatory limits and to levels as low as reasonably achievable before releasing them to the environment. Waste-processing systems would be designed to meet the design objectives of 10 CFR Part 50, Appendix I ("Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As Is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents"). Radioactive material in the reactor coolant would be the primary source of gaseous, liquid, and solid radioactive wastes in light-water reactors. Radioactive fission products build up within the fuel as a consequence of the fission process. These fission products would be contained in the sealed fuel rods, but small quantities would escape the fuel rods and contaminate the reactor coolant. Neutron activation of the primary coolant system would also be responsible for coolant contamination.

The Offsite Dose Calculation Manual (ODCM) for the operating Fermi 2 was revised in 2010 and is attached as Appendix C to the 2010 radioactive effluent and monitoring report for Fermi 2 (Detroit Edison 2011c). It describes the methods and parameters used for calculating offsite radiological doses from liquid and gaseous effluents. The ODCM also describes the methodology for calculation of gaseous and liquid monitoring alarm/trip set points for release of effluents from Fermi 2. Operational limits for releasing liquid and gaseous effluents are also specified in the ODCM to ensure compliance with NRC regulations. This ODCM will be revised to include operation of Fermi 3 or a similar ODCM will be developed for Fermi 3.

Summary descriptions of the liquid, gaseous, and solid radioactive waste management systems for the proposed Fermi 3 are presented in the following sections. A more detailed description of these systems can be found in Chapter 11 of the ESBWR DCD (GEH 2010).

Liquid Radioactive Waste Management System

The liquid radioactive waste management system (LWMS) would function to collect, monitor, process, store, and dispose of liquids containing radioactive material. The LWMS consists of four subsystems: equipment drain system, floor drain system, chemical drain system, and detergent drain system. The LWMS process flow diagram is provided in Figure 11.2-1 of the DCD (GEH 2010). Processing would be managed using evaporation, centrifugal separation, demineralization, and filtration in several process trains consisting of tanks, pumps, reverse osmosis, ion-exchanger, and filters. The system is designed to handle both normal and anticipated operational occurrences. Normal operations would include processing of (1) reactor coolant system effluents, (2) floor drains and other wastes with potentially high suspended solid contents, (3) chemical wastes, and (4) detergent wastes.

All liquid effluent discharges from the tanks to the environment are monitored so that the radioactivity release levels do not exceed the levels specified in 10 CFR Part 20, Appendix B, Table 2. The total liquid radioactive source term for liquid effluents can be found in Table 12.2-19b of the DCD (GEH 2010). Calculated doses to the maximally exposed individual (MEI) and the population within 50 mi are presented in Section 5.9.2.

Gaseous Radioactive Waste Management System

The gaseous radioactive waste management system would function to collect, process, and discharge gaseous radioactive effluents. Gaseous radionuclides generated during normal operation of Fermi 3 include gaseous fission products and gaseous radionuclides formed by neutron activation of the reactor coolant and contained gases. These gases would be retained in the plant systems and removed in a controlled fashion through the gaseous waste management system. The building heating, ventilating, and air-conditioning (HVAC) systems and power cycle off-gas system (OGS) are the two main sources of the plant gaseous effluent. The gaseous waste management system, or OGS, collects waste from multiple sources and delays its release to allow short-lived radionuclides to decay. In the off-gas process, the OGS would use activated charcoal absorber beds for holdup and decay of radioactive gases containing radioactive isotopes of krypton, xenon, iodine, nitrogen, and oxygen.

All gaseous effluents from the gaseous waste processing system, the containment ventilation purge system, the main condenser exhaust, and ventilation from the Radwaste Building, the Fuel Pool Building, Reactor Building, Turbine Building, and the safeguards and access-controlled areas would be released via the plant stacks. Gaseous effluents would be monitored upon discharge so that radioactivity release levels are not exceeded. The total gaseous radioactive source term for gaseous effluents can be found in Table 12.2-16 of the DCD (GEH 2010) and FSAR Table 12.2-206 (Detroit Edison 2012). Calculated doses to the MEI are presented in Section 5.9.2.

Solid Radioactive Waste Management System

The solid radioactive waste management system (SWMS) for Fermi 3 would function to control, collect, handle, process, package, and temporarily store dry or wet solid radioactive waste before shipment offsite. The SWMS located in the Radwaste Building is a four-part system, including the waste collection system, the waste processing system, the dry waste accumulation and conditioning system, and the container storage system. The SWMS process flow diagram is provided in Figure 11.4-1R of the Fermi 3 FSAR (Detroit Edison 2012). Solid radioactive wastes include filter backwash sludge, reverse-osmosis concentrates, bead resins generated by the LWMS, the reactor water cleanup/shutdown cooling system, the fuel and auxiliary pools' cooling systems, the high-efficiency particulate air (HEPA) and cartridge filters, and rags, plastic, paper, protective clothing, tools, and equipment. The SWMS is designed to handle both normal and anticipated operational occurrences. There are no onsite facilities for permanent disposal of solid wastes, so the packaged wastes would be temporarily stored in the Radwaste Building prior to being shipped to a licensed disposal facility. The Radwaste Building is designed to accommodate up to 10 years' worth of packaged Class B and Class C waste, and 3 months' worth of packaged Class A waste.

The estimated annual solid radwaste volumes of dry active solids, wet solids, and mixed waste generated by an ESBWR are estimated to be 363, 110.8, and 0.416 m^3/yr, respectively (FSAR Table 11.4-2R in Detroit Edison 2012). FSAR Table 11.4-2R also identifies the annual quantity of waste in Class A, B, and C that would be stored in the facility or shipped offsite.

3.4.2.4 Nonradioactive Waste Systems

The following sections provide descriptions of the nonradioactive waste systems proposed for Fermi 3, including systems for chemical or biocide, sanitary, and other effluents. This category of effluent includes nonradioactive gaseous emissions, liquids, hazardous waste, mixed wastes, and solids.

Effluents Containing Chemicals or Biocides

Water chemistry for various plant water uses would be controlled with the addition of biocides, algaecides, corrosion inhibitors, scale inhibitors, and dehalogenators. Fermi 3 would use chemicals and biocides similar to those currently used for the existing Fermi 2, including sodium hypochlorite, sodium silicate, and sodium bisulfite. Cooling water effluents from Fermi 3 would be discharged to Lake Erie and may be subject to the limitations of the Fermi site's existing NPDES permitted outfalls. Estimated concentrations of chemicals in the Fermi 3 discharge are presented in Table 3-6 (Detroit Edison 2011b).

Makeup water to the SWS would be treated with the biocide/algaecide sodium hypochlorite before it enters the pumps at the intake from Lake Erie. The SWS would supply water to the CIRC, the PSWS, and the FPS. Biocide injection is an important step to remove plant and animal life from the water, including invasive zebra mussels. If mussels do make it into the SWS, they could be controlled through either chlorination or thermal shock treatment.

Table 3-6. Estimated Concentrations of Chemicals in Fermi 3 Cooling Water Discharges[(a)]

Chemical	Maximum Concentration (ppm)	Mean Concentration (ppm)
Sodium (Na)	46.6	34.3
Calcium (Ca)	71.9	71.9
Magnesium (Mg)	17.4	17.4
Silica (SiO_2)	19.9	19.5
Chloride (Cl)	61.3	42.5
Sulfate (SO_4)	38.5	38.5
Potassium (K)	3.6	3.6
Scale inhibitor/dispersant	11.6	11.6
Bicarbonate alkalinity ($CaCO_3$)	167.8	167.7
Total dissolved solids (TDS)	428.5	397.4
Total suspended solids (TSS)	16.0	16.0

Source: Detroit Edison 2011b
(a) Based on two cycles of concentration.

Both the influent to and the effluent from the CIRC would be treated. A biocide, a corrosion inhibitor, and a scale inhibitor would be injected into the CIRC at the inlet to the condenser. Before the CIRC water is discharged to Lake Erie, the water would be treated using sodium bisulfite for dehalogenation and maintenance of oxidant water quality standards. Water entering the PSWS also would be treated with biocide, corrosion inhibitor, and scale inhibitor. When the water from Lake Erie has high turbidity, an additional chemical to reduce sediment would be injected into the PSWS.

Water discharge temperatures would vary monthly as shown in Table 3-5 (Detroit Edison 2011b). The discharge temperature at times could reach a maximum of 86°F (Detroit Edison 2011b). When the Turbine Bypass System is in operation, the temperature of the discharge could reach up to 96°F. Impacts presented in subsequent sections consider discharges during normal operations and at full capacity.

Sanitary System Effluents

Sanitary waste effluent would first be mechanically treated at Fermi 3 using an onsite treatment system consisting of a waste basin, wet well, septic tank, settling tank, wet well pumps, sewage discharge pumps, and associated piping and controls. After onsite treatment, sanitary waste water would be discharged to the Monroe Metropolitan Wastewater Treatment Facility. In addition to wastes generated by domestic uses, Detroit Edison would discharge the demineralized water effluent from the auxiliary boiler to the Sanitary Waste Discharge System. Detroit Edison projected that the maximum volume of sanitary effluent would be 253 gpm during normal operations. During shutdown operations, Detroit Edison projected that the average volume of sanitary effluent would be 258 gpm (Figure 3.3-1 of the ER) (Detroit Edison 2011b).

Gaseous Effluents

Gaseous emissions would be produced by the combustion of diesel fuel in the diesel engines that would power the two 17.1-MW standby generators (SDG), two 1650-kW ancillary diesel generators (ADG), the two 200-kW fire pumps (FP), and one 30-MW (or 50 tons of steam per hour) auxiliary boiler. Based on four operating hours per month (or 48 hours per year) for two SDGs and two diesel-driven fire pumps, eight operating hours annually for two ADGs, and 720 hours of operation annually for an auxiliary boiler, the estimated annual emissions from these seven stationary combustion sources are 0.85 tons of particulates, 0.11 tons of sulfur oxides, 0.94 tons of volatile organic compounds (VOCs), 9.91 tons of nitrogen oxides, and 7734 tons of carbon dioxide (Detroit Edison 2011b, d). These emissions would be permitted in accordance with MDEQ and Federal regulatory requirements.

The SDGs, ADGs, and FPs would be required to comply with the requirements of the National Emission Standards for Hazardous Air Pollutants given in 40 CFR 63.6603 and 63.6604. These regulations specify emission limits and, for nonemergency diesels, performance tests, limitations on fuel sulfur content, and operating limitations. In addition, depending on when the engines are built and installed, there may be additional requirements under the Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (40 CFR Part 60, Subpart IIII).

Small amounts of VOCs would also be generated from the use of common building maintenance materials such as paints, adhesives, and caulk; from mechanical maintenance materials such as oils and solvents; and periodically from activities such as asphalt resealing.

Other Effluents

Fermi 3 would have two standby diesel generators, two ancillary diesel generators, two diesel-driven fire pumps, and one package auxiliary boiler system. The gaseous and particulate emissions from the operation of the standby and ancillary diesel generators, fire pumps, and the auxiliary boiler would be in compliance with all applicable standards (Detroit Edison 2011b).

Fermi 3 would have nonradioactive liquid discharges from stormwater runoff and various plant drains. The potential release of nonradioactive liquid effluents to Lake Erie would be controlled to meet restrictions of the Fermi 3 NPDES permit and Section 401 Water Quality Certification (Detroit Edison 2011b).

The location of Fermi 3 is within the Swan Creek watershed, and water running off of the Fermi 3 developed area would drain primarily to Swan Creek before entering Lake Erie. Drop inlets on the power block would collect the stormwater runoff resulting from storm events and route it to Swan Creek. If storm drains were blocked, runoff would drain off the elevated area in all directions and flow into the North Lagoon, the South Lagoon, or Lake Erie. Stormwater drainage patterns are shown in Figures 2.4-215 and 2.4-217 of the FSAR (Detroit Edison 2012).

Fermi 3 would produce effluents from various plant drains, including equipment drains, floor drains, laundry and chemical drains, and other miscellaneous periodic drains. Effluent from these drains would be treated, combined with the cooling water discharge, and then discharged into Lake Erie through the discharge pipe.

Table 3-7 lists the types of hazardous wastes generated by the existing Fermi 2, including laboratory solvents, paint wastes, and aerosol residues; similar wastes are expected from operation of proposed Fermi 3 (Detroit Edison 2011b). The generation, treatment, storage, and disposal of hazardous wastes are governed by Federal Resource Conservation and Recovery Act (RCRA) regulations. Detroit Edison addresses RCRA requirements for Fermi 2 and would manage hazardous wastes from Fermi 3 in the same manner.

Table 3-7. Quantities of Hazardous Wastes Generated during Fermi 2 Operations

Hazardous Waste Type	2007 (lb)	2006 (lb)	2005 (lb)
Paint – related materials	43	1782	387
Oil/solvent waste	103	20	506
Fiber wound parts – cleaner filters	7	0	309
Vehicle antifreeze – used	600	0	20
Munge-Blanchard and surfacegrinder/marble saw	180	0	210
Lead paint/contaminated mat	0	80	120
Lead contaminated rags/debris	45	0	405
Aerosol cans	692	70	1167
Leaking lead-acid batteries	0	75	0
Cutting fluids	0	80	0
Sand blast grit	0	1222	0
Parts cleaner solvent	0	32	0
Total	**1670**	**3361**	**3136**

Source: Detroit Edison 2011b

Mixed waste is a combination of hazardous waste and low-level radioactive material, special nuclear material, or byproduct materials. Mixed waste could be created during activities such as routine maintenance, refueling, and radiochemical laboratory work. NRC (10 CFR) and EPA (40 CFR) regulations govern generation, management, handling, storage, treatment, disposal, and protection requirements associated with these wastes. Management of these wastes would conform to applicable Federal and State requirements in a similar manner as that for Fermi 2. The quantities expected from Fermi 3 would be small (Detroit Edison 2011b), as they are from other nuclear power plants.

During construction of Fermi 3, solid effluents that could be disposed of in a landfill include clays, sand, gravels, silts, topsoil, tree stumps, root mats, brush and limbs, vegetation, and rocks. Such a landfill for land clearing debris does not require a permit but must comply with regulations issued by the State of Michigan for solid waste facilities.

During operation of Fermi 3, solid waste would be generated from periodic plant maintenance projects. Nonradioactive solid waste would be reused or recycled according to existing Fermi 2 plans to the extent practicable, and the rest would be disposed of at an approved and licensed offsite commercial waste disposal facility.

3.4.3 Summary of Resource Parameters during Operation

Table 3-8 summarizes the operational parameters that are relevant to assessing the environmental impacts of operating Fermi 3.

Table 3-8. Resource Parameters Associated with Operation of Proposed Fermi 3

Item	Value	Description and References
Project footprint	Permanent commitment of approximately 155 ac onsite, and 1069 ac for offsite transmission corridor	ER Table 10.1-2
Operations workforce	900 workers	ER Section 5.8.2.1, p. 5-158
Total makeup water intake	Minimum: 23,780 gpm; average: 28,993 gpm; maximum: 34,264 gpm	ER Figure 3.3-1, p. 3-22
NPHS makeup water intake	Minimum: 23,750 gpm; average: 28,963 gpm; maximum: 34,234 gpm	ER Figure 3.3-1, p. 3-22
NPHS drift and evaporation	Minimum: 11,882 gpm; average: 14,488 gpm; maximum: 17,124 gpm	ER Figure 3.3-1, p. 3-22
NPHS discharge	Minimum: 11,868 gpm; average: 14,474 gpm; maximum: 17,110 gpm	ER Figure 3.3-1, p. 3-22
Waste heat to atmosphere	1.07×10^{10} BTU/h	ER Section 3.4.1.6, p. 3-26
Blowdown temperature	Monthly discharge temperatures range from 53.8 to 81.5°F	ER Table 3.4-1, p. 3-30
Solid radwaste volume	Dry active: 363 m^3/yr; wet solid: 110.8 m^3/yr; mixed: 0.416 m^3/yr	DCD Table 11.4-2
Sanitary system discharge	Average: 88 gpm; maximum normal operations: 253 gpm; average shutdown operations: 258 gpm	ER Figure 3.3-1, p. 3-22
Power transmission system	Vegetation management on 1069 ac	ER Section 2.2.2.2, p. 2-22; Table 4.1-1, p. 4-20
NPHS sound level at 1000 ft	55 to 60 dBA at 1000 ft	ER Section 3.4.1.6, p. 3-26
AHS sound level at 1000 ft	55 to 60 dBA at 1000 ft	ER Section 3.4.1.6, p. 3-26

3.5 References

10 CFR Part 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, "Standards for Protection against Radiation."

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

40 CFR Part 60. Code of Federal Regulations, Title 40, *Protection of Environment,* Part 60, "Standards of Performance for New Stationary Sources."

40 CFR Part 63. Code of Federal Regulations, Title 40, *Protection of Environment,* Part 63, "National Emission Standards for Hazardous Air Pollutants for Source Categories."

72 FR 57432. October 9, 2007. "Limited Word Authorizations for Nuclear Power Plants, Final Rule." *Federal Register*. U.S. Nuclear Regulatory Commission.

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Detroit Edison Company (Detroit Edison). 2011b. *Fermi 3 Combined License Application, Part 3: Environmental Report*. Revision 2, Detroit, Michigan. February. Accession No. ML110600498.

Detroit Edison Company (Detroit Edison). 2011c. *Fermi 2 – 2010 Radioactive Effluent Release and Radiological Environmental Operating Report, January 1, 2010, through December 31, 2010*. Accession No. ML111220090.

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GE Hitachi Nuclear Energy Americas, LLC (GEH). 2010. *ESBWR Design Control Document*. Revision 9. December. Accession No. ML103440266.

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National Environmental Policy Act, as amended (NEPA). 42 USC 4321, *et seq*.

U.S. Environmental Protection Agency (EPA). 2009. *Final Rule: Effluent Guidelines for Discharges from the Construction and Development Industry.* EPA 821-F-09-004. November.

4.0 Construction Impacts at the Proposed Site

This chapter examines the environmental issues associated with the construction of a proposed new Enrico Fermi Unit 3 (Fermi 3), at the Enrico Fermi Atomic Power Plant (Fermi) site, as described in the application for a combined license (COL) submitted by Detroit Edison Company (Detroit Edison). As part of its application, Detroit Edison submitted an Environmental Report (ER) (Detroit Edison 2011a), which discusses the environmental impacts of building, operating, and decommissioning the proposed Fermi 3, and a Final Safety Analysis Report (FSAR) (Detroit Edison 2012f), which addresses safety aspects of construction and operation.

In addition to the COL application, Detroit Edison has applied for a Department of Army permit from the U.S. Army Corps of Engineers (USACE) to conduct activities in or affecting waters of the United States, including wetlands. Also, Detroit Edison will be required to submit a number of other applications for permits and certifications related to construction to the Michigan Department of Environmental Quality (MDEQ). As of October 2012, no preconstruction activities related to development of Fermi 3 or associated facilities have occurred on the Fermi site, and none are expected in the immediate future.

As discussed in Section 3.3 of this EIS, the U.S. Nuclear Regulatory Commission's (NRC's) authority is limited to "construction activities that have a reasonable nexus to radiological health and safety and/or common defense and security" (72 *Federal Register* [FR] 57416). Many of the activities required to build a nuclear power plant do not fall within the NRC's regulatory authority and therefore are not "construction" as defined by the NRC; such activities are referred to as "preconstruction" activities in Title 10 of the Code of Federal Regulations (CFR) 51.45(c). The NRC staff evaluates the direct, indirect, and cumulative impacts of the construction activities that would be authorized with the issuance of a COL. The environmental effects of preconstruction activities (e.g., clearing and grading, excavation, and erection of support buildings) will be included in the evaluation of cumulative impacts.

As described in Section 1.1.3 of this EIS, the USACE is a cooperating agency on this EIS consistent with the updated Memorandum of Understanding (MOU) signed with the NRC (USACE and NRC 2008). The NRC and USACE established this cooperative agreement because both agencies have concluded it is the most effective and efficient use of Federal resources in the environmental review of a proposed new nuclear power plant. The goal of this cooperative agreement is the development of one EIS that provides all the environmental information and analyses needed by the NRC to make a license decision as well as the information needed by the USACE to perform analyses, draw conclusions, and make a permit decision in the USACE's regulatory permit decision document. In an effort to accomplish this goal, the environmental review described in this EIS was conducted by a joint NRC/USACE team. The review team was composed of NRC staff and its contractors and staff from the USACE.

The USACE is responsible for ensuring that the information presented in this EIS is adequate, to the extent possible, to allow USACE to evaluate, in part, the proposed jurisdictional activities in accordance with USACE regulations; the Clean Water Act (CWA) Section 404(b)(1) "Guidelines," which contain the substantive environmental criteria used by the USACE in evaluating discharges of dredged or fill material into waters of the United States; and the USACE public interest review. The USACE will decide whether to issue a permit on the basis of an evaluation of the probable impact, including the cumulative impacts of the proposed activity on the public interest. In accordance with the Guidelines, no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have a less adverse impact on the aquatic ecosystem, provided the alternative does not have other significant adverse consequences. The USACE permit decision will reflect the national concern for both protection and utilization of important resources. The benefit that reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. Factors that may be relevant to the proposal, including its cumulative effects, will be considered; among those factors are conservation, economics, aesthetics, general environmental concerns, wetlands, historic resources, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and in general, the needs and welfare of the people (see Appendix J of this EIS for a summary of the USACE public interest review factors and Detroit Edison's proposed analysis of the impacts of alternative site layouts on waters of the United States, including wetlands).

Many of the impacts that the USACE must address in its analysis are the result of preconstruction activities. In addition, most of the activities conducted by a COL applicant that would require a permit from the USACE would be preconstruction activities.

While both the NRC and the USACE must meet the requirements of the National Environmental Policy Act of 1969, as amended (NEPA), both agencies have mission requirements that must be met in addition to the NEPA requirements. The NRC's regulatory authority is based on the Atomic Energy Act of 1954, as amended (42 USC 2011 *et seq.*). The USACE's regulatory authority that is related to the proposed action is based on Section 10 of the Rivers and Harbors Appropriation Act of 1899 (RHAA) (33 USC 403 *et seq.*), which prohibits the obstruction or alteration of navigable waters of the United States without a permit from the USACE, and Section 404 of the Clean Water Act (33 USC 1344), which prohibits the discharge of dredged or fill material into waters of the United States without a permit from the USACE. Therefore, the applicant may not commence preconstruction or construction activities in jurisdictional waters, including wetlands, without a USACE permit.

The USACE will make its evaluation after completion of its public interest review including full consideration of the recommendations of Federal, State, Tribal, and local resource agencies and members of the public, the 404(b)(1) Guidelines Evaluation, mitigation plan approval, and after it completes the following consultations and coordination efforts, if applicable: Section 106 of the National Historic Preservation Act (NHPA), including, as appropriate, development and implementation of any Memorandum of Agreement (MOA); Section 7 of the Endangered Species Act (16 USC 1531–1544); State forest conservation plans; State water quality certifications; and State coastal zone consistency determinations. Because the USACE is a cooperating agency under the MOU for this EIS, the USACE's decision whether to issue a permit will not be made until after the final EIS is issued and its evaluation is completed.

The collaborative effort between the NRC and the USACE in presenting their discussion of the environmental effects of building the proposed project, in this chapter and elsewhere, must serve the needs of both agencies to the extent possible. Consistent with the MOU, the staffs of the NRC and the USACE collaborated (1) in the review of the COL application and information provided in response to requests for additional information (developed by the NRC and the USACE) and (2) in the development of the EIS. 10 CFR 51.45(c) requires that the impacts of preconstruction activities be addressed by the applicant as cumulative impacts in its ER. Similarly, the NRC's analysis of the environmental effects of preconstruction activities on each resource area would be addressed as cumulative impacts normally presented in Chapter 7. However, because of the collaborative effort between the NRC and the USACE in the environmental review, the combined impacts of the preconstruction and construction activities that would be authorized by the NRC with its issuance of a COL are presented in this chapter. For each resource area, the NRC also provides an impact analysis solely for construction activities that meet the NRC's definition of construction in 10 CFR 50.10(a). Thereafter, both the assessment of the impacts of 10 CFR 50.10(a) construction activities and the assessment of the combined impacts of preconstruction and construction are used in the description and assessment of cumulative impacts in Chapter 7 of this EIS.

In addition to guidance provided in NUREG-1555, staff used guidance provided in the NRC Staff Memorandum *Addressing Construction and Preconstruction Activities, Greenhouse Gas Issues, General Conformity Determinations, Environmental Justice, Need for Power, Cumulative Impact Analysis, and Cultural/Historical Resources Analysis Issues in Environmental Impact Statements* (NRC 2011). For most environmental resource areas (e.g., aquatic ecology), the environmental impacts are not the result of either only the preconstruction activities or only the construction activities. Rather, the impacts are attributable to a combination of preconstruction and construction activities. For most resource areas, the majority of the impacts would occur as a result of preconstruction activities.

This chapter is divided into 13 sections. In Sections 4.1 through 4.10, the review team evaluates the potential impacts on land use, water use and quality, terrestrial and aquatic ecosystems, socioeconomics, environmental justice, historic and cultural resources, meteorology and air quality, nonradiological and radiological health effects, and nonradioactive waste impacts of building Fermi 3.

In accordance with 10 CFR Part 51, impacts were analyzed and an impact category level (SMALL, MODERATE, or LARGE) of potential adverse impacts was assigned for each resource area by the review team on the basis of the definitions for these terms established in Chapter 1 of this EIS. The impacts on some resource areas (e.g., the impacts on taxes under the socioeconomic resource area) may be considered beneficial and are stated as such. The review team's determination of an impact category level was based on the assumption that the mitigation measures identified in the ER or the activities planned by various State and county governments, such as infrastructure upgrades (discussed throughout this chapter), would be implemented. Failure to implement these upgrades might result in a change in the impact category level. Possible mitigation of adverse impacts, where appropriate, is discussed in Section 4.11. A summary of the construction impacts is presented in Section 4.12. Citations for the references cited in this chapter are listed in Section 4.13. Cumulative impacts of construction and operation are discussed in Chapter 7. The technical analyses provided in this chapter support the results, conclusions, and recommendations presented in Chapters 7, 9, and 10 of this EIS.

The review team's assessment of the impacts from the construction of proposed Fermi 3 draws on information presented in Detroit Edison's ER Revision 2 (Detroit Edison 2011a) and supplemental documents, as well as other government and independent sources.

4.1 Land Use Impacts

This section provides information on land use impacts associated with site-preparation activities and the building of Fermi 3 at the Fermi site. Topics discussed include land use impacts at the Fermi site and in the vicinity of the site, and land use impacts in the transmission line corridor and offsite areas. For the purposes of the analysis, the site vicinity is defined as the area encompassed by a 7.5-mi radius around the site.

4.1.1 The Site and Vicinity

Approximately 301 acres (ac) of land on the Fermi site would be used to build Fermi 3 and associated facilities (Detroit Edison 2011a). Land would be used for an equipment and materials laydown and access area (143 ac); a new power block, including nuclear containment structure, turbine building, cooling towers and batch plant (87 ac); parking, warehouse, and access roads (22 ac); and a switchyard and onsite transmission line corridor (18 ac). An administrative building and meteorological tower would occupy 13 ac (Detroit Edison 2011a). An additional 18 ac would be used, but Detroit Edison has not indicated the specific use of this land. Approximately 189 ac of the land required for Fermi 3 would be land previously undisturbed by urban development, and 112 ac would be land that had been previously disturbed when building Fermi 1 or 2 (Detroit Edison 2011a). The footprint of Fermi 3 and an exclusion area extending 2927 ft out from the center of the reactor building would overlap part of the exclusion area of Fermi 2, which is defined as an area extending 2001 ft from the center of the Fermi 2 containment structure (Detroit Edison 2011a). This overlap would not constitute a land use conflict.

Land preparation and building activities for Fermi 3 would involve clearing, grading, excavation, and draining land, resulting in the alteration of existing vegetation, topography, and drainage patterns. Mitigation measures implemented to reduce preconstruction and construction activity impacts would include erosion control, controlled access roads, and restricted building zones. Surface features and soils would be stabilized and restored after completion of building activities, and permanently disturbed locations would be stabilized and contoured to blend with the surrounding area. Vegetation stabilization and restoration methods would comply with applicable laws, regulations, permit requirements and conditions, good engineering and construction practices, and recognized environmental best management practices (BMPs).

Excavated material from the power block and cooling system would be used as backfill for building the cooling tower and cooling water system. Detroit Edison expects to use the remaining excavated material (265,000 cubic yards [yd^3]) as fill for onsite road improvements and in building the parking and laydown areas (Detroit Edison 2011a). No onsite borrow pits or landfills are anticipated. Material dredged while building the water-intake structure, barge slip, and associated facilities would be disposed of in the existing onsite spoils disposal pond, (Detroit Edison 2011a).

Approximately 34.5 ac of wetlands and 5.2 ac of open water on the Fermi site would be disturbed. Approximately 23.7 ac of the disturbed wetlands would be only temporarily disturbed and would be rehabilitated (Detroit Edison 2012). Approximately 8.3 ac of the disturbed wetlands and the 5.2 ac of disturbed open water would be permanently lost. Approximately 2.5 ac of the disturbed wetlands are forested wetlands that would be converted to emergent wetlands. Most wetland impacts on or close to the Fermi site would require permits from the USACE and the MDEQ. Wetland impacts and associated mitigation are discussed further in Sections 4.3.1.3 and 4.3.1.5.

All of the roughly 64-ac agricultural field in the west-southwest part of the Fermi site, including the prime farmland contained within, would be temporarily disturbed to establish an equipment and material laydown area (Detroit Edison 2011a). Although the temporarily disturbed farmland would ultimately become available for possible future agricultural use after the building period, compaction or removal of topsoil during the use of the land for laydown could permanently alter the soil properties responsible for designation of portions of the field as prime farmland. Although approximately 21 ac of forested land would be cleared to accommodate new facilities

(Detroit Edison 2011a), Detroit Edison does not manage any land on the Fermi site for timber production and has no plans to do so in the future (Detroit Edison 2009a).

Approximately 45 ac of land managed as part of the Detroit River International Wildlife Refuge (DRIWR) would be disturbed during development of Fermi 3, of which approximately 26 ac would be only temporarily used, while approximately 19 ac would be permanently occupied (Detroit Edison 2011a). Detroit Edison currently has a Cooperative Agreement with the U.S. Fish and Wildlife Service (FWS) for management of the onsite portion of the DRIWR, and a reduction of this size is consistent with the 2003 Cooperative Agreement and the FWS Comprehensive Conservation Plan for the Refuge (see Section 2.1.1).

The Fermi site and some adjoining areas lie within the Coastal Zone defined by the State of Michigan under the Coastal Zone Management Act, which is designed to ensure the reasonable use of coastal areas (see Section 3.1). Before ground disturbance, Detroit Edison must obtain a coastal zone consistency determination from the MDEQ (Detroit Edison 2011a) (see Section 2.1.1). On January 24, 2012, the MDEQ issued Permit No. 10-58-0011-P to Detroit Edison (MDEQ 2012). Issuance of this permit constitutes a coastal zone consistency determination from the MDEQ.

Temporarily disturbed areas would be restored to their existing topographic and hydrological conditions and be planted with natural vegetation once no longer needed, to assist in protecting coastal lands from erosion and pollution (Detroit Edison 2011a). Because the public is already excluded from lands where Fermi 3 would be built and from areas of Lake Erie within the offshore portions of the security zone, Fermi 3 is not expected to interfere with public recreation in or enjoyment of the Coastal Zone. The project would be situated in an area already zoned as Industrial and dedicated to energy production; it would therefore not alter general land use patterns already established in the Coastal Zone. The aesthetics of the surrounding landscape and adjoining waters of Lake Erie have already been influenced by existing Fermi facilities, and the addition of Fermi 3 would not alter the general aesthetic character.

As stated in Section 2.2.1, Detroit Edison owns the mineral rights to the entire Fermi site, except for approximately 0.88 ac in southeastern part of the site (Detroit Edison 2011a). Development of Fermi 3 would not involve that 0.88 ac.

The majority of the proposed Fermi 3 buildings and structures would be situated outside the 100-year and 500-year floodplains (Detroit Edison 2011a). Detroit Edison designed the proposed layout to minimize floodplain encroachment. The majority of the floodplain impacts would be temporary, and the small number of permanent impacts would not noticeably reduce floodplain capacity. Additional description of floodplain impacts is provided in Section 4.2. Development in floodplain areas requires review and approval by Frenchtown Charter Township. A barge slip, water intake, and cooling tower outfall would be built on the Lake Erie shoreline, in an area subject to coastal flooding.

Some dredging in Lake Erie could be needed for a passage from the main channel of the lake to the barge slip, to accommodate movement of heavy equipment and components to the site by barge. Dredged material would be removed and transported to an existing onsite spoils disposal pond area for treatment prior to disposal (Detroit Edison 2011a). All dredging would be performed in compliance with permits from the USACE and MDEQ.

Fermi 3 construction traffic would use existing onsite roads, as well as a new access road designated as New Fermi Drive, which would extend from Dixie Highway to Fermi 3 (Detroit Edison 2011a). Installation of the new road is not expected to interfere with existing land use on the Fermi site. In addition to the new road, existing roadways onsite might be widened or additional surface layers added to roads used by heavy construction equipment, in order to reduce the potential for erosion and siltation. Traffic increases would be localized and occur mainly during shift changes. Rail access to the Fermi site currently exists, and would be available for Fermi 3 if necessary (see Section 3.1), with no new or modified rail lines required (Detroit Edison 2011a).

Fermi 3 and associated facilities (other than offsite transmission lines) would be situated entirely within the existing Fermi site. Land on the entire site is zoned as “Public Service” by Frenchtown Township and designated as “Industrial” by Monroe County (James D. Anulewicz Associates, Inc., and McKenna Associates, Inc. 2003; Monroe County Planning Department and Commission 2010). The new facilities would be consistent with these zoning designations. No impacts on land use planning in Monroe County or Frenchtown Township would be expected as a result of Fermi 3, as the facility would comply with all applicable land use and zoning regulations of Monroe County and Frenchtown Township. Regional and State land use plans do not contain designations that apply specifically to the Fermi site, and these plans would therefore not be affected by Fermi 3. Development of Fermi 3 would, therefore, be in compliance with all local, regional, and State land use plans.

The existing onsite 120-kilovolt (kV) and 345-kV transmission lines serving Fermi 2 would be rerouted to cross mostly emergent wetland and uplands in the DRIWR (Detroit Edison 2011a). New 345 kV transmission lines serving Fermi 3 would be built within the relocated corridor alongside the rerouted Fermi 2 lines. As stated previously, a proposed new switchyard for Fermi 3 would occupy about 10 ac of land that has previously been restored to prairie vegetation (Detroit Edison 2011a).

Some offsite land use changes could indirectly result from the development of Fermi 3. Possible impacts include the conversion of some land in surrounding areas to housing developments (e.g., recreational vehicle parks, apartment buildings, single-family condominiums and homes, and manufactured home parks) and retail development to accommodate workers. Property tax revenue from the addition of Fermi 3 could induce additional growth in Monroe County as a result of infrastructure improvements (e.g., new roads and utility services). Additional information on roads, housing, and construction-related infrastructure impacts is discussed in Section 4.4, with operations-related infrastructure impacts presented in Section 5.4.

Based on information provided by Detroit Edison, and the review team's independent evaluation, the review team concluded that the land use impacts of preconstruction and construction activities on the Fermi site would be SMALL and that mitigation measures beyond those required by Federal and State agencies would not be warranted. This conclusion recognizes that the impacts on the DRIWR are consistent with Detroit Edison's Cooperative Agreement with the FWS for management of the DRIWR, that Detroit Edison would ensure that the Fermi 3 project is consistent with Michigan's objectives for managing its coastal zone, and that Detroit Edison would perform compensatory mitigation required by the USACE and MDEQ for unavoidable losses of wetlands. It also recognizes that ITC*Transmission* would obtain a coastal zone consistency determination for that part of the proposed transmission line to be built on the Fermi site. Because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concluded that the land use impacts of NRC-authorized construction activities would also be SMALL. As previously noted, the project would require certification from the State of Michigan that it would be consistent with Michigan's coastal zone management program.

4.1.2 Transmission Line Corridors and Other Offsite Facilities

Three new 345-kV transmission lines have been proposed to serve Fermi 3, and would extend offsite along a 29.4-mi route in Monroe, southwest Wayne County, and southeast Washtenaw County. Within the required corridor, approximately 18.6 mi of lines would be sited within established transmission line rights-of-way, and approximately 10.8 mi of the corridor would be sited along new undeveloped right-of-way (Detroit Edison 2011a). The lines would be connected to the ITC*Transmission* Milan Substation for distribution to the grid. New towers would require foundation excavations, and the new lines would be constructed, owned, and operated by ITC*Transmission*. The Milan Substation currently occupies 4 ac; it is likely that the substation footprint would be expanded to an area of approximately 23 ac, encompassing approximately 19 ac of additional land, to accommodate the three new transmission lines from Fermi 3 (Detroit Edison 2011a).

Approximately 1069 ac would be used for the proposed lines, assuming that a 300-ft-wide right-of-way (ROW) would be required for a distance of 29.4 mi (Detroit Edison 2011a). Additional acreage for laydown and other activities, located outside the corridors, might also be required. No new roadway access would be anticipated, with existing roads used for access and construction traffic. While the new lines are being built, the corridor areas might be fenced to prevent impacts on other land uses. Once the lines are installed, a small amount of land around the transmission tower bases would be lost from productive use in agricultural areas, while in forested areas, the corridor would remain cleared. Clearance of new corridor would result in vegetation removal and brush piles, disturbance of soils and soil erosion, and damage to culverts and roadways. Within the 300-ft corridor, there would be impacts on forest, agricultural lands, wetlands and streams, residences, undeveloped land, and recreational uses.

Practices used for extending the new transmission lines to the Milan Substation would be expected to comply with the requirements of local, State, and Federal environmental regulations. ITC*Transmission* has stated that industry standards for best environmental practices would be observed, including (1) continual and responsible management of wastes and chemicals to prevent and avoid pollution, (2) use of environmentally preferable materials, (3) reduction or elimination of wastes at the source, (4) appropriate storage and handling of wastes, (5) recycling and reuse of waste materials, and (6) sediment and erosion control (ITC 2010). Detroit Edison has stated that it expects ITC*Transmission* to largely restore existing land uses, other than forest, in the transmission line corridor once the transmission line is built (Detroit Edison 2011a).

Land use in each section of the corridor for the proposed new transmission lines is shown in local Township and County future use plans as being utility use, while land for the new corridor is shown as agricultural (Monroe County Planning Department and Commission 2010; James D. Anulewicz Associates, Inc., and McKenna Associates, Inc. 2003). Sections 460.551–460.575 of the Michigan Compiled Laws (MCL) authorize the Public Service Commission to regulate electric transmission lines. In siting the new transmission line, Detroit Edison would contact the State Historic Preservation Office (SHPO), FWS, MDEQ, and USACE.

Based on information provided by Detroit Edison, ITC*Transmission*, and the review team's own independent review, the review team concluded that the land use impacts of building the new transmission line would be SMALL, and no additional mitigation beyond that required by other environmental permits would be warranted. None of the impacts related to transmission lines would result from NRC-authorized activities.

4.2 Water-Related Impacts

Water-related impacts associated with building a nuclear power plant are similar to impacts associated with building any large industrial facility development project and to the impacts that occurred during the construction of Fermi 2. Prior to initiating onsite activities, including any site preparation work, Detroit Edison is required to obtain the appropriate authorizations that regulate alterations to the hydrological environment. These authorizations would likely include:

- Clean Water Act Section 404 Permit. This permit is required for the discharge of dredged and/or fill material into waters of the U.S.
- Clean Water Act Section 401 Water Quality Certification. This certification would be issued by the MDEQ to ensure that the project does not conflict with State and Federal water-quality management programs. Permit No. 10-58-0011-P was issued to Detroit Edison on

January 24, 2012 (MDEQ 2012). Issuance of this permit constitutes the required State of Michigan 401 Water Quality Certification.

- Clean Water Act Section 402(p) National Pollutant Discharge Elimination System (NPDES). The MDEQ administers the NPDES program for the U.S. Environmental Protection Agency (EPA) Construction General Permit and industrial discharge permits. These permits regulate point source stormwater and wastewater discharges. Discharge of excavation dewatering water would require an additional permit under Section 402(p). Discharges from hydrostatic pressure testing of new and existing piping, tanks, and other equipment would be regulated under an NPDES General Hydrostatic Pressure Test Water permit.
- Section 10 of the Rivers and Harbors Appropriations Act of 1899 Permit. This permit would be issued by the USACE to regulate any structure or work in, over, under, or affecting waters of the United States, such as Lake Erie. Maintenance dredging activities under Section 10 are currently authorized by USACE Permit No. LRE-1988-10408.
- Federal Coastal Zone Management Act of 1972. This concurrence of consistency with the policies of the State coastal program would be issued by the MDEQ. It applies to any activity that is in land, water, or any natural resource in the coastal zone or any activity that affects land use, water use, or any natural resource in the coastal zone, if the activity requires a Federal license or permit. Permit No. 10-58-0011-P was issued to Detroit Edison on January 24, 2012 (MDEQ 2012). Issuance of this permit constitutes the required coastal zone consistency determination from the MDEQ.
- MDEQ Soil Erosion and Sedimentation Control (SESC) Permit. This permit regulates controls on soil and sediment at construction sites. The authority for this permit is assigned to the Monroe County Drain Commissioner.
- MDEQ Permit Under Act 451, Natural Resources and Environmental Protection Act, Part 325, "Great Lakes Submerged Lands." This Michigan law regulates dredging activities in the Great Lakes. Permit No. 10-58-0011-P was issued to Detroit Edison on January 24, 2012 (MDEQ 2012) and authorizes construction-related activities under Part 325. Maintenance dredging activities under Part 325 are currently authorized by MDEQ Permit No. 11-58-0055-P.
- MDEQ Permit under Act 451, Natural Resources and Environmental Protection Act, Part 303, "Wetlands Protection." This Michigan law regulates dredge and fill activities in jurisdictional wetlands. Permit No. 10-58-0011-P was issued to Detroit Edison on January 24, 2012 (MDEQ 2012) and authorizes construction-related activities under Part 303.
- Monroe County Environmental Health/Sanitary Code Well Permit. Well permit is required for construction of wells, including dewatering and monitoring wells.

Hydrological alterations are discussed in Section 4.2.1; water use impacts are discussed in Section 4.2.2; water-quality impacts are discussed in Section 4.2.3; and water monitoring is discussed in Section 4.2.4.

4.2.1 Hydrological Alterations

Building the proposed Fermi 3 facility would affect several surface water bodies, site drainage patterns, and groundwater underlying the site.

4.2.1.1 Surface Water Bodies

Surface water bodies that would be altered by site preparation and building activities include Lake Erie, Swan Creek, and several onsite water bodies.

As part of building Fermi 3, Detroit Edison plans to construct a water intake structure and a water discharge pipe in Lake Erie. The intake structure would be located between two rock groins that extend 600 ft from the facilities' shoreline into the lake. The discharge pipe will extend 1300 ft from the shoreline in the plant vicinity and into Lake Erie. Dredging, bedding placement, and cover material would be required between the intake rock groins and along the discharge pipe pathway and outfall structures. The MDEQ has issued Permit No. 10-58-0011-P to Detroit Edison authorizing dredging activities related to the construction of the intake structure and the discharge pipe (MDEQ 2012). The permit describes State of Michigan conditions, mitigation, and monitoring that must be adhered to for permit compliance. Detroit Edison applied for a USACE permit for activities associated with the proposed Fermi 3 project, including activities related to constructing the intake structure and discharge pipe, to USACE on September 9, 2011 (Detroit Edison 2011e). The USACE and MDEQ permitting processes would ensure that construction and preconstruction impacts are avoided as practicable, then reduced as practicable by implementation of BMPs or other appropriate measures, and then mitigated by compensation and/or other appropriate means.

Maintenance dredging for the intake canal would also be required for ongoing Fermi 2 operations during building activities for Fermi 3. Maintenance dredging activities for Fermi 2 are currently authorized by (1) USACE Permit No. LRE-1988-10408 and (2) MDEQ Permit No. 11-58-0055-P.

Swan Creek could receive increased stormwater runoff from construction areas. In addition, the water removed from the subsurface during construction dewatering would likely be discharged into stormwater outfalls that flow to the mouth of Swan Creek.

During the building of Fermi 3, the north canal (overflow canal) and the small pond (the central canal) would be dewatered and backfilled, and the south canal (discharge canal) would be partially dewatered and backfilled (Detroit Edison 2011a; Figure 4-1). It is estimated that a total

Figure 4-1. Areas Affected by Building Activities for Fermi 3 (Detroit Edison 2011a)

of 5.2 ac of open water would be permanently impacted (Doub 2011). In addition, some onsite wetlands would be temporarily or permanently affected by building activities. Approximately 8.3 ac of wetlands would be permanently affected (Doub 2011). Impacts on waters of the United States and jurisdictional wetlands are regulated by the USACE and the MDEQ. The jurisdictional determinations are discussed in Section 2.7.1. As described above, the MDEQ has issued Permit No. 10-58-0011-P to Detroit Edison authorizing activities related to construction and dredging in regulated wetlands, at the shoreline, and in Lake Erie, below the State of Michigan ordinary high water mark (MDEQ 2012). The permit describes State of Michigan conditions, mitigation, and monitoring that must be adhered to for permit compliance. The USACE and MDEQ permitting processes would ensure that construction and preconstruction impacts are avoided as practicable, then reduced as practicable by implementation of BMPs or other appropriate measures, and then mitigated by compensation and/or other appropriate means.

Building activities would decrease the available area of floodplain at the site, due to the emplacement of fill and building of new facilities that will occupy land which is currently available to accommodate flood waters. However, the majority of impacts on areas within the floodplain will be temporary, and the small amount of permanently affected area is not anticipated to cause noticeable impacts on the floodplain capacity at the Fermi site. In addition, Detroit Edison's proposed compensatory mitigation of anticipated aquatic resource losses would restore and provide additional capacity to accommodate flood waters in coastal areas of Monroe County (Detroit Edison 2011e).

4.2.1.2 Landscape and Drainage Patterns

It is anticipated that a total of 189 ac of previously undeveloped land at the Fermi site would be affected by building activities related to the Fermi 3 power block, new parking structures, a warehouse, construction and preconstruction parking, construction and preconstruction laydown, a new switchyard, a new meteorological tower, and administrative buildings (Figure 3-2). Stormwater runoff from all building and site preparation activities would be regulated by an NPDES Construction General Permit under Section 402(p) of the Clean Water Act (EPA 2009). Before commencing any building activities, Detroit Edison would be required to develop an SESC plan to obtain an SESC permit. The SESC plan would include descriptions of the BMPs used during preconstruction and construction activities to prevent and manage erosion and offsite sedimentation. The SESC permit is needed to obtain the NPDES Construction General Permit.

During preconstruction and construction activities, the site stormwater drainage patterns and runoff quantities would be affected. Construction of the power block area would require excavation and alteration of the land surface in the vicinity of Fermi 3 in order to build an elevated area for the safety structures and to install a stormwater drainage system for the site. The existing site grade would be raised to 589.3 ft North American Vertical Datum of 1988

(NAVD 88) in the vicinity of the safety-related structures. Stormwater drainage patterns would be altered during clearing and grading activities for the new buildings, transmission lines, a substation, laydown areas, and the meteorological tower. The site clearing and building activities for the proposed Fermi 3 would also convert some land that is currently available for drainage to an impervious surface, so the quantity of stormwater runoff would increase compared to current conditions.

Offsite areas would be affected by the installation of the new 345-kV transmission lines along a 29.4-mi route to the Milan Substation, 10.8 mi of which is currently not developed. It is estimated that the undeveloped portion of the transmission line corridor would be approximately 393 ac, assuming the width along the 10.8-mi transmission line corridor would be 300 ft (Detroit Edison 2011a). Development of the new transmission lines would also take place along an existing 18.6 mi of ROW currently used for transmission structures and lines (Detroit Edison 2011a). The 10.8-mi undeveloped portion of the transmission line corridor would cross nine drains or streams, and these water bodies could be affected by building the line. The previously developed transmission line ROW crosses 12 drains or streams and eight wetland areas that could be affected by activities associated with upgrading the transmission lines (Detroit Edison 2011a).

4.2.1.3 Groundwater

Groundwater would not be used during the building of Fermi 3, but it would be affected during building activities. Building activities and conditions that could affect groundwater levels and alter groundwater flow around Fermi 3 include the following: excavation of portions of site aquifers (overburden and Bass Islands Group) and emplacement of the high-conductivity structural fill, filling in of the onsite water bodies, changes in recharge due to impervious surfaces and stormwater routing, and dewatering during excavation. Excavation dewatering would lower the water levels locally, in the overburden and in the Bass Islands Group bedrock aquifer. The impacts of excavation dewatering are discussed more fully in Section 4.2.2.2. Water produced during excavation dewatering would likely be discharged to Swan Creek via the North Lagoon by using the NPDES stormwater outfalls.

A drop in the groundwater elevation as a result of dewatering would not affect water levels in the onsite wetlands because the wetlands are hydraulically connected to Lake Erie. This means that any loss of wetland inflow due to dewatering would be quickly replaced by inflow from the lake. Detroit Edison (2011a) estimates that the water levels in the Quarry Lakes would drop between 1 and 2 feet as a result of dewatering operations for preconstruction and construction activities. Impacts on groundwater systems during dewatering would be reduced by installing flow barriers at the edges of the excavation area (Detroit Edison 2011a). Methods such as the (1) emplacement of a concrete wall extending from the surface to below the base of the excavation around the perimeter of the deep excavation area or (2) installation of a grout curtain at the perimeter of excavation would be used. Detroit Edison (2011a) also states that grouting in the bottom of the excavation could also be used to reduce groundwater inflows into the excavation area. These steps would limit the impacts of dewatering on offsite groundwater systems and groundwater users.

4.2.1.4 Summary of Hydrological Alterations

In summary, the hydrological alterations associated with building on and near the Fermi site would be limited to dredging for the intake and discharge structures and barge slip, altering the surface topography and hydrology (e.g., site grading, laydown areas, filling of onsite water bodies), and dewatering the excavation for construction of the nuclear facilities. Offsite hydrological alterations are associated with the proposed new or expanded transmission line corridors where the lines cross wetlands and drainages. The impacts of hydrological alterations resulting from both onsite and offsite construction activities would be localized and reduced with the implementation of BMPs and mitigation measures required by the necessary permits and certifications. Any impacts on USACE jurisdictional water resources associated with the compensatory mitigation construction activities proposed by Detroit Edison would be evaluated by the USACE during its permit evaluation process.

4.2.2 Water Use Impacts

This section describes, analyzes, and assesses the impacts of proposed project preconstruction and construction activities on the use of both groundwater and surface water resources. It identifies the proposed preconstruction and construction activities that could have impacts on water use and analyzes and evaluates proposed practices designed to minimize adverse impacts on water use. The impacts of building a nuclear power plant on water use are similar to impacts associated with building any large industrial construction project.

4.2.2.1 Surface Water Use Impacts

Surface water obtained directly from Lake Erie would be used to support building activities at the site. Potable water to support preconstruction and construction would be obtained from Frenchtown Township, which also uses water from Lake Erie. Fermi 3 building activities are anticipated to require between 350,000 and 600,000 gallons per day (gpd) for concrete batch plant operation, temporary fire protection, dust control, and sanitary needs (Detroit Edison 2011a). Since this water withdrawn from Lake Erie would be for consumptive use (apart from the sanitary water returned to the system) no runoff is anticipated to be generated from these building activities. The usage rate of water for preconstruction and construction activities would be approximately 2 percent of the usage rate of water consumed for operation of Fermi 3, which is 0.1 percent of average consumptive use rate in Lake Erie basin between 2000 and 2006 and 0.001 percent of the average rate of Lake Erie water withdrawn between 2000 and 2006. In addition, annual water use during preconstruction and construction activities would be minute compared to the total volume of Lake Erie (approximately 0.00017 percent). The Great

Lakes Compact of 2008 requires any new water use of more than 5 million gallons per day (MGD) to be subjected to a regional review. Water use during the building of Fermi 3 would be less than 5 MGD, so water use for building activities would not be subject to regional review.

Detroit Edison (2011a) states that the only user of surface water near Fermi 3 preconstruction and construction activities would be the Fermi 2 power plant. Figure 4-1 shows the area of Lake Erie that would be affected by withdrawals of water from Lake Erie for use as construction water. Though the intake area for Fermi 3 and Fermi 2 would be shared, Detroit Edison (2011a) states that water withdrawals for operations at Fermi 2 would not be affected by Fermi 3 building activities.

On the basis of information provided by Detroit Edison (2011a) and the review team's independent evaluation, the review team concludes that surface water use impacts of preconstruction and construction activities would be SMALL and that no mitigation would be warranted. On the basis of the above analysis, the NRC staff concludes that the impacts of NRC-authorized construction activities would be SMALL. The NRC staff also concludes that no further mitigation measures would be warranted.

4.2.2.2 Groundwater Use Impacts

Excavation dewatering is the only anticipated use of groundwater during building and site-clearing activities for Fermi 3. Excavation will occur in the power block area and a barrier would be installed around the edge of the excavation area to limit flow into the excavation. This barrier would extend from the ground surface to below the maximum depth of excavation, into the Bass Islands Group bedrock aquifer (Detroit Edison 2011a). The barrier would be a concrete wall or a grout curtain extending from the ground surface to below the excavation at the perimeter of excavation. Grouting could also be done in the bottom of the excavation. Installing a barrier would reduce the groundwater flow into the excavation area, especially from the water in the overburden (Detroit Edison 2011a). Dewatering would occur from the bedrock aquifer, but groundwater in the site overburden drains down into the bedrock aquifer. Because the units are hydraulically connected, groundwater would also be drained from the overburden. Detroit Edison (2011a) anticipates that the proposed barriers around the excavation areas would minimize groundwater inflow, such that using sumps at the bottom of the excavation would be sufficient for dewatering the area of interest.

Detroit Edison (2011a) modeled the effects of excavation dewatering at the Fermi site by using a modified version of a published U.S. Geological Survey (USGS) MODFLOW model of Monroe County (Reeves et al. 2004). The review team performed an independent evaluation of the model and found the methods, parameters, and conclusions to be satisfactory. Detroit Edison (2011a) determined that construction and preconstruction dewatering activities could affect the groundwater table of the bedrock aquifer in the vicinity of the site and also that users in the vicinity could be affected by the lower water levels. Two alternative scenarios estimating drawdown caused by construction and preconstruction dewatering activities are presented in the ER:

- In Scenario 1, Detroit Edison assumed there would be a reinforced diaphragm concrete wall in the subsurface to reduce the water drainage from the aquifer for dewatering.
- In Scenario 2, Detroit Edison assumed that there would be a grout curtain or freeze wall to reduce the water drainage from the aquifer during dewatering.

Both scenarios assumed that the bottom of the excavation would be grouted to reduce groundwater inflows. Based on the results of the model scenarios, the reinforced diaphragm concrete wall would be a better flow barrier and result in smaller drawdown in the groundwater system in the area of the site, although the differences offsite were not significant (Detroit Edison 2011a).

Groundwater wells that could be affected by drawdown from dewatering during the building of Fermi 3 are nearby household wells, irrigation wells, and other wells (Detroit Edison 2011a). The model results indicate that the reinforced diaphragm concrete (Scenario 1) wall could limit offsite impacts due to dewatering somewhat better than the grout curtain or freeze wall (Scenario 2). The nearest well to the site is a domestic water supply well located approximately 3800 ft from the center of the power block area, where both modeling scenarios predict that drawdown would be highest. In Scenario 1, a drawdown of 1 ft or greater is confined within the site boundary and is estimated to be less than 1 ft at the nearest offsite well (Figure 4-2). In Scenario 2, a drawdown of 2 ft or greater is confined within the site boundary and is estimated to be slightly less than 2 ft at the nearest offsite well (Figure 4-3). These drawdowns are the modeled maximum amounts associated with long-term dewatering to arrive at steady-state conditions.

The predicted impact of excavation dewatering is less than the observed seasonal fluctuation in local bedrock wells. Water levels in Fermi site wells screened in the Bass Islands Group aquifer have been observed to fluctuate an average of 4 ft within a year (Detroit Edison 2011a). Groundwater elevations in the vicinity of the Fermi site have declined between approximately 10 and 15 ft since the early 1990s as a result of dewatering for offsite quarry operations elsewhere in Monroe County (Reeves et al. 2004). Onsite dewatering during construction is temporary and may result in an additional decrease of 2 ft or less to nearby users; therefore, their water source is not expected to be affected. As a result, dewatering would not create significant, long-term impacts on nearby water users. Detroit Edison has committed to supply water to meet all users' needs, if necessary (Detroit Edison 2011a).

The groundwater flow beneath the site has been reversed from toward Lake Erie (historically) to toward quarry operations to the north and southwest of the Fermi site. While dewatering at the site may affect groundwater flow directions in the area, these effects will be minor and temporary due to limited scope and timeframe of dewatering activities.

Figure 4-2. Modeled Drawdown of Groundwater in the Bass Islands Group as a Result of Dewatering for Fermi 3 Construction – Scenario 1 (Detroit Edison 2011a)

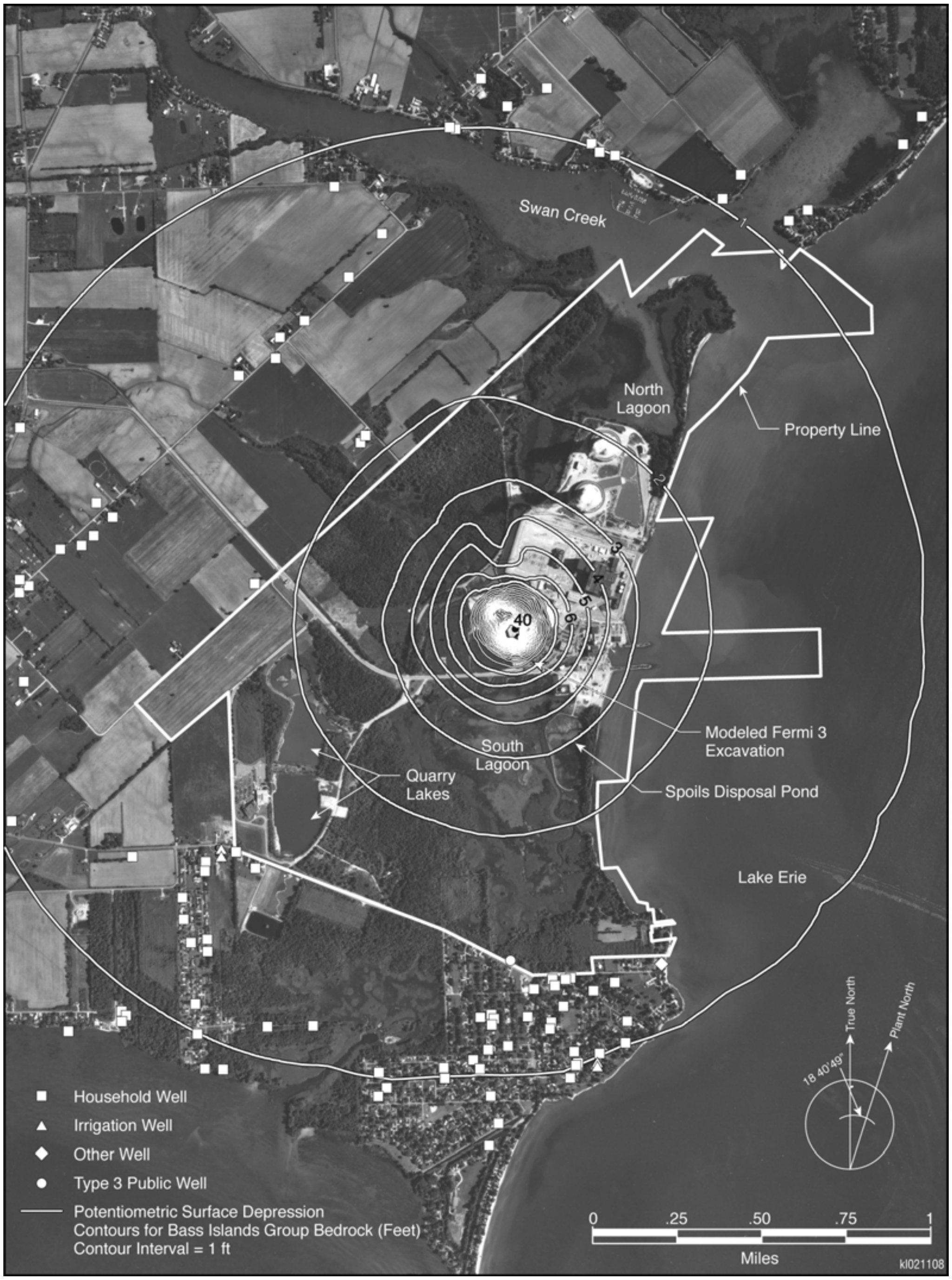

Figure 4-3. Modeled Drawdown of Groundwater in the Bass Islands Group as a Result of Dewatering for Fermi 3 Construction – Scenario 2 (Detroit Edison 2011a)

Groundwater dewatering activities are not expected to affect onsite wetlands, because these wetlands are hydraulically connected to Lake Erie and inflow from the lake would rapidly supply the wetland with water if dewatering caused drawdown of the groundwater table in wetland areas.

On the basis of information provided by Detroit Edison (2011a) and the review team's independent evaluation, the review team concludes that groundwater use impacts of construction and preconstruction activities for Fermi 3 would be SMALL and no further mitigation would be warranted. On the basis of the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the impacts of NRC-authorized construction activities would be SMALL. The NRC staff also concludes that no further mitigation measures would be warranted.

4.2.3 Water Quality Impacts

Water quality impacts from construction activities are similar to those from other large industrial construction projects. Impacts on the quality of the water resources of the site are expressed for surface water (Swan Creek and Lake Erie) features and groundwater (i.e., the water table in the overburden and Bass Islands Group aquifer) features that are most directly affected by construction and preconstruction activities.

4.2.3.1 Surface Water Quality Impacts

The water quality of surface water bodies on or near the Fermi site could be affected by building and site clearing activities and impacts from these activities on the quality of surface water need to be considered. These impacts are discussed in the applicant's ER (Detroit Edison 2011a).

Installation of fish return and intake and discharge structures in and along the shoreline of Lake Erie and installation of culverts in the overflow and south canals would disturb sediments during building and dredging activities, potentially increasing turbidity near the intake and discharge structures and the overflow and south canal at the Fermi site. Dredged sediments would be disposed of in the Spoils Disposal Pond (Figure 4-1), and the water draining from dredged sediments would drain through an NPDES outfall. The outfall from the Spoils Disposal Pond is regulated by the Fermi 2 NPDES permit. Discharge from the Spoils Disposal Pond associated with Fermi 3 dredging activities would be regulated under the existing Fermi 2 NPDES permit, which allows 450 million gallons per year to be discharged from the pond (Detroit Edison 2011a). The applicant anticipates that the Spoils Disposal Pond has adequate capacity for the Fermi 3 dredged material (Detroit Edison 2011a).

Construction-related activities may potentially affect water quality near the site. Pollutants (e.g., oil and grease, copper, zinc, and other pollutants from vehicles) resulting from increased traffic related to building activities could be entrained into stormwater runoff during rainfall events. Construction activities such as the discharge of water from dewatering, filling of the onsite canals, disposal of dredge spoils, and land clearing and grading could increase erosion and/or carry sediment in stormwater runoff from the site into the North Lagoon (to Swan Creek), South Lagoon, the Quarry Lakes, or Lake Erie. Areas of concern for potentially increasing sediment in runoff include the power block area, new buildings, transmission lines, a substation, laydown areas, and the meteorological tower. The impacts of these activities on surface water quality would be reduced by NPDES permitting, implementation of the approved SESC plan that includes soil erosion controls (such as silt fences and straw bales), and adherence to a Pollution Incident Prevention Plan (PIPP) to prevent contamination.

The NPDES construction permit requires monitoring of the discharges for turbidity during all construction and preconstruction activities (EPA 2009). Starting in August 2011, EPA-defined construction projects disturbing an area larger than 20 ac will be required to monitor construction-related discharges for turbidity (EPA 2009). After that date, the turbidity of EPA-defined construction[a] stormwater discharges from projects larger than 20 ac will be required to be below an average of 280 nephelometric turbidity units (NTUs).

As mentioned, to build and operate the proposed Fermi 3, Detroit Edison must obtain authorizations from Federal and State regulatory agencies. This would limit the impacts of regulated activities.

In summary, hydrological alterations resulting from site preparation and building activities, including discharge of water from dewatering, clearing, grading, filling and dredging for the intake and discharge, would be localized and temporary. In addition, State and Federal permits and certifications would require the disturbed land to be stabilized to prevent erosion through implementation of BMPs to minimize impacts, and potential impacts to be monitored. As a result, the review team concludes that the surface water quality impacts of construction and preconstruction activities for Fermi 3 would be SMALL, and no mitigation beyond the BMPs would be warranted. On the basis of the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the surface water quality impacts of NRC-authorized construction activities would be SMALL. The NRC staff also concludes that no further mitigation measures beyond the BMPs would be warranted.

4.2.3.2 Groundwater Quality Impacts

During site preparation and building activities for the proposed Fermi 3, the potential would exist for spills to transport pollutants (e.g., gasoline) to groundwater in the overburden. As noted, Detroit Edison would develop a PIPP and the subsequent NPDES construction stormwater

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(a) EPA-defined construction would include all building activities occurring at the site, including both NRC-defined preconstruction activities and construction activities.

permit that would require the implementation of BMPs that would prevent or promptly mitigate any spills.

Because of the planned use of good housekeeping rules and BMPs, including maintaining an inventory of potential sources, performing preventive maintenance and inspections, providing signs and labels, and providing secondary containment, the review team concludes that the groundwater quality impacts of preconstruction and construction activities for proposed Fermi 3 would be SMALL, and no further mitigation beyond the BMPs would be warranted. On the basis of the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the groundwater quality impacts of NRC-authorized construction activities would be SMALL. The NRC staff also concludes that no further mitigation measures beyond the BMPs would be warranted.

4.2.4 Water Monitoring

Detroit Edison (2011a) presented construction monitoring programs in Sections 2.3.4.1 and 6.3 of the ER. A discussion of previous monitoring efforts at the Fermi site is presented in Section 2.3.4.

Measurements at the NOAA gaging station (ID 9063090) on Lake Erie in the vicinity of the Fermi 2 intake structure are expected to continue to provide hourly Lake Erie water level measurements at the site. The NPDES permit for Fermi 2 requires monitoring of five outfalls, including the outfall associated with the Dredge Spoils Pond (Figure 4-1). In addition, Fermi 2 is required to analyze the intake water for total mercury on a monthly basis. Fermi 2 NPDES monitoring is anticipated to be ongoing during construction and preconstruction activities. The NPDES stormwater construction permit would require monitoring of any discharge from the building areas for turbidity. Monitoring frequency and location would be decided during the permitting process.

Currently, groundwater monitoring well networks exist on the Fermi site to monitor potential impacts on groundwater levels and quality. Some of these wells would be affected by land clearing and building activities for Fermi 3 and would be taken out of service prior to the start of work (Detroit Edison 2011a). Detroit Edison (2011a) has committed to follow NRC (2007) guidance in NUREG/CR-6948 for groundwater monitoring at the site during both the building and operation phases.

At the start of dewatering activities, Detroit Edison (2011a) would monitor groundwater levels both in the overburden and the Bass Islands Group aquifer at frequent intervals. When groundwater levels would reach equilibrium during the dewatering activities, Detroit Edison would reduce the monitoring frequency (Detroit Edison 2011a).

4.3 Ecological Impacts

This section describes potential impacts on ecological resources (terrestrial, wetlands, and aquatic resources) from the construction of Fermi 3.

4.3.1 Terrestrial and Wetland Impacts

This section addresses potential terrestrial and wetland impacts from building Fermi 3 and associated facilities at the Fermi site.

4.3.1.1 Terrestrial Resources – Fermi Site and Vicinity

Impacts on Habitats

All ground-disturbing activities related to building Fermi 3, other than transmission lines, would occur within the existing Fermi site boundary. Although all impacts on terrestrial ecosystems cannot be avoided, the footprint of Fermi 3 was established to minimize impacts on high-quality terrestrial habitats, including wetlands. The proposed location of the power block and cooling tower are in an area bounded by Fermi Drive, Doxy Road, Fermi 2, and Lake Erie, thereby minimizing impacts on the South Lagoon wetlands. The proposed facilities, as well as the needed temporary parking and laydown areas, have been sited to minimize impacts on undisturbed habitats, including wetlands (see Figure 4-1).

Approximately 197 ac of terrestrial wildlife habitat on the Fermi site would be disturbed while building the proposed Fermi 3 facilities (Detroit Edison 2011a). Approximately 51 ac of that habitat would be permanently lost because it would be cleared, grubbed, and graded to develop permanent facilities. Temporary disturbance of the remaining 146 ac of terrestrial habitat would be necessary to accommodate temporary laydown and parking areas (see Table 4-1). Although the project would reportedly disturb only 189 ac of previously undeveloped land, of which approximately 42 acres would be permanently occupied (Detroit Edison 2011a), some of the terrestrial habitat impacts would take place in areas of previous development. Detroit Edison has stated its intention to restore temporarily disturbed areas with regionally indigenous species (Detroit Edison 2011a).

Detroit Edison has determined the placement of proposed facilities in an effort to minimize impacts on wetlands and forest cover. Approximately 130 ac of the permanent and temporary impacts would involve grassland habitats (Table 4-1). Approximately 63 ac of the affected grassland habitat consists of agricultural land presently used for row crops, which would be made available again for use as upland cropland after Fermi 3 is built (Detroit Edison 2011a). The remainder of the affected grassland habitat consists of existing ROW land, idle and old field land, and a portion of a restored tallgrass prairie project established by Detroit Edison. Impacts on the restored tallgrass prairie are discussed below under Important Habitat – Fermi Site.

Table 4-1. Area of Terrestrial Habitat Types on Fermi Site to Be Disturbed by Building Fermi 3

Cover Type (Habitat)	Acres Permanently Lost	Acres Temporarily Disturbed	Total Acres of Habitat Type on Site
Terrestrial Habitats			
Coastal emergent wetland open water	0	0	35
Coastal emergent wetland vegetated	1.7	2.2	238
Grassland: right-of-way	9.6	13.5	29
Grassland: idle/old field/planted	25.7	17.6	75
Grassland: row crop	1.0	63.0	64
Shrubland	2.0	38.5	113
Thicket	1.7	0	23
Forest: coastal shoreline	1.0	0	47
Forest: lowland hardwood	0	4.8	92
Forest: woodlot	8.6	6.3	117
Total Terrestrial Habitats Lost	**51.3**	**145.9**	**833**
Developed Areas	**0**	**0**	**212**
Open Water			
Lakes, ponds, rivers	0	0	44
Lake Erie	0	0	171

Source: Detroit Edison 2011a

Approximately 42 ac of the impacts would involve shrubland or thicket habitats (Table 4-1). Only about 21 ac of impact would involve forest habitats. Less than 4 ac of coastal emergent wetland would be affected (this figure represents coastal emergent wetland as a generalized habitat type only; impacts on wetlands as defined by the USACE/MDEQ are discussed in Section 4.3.1.3.). Clearing and disposal of woody vegetation would have to be performed consistent with the provisions of the Michigan Department of Agriculture (MDA) Emerald Ash Borer Interior Quarantine on firewood and other ash tree products in effect at the time of site preparation activities to avoid spreading the emerald ash borer (*Agrilus planipennis*) (MDA 2009).

Even temporary clearing of forest, shrubland, and thicket areas would reduce shelter and forage habitat until woody vegetation can re-establish those habitat elements. Clearing forest habitat would have longer-term impacts, but revegetation would gradually restore the lost habitat.

Although forested areas would be cleared for the project, most of the forested areas to be cleared would be on the edges of forest cover patches. No large forested blocks would be fragmented by project activities. The impacts on species sensitive to forest fragmentation would, therefore, be minimal. As shown in Table 4-1, temporary forest clearings would occur on only about 11 ac of the Fermi site.

Once no longer needed, temporarily disturbed vegetated areas would be revegetated with plants native to the project vicinity (Detroit Edison 2011a). EPA (2012) recommended that Detroit Edison take the following actions when revegetating temporarily disturbed habitats:

- Use native species appropriate to the sites to be revegetated;
- Prior to clearing and revegetating temporarily disturbed habitats, develop measures of success for the revegetation based on the percentages of the numbers and/or area covered by the planted native species and any non-native invasive species; and
- Where forested land needs to be cleared for overhead transmission lines, consider establishing low-growing native plants conducive to periodic mowing.

Because many of the areas that would be disturbed contain substantial amounts of nonnative invasive plant species, a restored vegetation community of predominantly native species eventually could provide higher-quality forage and shelter habitat than the existing vegetation community in those areas. However, especially for forested areas, several years would be needed for new vegetation to grow enough to replicate the ecological functions of the original vegetation.

As indicated in Section 4.3.1.3, approximately 34.5 ac of wetlands would be disturbed, including approximately 23.7 ac of temporary impacts, approximately 8.3 ac of permanent fill (conversion to non-wetland), and approximately 2.5 ac of forested wetland permanently cleared of trees (converted to emergent or scrub-shrub wetlands). This includes not only coastal emergent wetlands, as indicated in Table 4-1, but also some other areas within forest and other habitats that were delineated as wetlands. Both the USACE and MDEQ require compensatory mitigation for the unavoidable loss of wetlands that are regulated by these agencies. Approximately 1.9 ac is not regulated by either agency, and Detroit Edison has not proposed compensatory mitigation for this acreage. Wetland losses and mitigation are discussed in more detail in Section 4.3.1.3.

The potential for short-term impacts on undisturbed wetlands and terrestrial habitats would be minimized by using BMPs to reduce stormwater runoff and the risk of pollution from soil erosion and sediment and pollutant spills (Detroit Edison 2011a). Detailed measures for BMPs would be included in the SESC plan and PIPP for the project (see Section 4.2).

The U.S. Department of the Interior (DOI) (2012) recommended that Detroit Edison develop a wildlife management plan to compensate for the loss of wildlife habitat, including development of quality grassland habitat to offset the loss of the prairie restoration area and to provide nesting habitat for grassland avian species (e.g., bobolink [*Dolichonyx oryzivorus*], eastern meadowlark [*Sturnella magna*], and savannah sparrow [*Passerculus sandwichensis*]).

Impacts on Wildlife

Wildlife inhabiting work areas could be inadvertently killed or forced to move into adjacent habitats. Larger and more mobile species would likely flee during land-clearing activities, such as tree felling, grubbing, and grading. Mortality is expected to be limited to the least-mobile wildlife, mainly small, slow-moving, burrowing, or cavity-dwelling species, such as certain small mammals and reptiles as well as nesting forest, shrub, and grassland birds. Increased wildlife mortality in the form of road kill may result from increased traffic volume on nearby roadways. Impacts on waterfowl, shorebirds, and other wetland birds are likely to be minimal considering the limited impacts on wetland habitats.

One of the small, slow-moving species that may be affected by land-clearing and building activities is the eastern fox snake (*Pantherophis gloydi*). As discussed in Section 2.4.1, the eastern fox snake is the only State-listed terrestrial animal species on the Fermi site that could be affected in this manner. In addition to possible direct mortality, some of the snake's habitat on the Fermi site would likely be affected, some temporarily and some permanently.

Detroit Edison has prepared a Habitat and Species Conservation Plan (Detroit Edison 2012a) addressing protection of the eastern fox snake when building Fermi 3 facilities on the Fermi site, with the intention of minimizing impacts on individual specimens. The plan calls for measures including, but not limited to, training construction workers about the snake's rarity, protection status, and appearance, and instructing workers to inform inspectors with stop-work authority to allow time to catch and relocate the snakes. The Fermi 3 layout has been configured to minimize impacts on wetlands and other potential eastern fox snake habitat. The potential impacts on the eastern fox snake are discussed in more detail in Section 4.3.1.3.

As stated previously, larger or more mobile mammals and birds, including most raptors, game birds, and forest, shrub, and wetland birds, would leave the area when site disturbance activities begin. Such wildlife is expected to consist mostly of common species that adapt readily to changing environments, such as opossum (*Didelphis virginiana*), white-tailed deer (*Odocoileus virginianus*), eastern cottontail rabbit (*Sylvilagus floridanus*), eastern gray squirrel (*Sciurus carolinensis*), eastern chipmunk (*Tamius striatus*), raccoon (*Procyon lotor*), woodchuck (*Marmota monax*), and skunk (*Mephitis mephitis*). Populations of these species on the Fermi site may experience increased mortality due to road kill or from hunting if displaced from the Fermi site, where no hunting is allowed, to private land where hunting is allowed. The carrying capacity of nearby habitats receiving displaced individuals may be exceeded, resulting in increased competition and mortality due to limited resources. However, all of these species are abundant in the region and highly adaptable. These animals are expected to move away from the impact area to neighboring habitats both onsite and offsite. Although approximately 51 ac of wildlife habitat would be permanently lost (with the exception of some wetlands types that would be mitigated), the types of habitat affected are common in the area. The resulting impacts on most wildlife would be minimal, with no mitigation measures needed. None of these species is of conservation concern in the State of Michigan or at the Federal level, and all are common in suitable habitats throughout the region. Impacts on important species are discussed in more detail below. Impacts on wildlife dependent on wetland habitat would be mitigated as a result of implementing the wetland mitigation discussed below.

Animals that move away from work areas may experience higher mortality rates due to road kill and increased competition with resident individuals in receiving habitats. Mammals that may suffer increased road kill include the white-tailed deer, eastern cottontail rabbit, eastern gray squirrel, eastern chipmunk, opossum, raccoon, and woodchuck. Most turtle, snake, and amphibian species, including the eastern fox snake, are also at risk for road kill. However, in a review of roads and their ecological impacts, Forman and Alexander (1998) concluded that except for local spots, road kill rates rarely limit population size.

The proposed new roads have been routed in a manner that minimizes forest fragmentation to the extent practicable. Fragmenting forest habitat can also be detrimental to many species of wildlife that favor forest-interior settings, including many migratory forest birds. The review team concluded that these impacts on common species would not be detectable beyond the local vicinity and would not destabilize regional populations. Impacts on the eastern fox snake and other rarer species are discussed further in Section 4.3.1.3.

Human activity, machinery operations, lighting, traffic, noise, and fugitive dust would likely displace wildlife in habitats surrounding work areas. The impact of fugitive dust is expected to be negligible because unpaved access roads and other exposed soils would be watered as necessary. Emissions from heavy equipment are expected to be minimal because of regularly scheduled maintenance procedures. The impact on terrestrial wildlife from these impact sources would be minimal, and no additional mitigation measures are needed.

There is limited published literature regarding bird collisions with elevated construction equipment, such as cranes. Erickson et al. (2005) reviewed the literature on anthropogenic bird mortality and concluded that collisions with communications towers, while potentially significant on a case-by-case basis, are far less important on a nationwide basis than is mortality from buildings, power lines, automobiles, domestic cats, and pesticides. Assuming elevated construction equipment such as cranes create a similar hazard as communication towers, it may reasonably be concluded that a small number of cranes for a limited duration (as planned for building Fermi 3) would have minimal impact on birds.

Noise generated by site activities, workers, and equipment can affect wildlife. Effects may include physiological changes, abandonment of nests or dens, curtailed use of foraging areas, and other behavioral modifications. Noise may displace wildlife, which may increase resource demand in adjacent habitats, exceeding carrying capacity and ultimately resulting in higher mortality rates. Because most of the noise would be close to the existing Fermi structures, much of the wildlife in the area may have already adapted to industrial noise levels. It is therefore expected that the overall impact of construction noise on wildlife would be minimal.

Noise from site-preparation and site-development activities can affect wildlife by inducing physiological changes, nest or habitat abandonment, or behavioral modifications, or it may disrupt communications required for breeding or defense (Larkin 1996). However, it is not unusual for wildlife to adapt to such noise (Larkin 1996). Development activities that would generate noise include operation of equipment such as jackhammers, pile drivers, and heavy construction vehicles. Short-term noise levels from development activities onsite could be as high as 90 decibel(s) (acoustic) (dBA) at a distance of 50 ft from construction activity (Detroit Edison 2011a). That level would not extend far beyond the boundaries of the construction footprint. The threshold at which birds and small mammals are startled or frightened is 80 to 85 dBA (Golden et al. 1980). The review team expects that noise levels associated with creation of the transmission line corridor would be similar to noise levels associated with onsite development activities, but would be incurred for a more limited duration at any given location. Thus, impacts on wildlife from noise are expected to be negligible.

Accidental spills associated with construction activities could affect terrestrial wildlife but are of a greater concern to aquatic organisms (see Section 4.3.2). Refueling stations, fuel storage, oil storage, and storage of other fluids also pose a risk to surface waters that some wildlife species rely upon. However, activities and spill countermeasures, including the use of BMPs, would be implemented in a way that minimizes the potential for spills and limits the spread of spilled materials, thereby limiting mortality and morbidity of wildlife (Detroit Edison 2011a). As discussed in Section 4.2, a PIPP that addresses actions to be taken in the event of such spills would be implemented. Accordingly, impacts from a spill occurrence are expected to be minor, and no additional mitigation measures would be needed. BMPs related to the management of effluent and stormwater runoff as required by the Storm Water Management Plan and NPDES permit would also limit these impacts.

The DOI (2012) recommends that Detroit Edison implement several measures to reduce impacts on wildlife, especially migratory birds. First, DOI recommends restricting the timing of activities that disturb habitat for migratory birds to periods when migratory bird species known to use those habitats have migrated out of the area. Second, the DOI recommends that Detroit Edison complete removal of potential nesting habitat before spring nesting begins, or initiate removal after the breeding season has ended, to avoid take of migratory birds, eggs, young, and/or active nests. The DOI would prefer that no habitat disturbance, destruction, or removal occur between April 15 and August 15, to minimize potential impacts on migratory birds during their nesting season. The review team notes, however, that some species may initiate nesting before April 15.

4.3.1.2 Terrestrial Resources – Transmission Lines

Building Fermi 3 would require installation of three new transmission lines in an assumed 300-ft-wide corridor from the Fermi site to the Milan Substation, a distance of approximately 29.4 mi. The proposed transmission line route is described and illustrated in Section 2.4.1.2 and Figure 2-5. The 345-kV transmission system and associated corridors are exclusively owned and operated by ITC*Transmission*. Detroit Edison would not control the development or operation of the transmission system. Accordingly, the impacts discussed for the proposed new transmission lines are based on publicly available information and reasonable expectations of the configurations and practices that ITC*Transmission* would likely follow based on standard industry practice. In general, the impacts on terrestrial resources from building new transmission lines for Fermi 3 would be similar to those for building onsite facilities, as described in Section 4.3.1.1.

Impacts on Habitats

Vegetation communities occurring along the transmission line route are similar to those away from the Lake Erie shoreline on the Fermi site, as described in Section 2.4.1.1. Impacts on vegetation in the initial 18.6 mi of the corridor are expected to be minimal because of the expected use of existing corridor and because access for installing new infrastructure is good. Potential impacts from building the transmission lines would, therefore, be limited primarily to the western 10.8 mi of the route. The level of vegetation maintenance to date within this undeveloped segment of the route has been minimal except to remove tall woody vegetation. Initial development of this segment would likely result in clearing of trees and other woody vegetation, followed by more intensive maintenance during operation of the transmission lines. Clearing and disposal of woody vegetation would have to be performed in a manner consistent with the provisions of the MDA Emerald Ash Borer Interior Quarantine on firewood and other ash tree products in effect at the time of site preparation activities to avoid spreading the emerald ash borer (MDA 2009). Access from existing roads is sufficient such that few, if any, new access roads would need to be built. Clearing would likely be necessary in areas of deciduous forest and forested wetlands.

Table 2-7 presents the vegetative cover types that occur within the 29.4-mi Fermi 3 transmission line corridor. Table 4-2 presents similar information for just the 10.8-mi segment of the transmission line corridor that is currently undeveloped. Most terrestrial ecology impacts would occur in this 10.8-mi segment. Based on the vegetation cover data in Table 4-2, the review team estimates that approximately 244 ac of forest cover would be permanently cleared to build the transmission line, including approximately 170 ac of deciduous forest and 74 ac of woody wetlands. The deciduous forest would be permanently converted to grassland or old field habitat, and the woody wetlands would be permanently converted to emergent wetlands. Because wetlands in the landscape traversed by the proposed transmission line corridor tend to occur in scattered locations close to streams and drainages, the review team expects that

Table 4-2. Vegetative Cover Types Occurring in the Undeveloped 10.8-mi Segment of the Transmission Line Corridor

Plant Community	Acres in Corridor[a]	Percent of Vegetative Community in Region[b]	Acres in Region[b]
Open water	0	0	725,910
Developed	11	0.001	1,089,795
Barren land	0	0	10,346
Deciduous forest	170	0.06	282,046
Evergreen forest	0	0	6717
Mixed forest	0	0	5765
Shrub/scrub	6	00.19	3179
Grassland/herbaceous	10	0.02	41,308
Pasture/hay	45	0.02	219,241
Cultivated crop	90	0.007	1,217,689
Woody wetlands	74	0.06	128,090
Emergent herbaceous wetland	9	0.02	56,711
Total	**415**	**0.01[c]**	**3,786,797**

Source: Adapted from Detroit Edison 2011a

(a) The number of acres in the corridor for each plant community was estimated by Detroit Edison using geographical information system (GIS) measurements of land cover data. The total area of these communities in the corridor sums to 415 ac, which is greater than the area within a 10.8 mi-long, 300 ft-wide corridor (393 ac). It is assumed that this difference results from slight inaccuracies in GIS measurements. This difference does not affect the analysis of impacts presented here.

(b) Region is defined as the area within a 50-mi radius of the Fermi site (see Section 2.2).

(c) Calculated using 415 as a percentage of 3,786,797.

ITC*Transmission* would be able to place the new towers in a way that would require permanent loss due to filling of no more than 0.5 ac of wetlands. Table 4-2 also indicates that even if all of the affected habitats in the 10.8-mi segment were permanently lost, the losses would be minimal when compared to the amount of the same cover types in the region.

As described in Section 4.3.1.1 for the site, most large or more mobile wildlife species present are expected to be sufficiently mobile and would temporarily move out of the way to avoid activity, but smaller ground- and cavity-dwelling animals, as well as nesting birds, would be more vulnerable to mortality from land clearing. Wildlife species that favor disturbed vegetation communities would be expected to benefit and use the newly cleared corridor following erection of the transmission lines. The impact on terrestrial wildlife resources would therefore be relatively minor, and no additional mitigation would be warranted beyond that typically used by ITC*Transmission*. Impacts on important species that may inhabit the transmission line corridor are discussed in Section 4.3.1.3.

4.3.1.3 Important Terrestrial Species and Habitats

Important Species – Fermi Site

This section describes the potential impacts on important species, including Federally proposed, threatened, or endangered terrestrial species; State-listed species; and other ecologically important species, resulting from construction of Fermi 3 and the onsite 345-kV transmission lines. The species and the potential impacts of construction activities on these species are described in the following sections. As part of the NRC's responsibilities under Section 7 of the Endangered Species Act of 1973 (ESA), the NRC staff prepared a Biological Assessment (BA) prior to issuance of the final EIS that evaluated potential impacts of preconstruction and construction activities on Federally listed (or proposed) threatened or endangered aquatic and terrestrial species (Appendix F).

Section 2.4.1 describes the important terrestrial species and habitats located within the Fermi site and vicinity and the transmission line corridors. When contacted by Detroit Edison in October 2007, the FWS stated that the proposed Fermi 3 occurs within the potential range of several plant and animal species listed under the ESA (Detroit Edison 2010a). At that time, the FWS also indicated that it had had no records of occurrence of any ESA-listed species in the project area, and that no designated critical habitat for ESA-listed species occurred on or in the vicinity of the Fermi site (Detroit Edison 2010a). In a letter to the NRC in January 2009 (FWS 2009a), however, the FWS identified several terrestrial species that were ESA-listed or candidates for listing that could occur in the area of the Fermi 3 project and the transmission line corridor.

The Michigan Department of Natural Resources (MDNR) (Detroit Edison 2009d) identified eight terrestrial State-listed threatened and endangered animal and plant species that are known to occur or that could occur on or in the vicinity of the Fermi site. Since that time, two species, the bald eagle (*Haliaeetus leucocephalus*) and Frank's sedge (*Carex frankii*), have been removed from the State list of threatened and endangered species. Field studies in 2007, 2008, and 2009 identified one State-listed animal (eastern fox snake) and one State-listed plant species (American lotus [*Nelumbo lutea*]) on the Fermi site (Detroit Edison 2009b).

Table 4-3 summarizes the potential impacts from the proposed work on the Fermi site to each Federally or State protected species known to occur or potentially occur on the Fermi site. The impacts are discussed in greater detail as necessary below.

<u>Bald Eagle</u>

The bald eagle is a State-listed species of special concern and is no longer Federally listed as threatened (MNFI 2010). MDNR guidelines for bald eagle management follow those provided by the FWS *National Bald Eagle Management Guidelines* (FWS 2007). These guidelines

Table 4-3. Important Terrestrial Species Known or with Potential to Occur on the Fermi 3 Site

Common Name	Scientific Name	Federal Status[(a)]	State Status[(b)]	Potential Impacts
Plants				
American lotus	*Nelumbo lutea*	NL	T	Detroit Edison has stated that it plans to transplant American lotus disturbed by filling the south canal
Arrowhead	*Sagittaria montevidensis*	NL	T	No impacts anticipated
Eastern prairie fringed orchid	*Platanthera leucophaea*	T	T	No impacts anticipated
Red mulberry	*Morus rubra*	NL	T	No impacts anticipated
Reptiles				
Eastern fox snake	*Pantherophis gloydi*	NL	T	Building of permanent and temporary facilities would disturb habitat; snakes would be relocated to extent possible; temporary facilities would be removed and habitat restored
Birds				
Barn owl	*Tyto alba*	NL	E	No impacts anticipated
Bald eagle	*Haliaeetus leucocephalus*	NL (also BGEPA)	SC	No impacts anticipated
Common tern	*Sterna hirundo*	NL	T	No impacts anticipated
Mammals				
Indiana bat	*Myotis sodalis*	E	E	Summer roost areas may be present in wooded areas; limiting tree-clearing operations to seasons when bats would not be present on the site will minimize impacts
Insects				
Karner blue butterfly	*Lycaeides melissa samuelis*	E	T	No impacts anticipated

Sources: Detroit Edison 2009d, FWS 2009a

(a) ESA-E = listed under the ESA as endangered, ESA-NL = not listed under the ESA, ESA-T = listed under the ESA as threatened, BGEPA = protected under the Bald and Golden Eagle Protection Act, MBTA = protected under the Migratory Bird Treaty Act.

(b) E = endangered, SC = species of special concern, T = threatened.

suggest avoiding any activities within a 660-ft radius around a nest during the breeding season. The restricted area is imposed because bald eagles are extremely sensitive to human activity during the first 12 weeks of the breeding season. Detroit Edison (2011a) has indicated that it would adhere to these guideline limitations when building Fermi 3.

The bald eagle is unlikely to be adversely affected, given the distances between project activities and existing eagle nests, and as demonstrated by the continued nesting behavior near the Fermi 2 cooling towers. There is also evidence of the rebuilding of a nest in the coastal forest south of Fermi 2 (Detroit Edison 2011a).

Three eagle nests have been reported on the Fermi site, at least one of which was active in 2008 and 2009 (Detroit Edison 2009b). Two nests were located east of the Fermi 2 cooling towers near Lake Erie and are more than 700 ft away from any areas that would be disturbed by activities related to Fermi 3. The third was located in trees along the Lake Erie shoreline south of Fermi 2. However, the latter nest was apparently destroyed by winter storms in late 2007 or early 2008. What appeared to be a new eagle nest was observed in the coastal forest to the southeast of the Fermi 2 facilities in an eastern cottonwood (*Populus deltoides*) during the April 2009 survey session. This unconfirmed eagle nest was within 660 ft of an area that would be disturbed temporarily during construction and preconstruction of Fermi 3 (Detroit Edison 2009e). As of January 2011, none of the previously observed bald eagle nests could be seen on the Fermi site; they have presumably deteriorated because of nonuse and weather (Detroit Edison 2011b).

Bald eagles of various ages have been observed during all surveys conducted on the Fermi site. Three fledglings were observed on the Fermi site during the October 2008 survey. More fledglings or subadults (juveniles) were observed during the January 2009 survey and one subadult was observed during the April 2009 survey. The eagles using the Fermi site do not appear to be distressed by proximity to existing human activities, as demonstrated by successful fledging of young, even though the nests are adjacent to the existing Fermi 2 cooling towers, where mechanical noises and other human activities are common (Detroit Edison 2011a). Since the existing eagle nests to the northeast of the Fermi 2 cooling towers have been active and successful for several years and because no structural changes are being proposed in that area (i.e., no vegetation clearing or similar construction activities), it is not likely that bald eagles would be permanently displaced from that part of the Fermi site or otherwise disturbed in a substantial way during the building of Fermi 3.

Detroit Edison’s ER states that scheduling of work would be carefully planned to avoid activities near active nesting areas during the breeding season, such as in the area near the potential new eagle nest, in accordance with the *Bald and Golden Eagle Protection Act* (BGEPA) and the Migratory Bird Treaty Act (MBTA) (Detroit Edison 2011a). The breeding season at the Fermi site starts as early as mid-January and extends through June (Hoving 2010). Detroit Edison would coordinate with the FWS on construction locations and schedules (Detroit Edison 2011a).

Therefore, the review team anticipates that impacts on the bald eagle from the building of Fermi 3 would be minimal, and no additional mitigation measures, beyond those proposed by Detroit Edison in the ER, are needed.

Eastern Prairie Fringed Orchid

The eastern prairie fringed orchid (*Platanthera leucophaea*) is listed by the Federal and State governments as threatened. The FWS identified the eastern prairie fringed orchid as occurring in Monroe County. MDNR, however, did not include this orchid as known to occur on the Fermi site in its November 28, 2007, letter to Detroit Edison's consultant (Detroit Edison 2009d). Detroit Edison surveyed the vegetation of areas of the Fermi site most likely to be affected by construction of Fermi 3. In addition to reconnaissance surveys in 2007, more detailed surveys were conducted in 2008 and 2009, including during the plant's flowering period in early summer 2009. The surveys did not identify the eastern prairie fringed orchid on the Fermi site (Detroit Edison 2009b). From MDNR's review and Detroit Edison's more detailed surveys, the review team has concluded that the eastern prairie fringed orchid is unlikely to occur on the Fermi site, and the effects on this species would be negligible.

Indiana Bat

The Indiana bat (*Myotis sodalis*) is listed as endangered by the Federal and Michigan State governments. The NRC and Detroit Edison conferred with the FWS about this species in May 2009. There are no records of the Indiana bat being observed in Monroe County, but the habitat of the project site and transmission line corridor is suitable for roosting and is in the range of the species (FWS 2009a, b). Although there are no confirmed observations of the Indiana bat in Monroe County, the bat has been observed in nearby Washtenaw County as recently as 2005 (MNFI 2007a) and there are two known Indiana bat colonies in neighboring Lenawee County (Kurta 2010). Large trees with exfoliating bark are the preferred roosting habitat for the Indiana bat (NatureServe 2009), but trees as small as 5 in. in diameter at breast height (dbh) should be considered as potential roosting habitat (FWS 2009b). The death of many green ash (*Fraxinus pennsylvanica*) trees on the site and the wider region has resulted in many standing dead trees of 5 in. dbh or larger with peeling bark. These dead trees could temporarily serve as potential roosting habitat for Indiana bats until the dead bark sloughs off or the dead trees fall over. FWS inspected several such trees within the proposed Fermi 3 footprint in August 2011 and determined that none would continue to function as potential maternity roosts for more than a few years (Doub 2011).

The *Range-wide Indiana Bat Protection and Enhancement Plan Guidelines* (FWS 2009b) developed by the FWS for surface mining activities provides guidelines for avoidance, minimization, and mitigation measures to minimize effects on the Indiana bat. Among the measures identified are restrictions on timing of tree clearing to ensure no bats are present during clearing. The review team concludes that the impact of building Fermi 3 on the Indiana bat would be minimal as long as Detroit Edison follows the protection measures in the *Range-wide Indiana Bat Protection and Enhancement Plan Guidelines* (FWS 2009b), including limiting the clearing of potential roosting trees to the months when the bats would not be expected on the site, and no additional mitigation measures are needed. More information on how Detroit Edison plans to address the presence of the Indiana bat is provided in the Biological Assessment (Appendix F).

Karner Blue Butterfly

The Karner blue butterfly (*Lycaeides melissa samuelis*) is listed by the Federal and State governments as endangered and threatened, respectively. The NRC and Detroit Edison conferred with the FWS about this species in May 2009. The most recent documented record of the Karner blue butterfly in Monroe County was in 1986 (MNFI 2007b). The preferred habitat for this insect is dry, sandy soils where wild lupine (*Lupinus perennis*), its sole food source, grows. The soils of the Fermi site are more fine-grained than the preferred habitat and are not well drained (Bowman 1981). Although lupines were established in the prairie creation area in the existing onsite transmission corridor and were observed in 2000 and 2002, no lupines were observed in subsequent vegetation surveys conducted between 2006 and 2009 (Detroit Edison 2009b). The MDNR Endangered Species Coordinator stated that Karner blue butterflies are not likely to occur on the Fermi site because none were found when the entire area was carefully surveyed in recent years prior to introduction of Karner blue butterflies in the Petersburg Wildlife Management Area near Petersburg, Michigan (Hoving 2010). The maximum movement of the butterflies from their point of introduction is about 1 km, eliminating the possibility that introduced butterflies would now occur on the Fermi site (Hoving 2010).

Based on this information, the likelihood of the Karner blue butterfly occurring on the Fermi site is considered very low and the effects on this species of building Fermi 3 would be negligible.

American Lotus

The American lotus is a Michigan State-listed threatened species. It is a wetland plant common in moderately shallow areas of the South and North Lagoons and the south canal on the Fermi site. The species reaches a northern limit of its distribution in southern Michigan, but several healthy populations exist in southeastern Michigan (Sargent 2010). American lotus grows from thick and creeping underground tubers that make it impractical to determine how many plants are actually present in a given area (Sargent 2010). American lotus occurring in the south canal may be affected by building Fermi 3. According to the ER (Detroit Edison 2011a), MDNR endangered species specialists have recommended that plants in areas to be disturbed be transplanted to other areas of suitable habitat on or off of the Fermi site to minimize adverse impacts. The plants are hardy and have been successfully transplanted in the Southeastern Michigan area (Hoving 2010). Project activities are not expected to disturb the South or North Lagoons, and therefore, no American lotus in these areas would likely be affected. Detroit

Edison intends to engage in further consultation with the MDNR in developing an appropriate mitigation strategy for this species (Detroit Edison 2011a). Impacts from building Fermi 3 would be minimal and no mitigation measures are needed beyond those already identified by Detroit Edison in the ER.

Arrowhead

The arrowhead (*Sagittaria montevidensis*), a State-listed threatened species, has not been conclusively identified on the Fermi property. A specimen of the *Sagittaria* genus was observed during the 2008–2009 vegetation surveys (Detroit Edison 2009b), but mature specimens with flowers were not available to conclusively identify the species. The judgment by Detroit Edison's contractor was that the plant's observable characteristics did not support identification as *S. montevidensis*. The area in which the plant was observed would not be directly affected by building Fermi 3, in any case. Most of the habitat that might have been suitable for the species has been invaded by common reed (*Phragmites australis*). Therefore, impacts from building Fermi 3 would likely be negligible.

Eastern Fox Snake

The eastern fox snake (a Michigan State-listed threatened species) has been observed several times since 1990 on the Fermi property. According to Detroit Edison, more than 15 documented sightings of the eastern fox snake have been made on the Fermi site since 1990, including two sightings in 2008 during the wetlands delineation survey (Detroit Edison 2010b). Between one and six snakes have been observed on each occasion. Eastern fox snakes have been observed in a variety of habitats, even near Fermi 2 buildings. The snake's most likely preferred habitat occurs along the cattail marshes or wetland shorelines around woody debris, but many of the habitats present on the Fermi site are usable as habitat by the snake (MNFI 2007c). Of the 1260 ac of the Fermi site, there are approximately 833 ac of terrestrial habitat; much of it is potentially suitable habitat for the eastern fox snake. Fermi 3 building activities would affect approximately 197 ac of potential fox snake habitat (see Section 4.3.1.1). Of the potential fox snake habitat that would be disturbed, however, only approximately 21 ac would be emergent wetland, the snake's preferred habitat.

Approximately 51 ac of potential fox snake habitat would be converted permanently to developed uses. The remaining 146 ac of disturbed habitat would be restored to the pre-project vegetative cover type. The three largest areas to be disturbed (i.e., parking areas, construction laydown, and Fermi Road construction) are expected to be rehabilitated to a condition of equivalent or better general ecological value following completion of the project, although forest and other habitat with woody vegetation would take years to re-establish many pre-project ecological functions.

Traffic into the site and vicinity would increase greatly during construction. Currently, approximately 800 employees and 150 contract supplemental employees operate Fermi 2. Increased traffic associated with operation of Fermi 3 has the potential to increase wildlife mortality, including mortality of eastern fox snakes, resulting from vehicle-wildlife interactions. Approximately 2900 construction workers would be employed at the peak of construction. Traffic into the Fermi site would increase correspondingly, and additional traffic would be generated by deliveries (Detroit Edison 2011a).

Detroit Edison's Habitat and Species Conservation Plan (Detroit Edison 2012a) identifies several specific minimization and mitigation actions to reduce net impacts on the snake. Specific measures to minimize impacts called for in the plan include educating construction workers through use of a site-specific eastern fox snake manual, briefing workers on the possible presence of the snake, relocating snakes from work areas to other suitable habitat, and inspecting undeveloped areas for snakes prior to initiating work. Specific measures to mitigate impacts called for in the plan include walking down work areas to inspect for the eastern fox snake, developing procedures for capturing and relocating eastern fox snakes, instructing workers to halt work in the presence of an eastern fox snake until it can be relocated, and maintaining a log of monitoring efforts and actions taken. Additionally, the plan calls for a 15-mile-per-hour speed limit on roads crossing potential eastern fox snake habitat on the Fermi site and a requirement for drivers on such roadways to stop and wait for any eastern fox snakes to move out of the way (Detroit Edison 2012a). The Endangered Species Coordinator for MDNR has reviewed Detroit Edison's proposed Habitat and Species Conservation Plan for the eastern fox snake and has found it to be acceptable (Sargent 2012).

Given the extent of potential eastern fox snake habitat that would be disturbed, although much of it temporarily, and the increased traffic on roads crossing habitat on the Fermi site during construction and preconstruction, the review team recognizes that the Fermi 3 project could result in mortality of some eastern fox snake individuals and reduce the local population unless appropriate avoidance and mitigation measures are taken. The majority of the suitable eastern fox snake habitat on the Fermi site would not be disturbed directly, however. In addition to the eastern fox snake mitigation measures described in the paragraph above, the review team believes that monitoring of the snake would be necessary after building Fermi 3. The Habitat and Species Conservation Plan (Detroit Edison 2012a) calls for a minimum of 5 years' monitoring of eastern fox snakes once the proposed Fermi 3 facilities are built.

Summary of Impacts on Important Species on the Fermi Site

The construction and preconstruction impacts on important species on the Fermi site are projected to be minimal for most species with no additional mitigation. However, impacts on eastern fox snake population levels could be noticeable unless adequate mitigation measures are developed and implemented. The Fermi 3 facility layout minimizes impacts on wetlands and forest cover. With the exception of habitat for the eastern fox snake, specific habitats preferred by the important species of the region are mostly absent from the area to be affected by building the project. The staff expects that impacts on the eastern fox snake and its habitat would be mitigated according to provisions of Detroit Edison's Habitat and Species Conservation Plan for that species (Detroit Edison 2012a), and that those provisions will be incorporated into a State endangered species permit to be issued prior to any building activity at the site.

Important Habitat – Fermi Site

<u>Wetlands</u>

Detroit Edison conducted a wetlands investigation (Detroit Edison 2010a) to delineate wetland boundaries and assess functions and values of the wetlands present on the Fermi property. The results of the wetland investigation and the subsequent USACE jurisdictional determination and MDEQ Wetland Identification Program verification are summarized in Section 2.4.1.2. Detroit Edison revised its initial project plan to minimize impacts on wetlands, but requirements for placement of the proposed Fermi 3 and supporting facilities would result in unavoidable impacts on approximately 34.5 ac of wetland habitat on the Fermi site (see Figure 4-4). This area includes approximately 21.2 ac of emergent marsh, 8.0 ac of forested wetland, and 5.3 ac of scrub-shrub wetland. Of this area, approximately 23.7 ac would experience only temporary impacts; Detroit Edison would restore the contours, hydrology, and vegetation of temporarily impacted wetlands following construction (Detroit Edison 2011d).

Approximately 6.1 ac of emergent marsh and 2.2 ac of forested wetland (approximately 8.3 ac of total wetlands) would be filled and converted permanently to non-wetland (Detroit Edison 2011c). The activities resulting in the majority of wetland impacts noted above are regulated by USACE and/or MDEQ and require separate authorizations (permits) from each agency, as previously discussed. However, activities affecting approximately 1.9 ac of emergent wetlands (called "Wetland A" during the wetland delineation) would not require authorization from either agency.

The CWA Section 404(b)(1) Guidelines (40 CFR Part 230) (Guidelines) are the substantive criteria USACE uses to determine the environmental impact of regulated activities on aquatic resources (including wetlands) that would result from the discharge of dredged or fill material. Among other things, an applicant for a USACE Section 404 permit must demonstrate to the USACE that a proposed aquatic resource discharge plan constitutes the least environmentally damaging practicable alternative (LEDPA) and any impacts to special aquatic sites are unavoidable. The USACE requires compensatory mitigation for such unavoidable impacts to ensure that proposed activities are in compliance with the Guidelines and are not contrary to the public interest.

Detroit Edison conducted an analysis that evaluated alternatives to avoid and minimize impacts on special aquatic sites (Appendix J). This analysis involved four iterations to its proposed Fermi 3 site layout that have each reduced wetland impacts. During its analysis, Detroit Edison

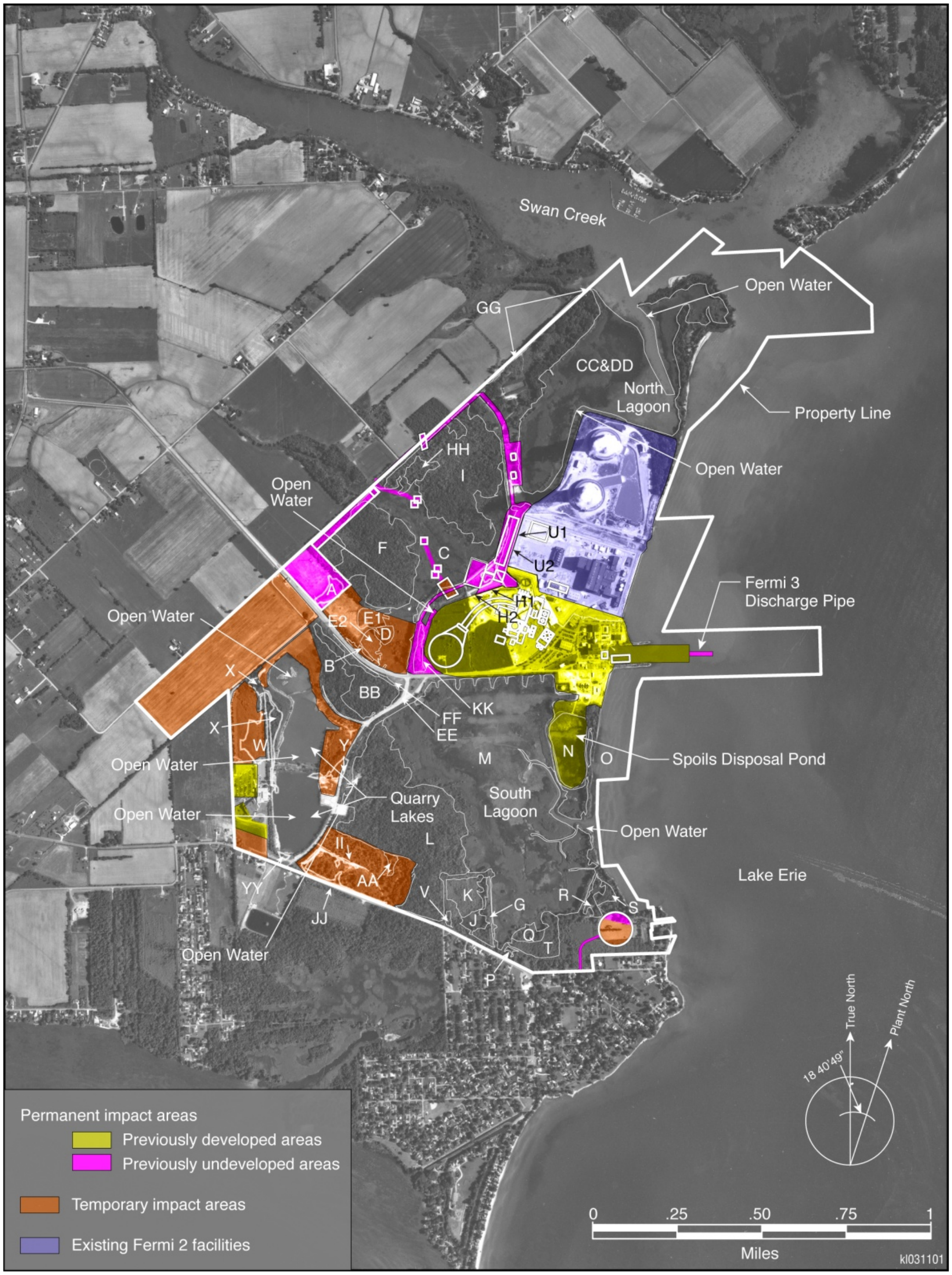

Figure 4-4. Wetlands Affected by Building of Fermi 3 (Detroit Edison 2011a)

relocated facilities out of special aquatic sites to upland areas and reduced the footprint of facilities in special aquatic sites. Most notably, Detroit Edison moved the proposed cooling tower from wetlands in the South Lagoon to an upland area closer to the proposed location for the Fermi 3 powerblock. Detroit Edison also clustered several support facilities, originally sited in wetlands, to the edge of the existing Fermi 2 developed area. Detroit Edison's analysis of aquatic resource impacts from possible onsite layout alternatives is contained in Appendix J, and the proposed site plan presented in this document is Detroit Edison's proposed LEDPA.

To offset the Detroit Edison-identified unavoidable impacts to aquatic resources as a result of its proposed LEDPA, Detroit Edison initially proposed a conceptual mitigation strategy that was included in Appendix K of the Draft EIS. The USACE LRE-2008-00443-1-S11 public notice (USACE 2011) provided additional opportunity for public comment on Detroit Edison's proposed LEDPA and concept mitigation strategy. Detroit Edison subsequently refined its mitigation strategy based on coordination with the USACE and produced the draft mitigation plan that is now contained in Appendix K of this document (Detroit Edison 2012c). The draft mitigation plan proposes to compensate for the unavoidable loss of aquatic function on the Fermi site by reestablishing comparable aquatic functions at an offsite location at a ratio of 3:1. The USACE is currently reviewing Detroit Edison's onsite alternatives analysis to determine if the proposed impacts could be further decreased through additional practicable avoidance and/or minimization measures. The USACE is also currently reviewing Detroit Edison's draft mitigation plan relative to the USACE public interest review and compliance with the Guidelines. See Appendices J and K for more details.

The MDEQ also regulates dredge and fill activities in jurisdictional wetlands and dredging activities under Act 451, Natural Resources and Environmental Protection Act, Part 303 "Wetlands Protection" and Part 325 "Great Lakes Submerged Land Act," respectively. These authorizations are separate and different from the USACE Section 10/404 authorization. The MDEQ issued Permit No. 10-58-0011-P to Detroit Edison on January 24, 2012 (MDEQ 2012) and authorizes activities under Parts 303 and 325. The permit, by condition, also requires a mitigation plan that adequately offsets State-regulated wetland impacts (Detroit Edison 2012d).

According to Detroit Edison (2011a), work within wetlands would be carried out using BMPs to minimize impacts on wetlands near and downgradient of the disturbance zone. Temporary impacts on the soil and runoff would result from vegetation clearing and grading. Silt fences and other necessary erosion control features, as specified in a SESC plan to be approved by the MDEQ prior to site disturbance, would be erected prior to soil disturbance. The SESC would have to be developed consistent with Michigan's Soil Erosion and Sediment Control Program, which includes requirements for design and the timing of implementation of BMPs. Exposed soil would be covered, bermed, or protected with a temporary seeding until backfilled and graded. Construction effluent and stormwater runoff would be monitored as required by the NPDES stormwater construction permit and other applicable construction permits (Detroit Edison 2011a).

According to Detroit Edison, silt fencing or other barriers to protect wetlands from sedimentation would be placed between areas of proposed ground disturbance and adjoining wetlands. Entry into the wetlands by equipment or workers would be prohibited unless necessary. Other BMPs would be applied as appropriate (Detroit Edison 2011a). Wherever possible, disturbed areas would be revegetated as soon as possible following disturbance to minimize the potential for soil erosion and stormwater runoff. Plantings would be of native species.

EPA (2012) recommends, in addition to the requirements of Michigan's Soil Erosion and Sediment Control Program, the following measures to further minimize impacts on wetlands:

- Perform work in wetlands during frozen ground conditions, if feasible;
- Minimize width of temporary access roads;
- Use easily removed materials for temporary access roads and staging areas (e.g., swamp/timber mats) in lieu of materials that sink (e.g., stone, rip-rap, wood chips);
- Use swamp/timber mats or other alternative matting to distribute the weight of the construction equipment to minimize soil rutting and compaction;
- Use vehicles and construction equipment with wider tires or rubberized tracks, or use low ground pressure equipment to further minimize impacts when developing access routes and staging areas;
- Use long-reach excavators, where appropriate, to avoid driving or staging in wetlands; and
- Place mats under construction equipment to contain any spills.

Without mitigation, the impacts on wetlands associated with the development of the Fermi site would be noticeable due to the areal extent of permanent and temporary impacts and the temporal loss of wetland functions attributable to construction and post-construction rehabilitation of temporarily disturbed wetlands. Detroit Edison's onsite analysis (see Appendix J) resulted in a site layout that would both avoid and minimize activities in wetlands. Detroit Edison's proposed BMPs would further minimize impacts.

<u>Detroit River International Wildlife Refuge</u>

The proposed Fermi 3 footprint would encroach into a portion of the Fermi site that is managed as part of the DRIWR. Additional discussion can be found in Section 4.1. The DRIWR Lagoona Beach Unit (a total of 656 ac) is located entirely within the Fermi site. Development of Fermi 3 would encroach into approximately 45 ac, or about 7 percent of the Lagoona Beach Unit (see Figure 4-5); approximately 19 ac would be permanently lost and approximately 26 ac would be temporarily lost for the duration of the construction period (Table 4-4) (Detroit Edison 2011a).

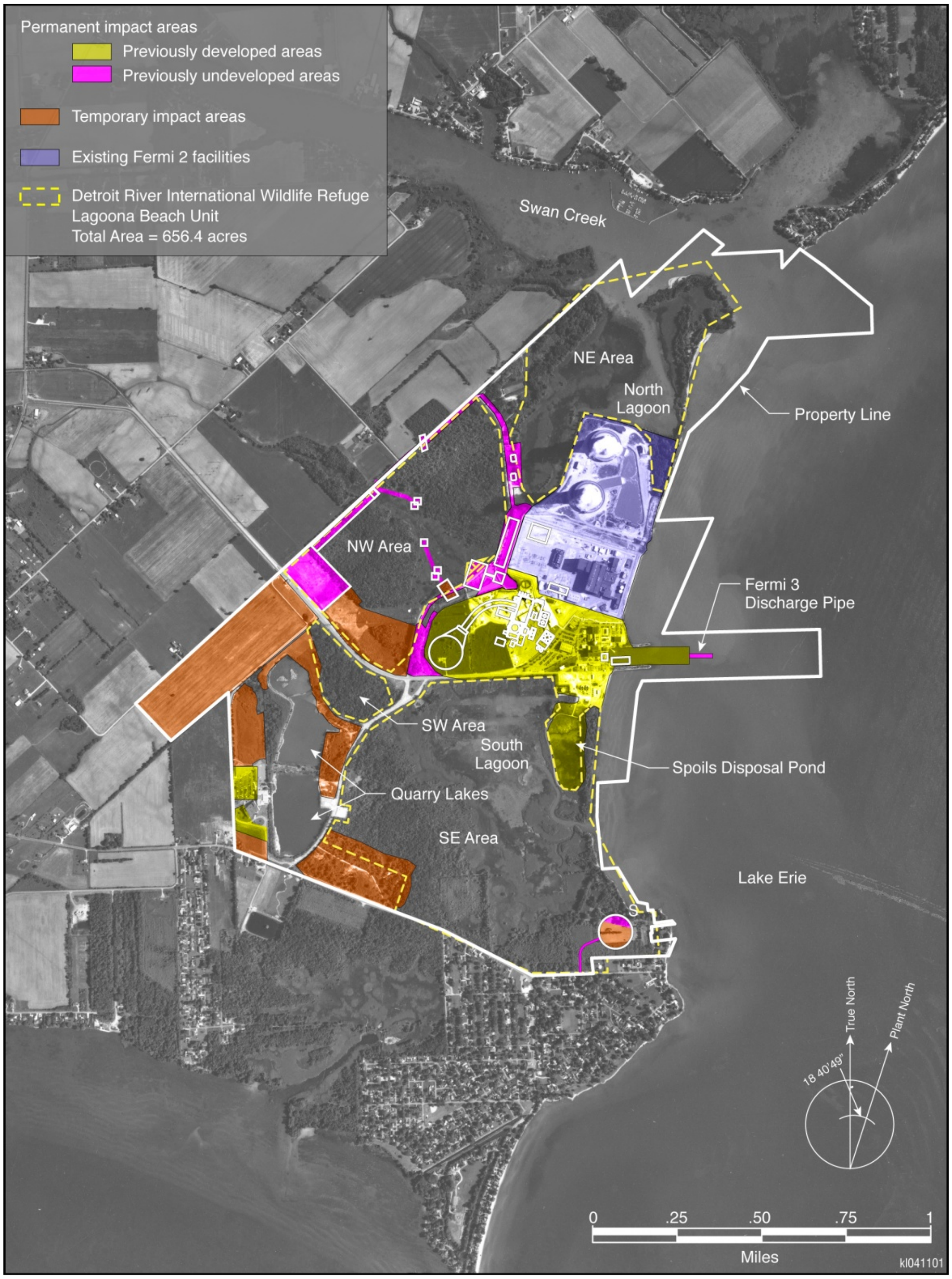

Figure 4-5. Permanent and Temporary Impacts on DRIWR, Lagoona Beach Unit from Fermi 3 Building Activities, Overlaid on Existing Terrestrial Communities (Detroit Edison 2011a)

Table 4-4. Area of DRIWR, Lagoona Beach Unit Affected by Fermi 3 Building Activities

Refuge Area	Area Size (acres)	Permanent Impacts (acres)	Temporary Impacts (acres)
NE	161.7	0	0
NW	161.1	16.1	22.7
SE	311.2	2.6	3.5
SW	22.4	0	0
Total	**656.4**	**18.7**	**26.2**

Source: Detroit Edison 2011a

The agreement between Detroit Edison and the FWS that established the wildlife refuge allows for modifications to the agreement (such as the proposed building of Fermi 3) by either party at any time (Detroit Edison 2003). The impacts of reducing the effective area of the DRIWR are principally land use impacts, which are discussed in Section 4.1.1. However, DRIWR is important as an ecological habitat because of its coastal wetlands. Accordingly, the impacts on the DRIWR are defined primarily by the overall wetlands impacts, as discussed above.

Transmission Line Corridor Prairie Planting

Approximately 10 ac of the existing tallgrass prairie restoration area would be permanently lost in order to build the onsite Fermi 3 switchyard (Detroit Edison 2011a). Detroit Edison revised the site layout three times to reduce wetlands impacts that would result from building Fermi 3 (Doub 2011). Ultimately, use of the prairie restoration site was necessary to avoid unnecessary filling of wetlands, including forested wetlands. The EPA (2012) recommends that Detroit Edison consider restoring tallgrass prairie on a portion of the agricultural land that is proposed for use as a temporary laydown area after project completion, as replacement for the tallgrass prairie habitat lost to build the Fermi 3 switchyard.

Important Terrestrial Species – Transmission Lines

Important species potentially occurring in or along the transmission line corridor are described in Section 2.4.1.3 and Section 2.4.1.4. The FWS (2009a) identified several terrestrial species that are Federally listed under the ESA or that are candidates for such listing that could occur in the area of the transmission line route. Federally listed species identified as potentially present in Monroe County are the Indiana bat, Karner blue butterfly, and eastern prairie fringed orchid. For Wayne County, the Federally listed species identified are the Indiana bat and eastern prairie fringed orchid. For Washtenaw County, the Federally listed species identified are the Indiana bat, Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii*), and eastern prairie fringed orchid. The FWS also noted that the eastern massasauga (*Sistrurus catenatus catenatus*), a candidate species, may be present in Washtenaw and Wayne Counties. No Federally designated critical habitat occurs in the vicinity of the transmission line corridor.

The State of Michigan has identified numerous State-listed species in Monroe and Wayne Counties, but the MDNR has not commented on which species may be present in the proposed transmission line corridors. A list of Federally and State-listed species that occur in Monroe, Washtenaw, and Wayne Counties and that may occur within the transmission line corridor is provided in Table 2-8. The Indiana bat, eastern prairie fringed orchid, Karner blue butterfly, and Mitchell's satyr butterfly are also State-listed as threatened or endangered. The eastern massasauga is State-listed as a species of special concern. Among other State-listed threatened or endangered species that may be present within the transmission line corridor are the eastern fox snake and barn owl (*Tyto alba*).

ITC*Transmission* would need to confer with the MDNR to determine which State-listed species could be affected by development of the transmission line. Once the exact corridor boundary has been defined, field surveys may be required prior to ground disturbance. Because ITC*Transmission* has some leeway in the locations of transmission line towers and because transmission line development does not require the level of disturbance that Fermi 3 would require, the impacts on terrestrial species from transmission line development are expected to be minimal, assuming that measures to avoid, minimize, and mitigate impacts on habitats and wildlife equivalent to those implemented on the Fermi site are implemented.

The impacts on important species from development of the proposed transmission lines are projected to be minimal, as long as ITC*Transmission* coordinates with the FWS, MDEQ, and MDNR and implements any avoidance, minimization, or mitigation measures those agencies require to minimize impacts on Federal and State-listed species.

Important Terrestrial and Wetland Habitats – Transmission Lines

Important habitats are defined in Section 2.4.1.2 and discussed for the proposed transmission line corridor in Section 2.4.1.4. Wetlands are the only important habitat crossed by the anticipated transmission line route. Approximately 93.4 ac of forested wetland occur within the expected transmission line corridor; most, if not all, would be permanently cleared of trees (Detroit Edison 2011a). These wetlands would be converted to scrub-shrub or emergent wetlands to maintain clearance for the conductors. No wetlands would be affected in the initial 18.6 mi of the route because adequate cleared corridor to accommodate the new transmission lines is already present. No wetlands are present in the area where the Milan Substation site would be expanded (Detroit Edison 2011a). The undeveloped western 10.8-mi section could require placing towers in wetlands that cannot be spanned (span distances usually cannot exceed 900 ft). The total potential permanent impact on wetlands from installation of all the towers is expected to be approximately 0.5 ac, based on the projected surface area needed to build tower foundations (Detroit Edison 2011a). Clearing trees from forested wetlands would be necessary to construct the transmission lines. After the transmission lines are in place, woody vegetation would be managed to maintain necessary clearance around the conductors; these impacts are discussed in Section 5.3.1.2. A conceptual transmission line corridor has been identified, but wetland delineation surveys have not yet been conducted to determine the precise locations and extent of wetlands. Permanent impacts on wetland areas would be mitigated according to a wetland mitigation plan ITC*Transmission* would develop in coordination with the MDEQ and/or USACE, as necessary. Any mitigation measures required for the impacts are expected to be determined by ITC*Transmission* in coordination with applicable regulatory agencies, which may include the MDEQ and/or USACE, at the time permit applications are submitted.

The impacts on wetlands from building the transmission system could be noticeable, due to the areal extent of the temporary impacts and the long-term conversion of forested wetlands to scrub-shrub or emergent wetlands. With the expected wetland mitigation, however, the review team expects these impacts to be minimal.

4.3.1.4 Terrestrial Monitoring

Detroit Edison has not proposed terrestrial monitoring during construction or preconstruction of Fermi 3. However, the MDEQ requires performance monitoring of the required wetland mitigation associated with Permit No. 10-58-0011-P issued to Detroit Edison on January 24, 2012 (MDEQ 2012). The USACE could require monitoring for compliance with USACE-issued permits. The USACE is expected to require short- and long-term monitoring of Detroit Edison's wetland mitigation activities if the USACE issues a permit for regulated activities associated with the Fermi 3 project. The State and other Federal agencies may also require monitoring for compliance with permits issued, including, but not limited to, regular inspection of silt fences and seeded areas and other erosion control activities. Detroit Edison plans to monitor all areas restored, enhanced, or created as part of building Fermi 3 facilities. Sampling would be conducted once site preparation work is complete and for a minimum of 5 years after completion of the site preparation and construction work (Detroit Edison 2012a).

4.3.1.5 Potential Mitigation Measures for Terrestrial Impacts

In determining the site layout for Fermi 3, Detroit Edison has made efforts to avoid or minimize impacts on wildlife habitat, wetlands, and local wildlife and habitat. Nonetheless, some impacts on these resources are unavoidable. Accordingly, Detroit Edison has identified a number of measures that would serve to mitigate impacts on terrestrial habitats and species. Each is described in the paragraphs below.

Detroit Edison (2011a) has stated its intention to avoid adverse impacts on the bald eagle by not performing most work within 660 ft of bald eagle nest sites during the nesting season (approximately mid-January through June in southeastern Michigan). If plan changes would result in the need for work within that distance, the work would be timed to take place outside of the nesting season.

Construction Impacts at the Proposed Site

As indicated in the BA contained in Appendix F, development of Fermi 3 may affect, but is not likely to adversely affect, the Indiana bat, as long as Detroit Edison follows the protection measures in the *Range-wide Indiana Bat Protection and Enhancement Plan Guidelines* (FWS 2009b), including limiting the clearing of potential maternity roost trees to seasons when the bats would not be present in the region. Implementing these measures is expected to ensure, at most, minimal impacts on the Indiana bat.

A small area of American lotus plants in the south canal could be affected by the project. Detroit Edison has indicated that it plans to relocate any affected American lotus plants to other suitable habitat (Detroit Edison 2011a).

Fermi 3 building activities would affect approximately 197 ac of terrestrial habitat (see Section 4.3.1.1), much of it potentially suitable habitat for the eastern fox snake. Detroit Edison's proposed Habitat and Species Conservation Plan for the eastern fox snake (Detroit Edison 2012a) calls for mitigating impacts on the snake by training Fermi 3 construction workers to identify the snake and notify construction inspectors when one is sighted. Trained inspectors would have stop-work authority in order to protect individual snakes and snake habitat. Increased traffic from construction equipment and construction workers' vehicles could increase mortality of the eastern fox snake. Monitoring of the eastern fox snake population during and after building of Fermi 3 could help determine whether the impacts from building activities and impacts from increased traffic during and after construction warranted additional mitigation measures. An example of mitigation for traffic mortality impacts, if needed, might be to install fences impermeable to snakes that would serve as barriers to the snake along roads and reduce the likelihood of snakes being hit by vehicles. The proposed Habitat and Species Conservation Plan is discussed in more detail above in Section 4.3.1.3.

Detroit Edison has proposed to compensate for the unavoidable loss of aquatic function on the Fermi site by reestablishing comparable aquatic functions at an offsite location at a ratio of 3:1 (Appendix K). Clearing, grubbing, and other site preparation work could contribute to wildlife mortality and habitat loss. Habitat loss would be mitigated by restoring appropriate natural vegetation through planting of native species appropriate to each cleared area. Any impacts on terrestrial or wetland ecological resources associated with construction of the compensatory mitigation proposed by Detroit Edison would be evaluated by the USACE as part of its permit evaluation.

Mortality for most species is not anticipated to have noticeable effects on local populations. The staff expects that the risk of possible mortality of eastern fox snakes would be mitigated according to Detroit Edison's *Habitat and Species Conservation Plan* for that species (Detroit Edison 2012a), as incorporated into a State endangered species permit issued by the MDNR.

4.3.1.6 Summary of Construction Impacts on Terrestrial and Wetland Resources

Based on threatened and endangered species surveys, known threatened and endangered species locations, historical records, life history information, and information provided by Detroit Edison in its ER and Request for Additional Information (RAI) responses, and based on the review team's independent evaluation, the review team concludes that the impacts from construction and preconstruction activities for Fermi 3 on terrestrial resources on the Fermi site and transmission line corridor would be SMALL to MODERATE . This conclusion is based in part on the staff's independent review of mitigation measures proposed by Detroit Edison, especially the compensatory wetland mitigation required by the USACE and MDEQ, mitigation for American lotus impacts that would be required by the MDNR, Detroit Edison's stated intention of relocating affected American lotus, and Detroit Edison's proposed mitigation measures for the eastern fox snake (Detroit Edison 2012a). This conclusion is also based on conclusion of consultation with the FWS under the ESA. The potential for MODERATE impacts is limited to possible adverse effects on the eastern fox snake. The staff's evaluation of the potential impacts on the eastern fox snake recognizes the potential for mitigation measures proposed by Detroit Edison (Detroit Edison 2012a) and approved by the MDNR to significantly reduce impacts on that species, thereby leading to SMALL impacts, but acknowledges the possibility of MODERATE impacts if proposed mitigation is not implemented as described in their plan. The NRC staff concludes that the impacts of NRC-authorized activities on terrestrial resources would likewise be SMALL to MODERATE, with the potential for MODERATE impacts limited to possible adverse effects of construction equipment on the eastern fox snake.

4.3.2 Aquatic Impacts

Impacts on aquatic resources from building Fermi 3 would potentially affect Lake Erie and the north, central, and south canals; quarry lakes; Swan Creek; Stony Creek; and wetlands at the Fermi site. Activities that could affect these aquatic habitats include (1) building of a new intake structure, (2) building of a cooling water discharge structure, (3) construction of the barge slip, (4) building of a parking structure and a warehouse, (5) dewatering of the Fermi 3 excavation area, (6) culverting of the south canal; (7) filling of the north and central canal (Sections 3.2 and 3.3); and (8) building a fish return structure. Ground-disturbing activities that lead to soil erosion during site preparation and building of Fermi 3 could result in adverse effects on water quality in water bodies on or adjacent to the Fermi site including Lake Erie, the North and South Lagoons, Swan Creek, and wetlands. In addition, during building of new transmission lines, there is potential to affect stream habitats in Monroe, Washtenaw, and Wayne Counties. This subsection evaluates impacts that could occur on aquatic resources on or in the vicinity of the Fermi site during preconstruction and construction of Fermi 3 or during building of associated transmission lines. Preconstruction- and construction-related impacts on wetlands are described in detail in Section 4.3.1.3 of this EIS. As discussed in Section 2.4.2.1, drainage ditches and the circulating water reservoir on the Fermi site do not provide suitable aquatic habitat to support significant populations of aquatic organisms. Consequently, there would be no preconstruction- or construction-related impacts on aquatic resources within these surface water features.

4.3.2.1 Aquatic Resources – Site and Vicinity

This subsection evaluates impacts that could occur on aquatic resources on or in the vicinity of the Fermi site during preconstruction and construction of Fermi 3, including those in Lake Erie, the overflow canals, North and South Lagoons, quarry lakes, Swan Creek, and Stony Creek.

Lake Erie

Temporary or permanent loss of some aquatic habitat in Lake Erie could result from the building of the intake and discharge structures and development of the barge slip for Fermi 3. In addition, other preconstruction and construction activities on the Fermi site that result in ground-clearing, alteration of runoff patterns, or altered water quality in onsite surface waters have the potential to affect water quality and aquatic resources in adjacent areas of Lake Erie. These impacts are discussed in the following paragraphs.

Preconstruction activities associated with installation of the intake structure for Fermi 3 would include building a pump house on the Lake Erie shoreline near the intake facility, hydraulic dredging of the existing intake bay to accommodate the new intake structure, and construction of bulkheads within the intake bay. Ground-clearing and preconstruction activities on the shoreline for the pump house could result in increases in runoff to and sedimentation in adjacent nearshore areas of Lake Erie and could cause temporary effects on benthic habitat and biota due to siltation, as well as possible short-term localized declines in phytoplankton productivity and zooplankton densities in the areas within and adjacent to the existing intake bay due to an increase in suspended sediments.

Dredging for construction of the intake structure would be authorized by permits from the USACE and MDEQ and would require implementation of mitigation measures and BMPs stipulated in those permits (Section 4.2) to limit impacts on water quality and aquatic biota. The area between the groins of the intake bay is currently maintained under existing USACE and MDEQ permits (Section 4.2), and no additional dredging is proposed to accommodate development of the barge slip. No more than 3.7 ac of previously disturbed benthic habitat located between the groins of the intake bay would be affected by building these structures.

As described in Section 3.3.1.4, the proposed cooling water discharge pipeline would extend approximately 1300 ft into Lake Erie from the shore. In order to bury the pipeline, mechanical trenching of an area approximately 5 ft wide and 1300 ft long would be required, and would affect approximately 0.15 ac of benthic habitat, of which approximately 0.02 ac has not been disturbed previously by maintenance dredging activities. Installation of the discharge structure would require USACE and MDEQ permits (Section 4.2). It is anticipated that those permits would require implementation of mitigation measures to limit impacts on water quality and aquatic biota.

Dredging for these structures (considered preconstruction activities) would result in the temporary loss of benthic organisms because of the disturbance of substrate and physical impacts on individuals, as well as short-term localized declines in phytoplankton productivity and zooplankton density due to increased turbidity. The anticipated increases in turbidity would also temporarily degrade the quality of fish habitat in the affected area. Although backfilling of the discharge pipeline trench would restore the substrate and contours of the pipeline alignment, there would be permanent loss of a small amount of aquatic habitat (less than 1 ac) within the footprints of the intake structure and the barge slip, and at the end of the discharge pipeline where the diffusers would be located. There are no known sensitive or important aquatic habitats within the areas that would be affected by these activities (e.g., aquatic vegetation or other structured habitat), and species diversity within the area is generally low (Detroit Edison 2011a; AECOM 2009). As a consequence, impacts on aquatic biota and habitats from development of the barge slip, intake structure, and discharge structure would be temporary, easily mitigated, and minor.

As described in Section 4.2.3.1, stormwater runoff from preconstruction and construction areas and discharge of water from excavation dewatering into any onsite surface waters would eventually enter Lake Erie, where aquatic resources could be affected by sediment or contaminants. As described in Section 4.2.3.1, Detroit Edison would obtain an NPDES stormwater construction permit that would require monitoring of preconstruction and construction-related discharges and would require soil erosion controls and other BMPs to comply with regulations designed to prevent degradation of water quality.

The review team considered whether preconstruction and construction activities would affect the potential for harmful algal blooms in Lake Erie in the vicinity of the Fermi site. Because the NPDES stormwater construction permit, the stormwater management plan for the Fermi site, and the employment of BMPs would have sufficient controls to protect water quality in Lake Erie, the review team concluded that chemical and physical discharges from building activities would not affect the density and distribution of aquatic nuisance species, including lyngbya (*Lyngbya wollei*), in Lake Erie.

Based on the analysis of information regarding building the intake structure, barge slip, and discharge structure in Lake Erie, the potential for water quality impacts from building activities at other areas of the Fermi site, and the implementation of mitigation measures and BMPs that would be stipulated in required permits, the review team concludes that the preconstruction- and construction-related impacts on aquatic resources in Lake Erie would be temporary, easily mitigated, and minor, and no further mitigation measures beyond those identified in the appropriate permits would be warranted.

Construction Impacts at the Proposed Site

Overflow Canals (North, Central, and South Canals)

Building of the parking structure and a warehouse would result in the complete filling of the central and the north canals and portions of the south canal. Impacts from filling these areas would result in the loss of approximately 7 ac of aquatic habitat and would affect the communities and aquatic organisms that currently reside in them. Surveys of aquatic organisms within the north, central, and south canals in 2008 and 2009 indicated that the fish and macroinvertebrate species present are common in surrounding aquatic habitats within the region; no sensitive or unique species or habitats were observed (AECOM 2009). The isolated central canal has no direct hydrological connection with the other onsite water bodies (Section 2.3.1.1), and aquatic organisms within the central canal would be killed when it is filled. Filling of the north and partial filling of the south canal systems would mostly result in habitat loss along the canal banks. Although most benthic organisms within the filled areas of the north and south canals would be killed, some of the fish and other more mobile animals within the affected areas may be able to escape harm by leaving the affected areas and moving to other portions of the canals, Swan Creek, and the South Lagoon. Some impacts in the south canal would be temporary; a culvert would be installed in the south canal and the existing bottom might be maintained or restored after installation. Dewatering of excavation areas would not affect water levels in the north or south canals or the associated wetland areas because they are hydraulically connected to Lake Erie (see Section 4.2.1).

Backfilling these onsite water bodies may affect stormwater runoff flowing to the North and South Lagoons, potentially causing a small increase of sediment loading into the North and South Lagoons, Swan Creek, and Lake Erie. An NPDES stormwater construction permit issued by the MDEQ would be needed for preconstruction and construction and, as part of the NPDES stormwater construction permit, a SESC Plan would be implemented. The SESC Plan would identify BMPs to be implemented to alleviate the potential for increased sediment loading to other surface water areas (Detroit Edison 2011a). Based on the amount of aquatic habitat that would be affected, the nature of the aquatic habitat and organisms that occupy the overflow canals and the hydrologically connected surface water habitats, and the planned implementation of BMPs to address concerns related to stormwater runoff, the review team concludes that the impacts associated with filling these areas for building the parking structure and warehouse (both considered preconstruction activities) would be minor and no additional mitigation would be warranted. No NRC-authorized construction activities would affect these water bodies.

Quarry Lakes

There would be no direct effects of NRC-authorized construction activities on the Quarry Lakes, and runoff from preconstruction and construction areas would not enter the lakes because of the topography of the Fermi site. Dewatering associated with the construction of Fermi 3 includes dewatering the excavation site for the reactor. Groundwater modeling conducted by Detroit

Edison (2011a) indicated that water levels in the Quarry Lakes could drop between 1 and 2 ft as a result of dewatering operations for preconstruction and construction activities (see Section 4.2.2.2). Methods being considered by Detroit Edison for reducing the amount of groundwater that would be extracted during dewatering operations are described in Section 4.2.1.3. As identified in Section 2.4.2.1, the Quarry Lakes were created when water filled abandoned rock quarries used for site development and construction of Fermi 2. These small lakes are steep-sided, approximately 50 ft deep, and support aquatic species common to Lake Erie coastal marsh habitats. Because of the steep sides, a decrease in water depth of up to 2 ft would result in only small temporary changes in surface area and would expose only small areas of benthic habitat. Assuming a decrease in water depth of 2 ft, the overall change in water volume would be less than 5 percent. Based on the amount of aquatic habitat that would be affected and the nature of the aquatic organisms that occupy these lakes, the impacts associated with the estimated depth changes would be temporary and minor and no mitigation would be required.

Swan Creek

The entire Fermi site is located in the Swan Creek watershed. Although no preconstruction or construction activities would occur in Swan Creek, stormwater runoff into the creek from preconstruction and construction areas could occur, and water removed from the subsurface during excavation dewatering would be discharged into stormwater outfalls that flow to Swan Creek via the North Lagoon (see Section 4.2.1.3). As described in Section 4.2.3.1, Detroit Edison would obtain an NPDES stormwater construction permit that would require monitoring of construction-related discharges and soil erosion controls and other BMPs to comply with regulations designed to prevent the water quality in Swan Creek from being affected by runoff from construction areas. As a consequence, construction-related impacts on aquatic resources within Swan Creek and adjacent areas of Lake Erie would be temporary, easily mitigated, and minor, and no further mitigation measures beyond the identified BMPs would be warranted.

Stony Creek

The entire Fermi site is located in the Swan Creek watershed, and no preconstruction or construction activities for Fermi 3 are planned in the vicinity of Stony Creek or within the Stony Creek watershed. Consequently, there would be no construction-related impacts on aquatic resources within Stony Creek.

4.3.2.2 Aquatic Resources – Transmission Lines

A short length (less than 1 mi) of new transmission line corridor would be developed on the Fermi site to transmit power from the Fermi 3 generator to a new Fermi 3 switchyard. This new onsite transmission line corridor would be approximately 170 ft wide and include two sets of towers that would carry both rerouted Fermi 2 transmission lines and new Fermi 3 transmission lines (Detroit Edison 2011a). Surface water and wetland features located along the proposed onsite corridor include the south canal (see Section 2.4.2), a drainage area that is composed of a mosaic of emergent wetland, and some forested wetlands (Detroit Edison 2011a). There are no surface water features within the footprint for the new switchyard (Detroit Edison 2011a). Clearing of the onsite transmission line ROW, erecting the transmission towers, and stringing of the transmission lines would all be accomplished using methods that minimize impacts on wetlands and forest vegetation (Detroit Edison 2011a). The south canal and the drainage area within this portion of the Fermi site would be spanned by the transmission lines; impacts on the drainage area are expected to be minor because no activities associated with the transmission structure installation are expected to occur within the drainage channel (Detroit Edison 2011a).

Three new 345-kV transmission lines for Fermi 3 would be located within an assumed 300-ft-wide corridor from the Fermi site to the Milan Substation, a distance of approximately 29.4 mi. While the onsite Fermi 3 transmission lines would be owned by Detroit Edison up to the point of their interconnection with the new Fermi 3 switchyard, ITC*Transmission* would exclusively own and operate the offsite lines and other transmission system equipment between the Fermi 3 switchyard and the Milan Substation, and Detroit Edison would not control the building or operation of the transmission system. Detroit Edison expects to contract with ITC*Transmission* to maintain the transmission towers and lines located on Detroit Edison property (Detroit Edison 2011a).

The transmission line corridor route is described in Section 2.4.1.2 of this EIS and is illustrated in Figure 2-5. The three 345-kV lines for Fermi 3 would be built in an east-west common corridor that currently contains transmission lines for Fermi 2 for approximately 5 mi to a point just west of I-75. From this point, the three Fermi-Milan lines would be in a corridor shared with non-Fermi lines that travel to the west and north for approximately 13 mi. The last 10.8 mi of the proposed corridor that would proceed west to the Milan Substation are currently undeveloped, and no transmission infrastructure exists. This portion of the corridor has been under ITC*Transmission*'s control for future transmission development, but vegetation maintenance has been minimal except to remove tall, woody vegetation. According to FWS National Wetland Inventory mapping, the identified transmission route crosses about 30 wetlands or other waters that may be regulated by the USACE and/or MDEQ (FWS 2010). The 18.6-mi existing eastern section of the transmission route crosses 12 narrow agricultural drains and small streams; the undeveloped western 10.8-mi section of the route crosses nine drains and small streams. Reconfiguration of existing conductors would, for the most part, allow for the use of existing infrastructure to create the new lines, and access for installing additional lines is good because the vegetation has been managed to exclude tall woody vegetation. Therefore, preconstruction impacts on aquatic resources along the eastern 18.6 mi of the transmission line corridor are expected to be minor. Existing aquatic habitats in this portion of the corridor would be spanned, and BMPs would be used to protect aquatic habitats crossed by the new lines. Such BMPs include, but are not limited to, the use of silt fencing, hay bales, and similar practices to ensure the protection of aquatic habitats in close proximity to construction activity. Similarly, agricultural drains and small streams occurring in the undeveloped western corridor are narrow, and Detroit Edison anticipates using tower spans of 700–900 ft to avoid placing structures within stream channels (Detroit Edison 2011a). Roads in the vicinity are expected to provide sufficient access to this region of the corridor without the need for construction of new access roads. There are no aquatic habitats within the area that would be affected by the anticipated expansion of the Milan Substation. The review team concludes that impacts on aquatic habitats within the proposed transmission line corridor would be temporary, easily mitigated, and minor, and no additional mitigation would be required.

4.3.2.3 Important Aquatic Species and Habitats

This section describes the potential impacts of building Fermi 3 facilities and associated 345-kV transmission lines on important aquatic species including species that have been listed under the ESA, species that are listed by the State, and commercially and recreationally important species. The magnitude of impacts resulting from preconstruction and construction activities would depend on the sensitivity of a species to localized disturbance and water quality changes, species-specific habitat requirements, critical time periods in a species' life cycle, and the intensity and duration of the disturbance. The general biology, status, and habitat requirements of important aquatic species are presented in Sections 2.4.2.

Commercially and Recreationally Important Species

Commercially and recreationally important species that could occur in the vicinity of the Fermi site are identified in Section 2.4.2.3, along with information about their habitat requirements and life histories. Building the parking structure and a warehouse (both considered preconstruction activities) would result in filling the isolated central canal and portions of the north and south canals on the Fermi site, resulting in mortality to all aquatic organisms in the central canal and mortality to some aquatic organisms in the north and south canals. Commercially and recreationally important species that inhabit the canals include channel catfish (*Ictalurus punctatus*), common carp (*Cyprinus carpio*), gizzard shad (*Dorosoma cepedianum*), goldfish (*Carassius auratus*), and largemouth bass (*Micropterus salmoides*), among others (AECOM 2009), although no fishing activities are allowed within the onsite canals. As described in Section 2.4.2, surveys conducted in the vicinity of the Fermi site indicated that the species in the habitats that would be affected by filling were also found to be relatively abundant in other aquatic habitats in the vicinity of the Fermi site.

Approximately 4 ac of aquatic habitat in Lake Erie would be affected during modification and dredging of the intake bay (i.e., the area between the rock groins), building the new intake structure and the barge slip within the intake bay, and placement of the discharge structure for the facility. Although some commercially and recreationally important fish species are known to occur within the intake bay and in the area that would be affected during development of the discharge structure (AECOM 2009), most individuals are expected to temporarily move away from the immediate area during in-lake activities. This short-term displacement of individuals is not expected to have noticeable population-level impacts on commercial and recreational fish species. Migratory pathways for commercially or recreationally important species would not be physically blocked during in-lake activities.

As described in Section 4.2.3.1, the water quality of surface waters on or near the Fermi site could be affected by site-clearing and building activities. Stormwater runoff from the site into the North Lagoon (which drains to Swan Creek), South Lagoon, or Lake Erie could contain increased amounts of sediment or other pollutants, and installation of intake and discharge structures in and along the shoreline of Lake Erie would disturb sediments during building and dredging activities, potentially increasing turbidity near the Fermi site. Increased turbidity and noise could adversely affect migratory behavior, spawning behavior, and spawning success for some fish species.

To build and operate Fermi 3, Detroit Edison must obtain approvals from Federal and State regulatory agencies, including Section 10 and 404 permits from the USACE, Part 325 and 303 permit from the MDEQ, an NPDES construction stormwater permit from the MDEQ, and a Section 401 Water Quality Certification from the MDEQ. (MDEQ granted Section 401 Water Quality Certification on January 24, 2012; see Appendix H.) The MDEQ would also require Detroit Edison to develop both an SESC and a PIPP prior to obtaining the NPDES permit. With the implementation of preconstruction and construction-runoff and spill-control measures to be detailed in the PIPP and compliance with regulatory permits, it is unlikely that turbidity or contaminants from construction activities would be present at levels that would substantially affect fish migration or spawning.

As described in Section 2.4.2.2, there are no important commercial or recreational fisheries present within the assumed transmission line route due to the small sizes of the drainages crossed by the transmission line corridor. However, some of the streams to be crossed by the proposed transmission lines support some commercially or recreationally important species. Building of transmission lines could affect individuals in the vicinity of stream crossings because of soil erosion, sedimentation, accidental spills of fuel or lubricants from construction equipment, and temporary disturbance and/or displacement of aquatic biota. Along the eastern 18.6 mi of the proposed transmission line corridor, reconfiguration of existing conductors would allow for the use of existing infrastructure to create the new lines. Aquatic habitats in this portion of the corridor would be spanned and BMPs, such as placement of silt fencing, hay bales, and similar practices, would be implemented to protect aquatic habitats in close proximity to construction activity. Similarly, streams occurring in the western portion of the proposed corridor are narrow, and Detroit Edison anticipates using line spans of 700-900 ft to avoid erecting towers within the active channel and blockage of waterways. Existing roads in the vicinity are expected to provide sufficient access to this region of the corridor without the need for construction of new access roads. The MDEQ and/or USACE would perform additional regulatory review of proposed plans for building of the needed transmission lines, which would be built, owned, and maintained by ITC*Transmission*. Potential impacts on water quality are expected to be addressed through mitigation measures and BMPs required under issued permits.

On the basis of an evaluation of information presented in Detroit Edison's ER and other existing information, the review team concludes that construction and preconstruction impacts on commercially and recreationally important species in the vicinity of the Fermi site and along associated transmission line corridors would be mostly temporary and minor, and no additional mitigation would be expected. Preconstruction and construction activities are expected to affect relatively little habitat and few individuals of commercially and recreationally important species in areas affected by building activities. Implementation of BMPs and other mitigation measures stipulated in required permits would further reduce impacts.

Federally and State-Listed Aquatic Species

This section evaluates the potential for Federally and State-listed aquatic species to be adversely affected by preconstruction and construction activities for Fermi 3. Section 2.4.2.3 identifies and describes Federally and State-listed species that could occur in Monroe, Wayne, and Washtenaw Counties within which building activities related to development of Fermi 3 would be conducted.

Based on habitat requirements, current distributions, and survey data, aquatic species with a potential to occur in the vicinity of the Fermi site or the proposed transmission line route were identified in Section 2.4.2.3 (see Table 2-15). Three Federally listed aquatic species (northern riffleshell [*Epioblasma torulosa rangiana*]; rayed bean [*Villosa fabalis*]; and snuffbox mussel [*E. triquetra*]), all of which are freshwater mussels, were identified as having the potential to occur in Monroe, Washtenaw, or Wayne Counties in Michigan (Table 2-15). None of these species has ever been documented either on the Fermi site or along the proposed transmission line route, and, based on current population status, records of occurrence, and habitat preferences, only the rayed bean and the snuffbox mussel are believed to have the potential to occur on or in the immediate vicinity of the Fermi site.

The northern riffleshell is considered unlikely to occur on or adjacent to the Fermi site due to the lack of suitable stream habitat; it is unknown whether there could be suitable habitat for the northern riffleshell in portions of streams that would be crossed by the proposed transmission line route within Monroe or Wayne Counties, although the species has not been reported from the streams that would be crossed.

Including the species identified above, which also are all listed as endangered by the State of Michigan, the State-listed species that have been observed or that have a reasonable potential to occur on or adjacent to the Fermi site include three mussel species (rayed bean, salamander mussel [*Simpsonaias ambigua*], and snuffbox mussel) and three fish species (pugnose minnow [*Opsopoedus emiliae*], sauger [*Sander canadensis*], and silver chub [*Macrhybopsis storeriana*]) (Section 2.4.2.3; Table 2-15). Of these species, only the silver chub is known to occur at the Fermi site (Table 2-15).

The only known extant population of the white catspaw (*Epioblasma obliquata perobliqua*), which is Federally and State-listed as endangered, occurs in one stream drainage in Ohio. This species is presumed to be extirpated from Michigan; as a consequence, it is believed that this species would not be present near the Fermi site or in streams that would be crossed by the proposed transmission line corridor. Therefore, the review team concluded that the white catspaw would not be affected by preconstruction or construction activities for Fermi 3 and additional evaluation was not included in the final EIS or the BA.

There are other State-listed mussel and fish species, as shown in Table 2-15, that are considered unlikely to occur at the Fermi site but have the potential to occur in streams that would be crossed by the proposed transmission line corridor in Monroe, Wayne, or Washtenaw Counties. There is currently insufficient information to determine whether any of those species are present in the streams that would be crossed.

Building of offsite transmission lines could affect Federally and State-listed organisms in the vicinity of stream crossings in the same ways as described in the previous section for commercially and recreationally important species. Additional regulatory review of proposed plans for construction of the needed transmission lines, which would be built, owned, and maintained by ITC*Transmission*, may be conducted by the MDEQ and/or USACE, and potential impacts on Federally and State-listed aquatic species are expected to be addressed through mitigation measures and BMPs required under issued permits.

Potential impacts on Federally and State-listed species that were deemed to have a potential to occur in the waters on or in the immediate vicinity of the Fermi site or in streams that would be crossed by the proposed transmission line corridor, on the basis of previous records in the area or the expected overall range of the species, are evaluated in more detail in the following subsections.

<u>Northern Riffleshell (*Epioblasma torulosa rangiana*)</u>

The northern riffleshell is Federally listed as endangered and is also listed as endangered by the State of Michigan. Because there is no suitable habitat for the northern riffleshell on the Fermi site or in adjacent waters of Lake Erie (Section 2.4.2.3), construction activities at the Fermi site would have no impact on this species. Although suitable habitat for the northern riffleshell could be present in some of the streams that would be crossed by the proposed transmission line corridor, extant populations of this species in Michigan are only known to be present in the Black River in Sanilac County and the Detroit River in Wayne County (Carman and

Goforth 2000). Even if present in streams crossed by the transmission line corridors, the building of transmission lines for Fermi 3 is not expected to affect the northern riffleshell because aquatic habitats that are crossed by the corridor would be spanned without placement of structures within stream channels and because BMPs would be implemented to protect water quality in aquatic habitats located near construction activity. Additional regulatory review of proposed plans for construction of the transmission lines, which would be built, owned, and maintained by ITC*Transmission*, may be conducted by the MDEQ and/or USACE, and potential impacts on water quality are expected to be addressed through mitigation measures and BMPs required under issued permits. On the basis of this information, the review team concludes that preconstruction- and construction-related activities would have no effect on the northern riffleshell.

Pugnose Minnow (*Opsopoeodus emiliae*)

The pugnose minnow is listed as endangered by the State of Michigan and has the potential to occur in streams in Monroe and Wayne Counties. Although there is a potential for suitable habitat for the pugnose minnow to be present in the vicinity of the Fermi site, especially in weedy aquatic habitats such as those present in the North Lagoon or Swan Creek, no individuals were collected during recent surveys on the Fermi site and none were reported in past biological surveys of Stony Creek or the Swan Creek estuary near the Fermi site (AECOM 2009; MDEQ 1996, 1998; Francis and Boase 2007). If occasional individuals are present in the North Lagoon or near the mouth of Swan Creek, there is a potential for adverse effects due to water quality changes and increased turbidity related to stormwater runoff from preconstruction and construction areas (e.g., during building of the parking structure and warehouse) or due to discharge of water removed from the subsurface during excavation into stormwater outfalls that flow to Swan Creek via the North Lagoon (Section 4.2.1.3). As described in Section 4.2.3.1, Detroit Edison would obtain and implement an NPDES stormwater construction permit that would require monitoring of construction-related discharges and implement soil erosion controls and other BMPs to limit adverse effects on water quality due to runoff from construction areas. On the basis of this information, the review team concludes that preconstruction- and construction-related impacts on the pugnose minnow, if present, would be minor and that no additional mitigation would be required.

Rayed Bean (*Villosa fabalis*)

The rayed bean is Federally listed as endangered and is also listed as endangered by the State of Michigan. There are no streams on the Fermi site with conditions suitable for the rayed bean, and no extant populations are known to occur in the stream drainages that would be crossed by the proposed transmission line route. Although there are records of rayed bean specimens from shallow, wave-washed areas of western Lake Erie, information supplied by Detroit Edison suggests that it is unlikely that the species occurs in the vicinity of the Fermi site for a number of reasons: (1) approximately 30 years of information on mussels in the western basin of Lake

Erie (including in the vicinity of the Fermi site) have been collected and evaluated by the USGS, and no rayed bean specimens have been identified; (2) the USACE conducted mussel surveys in Lake Erie approximately 2 mi south of the Fermi site and found no live specimens or shells of the rayed bean; (3) the rayed bean was not observed in surveys conducted by the Michigan Natural Features Inventory just north of the Fermi site near the mouth of Swan Creek; and (4) observations made by divers during sediment sampling and buoy maintenance activities within the exclusion zone for the Fermi site indicate that the sediment is predominantly clay hardpan, which is not suitable for the rayed bean (Detroit Edison 2010c). In addition, most of the area that would be affected by development of the intake structure, the barge slip, and the discharge structure for Fermi 3 has been previously disturbed by periodic maintenance dredging.

The building of transmission lines for Fermi 3 is not expected to affect the rayed bean because (a) the species has not been reported from the streams that would be crossed by the proposed transmission line corridor, (b) aquatic habitats that are crossed by the corridor would be spanned without placement of structures within stream channels, and (c) BMPs would be implemented to protect water quality in aquatic habitats located near construction activity. On the basis of this information, the review team concludes that preconstruction- and construction-related activities for Fermi 3 would not affect the rayed bean.

<u>Salamander Mussel (*Simpsonaias ambigua*)</u>

The salamander mussel is listed as endangered by the State of Michigan and has the potential to occur in Monroe and Wayne Counties. There are no suitable stream habitats for the species on the Fermi site. There is the potential for suitable habitat and the appropriate host (mudpuppy; *Necturus maculosus*) for the salamander mussel to be present in Lake Erie near the Fermi site (see Section 2.4.2.3). Because the areas in Lake Erie that would be disturbed by modification and dredging of the intake bay, construction of the new intake structure, development of a barge slip within the intake bay, and placement of the discharge structure for the facility have either been previously disturbed by periodic maintenance dredging or have been identified as containing a clay hardpan substrate (Detroit Edison 2010c) and not the silt and sand substrate preferred by this species, it is considered unlikely that this species would be present.

Because no suitable habitat for this species (i.e., medium to large rivers or lakes) would be crossed by the proposed transmission line corridor, construction of the proposed transmission lines would not affect this species. On the basis of this information and the recommended mitigation described, the review team concludes that preconstruction- and construction-related impacts on the salamander mussel would be minor.

Sauger (Sander *canadensis*)

The sauger is considered a species of special concern by the State of Michigan and has the potential to occur in Lake Erie. However, the last reported occurrence of sauger in Monroe County was in 1996, and no individuals were collected during recent surveys on the Fermi site, Stony Creek, or the Swan Creek estuary (AECOM 2009; MDEQ 1996, 1998; Francis and Boase 2007). If present in nearshore areas of Lake Erie that could be affected by construction activities, sauger would likely move away during dredging and building activities because of increased noise and turbidity levels, resulting in temporary displacement but negligible levels of mortality. Detroit Edison would obtain and implement an NPDES stormwater construction permit that would require monitoring of construction-related discharges and would implement soil erosion controls and other BMPs to comply with regulations designed to prevent degradation of water quality in Swan Creek and other areas near the Fermi site. The small streams that would be crossed by the proposed transmission line corridor do not provide suitable habitat for the sauger. On the basis of this information, the review team concludes that preconstruction- and construction-related impacts on the sauger would be temporary and minor, and no additional mitigation would be warranted.

Silver Chub (*Macrhybopsis storeriana*)

The silver chub is considered a species of special concern by the State of Michigan. A single silver chub specimen was collected in July 2009 during monthly fish surveys conducted near the mouth of Swan Creek from 2008 to 2009. Although no construction activities for Fermi 3 would occur in the area where the individual was captured, increased stormwater runoff into the creek from preconstruction areas (e.g., from the parking structure and warehouse areas) could occur and groundwater removed during excavation dewatering would be discharged into stormwater outfalls that flow to Swan Creek via the North Lagoon (Section 4.2.1.3). Little is known about the life history of the silver chub, especially its tolerance of siltation and turbidity (Derosier 2004). While some researchers have suggested that silver chub are intolerant of turbidity and silt, others note that silver chub are found in silty rivers (Derosier 2004). As described in Section 4.2.3.1, Detroit Edison would obtain and implement an NPDES stormwater construction permit that would require monitoring of construction-related discharges and implement soil erosion controls and other BMPs designed to prevent water quality in Swan Creek from being affected by runoff from construction areas. As a consequence, preconstruction- and construction-related impacts on silver chub would be temporary and minor, and no additional mitigation would be warranted.

Snuffbox mussel (*Epioblasma triquetra*)

The snuffbox mussel is Federally listed as endangered and is also listed as endangered by the State of Michigan. It has the potential to occur in Monroe, Wayne, and Washtenaw Counties. Although there are no suitable stream habitats on the Fermi site, there is the potential for suitable habitats in Lake Erie, and the host required by this species (logperch, *Percina caprodes*) has been collected near the Fermi site in Swan Creek and in Lake Erie near the South Lagoon (see Section 2.4.2.3). The areas in Lake Erie that would be disturbed during the building of Fermi 3 facilities have either been previously disturbed by periodic maintenance dredging or have a clay hardpan substrate (Detroit Edison 2010c) rather than the sand, gravel, or cobble substrate preferred by this species. Therefore, it is considered unlikely that this species would be present in the project area.

It is not known whether suitable stream habitat or populations of the snuffbox mussel occur along the proposed offsite transmission line corridor. It is anticipated that the small streams that would be crossed by the proposed transmission line corridor could be easily spanned without placing structures in stream channels and that BMPs would be implemented to protect water quality in streams during building activities. Additional regulatory review of proposed plans for construction of the offsite transmission lines, which would be built, owned, and maintained by ITC*Transmission*, may be conducted by the MDEQ and/or USACE, and potential impacts on water quality are expected to be addressed through mitigation measures and BMPs required under issued permits. On the basis of this information, the review team concludes that preconstruction- and construction-related activities for Fermi 3 would not affect the snuffbox mussel.

<u>Summary of Impacts on Federally and State-Listed Aquatic Species</u>

Based on information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that impacts of construction and preconstruction activities on threatened and endangered aquatic species would be minor. For the northern riffleshell, the review team concluded that there would be no effect from preconstruction and construction activities because any streams containing suitable habitat could be easily spanned by the proposed transmission lines. Preconstruction activities also include building and upgrading transmission lines for Fermi 3. NRC-authorized construction activities, which exclude the preconstruction activities described above, would have no direct effects on any listed species. In addition, the implementation of BMPs that would be identified in the required NPDES stormwater construction permits would further reduce the potential for impacts from preconstruction and construction activities. The NRC staff concludes that the impacts of NRC-authorized construction activities on aquatic threatened and endangered species would be minor, and no additional mitigation measures would be warranted.

In compliance with Section 7 of the ESA, the NRC began informal consultation by letter to the FWS dated December 23, 2008 (NRC 2008). The review team completed a BA assessing the impact on three Federally protected freshwater mussel species of building and operating Fermi 3. The conclusions in the BA on potential impacts are provided above. A copy of the BA is included in Appendix F of this final EIS. The BA was forwarded to the FWS on March 30, 2012 (NRC 2012). In a letter dated June 8, 2012 (FWS 2012), the FWS concurred with the review team's determination that building Fermi 3 would have no effect on the three freshwater mussel species that are Federally protected as endangered species.

Critical Habitats

There are no areas designated as critical habitat for aquatic species in the vicinity of the Fermi site or along the route of the proposed transmission line.

4.3.2.4 Aquatic Monitoring

No monitoring of aquatic resources is planned for the site preparation and development activities onsite or in the transmission line corridor. Fermi 2 NPDES monitoring, which requires monitoring of five outfalls, is anticipated to be ongoing during construction and preconstruction activities. However, the current NPDES permit for the Fermi site does not require monitoring of aquatic ecological resources, and there are no requirements in the license for Fermi 2 to conduct monitoring of aquatic resources, including specific aquatic ecological monitoring of the algal community, benthic invertebrates, or fish. The NPDES stormwater construction permit for Fermi 3 would require monitoring for turbidity of any discharge from the building areas; monitoring frequency and location would be identified during the permitting process (Section 4.2.4). Ecological monitoring of aquatic resources during preconstruction and construction activities could be required as a condition of permits issued by various regulatory agencies. For example, the MDEQ could request monitoring of specific ecological attributes as part of stormwater construction permits.

4.3.2.5 Potential Mitigation Measures for Aquatic Impacts

No additional mitigation measures, beyond those that may be identified in the required NPDES stormwater construction permit and in any current or future permits issued by the USACE and MDEQ would be needed to reduce potential impacts on water quality and aquatic resources.

4.3.2.6 Summary of Impacts on Aquatic Resources

Based on information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that the impacts of preconstruction and construction activities on aquatic biota and habitats, including impacts on aquatic threatened and endangered species and other important species, would be SMALL, and no mitigation measures beyond those identified in the required NPDES stormwater construction permit, and in permits issued by the USACE and MDEQ, are proposed at this time. Based on the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the impacts of NRC-authorized construction activities would be SMALL. Any impacts on aquatic resources associated with the compensatory mitigation proposed by Detroit Edison would be evaluated by the USACE as part of the permitting process for that activity.

4.4 Socioeconomic Impacts

This section describes the socioeconomic impacts that might occur as a result of building activities for Fermi 3. Detroit Edison employed an initial workforce at the Fermi plant site in 2011 that primarily focused on activities related to Fermi 1 and Fermi 2. This first phase would occur over 2 years, and would contribute to readying the site for subsequent building of Fermi 3. Detroit Edison plans to begin the preconstruction work specific to Fermi 3 in 2013 and to complete all building activities in 2021. The size of the construction workforce over the first phase of activities would average 100 workers. During the second and main phase of building activity, the construction workforce would range from a minimum of 200 workers to a peak of approximately 2900 workers. The average size of the onsite workforce during the 10-year building period would be approximately 1000 workers (Detroit Edison 2011a).

The review team expects most of the socioeconomic impacts related to demographics, economy and taxes, as well as infrastructure and community services, to occur in the general vicinity of Fermi 3 and in the communities where the majority of the new construction workers recruited for the project (i.e., in-migrating workers) reside. The review team expects the characteristics of the workers recruited from outside the region to be similar to the current workforce with respect to choices and preferences (e.g., commute distance, available amenities), and that they will reside primarily in Monroe and Wayne Counties in Michigan and Lucas County in Ohio during the building period. More than 87 percent of the current Fermi 2 workforce resides in these three counties. Therefore, the review team expects that most of the construction workforce relocating into the area during the building of Fermi 3 would also reside in these three counties.

As discussed in Section 2.5, no more than 3.2 percent of the current Fermi 2 workforce resides in any one county outside Monroe, Wayne, and Lucas Counties. In addition, the current and projected populations of the regional area are so large that the current workforce at the Fermi site represents less than 1 percent of the total population in any of the counties or locations where these employees reside. Therefore, the review team expects that impacts beyond the three counties will be minor. The following discussion focuses on the three-county economic impact area.

Section 4.4.1 presents a summary of the physical impacts of the project. Section 4.4.2 provides a description of the demographic impacts. Section 4.4.3 describes the economic impacts, including impacts on the economy and tax revenue. Section 4.4.4 describes the impacts on the infrastructure and community services. Section 4.4.5 summarizes the socioeconomic impacts.

4.4.1 Physical Impacts

Building activities will cause temporary and localized physical impacts, such as noise, odors, vehicle/equipment exhaust, and dust. Vibration and shock impacts are not expected because of the strict control of blasting and other shock-producing activities. The review team believes these impacts would be mitigated by compliance with all applicable Federal, State, and local environmental regulations and site-specific permit conditions. This section addresses potential physical impacts that may affect people, buildings, and roads.

4.4.1.1 Workers and the Local Public

The Fermi site is located along the relatively straight Lake Erie coastline that extends from the site approximately 20 mi southwest toward the Michigan/Ohio border and approximately 10 mi northeast toward the mouth of the Detroit River. East of this coastline are the open waters of Lake Erie. West of the site, the land is predominantly used for agriculture. Development within a 10-mi radius of the Fermi site is concentrated in the City of Monroe, which is about 8 mi southwest of the site, and along the Lake Erie shoreline in several beachfront communities. The community nearest to the Fermi site, Stony Point, is 2 mi south of it. Residential areas are also located in portions of Berlin Township and Frenchtown Charter Township. Relatively recent housing developments are present just south of Pointe Aux Peaux Road (the Fermi site's southern boundary).

The nearest designated recreational areas are the beaches at Stony Point (2 mi south of the site) and Estral Beach (2 mi northeast of the site). Nearby State recreational areas include Point Mouillee State Game Area (3.1 mi to the northeast) and Sterling State Park (4.8 mi to the south-southwest). Scattered industrial facilities are located west and southwest of the Fermi site along the I-75 corridor and near the City of Monroe. Commercial development is present along major road corridors, including Dixie Highway, Telegraph Road, and I-75, and within the City of Monroe.

All building activities would occur within the Fermi site boundary and would be performed in compliance with Occupational Safety and Health Administration (OSHA) standards, BMPs, and other applicable regulatory and permit requirements. Approximately 89,198 people live within 10 mi of the site, but physical impacts attenuate rapidly with distance. Therefore, the people who would be the most exposed to noise, fugitive dust, and vehicle or equipment emissions resulting from building activities would be construction workers and, to a lesser extent, other personnel working onsite at Fermi 2. People working or living immediately adjacent to the Fermi site and transient populations, such as people using recreational facilities or temporary employees of other businesses in the area, would not be noticeably affected because of their lack of access to and distance from the site; these factors would limit the impacts on them from building activities.

Construction workers would receive safety training and would be required to use personal protective equipment to minimize health and safety risks. Emergency first-aid care would be available at the site, and regular health and safety monitoring would be conducted. People working onsite or living near the Fermi site would not experience any physical impacts greater than those that would be considered an annoyance or nuisance.

4.4.1.2 Noise

Noise is an environmental concern because it can cause adverse health effects, annoyance, and disruption of social interactions. Noise would result from clearing, earthmoving, preparing foundations, pile-driving, concrete mixing and pouring, erecting steel structures, and various stages of facility equipment fabrication, assembly, and installation. Blasting would be employed in a manner designed to prevent damage to existing structures, equipment, and freshly poured concrete (Detroit Edison 2011a).

People who would be the most exposed to noise would be construction workers and, to a lesser extent, other personnel working onsite at Fermi 2. Detroit Edison will comply with OSHA standards for the protection of worker safety (29 CFR Part 1910) and EPA standards governing the noise levels of compressors (40 CFR Part 204).

Although some building activities would occur near the main gate of the Fermi site, approximately1900 ft (0.36 mi) from the nearest residence, most building activity would occur at the locations of the reactor building and cooling tower, which are located more than 3200 ft (0.6 mi) from the nearest residence. At this distance, noise levels would be less than 54 dBA without pile-driving and 57 dBA with pile-driving. Projected noise impacts from building activities are discussed in further detail in Section 4.8.2.

Detroit Edison will comply with NRC and EPA guidance for implementing the Noise Control Act of 1972, as amended, and the Quiet Communities Act of 1978 (Detroit Edison 2011a). In addition, Detroit Edison will need to apply for a building permit from Frenchtown Charter Township, which would require that any building activities comply with Township Ordinances, including the Noise Ordinance and the Blasting and Vibration Regulation Ordinance. The Noise Ordinance prohibits noise disturbance of residences between the hours of 7:00 p.m. and 7:00 a.m.

Detroit Edison will employ standard noise control measures for construction equipment, such as the use of silencers on diesel-powered equipment exhausts, to limit engine noise during building. In addition, Detroit Edison will limit the types of building activities during nighttime and weekend hours, notify all potentially affected neighbors about planned activities, and establish a construction-noise monitoring program (Detroit Edison 2011a). Detroit Edison (2011a) stated that the noisiest activities would be limited to daytime hours. The review team expects that noise impacts on recreation and the general public would be minimal due to the distance between the site and recreational areas, because noise attenuates with distance, and because of intervening topography and foliage.

4.4.1.3 Air Quality

Air quality at the Fermi site is heavily influenced by the Detroit and Toledo metropolitan areas and surrounding emission sources. Monroe County is designated in nonattainment for the 1997 and 2006 National Ambient Air Quality Standard (NAAQS) for particulate matter smaller than 2.5 micrometers in aerodynamic diameter ($PM_{2.5}$) and is in a maintenance area for the 8-hr ozone standard (EPA 2010a). In July 2011, the MDEQ submitted a request asking the EPA to redesignate Southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011a). In July 2012, the EPA issued a proposed rule designating southeastern Michigan as having attained both the 1997 annual $PM_{2.5}$ NAAQS and the 2006 24-hour $PM_{2.5}$ NAAQS, based on 2009–2011 ambient air monitoring data (77 FR 39659, dated July 5, 2012), but the final determination has yet to be made.

Temporary and minor effects on local ambient air quality would occur as a result of building activities. Dust particle emissions would be generated during land-clearing, grading, and excavation activities. Air quality would also be affected by engine exhaust emissions from heavy construction equipment and machinery, concrete batch plant operations, and emissions from vehicles used to transport workers and materials to and from the site. Estimated emissions from building activities and the effect on local air quality are discussed in further detail in Section 4.7.

Detroit Edison will need to obtain a permit from the MDEQ, and will need to develop a dust-control program that will employ mitigation measures to control fugitive dust during building activities in accordance with MDEQ Rule 336.1372 (Detroit Edison 2011a). These mitigation measures may include but are not limited to the following:

- Spraying all work areas with water or other dust-suppressant compound;
- Covering debris, excavated earth, or other airborne materials with tarpaulins or any other approved material;
- Restricting the speed of vehicles that transport materials;
- Mechanically cleaning paved surfaces;
- Periodically maintaining off-road surfaces with gravel where trucks have frequent access; and
- Re-seeding work areas when no longer needed.

In addition, Detroit Edison will equip the onsite concrete batch plant with a dust control system that will be checked and maintained on a routine basis (Detroit Edison 2011a).

4.4.1.4 Buildings

Building activities would not affect any offsite buildings because they are distant from the site. In addition, vibration and shock impacts are not expected offsite because of the strict control of blasting and other shock-producing activities. Information about historic properties and the impacts of building on these properties is provided in Sections 2.7 and 4.6.

Building activities would not affect any onsite buildings. Controlled blasting would be employed to prevent damage to existing structures, equipment, and freshly poured concrete (Detroit Edison 2011a). In accordance with 10 CFR Part 50, Appendix A, Fermi 2 has been built to safely withstand any possible impact from natural phenomena, such as earthquakes, and could therefore withstand shock and vibration from activities associated with the development of Fermi 3, such as controlled blasting. Other onsite structures were constructed according to building codes and standards that address shock and vibration issues similar to those that would occur as a result of building activities associated with Fermi 3 (Detroit Edison 2011a).

4.4.1.5 Roads

This EIS assesses the impact of transporting workers and materials to and from the Fermi site from four perspectives: physical impacts related to deterioration in the quality of the roads, socioeconomic impacts resulting from congestion and reductions in level of service (LOS), air quality impacts resulting from the emissions from vehicles used to transport workers and materials to and from the site, and potential health impacts caused by additional traffic-related accidents. Only the physical impacts on roads are addressed in this section; the socioeconomic impacts resulting from congestion and reductions in LOS are discussed in Section 4.4.4.1.[a] The air quality impacts are addressed in Section 4.7, and human health impacts are addressed in Sections 4.8 and 4.9. Use of area roadways by construction vehicles could contribute to physical deterioration of roadway surfaces. Detroit Edison stated that additional layers may be added to roadway surfaces to support the construction vehicles (Detroit Edison 2011a). Given that any necessary road improvements will be a condition of the site plan review process by the Monroe County Road Commission (MCRC) and Michigan Department of Transportation (MDOT), physical impacts on roadways are expected to be minor. Detroit Edison would be required to provide improvements to local roadways as needed.

4.4.1.6 Aesthetics

Fermi 3 would be located within the developed area of the Fermi site, along its eastern boundary by Lake Erie. Surrounding the developed area are 656 ac of wetlands, open water, and forested land that buffer the view of the developed area from public roadways.

(a) LOS is a designation of operational conditions on a roadway or intersection, ranging from A (best) to F (worst). LOS categories as defined in the *Highway Capacity Manual* are listed in Table 2-40.

The review team expects visual impacts from grade-level building activities to be limited. Surrounding land use is predominantly agricultural, with a few residential areas that are within the viewshed of the plant site. The area around the Fermi site is a security zone, as defined under 33 CFR Part 165. In this security zone, boat traffic or other public use of the waters within a 1-mi circumference of the plant is prohibited. Therefore, views of the plant construction from the water would also be limited.

Two 400-ft-tall cooling towers are currently the predominant visible structures on the Fermi site and are visible from outside the site property boundaries in all directions. Several small beach communities are located along the Lake Erie shoreline within 5 mi of the Fermi site, including Estral Beach, Stony Point, Detroit Beach, and Woodland Beach. Activities associated with the building of the cooling tower for Fermi 3 would also cause aesthetic degradation from dust and night lighting that would be visible from locations within these communities and along the beaches and other recreational facilities (marinas, docks) along Lake Erie. Although taller than the existing cooling towers, building activities for the new 600-ft cooling tower would be consistent with the existing views of the Fermi site, and the review team expects no discernible adverse impact on visual aesthetics from the building of Fermi 3.

4.4.1.7 Summary of Physical Impacts

All building activities would occur within the site boundary. The review team has evaluated information provided by Detroit Edison, visited the site and its environs, and independently reviewed the potential physical impacts of building activities in the region and the local area around Fermi 3. The review team concluded that the expected physical impacts of building activities would be SMALL for all categories (workers and the local public, noise, air quality, buildings, roads, and aesthetics), and that no mitigation beyond that described by Detroit Edison in its ER would be warranted.

4.4.2 Demography

Detroit Edison employed an initial workforce at the Fermi plant site in 2011 that focused primarily on activities related to Fermi 1 and Fermi 2. This first phase would occur over 2 years, and would contribute to readying the site for subsequent building of Fermi 3. According to a response to comments provided by Detroit Edison in June, 2012 (ML12178A449), Detroit Edison would begin preconstruction work specific to Fermi 3 in 2013 and complete all construction activities in 2021.[(a)] In the ER, Detroit Edison also stated that the size of the

(a) The actual start date for preconstruction and construction activities is not known, but for analytical purposes the review team used the dates presented in the ER. The duration of activities and the relative schedule of workers are not expected to change from those presented in the ER, and it is unlikely that the change in schedule would affect the analysis presented in this EIS.

workforce over the first phase of activities (2011 to 2012) would range between 35 and 150 workers, with an average onsite workforce of 100 workers.

During the second and main phase of building activity, the building workforce would range from a minimum of 200 workers to a peak workforce of approximately 2900 workers in 2017. Beginning in 2017, Detroit Edison plans to begin staffing for operation and maintenance of the plant. The size of the operations and maintenance workforce would increase from approximately 50 workers in 2017 to full staffing in 2021 of 900 workers, while the size of the construction workforce would decrease from approximately 2900 workers in 2017 to 150 workers when building is completed in 2021. Between 2017 and 2021, Detroit Edison would have an average onsite workforce (combined building and operations and maintenance) of 1000 workers. Figure 4-6 shows the variation in the total onsite workforce over the building period. The review team will evaluate construction impacts by evaluating the average onsite workforce of 1000 workers and/or the peak workforce of 2900 workers, as appropriate.

Given the number of construction workers in the region, which includes portions of the Detroit Metropolitan Statistical Area (MSA) and the Toledo MSA, compared with the estimated size of the construction workforce for Fermi 3, the review team expects that a large number of the workforce would be drawn from within a 50-mi radius of the Fermi site. For purposes of analysis, the review team assumed approximately 85 percent of the building workforce

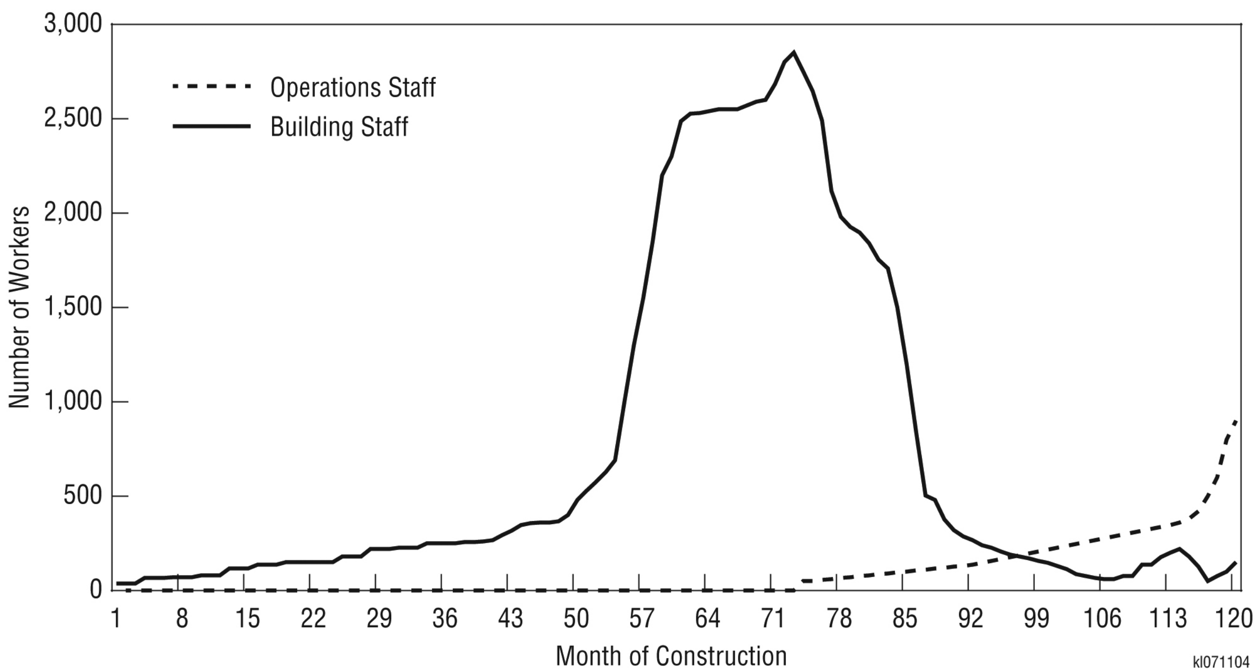

Figure 4-6. Total Number of Onsite Workers during the 10-year (120 Months) Building Period (Source: Detroit Edison 2011d)

(2465 workers during peak building employment and 850 workers on an average annual basis) would be drawn from within a 50-mi radius of the Fermi site. The residential distribution of the building workforce would likely differ from the residential distribution of the existing Fermi 2 workforce because a greater number of construction workers are located in Wayne and Lucas Counties, whereas Monroe County has the largest percentage of the operational workforce of Fermi 2. Within the economic impact area of Monroe and Wayne Counties, Michigan, and Lucas County, Ohio, Lucas County has more than twice the number of construction workers as Monroe County, and Wayne County has more than seven times the number of construction workers as Monroe County (see Tables 2-27 and 2-28). Therefore, building of Fermi 3 would likely draw more heavily from the construction workers in Wayne and Lucas Counties than those in Monroe County. Because these workers currently reside in the local area, they are already housed and serviced by the community, and the review team does not anticipate additional benefits or stresses associated with building of Fermi 3 by the existing workforce.

Despite the size of the construction workforce in the region, the review team expects that approximately 15 percent of the construction workforce (approximately 435 workers during peak building employment and 150 workers on an average annual basis) would be drawn from outside a 50-mi radius of the Fermi site. This estimate is based on the need for specialized skills and training that may not be available in the regional workforce and the expectation that a portion of the construction management, inspection, and owner's engineering staff would also likely relocate to the region during building.

The review team expects the characteristics of the workers recruited from outside the region with respect to choices and preferences (e.g., commute distance, available amenities) will be similar to those of the current workforce. Consequently, the review team could also assume the in-migrating workforce would move into the 50-mi region in the same proportions as the current operations workforce: with 87 percent residing in the three-county economic impact area and the remaining 13 percent outside of Monroe, Wayne, and Lucas Counties but within a 50-mi radius of Fermi 3. The settlement distribution of the in-migrating workers needed to support building of Fermi 3 is shown in Table 4-5.

The greatest potential impact on demographics in the region and the three-county economic impact area of Monroe, Wayne, and Lucas Counties would occur as a result of the relocation of workers during the peak building employment period. The following analysis focuses on demographic impacts associated with the peak building employment workforce, estimated to occur in 2017.

To estimate the maximum projected population increase associated with the in-migrating workers, the review team assumed all workers drawn from outside the region bring their families, and that each worker would have a household size of 2.6 persons, based on the national average household size in the U.S. Census Bureau's 2010 population data

Table 4-5. Counties Where In-migrating Construction Workforce Would Reside

County	Peak In-Migrating Construction Workforce in 2017	Percent of In-Migrating Workforce		Average Annual In-Migrating Construction Workforce
		By County[(a)]	Cumulative	
Monroe	250	57.5	57.5	86
Wayne	83	19.0	76.5	29
Lucas	47	10.7	87.2	16
All others within 50-mi region	55	12.8	100.0	19
Total	**435**			**150**

(a) The distribution of the in-migrating workforce by county is based on the residential distribution of the current Fermi 2 workforce (Detroit Edison 2008).

(USCB 2010a). On the basis of this assumption and the proportional settlement pattern shown in Table 4-5, the review team estimates that 650 persons would potentially relocate to Monroe County, 216 persons would relocate to Wayne County, and 122 persons would relocate to Lucas County. Approximately 143 persons would relocate elsewhere in the region. Projected population increases are shown in Table 4-6.

Based on the review team's analysis, the in-migrating workers and their families would increase the populations in Monroe, Wayne and Lucas Counties by less than 1 percent. As discussed in Section 2.5, Wayne and Lucas Counties are projected to experience population losses through 2020. Therefore, the projected increase in population associated with workers relocating to build Fermi 3 would have a beneficial impact on the two counties, because the population loss currently being experienced in Wayne and Lucas Counties, primarily due to the economy, would be partially offset by the in-migrating workers. While Monroe County is projected to have a modest population increase through 2020, the additional increase associated with the in-migrating construction workforce would be minimal. Therefore, the review team determined the three-county economic impact area would experience a SMALL beneficial demographic impact from building Fermi 3.

In addition, a small number of workers would in-migrate to counties outside of Monroe, Wayne, and Lucas Counties. Therefore, their impact on any one jurisdiction would not be noticeable. The current and projected populations of the regional area are so large that the in-migrating construction workforce for Fermi 3 would represent less than 1 percent of the total population in any of the counties or locations where these employees would reside. Therefore, the review

Table 4-6. Potential Increase in Population during the Peak Building Employment Period in 2017

County	Peak In-Migrating Workforce in 2017	Percent of In-Migrating Workforce	Estimated Increase in Population (number of workers × 2.6 persons per household)[a]	Projected 2020 Population[b]	Estimated Increase as Percent of Projected 2020 Population
Monroe	250	57.4	650	159,461	0.4
Wayne	83	19.1	216	1,812,593	0.01
Lucas	47	10.8	122	434,650	0.03
All others within region	55	12.6	143	–	–
Total	**435**		**1131**		

(a) National average household size in 2010 from population estimate by U.S. Census Bureau (USCB 2010a).
(b) Monroe and Wayne Counties 2020 and 2030 projections are from the Southeast Michigan Council of Governments (SEMCOG 2008). Lucas County projections are from the Office of Policy Research and Strategic Planning (Ohio Department of Development 2003). Projected populations are not provided for other counties within the 50-mi region. Given the small number of workers in-migrating to counties outside of Monroe, Wayne, and Lucas Counties, the impact on projected populations for any one jurisdiction would be minimal.

team concludes that the demographic impacts of building Fermi 3 on the remainder of the region would also be SMALL and beneficial.

The projected increase in population in Monroe, Wayne, and Lucas Counties associated with in-migrating workers and their families is less than 1 percent of the projected 2020 population for any of these counties.

Given the size of the regional population projected for 2020 of 6,130,056 persons within a 50-mi radius of the Fermi site (see Table 2-25), the projected increase associated with the in-migrating construction workforce would be minimal within the regional or local area.

4.4.3 Economic Impacts on the Community

This section evaluates the economic impacts on the 50-mi region from building Fermi 3, focusing primarily on Monroe, Wayne, and Lucas Counties. In 2010, more than 43,000 workers were employed in the construction industry in Monroe, Wayne, and Lucas Counties (USCB 2010b) (see Tables 2-28 and 2-29). Therefore, the review team expects most of the workers needed to support the building activities of Fermi 3 to be available in the local area.

4.4.3.1 Economy

Building activities for Fermi 3 would have a beneficial impact on the local economy through direct purchase of materials and supplies within the local area and through direct employment of the construction workforce. Studies of new power plant construction indicate that the estimated construction costs of a nuclear power plant average approximately $4000 per kilowatt (kW) of electrical generating capacity (MIT 2009). With a planned capacity of 1605 megawatts (MW), the cost to construct Fermi 3 would be approximately $6.4 billion.

Given the highly specialized nature of nuclear plant components, a large portion of the capital goods would be imported from outside the region. However, new units require substantial amounts of bulk materials and supplies (including concrete, steel, piping, wiring, and electrical components), some of which would likely be procured locally. Detroit Edison has estimated that approximately $232 million would be expended in the purchase of materials and supplies over the 10-year building period, including bulk quantities of concrete, reinforcing steel and embedded parts, structural steel, cables, wires, coils, and pipes. Based on materials and supplies purchased for Fermi 2 in 2008 and 2009, Detroit Edison estimates that approximately 23 percent of the materials and supplies (or approximately $53 million of materials and supplies) for Fermi 3 would be purchased from vendors or suppliers in the local area, depending on availability (Detroit Edison 2011a). Local purchases of supplies and materials would provide a short-term (but multi-year) beneficial stimulus to the regional economy.

In addition to the purchase of materials and supplies, direct employment for the building activities at Fermi 3 would benefit the local economy. The size of the construction workforce needed for Fermi 3 would range over an estimated 10-year building period from a minimum of 35 workers to a peak building employment workforce of 2900 workers. Detroit Edison estimates that the average size of the onsite workforce during the 10-year building period would be approximately 1000 workers (Detroit Edison 2011a).

The types of construction workers that would be used on the project and the number of construction workers in the economic impact area who would potentially be available to support building are shown in Table 2-30. As shown in Table 4-7, the average annual salary, based on 2008 U.S. Bureau of Labor Statistics (USBLS) data for workers in the construction industry within the economic impact area, is approximately $50,500 (USBLS 2008a). In 2008, workers in the construction industry also received an annual average nonwage compensation of $19,550, which included supplementary pay (i.e., premium pay for overtime and work on holidays and weekends), retirement benefits, insurance, and legally required benefits (worker’s compensation, Social Security, etc.) (USBLS 2008b).

Although the size of the building workforce and associated payroll spending would vary depending on the building schedule and mobilization in each particular year, on the basis of an

Table 4-7. Wage Estimates for Construction Industry Occupations in the Economic Impact Area[(a)] in 2008

Occupation	Mean Annual Wages ($)[(b)] Monroe, Michigan MSA	Detroit-Livonia-Dearborn, Michigan Metropolitan Division	Toledo, Ohio MSA
Construction and extraction occupations[(c)]	48,190	53,750	49,570
First-line supervisors/managers of construction Traces and extraction workers	56,200	69,470	67,740
Boilermakers	–[(d)]	66,420	54,090
Brick masons and block masons	–	53,290	52,260
Carpenters	42,910	52,100	45,380
Cement masons and concrete finishers	42,870	–	50,110
Stonemasons	–	–	–
Construction laborers	34,260	39,600	40,190
Paving, surfacing, and tamping equipment operators	–	43,880	47,050
Operating engineers and other construction equipment operators	53,990	51,470	54,000
Electricians	62,970	61,460	52,570
Insulation workers: floor, ceiling, and wall	–	–	26,130
Insulation workers: mechanical	–	–	–
Painters, construction, and maintenance	–	52,890	4410
Reinforcing iron and rebar workers	–	–	–
Plumbers, pipefitters, and steamfitters	60,100	66,740	60,120
Sheet metal workers	–	62,060	55,500
Structural iron and steel workers	50,240	60,190	45,970
Millwrights[(e)]	70,390	67,030	–

Source: USBLS 2008a

(a) Data are presented by the USBLS for metropolitan areas, which include the counties identified as the economic impact area.

(b) Annual wages have been calculated by multiplying the hourly mean wage by a "year-round, full-time" figure of 2080 hours. Wages include base rate pay, cost-of-living allowances, guaranteed pay, hazardous-duty pay, incentive pays such as commissions and production bonuses, tips, and on-call pay. Wages do not include back pay, jury duty pay, overtime pay, severance pay, shift differentials, non-production bonuses, employer costs for supplementary benefits, and tuition reimbursements.

(c) These estimates were calculated with data collected by the USBLS from employers in all sectors within the industry. Estimates do not include self-employed workers.

(d) – indicates this occupation is not reported in this metropolitan area.

(e) Millwrights are classified by the USBLS under the installation, maintenance, and repair occupations.

average annual workforce of 1000 workers and average annual salary of $50,500, the review team estimates that $50.5 million would be expended in payroll annually during the building activities for Fermi 3. Non-wage compensation has not been included in the average wage estimate for this analysis.

The review team assumes that a portion of the workers drawn from the regional area would be unemployed. As discussed in Section 2.5, the overall rate of unemployment in Monroe, Wayne, and Lucas Counties in 2010 ranged between 11.3 (Lucas County) and 14.8 (Wayne County) percent. Nationally, the rate of unemployment in the construction industry is slightly more than double the overall rate of unemployment. In 2010, the national rate of unemployment in the construction industry was 20.6 percent, compared to the overall unemployment rate in the country of 9.6 percent (USBLS 2012; data are not provided by industry at the State, county, or metropolitan level). Given the unemployment rate in the local area, specifically in the construction industry, the review team estimates that 25 percent of the 850 workers or approximately 212 workers would be drawn from the ranks of the unemployed on an annual basis over the 10-year building period. The review team expects 15 percent of the annual workforce, about 150 workers, will relocate from outside the region.

New workers (i.e., in-migrating workers and those previously unemployed) would have an additional indirect effect on the local economy because these new workers would stimulate the regional economy by their spending on goods and services in other industries.[(a)] A model developed by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA), called the Regional Input-Output Modeling System (RIMS II), quantifies this "ripple" effect through the use of regional industrial multipliers specific to a local economy. Each new direct job in the construction industry stimulates employment and results in additional indirect job creation in other industry sectors, such as services. This stimulus reflects additional economic activity from interdependent suppliers and vendors. The ratio of total jobs (direct plus indirect) to the number of new direct jobs is called the "employment multiplier." Construction workers who already live and work in the local area are a part of the baseline and are therefore not included in the calculation of new indirect effects.

In the three-county economic impact area, BEA estimates that for every new worker, an additional 0.7 jobs would be created (Detroit Edison 2011a). On the basis of the employment

(a) The assessment of direct and indirect employment impacts in this analysis serves as a lower boundary estimate by only including in-migrating and formerly unemployed workers. For example, the nature of construction work is transitory; workers typically move from job to job such that vacated positions are not necessarily available for new workers. However, the review team recognizes that direct construction employment does not necessarily "crowd out" private employment. In these cases, if already-employed construction workers quit their jobs to work at Fermi 3, their old jobs would then become available for other workers to fill.

multiplier, the 362 new workers (i.e., in-migrating workers and those previously unemployed) would create an additional 253 new indirect jobs (Table 4-8).

Table 4-8. Average Annual Direct and Indirect Employment for Fermi 3 during Construction

	Category	Calculation	Number of Workers
A	Direct employment		1000
B	Reside in region	A × 85%	850
C	(Otherwise employed at time of hire for Fermi 3)	B × 75%	(638)
D	(Unemployed at time of hire for Fermi 3)	B × 25%	(212)
E	Relocate from outside region	A × 15%	150
F	Indirect employment	(D + E) × 0.7	253
G	Total annual employment	F + A	1253
	Total annual new employment	D + E + F	615

As stated above, an estimated $50.5 million (2008 dollars) would be expended in wages annually over the 10-year building period, on the basis of an average annual salary of $50,500 for 1000 workers. New workers would constitute about $18 million of that total. A regional earnings multiplier was applied to the wages of new workers to determine the effect of the direct earnings on the local economy. For every dollar of wages earned by new workers on Fermi 3, BEA estimates that an additional $0.60 in income would be created in the local economy (Detroit Edison 2011a). The new workers' $18 million in new direct wages would create an estimated $11 million in indirect wages.

The employment of a large workforce over a 10-year building period would have short-term positive economic impacts on the local area by providing additional income to the regional economy, reducing unemployment, and creating business opportunities for housing and service-related industries for the duration of the building period. The review team concluded, on the basis of its own independent review of the likely economic effects of the proposed action, that on average, beneficial economic impacts – including 1253 direct and indirect jobs, $61.5 million in direct and indirect wages, and $53 million spending on purchases of materials and supplies from local vendors and suppliers – would be experienced throughout the 50-mi region during the 10-year building period. The beneficial impacts on the economy would end when the construction ends.

Given the size of the regional economy, which includes a combined 2008 labor force in Monroe and Wayne Counties, Michigan, and Lucas County, Ohio, of approximately 1.2 million workers, the review team estimates the impact of the building of Fermi 3 on the regional economy would be positive, but minor.

4.4.3.2 Taxes

The tax structure of the region is discussed in Section 2.5 of this EIS. Building Fermi 3 would primarily affect four main tax revenue sources. These include (a) State and local taxes on worker incomes, (b) State sales taxes on worker expenditures, (c) State sales taxes on the purchase of materials and supplies, and (d) local property taxes or payments in lieu of taxes based on the assessed value of Fermi 3 during building.

State and Local Income Taxes

The States of Michigan and Ohio would receive additional income tax revenue from the income tax on wages of new workers. Table 4-9 summarizes the estimated new income tax revenue that would be received by the State annually during the 10-year building period. However, the exact amount of income tax revenue is determined on the basis of a number of factors, such as income tax rates, residency status, deductions taken, and other factors.

Table 4-9. Estimated New State Income and Sales Tax Revenue Associated with the Construction Workforce

New Workers and Revenue (in millions of $US)	Michigan	Ohio
New Construction Workers		
Workers relocated from outside region	129	21
Workers previously unemployed	182	30
Total new construction workers	311	51
Tax Revenue		
Estimated annual income (at $50,500 per year)	$15.7	$2.6
Estimated annual State income tax revenue	$0.6[(a)]	$0.08[(b)]
Estimated annual spending on goods and services[(c)]	$4.4	$0.7
Estimated annual sales tax revenue[(d)]	$0.3	$0.04
Total estimated annual new State revenue	$0.9	$0.12

(a) As discussed in Section 2.5, the income tax rate in Michigan will be set at 3.9 percent in 2015.
(b) Ohio's tax rate for an income between $40,000 and $80,000 is $1056.40 plus 4.109 percent of excess over $40,000.
(c) Based on 28 percent of income before taxes (USBLS 2010c).
(d) The Michigan sales tax rate is 6 percent, and the Ohio sales tax rate is 5.5 percent.

As discussed in Section 4.4.2, approximately 85 percent of the annual workforce, or an average of 850 workers, are expected to be drawn from the region. Construction workers who already live and work in the region are already contributing to State income tax and sales tax revenue and are not included in this analysis. However, approximately 25 percent of the 850 workers, or approximately 212 workers, live in the area but are not currently working. Those workers would contribute to new State tax revenue during the building of Fermi 3.

The review team expects approximately 15 percent of the annual workforce (150 workers) to relocate from outside the region. If all in-migrating workers move to the region from outside the States of Michigan or Ohio, they would also provide new tax revenue. To estimate the income tax revenue for the State of Michigan and State of Ohio, the review team assumed a similar residential distribution to the current Fermi 2 workforce. On the basis of the current residential distribution of the Fermi 2 workforce, approximately 86 percent of the total workforce resides in Michigan, and 14 percent resides in Ohio (both within and outside of the economic impact area). (Fewer than 1 percent resides in Canada, and they are not included in this analysis.) Assuming the in-migrating workers and previously unemployed workers are divided between Michigan and Ohio in the same proportion as the current Fermi 2 workforce, approximately 86 percent of the new workers would pay taxes in the State of Michigan and 14 percent would pay taxes in the State of Ohio. Therefore, the estimated new State income tax revenue would be approximately $0.6 million annually for the State of Michigan (2008 dollars), based on an average annual salary for the new workers of $50,500 and a 40-hr work week, and it would be approximately $0.08 million annually for the State of Ohio. This analysis serves as an upper bound to potential impacts because, to the extent that in-migrating workers relocate to build Fermi 3 from other parts of the same State, Michigan and Ohio would not benefit from new income tax revenues.

As discussed in Section 2.5, several municipalities in Wayne County and in Lucas County impose taxes on income. Depending on the residential location of in-migrating workers, municipalities in Wayne County and Lucas County may also benefit from increased income associated with building Fermi 3.

State Sales Taxes on Worker Expenditures

The States of Michigan and Ohio and some of the local jurisdictions in Ohio would also receive sales tax revenue on expenditures made by the new workers. An estimated $0.3 million in new sales tax revenue would be received by the State of Michigan, and $0.04 million would be received by the State of Ohio, on the basis of the national averages for consumer spending on goods and services.

The review team determined the impact of additional sales tax revenue at the State and local level would be positive but minimal – less than 1 percent of each State's total income tax revenues.

State Sales Taxes on Commercial (Non-Safety Related) Construction Materials and Supplies

Detroit Edison estimated approximately $232 million would be spent on materials and supplies over the 10-year building period, including bulk quantities of concrete, reinforced steel and embedded parts, structural steel, cables, wires, coils, and pipes. Based on materials and supplies purchased for Fermi 2 in 2008 and 2009, Detroit Edison estimates that approximately

23 percent of the non-safety related materials and supplies (or approximately $53 million) for Fermi 3 would be purchased from the local area. A detailed analysis of the sources for these materials and supplies has not been conducted. For purposes of analysis, the review team assumed that 60 percent of the locally purchased materials and supplies would be purchased from within the State of Michigan and 40 percent would be purchased from within the State of Ohio. Based on a State sales tax rate in Michigan of 6 percent, as estimated $1.9 million would be received by the State of Michigan over the 10-year building period; and based on a State sales tax rate in Ohio of 5.5 percent, an estimated $1.2 million would be received by the State of Ohio over the 10-year building period.

The review team determined that the impact of additional sales tax revenue from the purchase of construction materials and supplies at the State level would be positive but minimal – less than 1 percent of each State's total sales tax revenues over a 10-year period.

Local Property Taxes

During building of Fermi 3, the assessed property value of the Fermi plant site would increase each year. For purposes of analysis, the review team has estimated that Monroe County would assess the property as a Construction in Progress, which allows for plants under construction to be assessed at 50 percent of the total cost of construction each year.

Detroit Edison estimated $232 million would be expended in the purchase of materials and supplies over the 10-year construction period, for an average of $23.2 million each year. In addition, Detroit Edison would spend an average of $50.5 million on labor costs. Therefore, the Fermi 3 plant would be assessed, on average, an additional $36.9 million each year, for a total of $2.03 billion in assessed value over the 10 years of construction. The estimated annual property tax revenue over the 10 years of construction, based on current millage rates, is shown in Table 4-10.

Monroe County, Frenchtown Charter Township, and other local jurisdictions would benefit from increased property taxes associated with Fermi 3. The tax revenue from the Construction in Progress assessment of Fermi 3 would result in a significant increase in property tax revenue for Monroe County, based on 2009 property tax revenue receipts.

4.4.3.3 Summary of Economic Impacts on the Community

On the basis of information provided by Detroit Edison and the review team's evaluation, the review team concluded that the employment impact of building activities on the economy would be LARGE and beneficial in Monroe County and in local jurisdictions within Monroe County and SMALL and beneficial elsewhere. An annual average of 150 new workers would relocate into the area (including 58 percent in Monroe County), and 212 workers who are currently unemployed would be employed for building the project over the 10-year building period. A

Table 4-10. Estimated Total Construction in Progress Property Tax Revenue from Fermi 3 Construction Based on 2009 Millage Rates

Jurisdiction	Millage (2009)	Total Estimated Annual Property Tax Revenue for Construction in Progress (in millions of $US)
Monroe County – operation	4.8	$9.7
Monroe County – senior citizens	0.5	$1.0
Monroe County Community College	2.18	$.4.4
Monroe County Library	1.0	$2.0
Monroe Intermediate School District	4.75	$9.6
Frenchtown Charter Township	6.8	$13.8
Jefferson schools	18.5	$37.5
State education tax	6.0	$12.2
Resort Authority	2.8	$5.7
Total Millage	**47.33**	**$96.1**

portion of the estimated $6.4 billion construction cost of Fermi 3 would be spent on materials and supplies in the local area. Tax revenue to local jurisdictions would accrue through personal income, sales, and property taxes and would have a LARGE beneficial impact on Monroe County and on local jurisdictions within Monroe County and a SMALL beneficial impact elsewhere in the 50-mi region.

4.4.4 Infrastructure and Community Service Impacts

This section describes the estimated impacts on infrastructure and community services, including transportation, recreation, housing, public services, and education. These impacts are associated primarily with the construction workforce.

4.4.4.1 Traffic

Existing transportation routes would be affected by transportation of equipment, materials, and supplies to the Fermi site and the construction workforce commuting to and from the site.

The Fermi site can be accessed by road, rail, and water, and all three modes of transportation would likely be used during the building of Fermi 3 (Detroit Edison 2011a). A large portion of the major equipment, materials, and supplies required for building would be shipped via barge or rail (Mannik and Smith Group, Inc. 2009), and Detroit Edison may expand the existing barge slip to accommodate the construction equipment, materials, and supplies (see Chapter 3). Facilities to support both barge and rail transport to the Fermi site are available onsite, and these modes of transportation would not affect other users of port or rail facilities in the area. Personal vehicles on roadways would be the primary transportation mode for the construction workforce and could affect the LOS on local roadways, particularly during the peak building employment period.

The interstate highways and local roadways described in Section 2.5.2.3 would be used by construction workers to commute to and from work and to transport a portion of the equipment, materials, and supplies to the Fermi site. The size of the workforce would vary over an estimated 10-year building period from a minimum of 35 workers to a peak building employment workforce of 2900 workers. As a result, traffic would increase on area roadways during the peak building employment period and would be highest during the morning commute to the site from 5:30 to 7:30 a.m. (0.49 vehicles per employee) and the afternoon commute from the site between 2:30 and 5:30 p.m. (0.44 vehicles per employee) (Mannik and Smith Group, Inc. 2009). Building-related traffic would be most concentrated on local roadways near the site, lessening as workers disperse in various directions on regional interconnecting roadways and highways. Peak traffic volumes would occur during the morning commute to the site from 5:30 a.m. to 7:30 a.m. (0.49 vehicles per employee) and the afternoon commute from the site from 2:30 p.m. to 5:30 p.m. (0.44 vehicles per employee) (Mannik and Smith Group, Inc. 2009). Traffic volumes associated with the Fermi site are shown in Table 4-11.

Table 4-11. Actual (2009) and Projected (2017) Traffic Volumes – Fermi Site

Workforce	Number of Vehicles (a.m.)	Number of Vehicles (p.m.)
Current Fermi 2 workforce (2009)	466	418
Workforce during peak building employment period (2017)	1421	1276
Total during peak building employment period	1887	1694
Outage workforce for Fermi 2	758	615
Total during peak building employment period and outage	2645	2309

Source: Mannik and Smith Group, Inc. 2009

Detroit Edison conducted a traffic study to evaluate the effect of the building workforce on the LOS of local roadways, focusing on the peak building employment period. The analysis focused on seven local roadway intersections and three interstate (I-75) interchanges, listed below:

- N. Dixie Highway and Stony Creek Road;
- N. Dixie Highway and Pointe Aux Peaux Road;
- N. Dixie Highway and Leroux Road;
- N. Dixie Highway and Enrico Fermi Drive;
- N. Dixie Highway and Post Road;
- Leroux Road and Toll Road;

- Enrico Fermi Road and Leroux Road;
- I-75 and N. Dixie Highway;
- I-75 and Nadeau Road; and
- I-75 and Swan Creek Road.

The LOS analysis was conducted in accordance with the Transportation Research Board's *Highway Capacity Manual* to evaluate the operational efficiency at each intersection and its approaching roadways. The traffic analysis indicates that unsatisfactory traffic conditions (LOS of E or F) would occur at several intersections during both the morning and afternoon commutes during the peak building employment period (see Tables 4-12 and 4-13). The review team reviewed the traffic analysis prepared by The Mannik and Smith Group, Inc. (2009) for Detroit Edison and concurred with the findings.

Deficient roadway conditions (i.e., LOS E or F) could be mitigated by roadway or traffic-flow improvements, including signal timing/phasing optimization, left-turn signal phase addition, temporary or permanent signalization, roadway widening (turn-lane additions), modification of existing roads, or addition of new roads. MCRC and MDOT will be responsible for reviewing and approving site plans as the plans affect area roadways during the site plan review and approval process for a building permit within Frenchtown Charter Township (Assenmacher 2011; Ramirez 2011). If further information is needed, MCRC and MDOT may require that a traffic impact study be conducted in accordance with Traffic and Safety Note 607C, "Traffic Impact Studies" (MDOT 2009). Detroit Edison would be required to provide improvements to local roadways as needed.

Other measures to alleviate unsatisfactory traffic conditions include staggering the Fermi 2 workforce and Fermi 3 building workforce start times, establishing multiple shifts for the building workforce, and busing the workforce from a remote site to reduce trips to and from the site (Mannik and Smith Group, Inc. 2009). In addition, a new road would be constructed parallel to and north of the existing Enrico Fermi Drive to separate the Fermi 2 operations workforce and Fermi 3 building workforce, so delays in accessing the site should be alleviated.

During Fermi 2 scheduled refueling outages, contract labor personnel are hired by Detroit Edison to carry out fuel reloading activities, equipment maintenance, and other projects associated with the outage. Detroit Edison employs approximately 1200–1500 workers for 30 days during each refueling outage, which occurs every 18 months for Fermi 2. During scheduled outages, traffic generated by the Fermi site is expected to increase by 758 vehicles during the peak morning commute and by 615 vehicles during the peak afternoon commute (Mannik and Smith Group, Inc. 2009). If the peak building employment period were to occur during a scheduled Fermi 2 outage, traffic conditions would be further exacerbated, especially during the morning and afternoon commute periods. However, these conditions would be short

Table 4-12. Impacts on Area Roadways during Peak Morning Building Workforce Commute

Intersection	Approach/Movement	Existing (2009) Level of Service	Peak Building Employment (2017) Level of Service	Potential Improvement Alternatives
Northbound I-75 ramps and N. Dixie Hwy.	Northbound ramp	C	F	• Signal timing/phasing modification
Northbound I-75 ramps and Nadeau Rd.	Northbound ramp/left turn	F	F	• Signalization • Lane use modification
Northbound I-75 ramps and Swan Creek Rd.	Northbound ramp/left turn	D	F	• Signalization • Lane use modification
	Northbound ramp/right turn	B	D	
Southbound I-75 ramps and Newport Rd.	Southbound approach	C	F	• Signalization • Lane use modification
N. Dixie Hwy. and Stony Creek Rd.	Stony Creek Rd./eastbound	C	F	• Signalization • Eastbound Stony Creek left/right turn lanes
N. Dixie Hwy. and Pointe Aux Peaux Rd.	N. Dixie Hwy./northeast-bound	B	F	• Signal timing/phasing optimization
N. Dixie Hwy. and Leroux Rd.	Leroux Rd./southwest-bound	B	E	• Left turn restriction
N. Dixie Hwy. and Enrico Fermi Dr.	N. Dixie Hwy./northbound	A	F	• Signal timing/phasing • Northbound/southbound turn lanes on N. Dixie Hwy. • Additional access point • Westbound lane use/storage
	N. Dixie Hwy./southbound	A	F	
	Enrico Fermi Dr./westbound	C	F	
N. Dixie Hwy. and Post Rd.	Post Rd./eastbound	C	F	• Signalization
	Post Rd./westbound	B	F	
Enrico Fermi Dr. and Leroux Rd.	Leroux Rd./northeast-bound	B	F	• Warning signage • Temporary closure

Source: Mannik and Smith Group, Inc. 2009

Table 4-13. Impacts on Area Roadways during Peak Afternoon Building Workforce Commute

Intersection	Approach/Movement	Existing (2009) Level of Service	Peak Building Employment (2017) Level of Service	Potential Improvement Alternatives
Southbound I-75 ramps and N. Dixie Hwy.	Westbound approach/ left turn	A	F	• Signal timing/phasing optimization • Westbound left-turn phase
Northbound I-75 ramps and Nadeau Rd.	Northbound ramp/ left turn	F	F	• Signalization • Lane use modification
Northbound I-75 ramps and Swan Creek Rd.	Northbound ramp/ left turn	E	F	• Signalization • Lane use modification
Southbound I-75 ramps and Newport Rd.	Southbound I-75 ramp/ northbound approach	E	F	• Signalization • Lane use modification
	southbound approach	D	F	
N. Dixie Hwy. and Stony Creek Rd.	Stony Creek Rd./ eastbound	C	F	• Signalization • Eastbound Stony Creek left/right turn lanes
N. Dixie Hwy. and Pointe Aux Peaux Rd.	N. Dixie Hwy./ southwest-bound	C	F	• Signal timing/phasing optimization
N. Dixie Hwy. and Leroux Rd.	Leroux Rd./ southwest-bound	B	F	• Left turn restriction
N. Dixie Hwy. and Enrico Fermi Dr.	Enrico Fermi Dr./ westbound	B	F	• Signal timing/phasing optimization • Northbound/southbound turn lanes on N. Dixie Hwy. • Additional access point • Westbound lane use/storage
N. Dixie Hwy. and Post Rd.	Post Rd./eastbound	C	F	• Signalization
	Post Rd./westbound	B	E	
Enrico Fermi Dr. and Leroux Rd.	Leroux Rd./northeast-bound	B	F	• Warning signage
	Leroux Rd./southwest-bound	B	F	• Temporary closure

Source: Mannik and Smith Group, Inc. 2009

term for the length of the outage (approximately 30 days) and would not represent normal conditions.

From the information provided by Detroit Edison, interviews with local planners and officials, and the review team's independent evaluation, the review team concluded that the offsite impacts of traffic from building of Fermi 3 would be temporary and noticeable but not destabilizing during the peak building employment period. However, Detroit Edison commissioned a traffic study that identified strategies that could mitigate the traffic to a manageable level. Detroit Edison has committed in the ER to working with MDOT and MCRC to determine possible mitigation measures (Detroit Edison 2011a).

4.4.4.2 Recreation

Recreational resources in Monroe, Wayne, and Lucas Counties may be affected by building activities for Fermi 3. Impacts may include (1) increased user demand associated with the projected increase in population as a result of the in-migrating building workers and their families, (2) an impaired recreational experience associated with the views of the building for the 600-ft cooling tower, and (3) access delays associated with increased traffic from the building workers on local roadways. Increased user demand as a result of the in-migrating building workers and their families may include increased competition for recreational vehicle (RV) spaces at campgrounds, which would be used for temporary housing for the workers.

Impacts associated with the increased use of the recreational resources in the vicinity and region would be minimal. The projected increase in population in Monroe, Wayne, and Lucas Counties associated with in-migrating workers and their families is less than 1 percent of the projected 2020 population for any of these counties and would minimally affect the availability and use of recreational resources in the area, especially considering that Wayne and Lucas Counties have experienced and are projected to continue to experience population losses through 2020.

Detroit Edison identified a large number of short-term accommodations within 50 mi of the city of Monroe. These accommodations would be rented by people using recreational areas and by other visitors/tourists to the region, and may also be used by a portion of the in-migrating workforce that does not select a more permanent type of housing. More than 375 establishments, including hotels and motels, bed-and-breakfasts, cabins and cottages, condos, historic inns, and RV parks and campgrounds, are located within 50 mi of the city of Monroe. In addition, the review team expects only a portion of the in-migrating workers would select short-term accommodations. Therefore, the review team expects recreationalists would be minimally affected by the use of short-term accommodations in the region by in-migrating workers.

Users of recreational resources in the immediate vicinity of the Fermi site may have a diminished recreational experience due to the views of building activities, especially tall structures such as the 600-ft cooling tower. Several small beach communities are located along the Lake Erie shoreline within 5 mi of the Fermi site, including Estral Beach, Stony Point, Detroit Beach, and Woodland Beach. Several public and private beaches are located along the Lake Erie shoreline in Monroe and Wayne Counties. Many small marinas and docks also are located along the Lake Erie shoreline within the vicinity of the Fermi site. Building activities associated with the cooling tower may create dust and debris, and night lighting would also be visible from Point Mouillee State Game Area (3.1 mi to the northeast) and Sterling State Park (4.8 mi to the south-southwest). Although the new 600-ft cooling tower will be taller than the existing cooling towers, building activities related to the new cooling tower would be consistent with the existing views of the Fermi site, and the review team determined there would be no discernible adverse impacts on recreational users from the building of the cooling tower for Fermi 3.

People using recreational facilities near the site may experience traffic congestion on the roads during the morning and afternoon commutes of the building workforce. Sterling State Park, in particular, is near the I-75 interchange with North Dixie Highway, which also provides access to the local road network for the Fermi site. From the information provided by Detroit Edison, interviews with local planners and officials, and the review team's independent evaluation, the review team concluded that the recreational impacts from building Fermi 3 could be temporary and noticeable but not destabilizing during the peak building employment period. However, measures to mitigate traffic delays at selected intersections and I-75 interchanges have been recommended for the building period; they would alleviate impacts on users of recreational facilities as well as members of the general public using local roadways. Therefore, the review team expects the recreational impacts from building Fermi 3 would be minimal after mitigation.

4.4.4.3 Housing

As discussed in Section 2.5, the review team expects that approximately 85 percent of the building workforce would be local workers who currently reside within a commute of approximately 50 mi from the Fermi site. The majority of these workers would commute from their homes to the project site and not be expected to affect the housing market. The review team expects the remaining 15 percent of the building workforce, or approximately 435 workers during peak employment, to relocate into the region. The review team expects these in-migrating workers will have characteristics similar to the current workforce with respect to choices and preferences (e.g., commute distance, available amenities). Therefore, the residential distribution of the in-migrating workforce is based on the residential distribution of the current Fermi 2 workforce, with most (about 85 percent) residing in Monroe and Wayne Counties in Michigan and Lucas County in Ohio during the building period. Table 4-14 compares the available housing with the number of in-migrating building workers.

Table 4-14. Impact on Housing Availability within Monroe, Wayne, and Lucas Counties

Parameter	Monroe	Wayne	Lucas
Workforce relocating from outside the region	250	83	47
Vacant housing units	4632	135,385	23,659
Estimated demand for housing as percent of housing availability	5.4	<0.01	0.2

Given the relatively large size of the regional housing market, the increased demand for housing for the relocating workers and their families would have no noticeable impact on the availability or price of housing. As presented in Section 2.5, the U.S. Census Bureau determined that more than 1 million housing units were located in Monroe, Wayne, and Lucas Counties in 2010, of which more than 300,000 were rental units. The vacancy rate within the three counties ranged between 2.4 and 4.4 percent for owner-occupied housing and 9.1 and 11.3 percent for rental units; approximately 146,000 housing units were vacant. The Southeast Michigan Council of Governments (SEMCOG 2008) reported 68 mobile home parks and 15,835 mobile home sites in Wayne County and 29 mobile home parks and 7452 mobile home sites, of which 17.2 percent surveyed in Monroe County were vacant, in 2006.

Substandard housing units are being demolished by Wayne and Monroe County, which has resulted in a net loss of housing units in Wayne County. However, the review team has also considered that a large number of housing units are in foreclosure, population in the local area is declining, and additional housing units are being approved for construction in Monroe County, which has resulted in a net gain in housing units. Despite the changes that are expected to occur in the housing market, the review team expects that the overall number of housing units will be more than sufficient to accommodate workers relocating from outside the local area.

In addition, more than 375 establishments are located within 50 mi of the city of Monroe and would be available as short-term accommodations for those relocating from outside the area or those choosing to minimize their commute for all or a portion of the work effort.

Given the large supply of housing and the size of the Detroit and Toledo metropolitan areas relative to the 435 in-migrating families during the peak building employment period, and the availability of short-term accommodations, the review team expects sufficient housing to be available for workers relocating to the area and that there would be minimal impacts on the housing supply or prices in the local area. In addition, given the large supply of housing as well as short-term accommodations, and the declining population in the area, the review team does not expect that the in-migration of 435 families would stimulate new housing construction.

Building Fermi 3 could affect housing values in the vicinity of the Fermi site. In a review of previous studies on the effect of seven nuclear power facilities, including four nuclear power plants, on property values in surrounding communities, Bezdek and Wendling (2006) concluded that assessed valuations and median housing prices have tended to increase at rates above national and State averages. Clark et al. (1997) similarly found that housing prices in the immediate vicinity of two nuclear power plants in California were not affected by any negative views of the facilities. These findings differ from studies that looked at undesirable facilities, largely related to hazardous waste sites and landfills, but also including several studies on power facilities (Farber 1998) in which property values were negatively affected in the short-term, but these effects were moderated over time. Bezdek and Wendling (2006) attributed the increase in housing prices to benefits provided to the community in terms of employment and tax revenues, with surplus tax revenues encouraging other private development in the area. Given the findings from the studies discussed above, the review team determines that the impact on housing value from building Fermi 3 would be minor.

4.4.4.4 Public Services

This section discusses the impacts on existing water supply and wastewater treatment and police, fire, and healthcare services in Monroe, Wayne, and Lucas Counties.

Water Supply and Wastewater Treatment Services

Approximately 85 percent of the project workforce would be local workers who currently reside within a 50-mi radius of the Fermi site. The majority of these workers would commute from their homes to the project site and would not relocate. Therefore, the majority of workers are currently served by water supply and wastewater treatment services within the communities in which they reside.

At peak employment, the review team expects about 435 workers to relocate with their families into the region, primarily to Monroe, Wayne, and Lucas Counties. These relocating workers would increase the demand on the water supply and on wastewater treatment services within the communities in which they choose to reside.

The review team expects that these workers would obtain housing within the existing housing market rather than stimulate new housing construction, and would not expand existing water supply or wastewater treatment services to new areas. Potable water is available to the existing housing market through wells or municipal water supplies, and residents either have access to municipal wastewater collection and treatment systems or individually own onsite wastewater disposal systems.

The estimated demand for water supply and wastewater treatment services in Monroe, Wayne, and Lucas Counties is shown in Table 4-15.

The review team expects the increase in demand for water supply by the in-migrating workers and their families will have a minor impact on municipal water suppliers in the local area because (1) the increase in population is projected to be small, (2) the in-migrating population

Table 4-15. Estimated Increase in Demand for Water Supply and Wastewater Treatment Services in Monroe, Wayne, and Lucas Counties from In-migrating Building Workforce

Increases	Monroe	Wayne	Lucas
Estimated increase in population	650	216	122
Estimated increase in residential daily water demand[(a)]	0.09 MGD	0.03 MGD	0.02 MGD
Estimated increase in residential daily wastewater flow[(b)]	0.05 MGD	0.02 MGD	0.01 MGD

(a) Average daily water use per person is estimated to be 135 gpd on the basis of the planning criteria used in DWSD (2004).

(b) Average daily wastewater flow per person is estimated to be 77 gpd on the basis of the planning criteria used in DWSD (2003).

would be served by a number of municipalities and jurisdictions, and (3) moving into existing homes implies that the residences would already be a part of the existing infrastructure.

In Monroe County, the largest municipal water supplier is the City of Monroe. The City of Monroe treatment plant is designed to treat 18 MGD, and its average daily water demand is 7.8 MGD (Monroe County Planning Department and Commission 2010). Other municipal water suppliers in Monroe County may also provide a water supply to the in-migrating population, including Frenchtown Charter Township; the City of Milan, Michigan; the City of Toledo, Ohio; and the Detroit Water and Sewerage Department (DWSD), which also serves portions of Monroe County. Therefore, the estimated water demand of 0.09 MGD for the additional people choosing to reside in Monroe County would have a minor impact on water suppliers.

Wayne County is serviced by the DWSD, which has a treatment capacity of 1720 MGD. The average daily water demand for the DWSD is 622 MGD (Ellenwood 2010). Therefore, the estimated water demand of 0.03 MGD for the additional people choosing to reside in Wayne County would have a minor impact on the DWSD.

The largest municipal water supplier in Lucas County is the City of Toledo, which also services the northeastern portion of the county, where workers are more likely to settle. Its plant has a treatment capacity of 120 MGD, with an average daily demand of 73 MGD (Leffler 2010). Therefore, the estimated water demand of 0.02 MGD for the additional people choosing to reside in Lucas County is expected to have a minor impact on the municipal water suppliers in Lucas County.

The increase in demand for wastewater treatment is expected to have a minor impact on wastewater treatment plants in the local area because of the number of jurisdictions that provide wastewater collection and treatment services in the local area compared with the size of the population increase associated with Fermi 3.

In Monroe County, the largest wastewater treatment plant is operated by the City of Monroe. It is designed to treat 24 MGD wastewater flows, and its average daily wastewater flow is 15.9 MGD (MDEQ 2011b). In addition, wastewater treatment services are provided by a number of municipalities in Monroe County, including the townships of Bedford, Berlin, Ida, and Raisinville; cities of Milan, Petersburg, and Luna Pier; and villages of Dundee, Carleton, and Maybee. Therefore, the estimated wastewater treatment flow of 0.05 MGD for the additional people choosing to reside in Monroe County would have a minor impact on wastewater treatment capability.

Wayne County is served by two large wastewater treatment facilities: the DWSD, which has a treatment capacity of 930 MGD and treats an average wastewater flow of 727 MGD (Ellenwood 2010), and the Downriver Treatment Plant, which has a treatment capacity of 125 MGD and treats an average wastewater flow of 52 MGD. In addition, Gross Ile Township, City of Rockwood, and City of Trenton maintain wastewater treatment facilities. Therefore, the estimated wastewater treatment flow of 0.02 MGD for the population choosing to reside in Wayne County would have a minor impact on wastewater treatment capability in Wayne County.

The City of Toledo's wastewater treatment plant is the largest in Lucas County. The plant has a treatment capacity of 195 MGD, with an average daily demand of 71 MGD (McGibbeny 2010). Therefore, the estimated wastewater treatment flow of 0.01 MGD for the population choosing to reside in Lucas County is expected to have a minor impact on wastewater treatment capability in Lucas County.

During the building of Fermi 3, the onsite workforce would place additional demands on the potable water supply to the Fermi site and on wastewater treatment services at the site. Potable water is currently provided to the plant site by Frenchtown Charter Township, and wastewater is treated through the Monroe Metropolitan Wastewater Treatment Facility. Detroit Edison estimates that approximately 8700 gpd of potable water would be required during the peak building employment period (Detroit Edison 2011a). The Frenchtown Charter Township water treatment plant and Monroe Metropolitan Wastewater Treatment Facility both have the capacity to accommodate the increased demand for these public services.

Surface water withdrawn directly from Lake Erie would provide the water supply for other building activities, including concrete batching, dust suppression, and fire protection. Therefore, municipal water supply services would not be affected by building activities. Impacts associated with surface-water withdrawal are discussed in Section 4.2.

The review team has concluded from the information provided by Detroit Edison, interviews with local planners and officials, and its own independent evaluation that the building of Fermi 3 would have minimal impacts on the local water supply and on wastewater treatment facilities.

Police, Fire Response, and Health Care Services

The building workforce for Fermi 3 would increase the demand for police, fire response, and health care services within the communities where the workers reside and at the Fermi site.

The review team expects the majority of the locally available workers would commute from their homes to the project site and would be served by the police, fire response, and health care services within the communities in which they reside. Although these workers' commute from their residences to their place of work would change, the demand for police, fire response, or health care services would not be appreciably different from that of the baseline population served by any one jurisdiction.

The review team expects that the remaining 435 workers during peak building employment would relocate into the region, primarily to Monroe, Wayne, and Lucas Counties. These relocating workers would increase the demand on police, fire response, and health care services within the communities in which they chose to reside.

As discussed in Section 4.4.2, the projected population increase associated with the in-migrating workers, based on an average household size of 2.6 persons, is 1131 persons. On the basis of the existing distribution pattern of the Fermi 2 operational workforce, it is estimated that 650 persons would relocate to Monroe County, 216 persons would relocate to Wayne County, and 122 persons would relocate to Lucas County (see Table 4-6). Approximately 143 persons would relocate elsewhere in the region. As shown in Table 4-16, the projected increase in population would have no measurable effect on the ratio of police officers, firefighters, or health care workers per 1000 residents who serve the population in Monroe, Wayne, or Lucas Counties, based on the 2010 population as presented in Section 2.5.

Building Fermi 3 may result in an increased demand for onsite police, fire response, or health care services, especially in the event of construction workplace injuries or accidents. Police, fire response, and other emergency response personnel may encounter traffic congestion on local roadways when responding to calls when the building workforce is commuting to the site, especially during peak building employment periods. However, the area around the Fermi site is sparsely populated, so there would not be a high demand for police, fire response, or other emergency response personnel. In addition, measures to mitigate traffic delays at selected intersections and I-75 interchanges have been recommended for the construction period; these could reduce the impacts on emergency responders as well as on members of the general public using local roadways. During the site plan review and approval process, Frenchtown Charter Township will require that the project, as necessary, be reviewed by the MCRC and MDOT. The MCRC may require that a traffic impact study be conducted in accordance with Traffic and Safety Note 607C, "Traffic Impact Studies" (MDOT 2009), and improvements to local roadways be considered by Detroit Edison at that time.

Table 4-16. Changes in Population Served by Law Enforcement Personnel, Firefighters, and Health Care Workers in Monroe, Wayne, and Lucas Counties

		Existing Conditions		Conditions with In-migrating Workers and Families Associated with Building Fermi 3	
Type of Public Service Workers	**Number of Officers/Firefighters/ Health Care Workers**	**Population Served**	**Officers/Firefighters/ Health Care Workers per 1000 Residents**	**Population Served[a]**	**Officers/Firefighters/ Health Care Workers per 1000 Residents**
County Sheriff and Municipal Law Enforcement Personnel					
Monroe	277	152,021	1.8	152,671	1.8
Wayne	6957	1,820,584	3.8	1,820,800	3.8
Lucas	973	441,815	2.2	441,937	2.2
Firefighters					
Monroe	606	152,021	4.0	152,671	4.0
Wayne	3407	1,820,584	1.9	1,820,800	1.9
Lucas	1195	441,815	2.7	441,937	2.7
Health Care Workers[b]					
Monroe, MI, MSA	2770	152,021	18.2	152,527	18.2
Detroit-Livonia-Dearborn Metro Division	69,030	4,296,250	16.1	4,296,533	16.1
Toledo, OH, MSA	34,600	651,429	53.1	651,551	53.1

Sources: FBI 2009; FEMA 2010; USBLS 2008a

(a) Population served includes the 2010 population data plus the projected population increase associated with relocating workers and their families. Normal population increases or decreases and any associated changes in the public services provided are not considered here.

(b) Occupational employment and corresponding population served are provided for the metropolitan area in which the county is located.

Detroit Edison will prepare and implement a construction safety plan that conforms to industry requirements and OSHA regulations to minimize the number of safety incidents that could occur onsite. The workers would be required to take training and become familiar with the plan and adhere to safety standards applicable to the construction industry (Detroit Edison 2011a). Fire suppression equipment and a first aid station are available onsite, and Detroit Edison has existing agreements with local emergency response organizations (Detroit Edison 2011a). Because of these offsite and onsite safety strategies, the review team expects that the impact of building activities on the demand for local emergency room service personnel would be minimal.

4.4.4.5 Education

The building workforce for Fermi 3 could increase the demand for educational services.

The review team expects that the locally available project workforce would commute from their homes to the project site and would not make any additional demands on educational services in Monroe, Wayne, and Lucas Counties.

As described in Section 4.4.2, the review team expects that the in-migrating workforce of 435 would relocate into the region, in the same distribution pattern as the current Fermi 2 workforce, primarily to Monroe, Wayne, and Lucas Counties. If the in-migrating workers were to bring their families, school enrollments would increase by an estimated 133 school-aged children in Monroe County, 44 school-aged children in Wayne County, and 25 school-aged children in Lucas County (Table 4-17).

During the 2008–2009 school year, enrollment in the nine public school districts in Monroe County was 23,283, and in Wayne County, enrollment in 35 public school districts was 276,862 (Table 4-18). During the same year, enrollment in eight school districts in Lucas County was 57,263. The review team determined that the impact of the projected increase in population associated with the building workforce for Fermi 3 on local schools would be negligible because

Table 4-17. Estimated Number of School-Aged Children Associated with In-migrating Workforce Associated with Building Fermi 3

Workers and Their Children	Monroe	Wayne	Lucas
Estimated number of building workers in-migrating to county	250	83	47
Estimated increase in population[(a)]	650	216	122
Estimated increase in number of school-aged children[(b)]	133	44	25

(a) Based on 2.6 persons per household (USCB 2010a).
(b) Based on the 2010 census data for the country, which shows that 20.4 percent of the population is between 5 and 19 years old (USCB 2010a).

Table 4-18. Building-Related Changes in Student/Teacher Ratio for School Districts in Monroe, Wayne, and Lucas Counties

	Existing Conditions			Conditions with In-migrating Workers and Families	
County	**Total Countywide Number of Teachers**	**Total Countywide Student Enrollment**	**Student/ Teacher Ratio throughout County**	**Total Countywide Student Enrollment[(a)]**	**Student/ Teacher Ratio throughout County**
Monroe	1254	23,283	18.6	23,554	18.8
Wayne	15,853	276,862	17.5	276,908	17.5
Lucas	3716	57,263	15.4	57,289	15.4

Source: U.S. Department of Education 2010

(a) Population served includes the 2008–2009 countywide school enrollment plus the projected number of school-aged children associated with in-migrating workers.

the children of the households associated with the relocated workers would be dispersed throughout numerous public schools in these school districts as well as in numerous private, parochial, charter, and alternative schools.

4.4.4.6 Summary of Infrastructure and Community Services Impacts

The review team has concluded from the information provided by Detroit Edison, interviews with staff from county departments, and its own independent evaluations that the impact of building activities on regional infrastructure and community services – including recreation, housing, water and wastewater facilities, police, fire, and medical facilities, and education – would be SMALL. The estimated peak workforce of 2900 would have a MODERATE, temporary adverse impact on traffic on local roadways near the Fermi site. These traffic-related impacts could be reduced but not eliminated with proper planning and mitigation measures similar to those discussed in the traffic study conducted for Detroit Edison by Mannik and Smith Group, Inc. (Mannik and Smith Group, Inc. 2009). These conclusions are predicated on the specific assumptions about the size, composition, and behavior of the project workforce discussed in detail in Section 4.4.2 of this EIS. Therefore, the projected increase in population associated with workers relocating to build Fermi 3 would mitigate the economic consequences of current population losses and have a beneficial impact on the two counties.

4.4.5 Summary of Socioeconomic Impacts

The review team has assessed the proposed building activities related to Fermi 3 and the potential socioeconomic impacts in the region and local area. Areas of physical impact on workers and the general public include noise levels, air quality, existing buildings, roads, and aesthetics. The review team has concluded that all physical impacts in the region and in the local area from building activities at Fermi 3 would be SMALL.

On the basis of information supplied by Detroit Edison and interviews conducted with public officials in Monroe, Wayne, and Lucas Counties, the review team concluded that impacts from building activities on the demographics of the entire 50-mi region would be beneficial and SMALL. Economic impacts would be beneficial and SMALL for all areas in the 50-mi region. Tax impacts would be SMALL and beneficial throughout the 50-mi region, except in Monroe County, where the review team determined there would be LARGE beneficial impacts on property taxes.

Infrastructure and community services impacts span issues associated with traffic, recreation, housing, public services, and education. Impacts from building activities on infrastructure and community services would be SMALL in all these areas except for traffic impacts during the peak employment period. Traffic-related impacts on local roadways near the Fermi site would be short-term, MODERATE, and adverse during the peak employment period, but manageable with the implementation of mitigation strategies similar to those discussed by Detroit Edison.

On the basis of the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concluded that the socioeconomic impacts of NRC-authorized construction activities would be SMALL, with two exceptions, which are outlined below. The NRC staff also concluded that no further mitigation measures beyond the actions outlined by the applicant in its ER would be warranted.

To determine the portion of the short-term MODERATE adverse traffic impact attributable to NRC-authorized construction activities, the NRC staff assumes, on the basis of Detroit Edison's ER, that 70 percent of traffic-related impacts over the life of the project would be associated with NRC-authorized construction activities. The NRC staff concluded that the applicant's percentage allocation of 70–30 based on expected labor hours was a reasonable estimate of the actual allocation. Using this allocation, the NRC staff concluded that the impact on traffic from Fermi 3 NRC-authorized construction activities would be short-term, MODERATE, and adverse and would largely occur during the peak building employment period. Detroit Edison may choose to implement the traffic-mitigation activities noted in Section 4.4.4.1, and it will implement the roadway improvements that are determined by MDOT and MCRC as a condition of Frenchtown Charter Township's site plan approval, which would reduce the traffic impacts to SMALL levels. The NRC staff concluded that the tax impact on Monroe County from NRC-authorized construction activities would be LARGE and beneficial.

4.5 Environmental Justice Impacts

In the context of the questions outlined in Section 2.6.1, the review team evaluated whether minority or low-income populations would experience disproportionately high and adverse human health or environmental effects from the building of Fermi 3. To perform this assessment, the review team (1) identified (through U.S. Census Bureau demographic data and on-the-ground assessments) minority and low-income populations of interest, (2) identified all potentially significant pathways for human health, environmental, physical, and socioeconomic effects on those identified populations of interest; (3) determined the impact of each pathway for individuals who are within minority or low-income populations; and (4) determined whether or not the characteristics of the pathway or special circumstances of the minority or low-income populations would result in a disproportionately high and adverse impact.

4.5.1 Health Impacts

Section 4.9 of this EIS assesses the radiological doses to construction workers and concludes that the doses would be within NRC and EPA dose standards. Section 4.9 further concludes that radiological health impacts on the construction workers for proposed Fermi 3 would be SMALL. In addition, there would be no radioactive material on the construction site except for very small sources such as those commonly used by radiographers; therefore, there would be no radiation exposure to members of the public living near the construction site. Based on this information, the review team concludes there would be no disproportionately high and adverse impact on low-income or minority members of the construction workforce or the local population.

Section 4.8 of this EIS assesses the nonradiological health effects for construction workers and the local population from fugitive dust, noise, occupational injuries, and transport of materials and personnel. In Section 4.8, the review team concludes that nonradiological health impacts on construction workers and the local population would be SMALL. The review team's investigation and outreach did not identify any unique characteristics or practices among minority or low-income populations that might result in disproportionately high and adverse nonradiological health effects.

4.5.2 Physical and Environmental Impacts

For the physical and environment-related considerations described in Section 2.6.1, the review team determined through literature searches and consultations that (1) the impacts on the natural or physical environment would not significantly or adversely affect a particular group; (2) no minority or low-income population would experience an adverse impact that would appreciably exceed or be likely to appreciably exceed those on the general population; and (3) the environmental effects would not occur in groups affected by cumulative or multiple adverse exposure from environmental hazards. Sections 4.5.2.1 through 4.5.2.4 summarize the physical and environmental effects on the general population, and Section 4.5.2.5 assesses the potential for disproportionately high and adverse physical and environmental impacts on minority or low-income populations.

The review team determined that the physical and environmental impacts from onsite building activities at the Fermi 3 site would attenuate rapidly with distance, intervening foliage, and terrain. There are four primary exposure media in the environment: soil, water, air, and noise. The following four subsections discuss each of these pathways in greater detail.

4.5.2.1 Soil

Building activities on the Fermi site represent the largest source of soil-related environmental impacts. The site is well-defined, and access is restricted. Soil-disturbing activities are localized on the site, sufficiently distant from surrounding populations, and have little ability to migrate, resulting in no noticeable offsite impacts. Soil migration will be minimized by adherence to regulations and permits and the use of BMPs.

4.5.2.2 Water

Water-related environmental impacts from erosion-related degradation of surface water and the introduction of anthropogenic substances into surface and groundwater would occur, but the impacts would be mitigated through adherence to permit requirements and BMPs. Increased water turbidity during dredging activities could affect near-shore water quality, but the effect would be minimized through adherence to permit requirements and BMPs. Consumptive use of surface water for building activities would also occur but would have only a minimal effect because the water supply is from Lake Erie. The water-related impacts of building activities associated with the proposed action would be of limited magnitude, localized, and temporary.

4.5.2.3 Air

Air emissions are expected from increased vehicle traffic, construction equipment, and fugitive dust from building activities. Emissions from vehicles and construction equipment would be unavoidable but would be temporary and minor in nature, and subject to management under State and Federal air regulations and permits. Furthermore, because of the distance between building activities and the closest minority or low-income population of interest, the review team did not identify any disproportionately high and adverse impacts from air-related pathways.

4.5.2.4 Noise

Noise would result from clearing; moving earth; preparing foundations; pile-driving; concrete mixing and pouring; erecting steel structures; and various stages of facility equipment fabrication, assembly, and installation. Detroit Edison, however, would employ standard noise control measures for construction equipment, limit the types of building activities during nighttime and weekend hours, notify all potentially affected neighbors of planned activities, and establish a construction-noise monitoring program. The review team determined that noise impacts on the public would be temporary and would not be significant; therefore the review team determined there would be no disproportionately high and adverse impact on any minority or low-income population from noise.

4.5.2.5 Summary of Physical and Environmental Impacts on Minority or Low-Income Populations

The review team's investigation and outreach did not identify any unique characteristics or practices among minority or low-income populations that might result in physical or environmental impacts on them that were different from those on the general population.

As discussed in Section 2.6, most of the census block groups classified as minority or low-income lie in urban centers to the north and south of the Fermi site, within and near Detroit (at the edge of the 50-mi region) and Toledo (about 25 mi from the Fermi site). The closest population of interest is a single census block group within Monroe County that qualifies as both a minority and a low-income population of interest. It is located approximately 5 mi from the Fermi site. This census block group would not be affected by any physical or environmental impact because the census block group is distant from the site. The review team did not identify any pathways by which any physical impacts would affect migrant farm workers if they were employed in transient farming activity near the Fermi site, and no subsistence activities are known to occur near the Fermi site.

On the basis of information provided by Detroit Edison and the review team's independent review, the review team found no pathways from soil, water, air, and noise that would lead to disproportionately high and adverse impacts on minority or low-income populations.

4.5.3 Socioeconomic Impacts

Socioeconomic impacts (discussed in Section 4.4) were reviewed to evaluate whether there would be any building activities that could have a disproportionately high and adverse effect on minority or low-income populations. Except for effects on traffic, any adverse socioeconomic impacts associated with the building of Fermi 3 are expected to be SMALL. While there likely would be adverse MODERATE impacts on traffic, these impacts are not expected to disproportionately affect low-income and minority populations.

4.5.4 Subsistence and Special Conditions

NRC's environmental justice methodology includes an assessment of minority or low-income populations of interest with unique circumstances, such as minority communities exceptionally dependent on subsistence resources or identifiable in compact locations, such as Native American settlements.

As discussed in Section 2.6.3, access to the Fermi site is restricted; such restricted access reduces any impact on plant-gathering, hunting, and fishing activities at the site. Detroit Edison and the review team interviewed community leaders in Monroe County with regard to subsistence practices, and no such practices were identified in the vicinity of the Fermi site.

There is no documented subsistence fishing in Lake Erie, Swan Creek, or Stony Creek, and no documented subsistence plant-gathering or hunting in the vicinity of the Fermi site. From the information provided by Detroit Edison, interviews with local planners and officials, and the review team's independent evaluation, the review team concluded that there would be no building-related disproportionately high and adverse impacts on subsistence activities by minority or low-income populations.

4.5.5 Summary of Environmental Justice Impacts

The review team evaluated the proposed activities related to building Fermi 3 and potential environmental justice impacts in the vicinity and region. The review team did not identify any potential environmental pathways by which the identified minority or low-income populations in the 50-mi region would be likely to experience disproportionately high and adverse human health, environmental, physical, or socioeconomic effects as a result of building activities; therefore, environmental justice impacts would be SMALL. On the basis of the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that there are no environmental pathways by which the identified minority or low-income populations in the 50-mi region would be likely to experience disproportionately high or adverse environmental or health impacts as a result of the NRC-authorized construction activities. Environmental justice impacts would therefore be SMALL.

4.6 Historic and Cultural Resources

The NEPA requires Federal agencies to take into account the potential effects of their undertakings on the cultural environment, which includes archaeological sites, historic buildings, and traditional places important to local populations. The NHPA also requires Federal agencies to consider impacts on those resources if they are eligible for listing on the *National Register of Historic Places* (NRHP) (such resources are referred to as "Historic Properties" in the NHPA). As outlined in 36 CFR 800.8, "Coordination with the National Environmental Policy Act of 1969," the NRC coordinated compliance with Section 106 of the NHPA in meeting the requirements of the NEPA.

Building new nuclear units can affect either known or undiscovered cultural resources. Therefore, in accordance with the provisions of the NHPA and NEPA, the review team must make a reasonable and good faith effort to identify historic properties in the area of potential effects (APE) and, if any such properties are present, determine whether any significant impacts are likely to occur. Identification is to occur in consultation with the SHPO, American Indian Tribes, interested parties, and the public. If significant impacts are possible, efforts should be made to mitigate them. As part of the NEPA/NHPA integration, even if no historic properties (i.e., places eligible for listing on the NRHP) are present or affected, the NRC must notify the SHPO before proceeding with their respective authorized activities. If it is determined that historic properties are present, the NRC and the USACE are required to assess and resolve adverse effects of their respective regulated activities for the undertaking.

4.6.1 Onsite Historic and Cultural Resources Impacts

Historic and cultural resources on the Fermi site are described in Section 2.7. As explained in Section 2.7, previous cultural resource identification efforts indicated the presence of eight archaeological site locations on the Fermi site (within the direct APE), none of which are recommended eligible for listing in the NRHP (Demeter et al. 2008; Taylor 2009). One architectural resource located on the Fermi site (within the direct APE), Fermi 1, has been recommended as eligible for listing in the NRHP under Criteria A and C as part of a separate undertaking (Kuranda et al. 2009). In its letter dated May 9, 2011 (which was received on May 10, 2011), the Michigan SHPO stated that Fermi 1 appears to meet the criteria for listing in the NRHP (Conway 2011).

The review team analyzed the construction and preconstruction activities related to building Fermi 3 and the potential cultural and historic resources impacts. Detroit Edison has not determined whether to remove the Fermi 1 external structure after the site is decommissioned and its NRC license is terminated. If the external structure is present when Fermi 3 building activities begin, then the NRC review team has determined that such activities would adversely affect Fermi 1. Thus, for the purposes of NHPA Section 106 consultation, based on (1) the measures that Detroit Edison would take to avoid or limit adverse impacts to significant cultural resources, (2) the review team's cultural resource analysis and consultation, and (3) Detroit Edison's commitment to follow its procedures should ground-disturbing activities discover cultural and historic resources, the NRC review team concludes with a finding of historic properties adversely affected (36 CFR Section 800.5(d)(2)) onsite and within the APE, based on the demolition of Fermi 1. The NRC review team consulted with the Michigan SHPO, Detroit Edison, and Monroe County Community College to develop an MOA (see Appendix F) to resolve the adverse effects on Fermi 1 pursuant to 36 CFR 800.6(c). Measures to mitigate adverse effects on Fermi 1 consist of preparation of recordation documentation for the Fermi 1 structure consistent with the Michigan SHPO's Documentation Guidelines and development of a public exhibit on the history of Fermi 1. These mitigation measures are described in greater detail in Section 2.7.4.

The review team also reviewed Detroit Edison's plan to develop procedures or guidance necessary to address the steps that Detroit Edison and its contractors will follow upon the unanticipated discovery of archaeological resources or human remains during construction and preconstruction activities. These procedures or guidelines will be in place prior to beginning ground-disturbing activities (e.g., preliminary site work, excavation, grading) for Fermi 3. The protective measures that will be reflected in these procedures and guidelines will consist of temporarily suspending activities in the area that may damage or alter any unanticipated cultural resources or human remains; securing the area to prevent additional disturbance of the unanticipated discovery; and notification of Detroit Edison's Engineering, Procurement, and Construction (EPC) Executive or his/her representative so that the Michigan SHPO and the Office of the State Archaeologist can be notified and determine the significance of the unanticipated discovery and what, if any, special disposition of the finds should be made (Detroit Edison 2009c, 2010b).

For the purposes of the review team's NEPA analysis, based on information provided by Detroit Edison, the review team's independent evaluation, and the review team's consideration of the intrinsic attributes of Fermi 1 that contributed to its cultural significance, the review team concludes that the impacts from building Fermi 3 on onsite historic properties would be MODERATE if the Fermi 1 structure is present when Fermi 3 construction activities begin. The attributes that make Fermi 1 eligible for listing in the NRHP are National Register Criterion A, for Fermi 1's role in the development of the nuclear power industry, and Criterion C, for the engineering design of the reactor and its associated components. Because access to the Fermi 1 site is restricted, the public will have an increased opportunity to learn about and understand Fermi 1's attributes once mitigation measures, which will consist of recordation documents and a public exhibit, are implemented. Thus, impacts on Fermi 1 are considered MODERATE because of these mitigation measures, even though its non-accessible external structure will be removed.

The review team concludes that the potential MODERATE impacts on cultural resources (i.e., Fermi 1) would be the result of NRC-authorized construction activities. The cumulative impacts on historic and cultural resources are analyzed and discussed in Chapter 7 of this EIS.

4.6.2 Offsite Historic and Cultural Resources Impacts

Offsite historic and cultural resources information is provided in Section 2.7. As explained in Section 2.7, previous cultural resource identification efforts indicated the presence of two archaeological resources and 83 architectural resources offsite, but within the indirect APE for Fermi 3. Neither of the two archaeological resources has been evaluated for NRHP eligibility (Demeter et al. 2008). Of the architectural resources, 21 were determined or recommended eligible for the NRHP listing under Criteria A, B, and/or C, and the remaining 62 have been recommended not NRHP-eligible (Demeter et al. 2008). The Michigan SHPO has indicated concurrence with the identification of historic properties for the Fermi 3 project in its letter dated May 9, 2011 (Conway 2011).

The process of building Fermi 3 would result in new facilities that would visually affect historic and cultural resources that are offsite, but within the indirect APE for the Fermi 3 project, and would have the potential to result in alterations to the visual landscape within the indirect APE for the Fermi 3 project. These alterations would consist of the introduction of new power plant facilities, including buildings and structures, into the existing viewsheds and settings of the 21 determined or recommended NRHP-eligible architectural resources and the settings of the two previously archaeological sites that have not been evaluated for NRHP eligibility. However, the existing viewsheds and settings of these 21 architectural resources and two archaeological sites include three existing power plant facilities along the shoreline of Lake Erie: the onsite decommissioned Fermi 1 facilities, the onsite operating Fermi 2 facilities, and the offsite operating Detroit Edison Monroe Power Plant to the south near the City of Monroe. As such, the indirect visual impacts that may result from building Fermi 3 would be consistent with existing landscape features in the viewsheds and settings of these 21 offsite architectural resources, such that there would be no new significant visual impacts that would affect the NRHP-eligibility determination or recommendations for the 21 offsite architectural resources that are within the indirect APE for the Fermi 3 project (Demeter et al. 2008). Similarly, there would be no new significant visual impacts on the two offsite archaeological resources that would affect NRHP-eligibility determinations or recommendations.

For the purposes of NHPA Section 106 consultation pursuant to 36 CFR 800.8, the NRC concludes with a finding of no adverse effect on offsite historic properties within the indirect APE, because, based on the characteristics of the existing offsite setting within the indirect APE, indirect visual impacts resulting from building Fermi 3 would be consistent with, and would not result in significant changes to, offsite historic properties within the indirect APE.

For the purposes of the review team's NEPA analysis, based on information provided by Detroit Edison, and the review team's independent evaluation, the review team concludes that the impacts from Fermi 3 construction and preconstruction activities on offsite cultural resources and/or historic properties within the indirect APE for the Fermi 3 project would be minor, because new facilities would be consistent with the landscape features within the existing setting of these offsite historic properties.

The portions of the proposed offsite transmission line route that are within the indirect APE for the Fermi 3 project will utilize an existing transmission line route, and will not result in new impacts on offsite historic or cultural resources within the Fermi 3 APE. The portion of the proposed offsite transmission line route that is located outside the Fermi 3 APE and extends north and west from the Fermi 3 project area to the Sumpter-Post Road junction in Wayne County will also utilize an existing transmission line route and will also result in no new impacts on offsite historic or cultural resources. The approximately 11-mi portion of the proposed offsite transmission line route from the Sumpter-Post Road junction in Wayne County to the Milan Substation in Washtenaw County will require a new transmission line route and may result in impacts on historic and/or cultural resources. The process of building new transmission lines may result in direct impacts on previously and as-yet-unidentified archaeological or architectural resources crossed by the proposed transmission lines or indirect visual impacts on as-yet-unidentified architectural resources in the vicinity of the new transmission lines. Cultural resource impacts would be evaluated during the siting process of transmission lines whose exact location is undetermined. Thus, the potential for direct and indirect or visual impacts exists, and in the absence of more detailed information, these impacts cannot be evaluated with certainty.

Detroit Edison has indicated that construction and operation of the transmission lines will be the responsibility of ITC*Transmission*, an intrastate transmission company. As such, any further investigations to identify the presence of cultural and historic resources and to evaluate the NRHP-eligibility of such resources would be the responsibility of ITC*Transmission*, who would conduct such investigations in accordance with applicable regulatory and industry standards to assess impacts (Detroit Edison 2011a).

Based on the review team's NEPA analysis of cultural resources, building the offsite transmission lines has the potential to impact cultural resources. Impacts could be minor if there are no significant alterations to the cultural environment. If these activities result in significant alterations to the cultural environment, the impact could be greater.

According to 10 CFR 50.10(a)(2)(vii), transmission lines are not included in the definition of construction and are not an NRC-authorized activity. Therefore, the NRC considers the offsite proposed transmission lines to be outside the NRC's APE and therefore not part of the NRC's consultation.

Section 2.7.3 contains a description of known cultural resources in the transmission line corridors. Cultural resources impacts related to construction of the proposed transmission lines are also discussed in Sections 10.2.1 and 10.4.1.5. Operational impacts of the proposed transmission lines on cultural resources are discussed in Section 5.6 and 10.2.2, and cumulative transmission line cultural resource impacts are discussed in Section 7.5.

4.7 Meteorological and Air Quality Impacts

Section 2.9 describes the meteorological characteristics and air quality of the Fermi site. The primary impacts that building Fermi 3 would have on local air quality would result from fugitive dust produced by soil disturbance, engine exhaust emissions from heavy construction equipment and machinery, concrete batch plant operations, and emissions from vehicles used to transport workers and materials to and from the site. Open burning of wastes is prohibited by the MDEQ (Detroit Edison 2011a).

4.7.1 Preconstruction and Construction Activities

Building the proposed Fermi 3 would result in temporary impacts on local air quality as a result of emissions associated with construction and preconstruction activities. Equipment and vehicle emissions from these activities would contain carbon monoxide, oxides of nitrogen, and volatile organic compounds (VOCs). As with any large-scale construction project, dust particle emissions would also be generated during land-clearing, grading, and excavation activities.

Fugitive dust particles would be generated by recently disturbed or cleared areas during windy periods and by the movement of machinery and materials over these areas. In general, emissions from these activities would vary based on the level and duration of each specific activity and site-specific factors such as local meteorology and soil conditions. The overall impact from fugitive dust is expected to be temporary and limited in magnitude, because the site is relatively flat and limited amounts of earthmoving will be required.

In the ER, Detroit Edison (Detroit Edison 2011a) concluded that, in view of the relatively isolated nature of the Fermi 3 construction area, the net impact of construction and preconstruction on air quality would be small and no mitigation measures beyond those required for dust under the Permit to Install would be warranted. Detroit Edison has not yet applied to the MDEQ for a Permit to Install, which will be needed prior to beginning preconstruction and construction activities at the proposed Fermi 3 site. The detailed data needed to support such a permit application remains to be developed, and modeling and emissions estimates were not presented in the ER.

Monroe County is in an area that has been designated a nonattainment area for $PM_{2.5}$ NAAQS and a maintenance area for 8-hr ozone (EPA 2010a). In July 2011, the MDEQ submitted a request asking the EPA to redesignate southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011a). In July 2012, the EPA issued a proposed rule designating southeastern Michigan as having attained both the 1997 annual $PM_{2.5}$ NAAQS and the 2006 24-hour $PM_{2.5}$ NAAQS, based on 2009–2011 ambient air monitoring data (77 FR 39659, dated July 5, 2012), but the final determination has yet to be made. If this proposal is eventually approved, Monroe County would then become a maintenance area for $PM_{2.5}$. In either case, the direct and indirect emissions of air pollutants associated with NRC's proposed Federal action to issue a COL for construction and operation of a new nuclear power plant at the Fermi 3 site, and the USACE-proposed Federal action to issue a permit to perform certain regulated activities at the Fermi 3 site would be subject to conformity evaluations. These conformity evaluations must show that the Federal actions would not affect the ability of southeast Michigan to meet and maintain $PM_{2.5}$ and ozone NAAQS.

Detroit Edison (2012b) provided emission estimates related to building Fermi 3 to assist the NRC in developing its conformity applicability analysis regarding whether a general conformity determination would be required under 40 CFR Part 93, Subpart B. This regulation requires a conformity determination for Federal actions in nonattainment and maintenance areas if the action results in emissions exceeding specified *de minimis* levels. Detroit Edison provided estimates for direct and precursor emissions of $PM_{2.5}$ and ozone ($PM_{2.5}$, nitrogen oxides [NO_x], VOCs, and sulfur dioxide [SO_2]). Particulate matter emissions with an aerodynamic diameter of 10 microns or less (PM_{10}) were not estimated.

As part of its emission estimates related to building Fermi 3, Detroit Edison included a list of building activities, the preliminary building schedule, and an estimate of equipment use by year (Detroit Edison 2012b).[(a)] It was assumed that building activities would begin in April 2011 and last for 62 months (18 months of site preparation activities followed by 44 months of site erection activities) up to May 2016. From this list, Detroit Edison estimated building-related emissions from 2011 to 2016. The review team examined the building activity and equipment usage estimates and performed an independent assessment of the building-related emissions using current EPA emissions factors and models. The first year of building-related activities (2011) is expected to result in the highest emissions of NO_x and VOCs, while the third year of building-related activities (2013) is expected to result in the highest emissions of $PM_{2.5}$ and SO_2.

Table 4-19 presents the highest annual emissions estimates for combined preconstruction and construction (NRC-authorized) activities during the 62-month building schedule. Peak emissions from the activities associated with building Fermi 3 would be up to about 1.1 percent (for $PM_{2.5}$) of total emissions in Monroe County and up to 0.2 percent (for $PM_{2.5}$) of total emissions in all neighboring counties that are currently designated as $PM_{2.5}$ nonattainment or ozone maintenance areas (EPA 2010b). Given these relatively small and temporary emissions, impacts are expected to be minor. Notwithstanding these small emissions, the NRC and the USACE will each perform a Clean Air Act Section 176 air conformity applicability analysis pursuant to 40 CFR Part 93, Subpart B, to determine whether additional mitigation may be warranted.

Specific mitigation measures to control fugitive dust would be identified in a dust-control plan or a similar document prepared prior to starting the project in accordance with all applicable State and Federal permits and regulations. As stipulated in MDEQ Rule 336.1372, Detroit Edison states the mitigation measures for transporting of bulk materials, roads and lots, and general construction activities (Detroit Edison 2011a). Some of these mitigation measures would include the following:

- Using practices for dust control that are consistent with State requirements;
- Spraying all work areas with water or other dust suppressants approved by the MDEQ;
- Reseeding laydown and other areas as they are no longer needed; and
- Installing a dust-control system on the concrete batch plant that will be checked and maintained regularly.

(a) The schedules presented in this section are those that Detroit Edison originally assumed in its ER Revision 2 (Detroit Edison 2011a). However, as of June 2012, no building-related activities related to development of Fermi 3 or associated facilities have occurred on the Fermi site, and a schedule for preconstruction and construction activities is not known at this time. Depending on the actual schedule, peak emission rates might vary.

Table 4-19. Estimated Maximum Annual Emissions of $PM_{2.5}$, NO_x, VOCs, SO_2, and CO_2 Associated with Preconstruction and Construction of Fermi 3[(a), (b)]

Source Category	Annual Emissions (tons)				
	$PM_{2.5}$	**NO_x**	**VOCs**	**SO_2**	**CO_2**
Mobile equipment[(c)]	4.5	123.2	53.4	0.4	26,231
Fugitive dust[(d)]	66.0	NA[(e)]	NA	NA	NA
Total	**70.5**	**123.2**	**53.4**	**0.4**	**26,231**

Source: Detroit Edison 2012b

(a) The peak year is 2011 for NO_x and VOCs, while the peak year is 2013 for $PM_{2.5}$, SO_2, and carbon dioxide (CO_2).

(b) Notation for air pollutants: CO_2 = carbon dioxide; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter with an aerodynamic diameter of 2.5 microns or less; SO_2 = sulfur dioxide; and VOCs = volatile organic compounds.

(c) Includes emissions from on-road vehicles, worker vehicles, nonroad engines, marine engines, and locomotive engines. It is assumed that construction workers would travel through the nonattainment/maintenance area to and from the Fermi site with a roundtrip distance of 57.2 mi.

(d) Includes emissions from material transfer, bulldozing, grading, blasting, cement production, wind erosion from active piles and the construction area, paved roads, and unpaved roads.

(e) NA = Not applicable.

Preconstruction and construction activities including on-road construction vehicles, worker vehicles, off-road construction equipment, marine engines, and locomotive engines will result in emissions of greenhouse gases (GHGs), primarily carbon dioxide (CO_2). As a site-specific estimate, during the 6-year building period, the highest CO_2 emissions of 26,231 tons/yr (23,796 metric tons/yr) are estimated in the third year, 2013 (Detroit Edison 2012b). This amounts to about 0.009 percent of the total projected GHG emissions in Michigan at 253,800,000 metric tons (MT) of gross[(a)] CO_2 equivalent (CO_2e)[(b)] in 2010 (CCS 2008). This also equates to about 0.0004 percent of total CO_2 emissions in the United States at about 5.5 billion MT in 2009 (EPA 2011).

Another estimate of the relative size of the Fermi 3 building emissions can be made based on the information in Appendix L, which provides the review team's estimate of emissions for a generic 1000 MW(e) nuclear power plant. If conservatively assuming that building emissions are proportional to design electric output, the scaled building equipment and workforce emissions for Fermi 3 equate to about 313,000 tons (284,000 MT) over 7 years, which is an

(a) Excluding GHG emissions removed due to forestry and other land uses and excluding GHG emissions associated with exported electricity.

(b) A measure to compare the emissions from various GHGs on the basis of their global warming potential (GWP), defined as the ratio of heat trapped by one unit mass of the GHG to that of one unit mass of CO_2 over a specific time period.

average of about 45,000 tons/yr (41,000 MT/yr). This also amounts to a small percentage of projected GHG emissions for Michigan and the United States.

As noted in Section 4.7.2, the site-specific estimate shows transportation accounts for about 50 percent of building CO_2 emissions, and there are measures that could be implemented to reduce traffic emissions. Detroit Edison has committed to developing and implementing a traffic management plan and controlling vehicle emissions through regularly scheduled maintenance. Implementing such measures could reduce the percentages of the projected Michigan and U.S. GHG emissions constituted by emissions related to building Fermi 3.

Based on these two analyses, the review team concludes that the potential impacts of GHG emissions from construction and preconstruction activities would not be noticeable, and thus, additional mitigation measures would not be warranted.

In general, emissions from construction and preconstruction activities (including GHG emissions) would vary based on the level and duration of a specific activity, but the overall impact is expected to be temporary and limited in magnitude. Considering the information provided by Detroit Edison and its commitments to implement a fugitive dust control program in accordance with MDEQ regulations and control vehicle emissions through regularly scheduled maintenance, the review team concludes that the impacts from Fermi 3 construction and preconstruction activities on air quality would not be noticeable because appropriate mitigation measures would be adopted. Additional mitigation may be warranted, depending on the outcome of conformity applicability analyses being performed by the NRC and USACE pursuant to the Clean Air Act Section 176 (42 USC Section 7506) and 40 CFR Part 93, Subpart B.

4.7.2 Transportation

The construction workforce at Fermi 3 will vary significantly over the building period. In the ER, Detroit Edison estimated that the maximum construction workforce would be about 2900 (Detroit Edison 2011a). Combined with the workers and deliveries for the existing Fermi 2 and maintenance workers for Fermi 2 refueling, the total onsite workforce could temporarily reach a maximum of more than 5000 workers. With up to 5000 workers commuting to and from the Fermi site at the time of peak Fermi 3 building activity, there is the potential for large traffic impacts around the major access roads to the site and along Enrico Fermi Drive, the main plant entrance road (see Section 4.4.4.1 of this EIS).

The primary access roads to the Fermi site could experience a significant increase in traffic during shift changes that could lead to periods of congestion. Stopped vehicles with idling engines would lead to increased emissions beyond what would occur from normal vehicle operation alone. However, the overall impact caused by increased traffic volume and congestion is difficult to estimate because exact worker residence locations, the time of building activities and shift changes, and local weather conditions (such as wind speed and direction, atmospheric stability, and ambient temperature) are largely unknown.

As discussed in Section 4.4.4.1 of this EIS, potential transportation-related impacts could be mitigated by implementing improvements, including signal installations and signal modifications; staggering worker shifts for operating staff, outage workers, and construction workers; busing and carpooling employees from off site; and minor lane additions and/or a second entrance to the site.

Emissions related to transportation are also included in Table 4-19, but are not presented separately from other building-related emissions. During the peak year for transportation emissions, annual transportation emissions would be about 18.5 tons per year for NO_x. This emission estimate corresponds to about 19 percent of total building emissions for that year. Annual emissions for $PM_{2.5}$ and SO_2 would be far less than 1 ton per year, while those for VOCs range from 1.3 to 27.3 tons per year. Emissions from the increase in vehicular traffic associated with construction and preconstruction activities would be temporary in nature.

Fermi 3 construction workforce transportation would also result in GHG emissions, principally CO_2. During the peak year for transportation emissions, annual CO_2 emissions from transportation would be about 13,384 tons (12,142 MT) CO_2, which corresponds to about 50 percent of total building emissions. The building workforce for the generic 1000 MW(e) reference plant in Appendix L would produce on average about 23,620 tons per year (21,430 MT per year) of CO_2. Both of these estimates are small fractions of the total projected GHG emissions in Michigan at 253,800,000 MT CO_2e in 2010 (CCS 2008) and of total CO_2 emissions in the United States at 5.5 billion MT CO_2 in 2009 (EPA 2011).

Based on Detroit Edison's commitment to developing and implementing a traffic management plan and control construction vehicle emissions through regulatory scheduled maintenance, information provided by Detroit Edison, and the review team's independent evaluation, the review team concludes that potential transportation impacts of construction and preconstruction activities on ambient air quality would be temporary and would not be noticeable because appropriate mitigation measures would be adopted. Based on its assessment of the relatively small construction workforce carbon footprint as compared to the Michigan and U.S. annual GHG emissions, the review team concluded that the atmospheric impacts of GHG from construction workforce transportation would not be noticeable and additional mitigation would not be warranted.

4.7.3 Summary of Meteorological and Air Quality Impacts

The review team evaluated potential impacts on air quality associated with criteria pollutants and greenhouse gas emissions during Fermi 3 site preconstruction and construction activities. The review team concludes that the impacts of Fermi 3 site development on air quality from emissions of criteria pollutants and CO_2 emissions are SMALL. Because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the air quality impacts of NRC-authorized construction activities would also be SMALL. Nonetheless, some mitigation measures beyond those the applicant has committed to implement may be warranted, depending on the outcome of conformity applicability analyses being performed by the NRC and USACE pursuant to the Clean Air Act Section 176 (42 USC Section 7506) and 40 CFR Part 93, Subpart B.

4.8 Nonradiological Health Impacts

Nonradiological health impacts on the public and workers from preconstruction and construction activities include exposure to dust and vehicle exhaust, occupational injuries, and noise, as well as the transport of materials and personnel to and from the site. Detroit Edison discussed these impacts qualitatively in Sections 4.4.1, 4.4.2, and 4.7.6 of the ER (Detroit Edison 2011a) and determined that for Fermi 3, these health impacts would be small.

The area around the Fermi site is predominantly rural, with a population of approximately 89,198 people within 10 mi of the site (Detroit Edison 2011a). This area is mostly used for agricultural production (Detroit Edison 2011a). The western basin of Lake Erie is adjacent to the Fermi site on the east (Detroit Edison 2011a). People who would be vulnerable to nonradiological health impacts from preconstruction and construction activities include construction workers and personnel working at the proposed Fermi 3 site; people working or living in the vicinity or adjacent to the site; and transient populations in the vicinity (e.g., temporary employees, recreational visitors, tourists).

The nonradiological impacts on health are described in the following sections: impacts on public and occupational health (Section 4.8.1), impacts of noise (Section 4.8.2), and impacts of transporting construction materials and personnel to and from the proposed site (Section 4.8.3). A summary of nonradiological health impacts is provided in Section 4.8.4.

4.8.1 Public and Occupational Health

This section includes a discussion of the impacts of site preparation and construction on public health and worker health.

4.8.1.1 Public Health

The physical impacts on the public from the building of Fermi 3 would include air pollution from dust and vehicle exhaust during site preparation (Detroit Edison 2011a). Detroit Edison stated that operational controls would be imposed to mitigate dust emissions to meet State requirements. Methods employed could include putting a dust-control system on the concrete batch plant, stabilizing construction roads and spoils piles, periodically spraying work areas with water or dust-suppressant compound, and revegetating unneeded disturbed areas (Detroit Edison 2011a).

Engine exhaust would be minimized by maintaining equipment in good mechanical order. Detroit Edison stated that open burning or the operation of vehicles and other combustion-engine equipment will comply with applicable standards, regulations, and requirements (Detroit Edison 2011a). The exhausts from the vehicles and operation of machinery during construction would comply with the Clean Air Act and the National Emission Standards for Hazardous Air Pollutants (NESHAP). Detroit Edison would obtain all necessary air quality permits from the MDEQ.

Preconstruction and construction activities would occur away from the public. The nearest accessible public area is approximately 0.48 mi from the Fermi 3 construction site (Detroit Edison 2011a), and the nearest residence is approximately 0.60 mi from preconstruction and construction areas (Detroit Edison 2011a). On the basis of the dust suppression and vehicle exhaust mitigation measures discussed above and the general public's distance from the Fermi site, the staff concludes that the nonradiological health impacts on the public from construction activities would be minimal. As discussed in Section 4.7, additional mitigation may be warranted, depending on the outcome of conformity applicability analyses being performed by the NRC and USACE pursuant to the Clean Air Act Section 176 (42 USC 7506) and 40 CFR Part 93, Subpart B.

4.8.1.2 Construction Worker Health

In general, human health risks to construction workers and other personnel working onsite are dominated by occupational injuries (e.g., falls, electrocution, asphyxiation, burns). Prior to the start of preconstruction and construction activities, Detroit Edison proposes to develop and implement a safety plan that adheres to all OSHA safety and health regulations for construction (Detroit Edison 2011a).

In addition to onsite preconstruction and construction activities, three new transmission lines and a separate switchyard would be needed for Fermi 3 (Detroit Edison 2011a). Most of the transmission lines would be built within or adjacent to existing transmission line corridors, but 10.8 mi of the proposed line would be built within a new ROW (Section 2.4.2.9). The transmission system in southeastern Michigan is owned and operated by ITC*Transmission*. The transmission lines and associated switchyards would be built in accordance with the National Electrical Safety Code and applicable construction standards and codes (Detroit Edison 2011a).

National nonfatal injury and illness recordable rate in 2009 for construction workers, including specialty trade contractors, averaged 4.3 percent (USBLS 2010a). The recordable rate for construction workers in Michigan was 3.2 percent (USBLS 2010b). The recordable rate takes into account occupational injuries and illnesses as total recordable cases, which includes the cases that result in death, loss of consciousness, days away from work, restricted work activity or job transfer, or medical treatment beyond first aid. The average and maximum onsite preconstruction and construction workforce for Fermi 3 during the 8-year construction period would be 1000 and 2900 workers, respectively (Detroit Edison 2011a).

The estimated yearly average and maximum occupational injuries and illnesses associated with construction activities based on the National recordable rate would be 43 and 125, respectively. When interpreting these results, it is especially important to recall that they are gross (total) injury estimates. If the workers are not employed building Fermi 3, they would be doing other work or would be unemployed. As noted above, the injury rate for construction activities in Michigan was even lower. Thus, the estimates developed above are conservative worst-case estimates of the net impact of Fermi 3 construction activities on workplace injuries.

Other nonradiological impacts on workers who would be clearing land or building the facility would include noise, fugitive dust, and gaseous emissions resulting from site preparation and development activities. Mitigation measures discussed in this section for the public, such as operational controls and practices, would also help limit impacts on workers. Onsite impacts on workers also would be mitigated through training and use of personal protective equipment to minimize the risk of potentially harmful exposure. First-aid stations would be available in the Fermi 3 construction area (Detroit Edison 2011a). The NRC staff assumes that Detroit Edison would adhere to all applicable NRC, OSHA, and State safety standards, practices, and procedures during building activities.

4.8.1.3 Summary of Public and Construction Worker Health Impacts

On the basis of mitigation measures identified by Detroit Edison in its ER, permits and authorizations required by State and local agencies, and the review team's independent review, the review team concludes that the nonradiological health impacts on the public and workers from preconstruction and construction activities would be minimal, and additional mitigation beyond the actions stated above would not be warranted.

4.8.2 Noise Impacts

Development of a nuclear power plant is similar to that of other large industrial projects and involves many noise-generating activities. Regulations governing noise from construction activities are generally limited to worker health. Federal regulations governing construction noise are found in 29 CFR Part 1910 and 40 CFR Part 204. The regulations in 29 CFR Part 1910 deal with noise exposure in the construction environment, and the regulations in 40 CFR Part 204 generally govern the noise levels of compressors. The Fermi site is located in unincorporated Frenchtown Township in Monroe County. Currently, there are no county or State noise regulations for Monroe County or Michigan (Detroit Edison 2011a). The only local noise regulation applicable to the Fermi site is Frenchtown Charter Township Noise Ordinance No. 184, which generally prohibits construction noise “unreasonably annoying to other persons, other than between the hours of 7:00 a.m. and 7:00 p.m.” No violations of this ordinance are expected because of the distance from the construction site to the nearest residence and the anticipation that good noise control practices (including limiting the noisiest construction activities to daytime hours) will be used.

In general, noise emissions vary with each phase of construction, depending on the level of activity, the mix of construction equipment for each phase, and site-specific conditions. Noise propagation to receptors is affected by several important factors, including source-receptor configuration, land cover, meteorological conditions (temperature, relative humidity, and vertical wind and temperature profiles), and screening (such as topography, and natural or man-made barriers). In the ER (Detroit Edison 2011a), Detroit Edison indicated that typical construction equipment, such as dump trucks, loaders, bulldozers, graders, scrapers, air compressors, and mobile cranes would be used, and that pile driving and blasting activities would take place, during the building of Fermi 3. This construction equipment would have average noise levels ranging from 67 dBA for a concrete vibrator to 89 dBA for a pile driver at a distance of 50 ft (Table 4-20).

As shown in Figure 4-7, the nearest sensitive receptor (residence) is about 1900 ft north-northeast of the construction area for the proposed Fermi 3 switchyard, which will be located near the main security gate, and more than 3200 ft northwest and north-northwest, respectively, of the proposed reactor building and natural draft cooling tower (NDCT). Under the conservative assumption that all construction equipment operates simultaneously and if only geometric spreading of noise is considered, the ER (Detroit Edison 2011a) indicates that the noise level at 1000 ft from the power block construction area would be less than 64 dBA without pile driving and 67 dBA with pile driving, as indicated in Table 4-20. For building activities at the reactor building or NDCT, noise levels at the nearest residence would be about 54 dBA without pile-driving and 57 dBA with pile-driving, based on the Detroit Edison’s estimate. For switchyard construction, it was conservatively assumed that four noisiest pieces of equipment (other than the pile-driver) would be operating simultaneously. The switchyard construction noise level at the nearest residence would be about 57 dBA. These estimates probably overestimate actual sound levels, in that all construction equipment is unlikely to operate simultaneously at the same location. For comparison, Tipler (1991) lists the sound level of a quiet office as 50 dBA, normal conversation (at 1 m) as 60 dBA, busy traffic as 70 dBA, a noisy office with machines or an average factory as 80 dBA, and construction noise (at 3 m) as 110 dBA. Tipler (1991) lists hearing and pain thresholds as 0 dBA and 120 dBA, respectively.

For a work schedule of 24 hr per day, noise levels from reactor and NDCT building activities at the nearest residence, which is more than 3200 ft from these areas, would be about 61 dBA

Table 4-20. Estimated Overall Average and Maximum Construction Equipment Noise Levels

Equipment	**L_{eq} at 50 ft (dBA)**[(a), (b)]	**L_{eq} at 1000 ft (dBA)**[(c)]	**L_{eq} at Nearest Receptor from Switchyard (1900 ft) (dBA)**[(c), (d)]	**L_{eq} at Nearest Receptor from Power Block (3200 ft) (dBA)**[(c), (e)]
Backhoe[(d)]	80	54	48	44
Grader[(d)]	82	56	50	46
Dozer[(d)]	83	57	51	47
Front End Loader[(d)]	83	57	51	47
Compactor	80	54		44
Trencher	74	48		38
Pile-Driver	89	63		53
Large Truck	77	51		41
Concrete Vibrator	67	41		31
Concrete Saw	68	42		32
Mobile Crane	70	44		34
Stationary Crane	68	42		32
Diesel Generator	79	53		43
Air Compressor	76	50		40
Welder	68	42		32
Grinder	75	49		39
Forklift	76	50		40
Manlift	76	50		40
Overall Average Noise Level[(f)]	**90**	**64**	**57 (63, 66)**[(g)]	**54 (61, 64)**[(g)]
Maximum Noise Level[(h)]	**93**	**67**	**57 (63, 66)**[(i)]	**57 (63, 66)**[(g)]

Source: Adapted from Detroit Edison 2011a

(a) Energy average sound pressure level at 50 ft horizontal distance from the equipment for work shift of 7–10 hr.
(b) Based on information provided in Barnes et al. (1977) and information available from previous similar projects.
(c) Noise levels calculated with the conservative assumption that geometric spreading is the only noise attenuation factor.
(d) Noise level at the nearest residence from the switchyard under the conservative assumption that the four noisiest pieces of equipment (other than the pile driver) would be operating simultaneously for construction of a proposed Fermi 3 switchyard.
(e) Noise level at the nearest residence from the power block area.
(f) Assuming only geometric spreading of noise and simultaneous operation of all construction equipment except pile driver.
(g) First and second values in the parenthesis are day-night average noise levels (L_{dn}) from construction only and construction combined with background level of 62 dBA L_{dn}, respectively.
(h) Assumptions in footnote (f) plus pile-driving noise (pile drivers would not be used during building of switchyard).
(i) Maximum noise level at the nearest receptor for the switchyard is the same as the overall average noise level because no pile-driving is needed for building activities at the switchyard.

Figure 4-7. Major Noise Sources and Nearby Sensitive Receptors during Building of Fermi 3

day-night average (L_{dn}) without pile-driving and 63 dBA L_{dn} with pile-driving (L_{dn} is defined in more detail in Section 2.10.2). Considering a background level of 62 dBA L_{dn} at the nearest residence, the calculated combined, or total (including background), noise level from either of these activities would be 64 dBA L_{dn} without pile-driving, and 66 dBA L_{dn} with pile-driving. For switchyard building activities, the background noise level at the nearest residence, which is about 1900 ft from this area, would be about 63 dBA L_{dn} and the combined noise level would be about 66 dBA L_{dn}.

Preconstruction and construction activities would be expected to occur 24 hr per day, 7 days per week during the peak construction period. However, as mentioned previously, simultaneous operation of all construction equipment is highly unlikely. Moreover, noisier activities, such as pile-driving, are anticipated to be limited to daytime hours to minimize potential noise impacts. In addition, if other noise attenuation mechanisms, such as ground effects or atmospheric absorption, are considered, noise levels from building Fermi 3 would be lower than the aforementioned values.

Detroit Edison has stated that it will comply with NRC and EPA guidance for implementing the Noise Control Act of 1972, together with subsequent amendments (Quiet Communities Act of 1978). In addition, the ER (Detroit Edison 2011a) lists various standard noise control measures and administrative measures that could be undertaken to reduce potential adverse effects of noise, including the following:

- Using silencers on construction equipment exhausts;
- Limiting the types of construction activities during nighttime or weekend hours;
- Notifying all affected neighborhoods of planned activities; and
- Establishing a construction noise monitoring program.

NUREG-1437 (NRC 1996) states that noise levels below 60 to 65 dBA L_{dn} are considered to be of small significance. More recently, the impacts of noise were considered in NUREG-0586, Supplement 1 (NRC 2002). The criterion for assessing the level of significance was not expressed in terms of sound levels but based on the effect of noise on human activities. The criterion in NUREG-0586, Supplement 1, is stated as follows:

> The noise impacts…are considered detectable if sound levels are sufficiently high to disrupt normal human activities on a regular basis. The noise impacts…are considered destabilizing if sound levels are sufficiently high that the affected area is essentially unsuitable for normal human activities, or if the behavior or breeding of a threatened and endangered species is affected.

In addition to the above activities, blasting may also occur during construction. Blasts would be designed and coordinated by a qualified blasting professional and vibration control specialist to ensure protection of adjacent structures (Detroit Edison 2012f). Controlled blasting techniques including cushion blasting, pre-splitting, and line drilling may be used. Blasting techniques are designed and controlled to prevent damage to structures, equipment, and freshly poured concrete (Detroit Edison 2011a). These controls also attenuate blasting noise. Distances to offsite buildings make additional mitigation unnecessary (Detroit Edison 2011a). However, given the impulsive nature of blasting noise, it is critical that blasting activities be avoided at night and on weekends and that affected neighborhoods be notified in advance of scheduled blasts.

Based on the temporary nature of peak construction and preconstruction activities, the distance to the nearest residence from the locations where construction and preconstruction activities would take place, the location and characteristics (i.e., ground cover) of the Fermi site, and good noise control practices, the review team concludes that the potential noise impacts of construction and preconstruction activities would be small, and no further mitigation measures would be warranted. However, should noise thresholds be exceeded for the listed receptors or the Frenchtown Charter Township Noise Ordinance be violated, the applicant would develop and implement an adaptive management plan to minimize potential noise impacts at nearby receptors.

4.8.3 Transporting Building Materials and Personnel to the Fermi 3 Site

This EIS assesses the impact of transporting workers and materials to and from the Fermi site from three perspectives: socioeconomic impacts, air quality impacts resulting from the dust and particulate matter emitted by vehicle traffic, and potential health impacts caused by additional traffic-related accidents. The socioeconomic impacts are addressed in Sections 4.4.1.5 and 4.4.4.1. The air quality impacts are addressed in Section 4.7, and human health impacts are addressed here and in Section 4.9. The general approach used to calculate nonradiological impacts of fuel and waste shipments is the same as that used to calculate impacts from transportation of construction materials and construction personnel to and from the Fermi 3 site. However, the only data available to estimate the demand for these transportation services were preliminary estimates. The assumptions that were made to determine reasonable estimates of the data needed to calculate nonradiological impacts are discussed below.

Building material requirements are based on information taken from the ER (Detroit Edison 2011a). The Detroit Edison ER estimates that building a new 1605-MW(e) reactor requires up to 460,000 yd^3 of concrete and 71,000 tons of structural steel and rebar, in addition to 6.8 million ft of power cable and control wire and up to 260,000 ft of piping that is more than 2.5 in. in diameter.

- The review team assumed that shipment capacities are about 13 yd^3 of concrete, 11 tons of structural steel, and 3300 ft of piping and cable per shipment. It was assumed that these materials would be transported to the site in a levelized manner over an 8-year period on the basis of the construction schedule given in the ER (Detroit Edison 2011a).
- Detroit Edison estimated that the number of workers would peak at 2900, with a daily average of approximately 1000 onsite workers over the 8-year construction period (Detroit Edison 2011a). With approximately 10 percent of the workforce expected to carpool (Detroit Edison 2011a), there would be about 950 vehicle roundtrips per day if, of those who carpooled, two persons shared a ride. It was assumed that each person would travel to and from the Fermi 3 site 250 days per year.
- On the basis of the approximate one-way shipping distance from Detroit, Michigan, the review team assumed that the average shipping distance for building materials would be 40 mi one way. The team assumed that the average commute distance for workers would be 37 mi one way (Detroit Edison 2011a).
- Accident, injury, and fatality rates for building materials were taken from Table 4 in ANL/ESD/TM-150, *State-Level Accident Rates for Surface Freight Transportation: A Reexamination* (Saricks and Tompkins 1999). Rates for the State of Michigan were used for construction material shipments, typically conducted in heavy-combination trucks. The data in Saricks and Tompkins (1999) are representative of heavy-truck accident rates and do not specifically address the impacts associated with commuter traffic (i.e., workers traveling to and from the site). For commuter traffic, accident, injury, and fatality rates were estimated by using data provided by the Michigan Department of State Police (MDSP 2005, 2006, 2007, 2008, 2009). A 5-year average for each rate was estimated by using data for Lenawee, Monroe, Washtenaw, and Wayne Counties.
- The U.S. Department of Transportation (DOT) Federal Motor Carrier Safety Administration evaluated the data underlying the Saricks and Tompkins (1999) rates, which had been taken from the Motor Carrier Management Information System. It determined that the rates were underreported. Therefore, the accident, injury, and fatality rates in Saricks and Tompkins (1999) were adjusted by using factors derived from data provided by the University of Michigan Transportation Research Institute (UMTRI 2003). The UMTRI data indicate that accident rates for 1994 to 1996 – the same data used by Saricks and Tompkins (1999) – were underreported by about 39 percent. Injury rates were underreported by 16 percent, fatality rates by 36 percent. As a result, the accident, injury, and fatality rates were increased by factors of 1.64, 1.20, and 1.57, respectively, to account for the underreporting. These adjustments were applied to the materials that are transported by heavy truck shipments, similar to those evaluated by Saricks and Tompkins (1999), but not to commuter traffic accidents.

The estimated nonradiological impacts of transporting materials to the proposed Fermi 3 site and of transporting workers to and from the site are shown in Table 4-21. The nonradiological impacts are dominated by transport of workers to and from the proposed Fermi site. The total annual construction fatalities represent an increase of about 0.8 percent above the average of 23 traffic fatalities per year that occurred in Monroe County from 2004 to 2008 (MDSP 2005, 2006, 2007, 2008, 2009). This represents a small increase relative to the current traffic fatality risks in the area surrounding the proposed Fermi 3 site.

Table 4-21. Impacts of Transporting Workers and Construction Materials to and from the Fermi 3 Site

Items Transported	Accidents per Year	Injuries per Year	Fatalities per Year
Workers	5.2×10^{1}	1.5×10^{1}	1.6×10^{-1}
Materials			
Concrete	2.0×10^{-1}	1.5×10^{-1}	9.6×10^{-3}
Structural steel/rebar	3.7×10^{-2}	2.7×10^{-2}	1.8×10^{-3}
Cable	1.2×10^{-2}	8.8×10^{-3}	5.6×10^{-4}
Piping	4.5×10^{-4}	3.4×10^{-4}	2.2×10^{-5}
Total	$\mathbf{5.2 \times 10^{1}}$	$\mathbf{1.5 \times 10^{1}}$	$\mathbf{1.8 \times 10^{-1}}$

On the basis of information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that the transportation impacts of preconstruction and construction activities would be minimal and that no further mitigation is warranted. On the basis of the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the impacts of NRC-authorized construction activities would be minimal. The NRC staff also concludes that no further mitigation measures would be warranted.

4.8.4 Summary of Nonradiological Health Impacts

The review team evaluated the mitigation measures identified by Detroit Edison in its ER, relevant permits and authorizations required by State and local agencies, and permits and authorizations required by local agencies to build the proposed Fermi 3. The review team also evaluated impacts on public health and on construction workers from fugitive dust, occupational injuries, noise, and the transport of materials and personnel. No significant impacts related to the nonradiological health of staff or personnel were identified during the course of this review.

On the basis of information provided by Detroit Edison in its ER (Detroit Edison 2011a) and the review team's independent evaluation, the review team concludes that the impacts of preconstruction and construction activities on nonradiological health from proposed Fermi 3 would be SMALL, and no further mitigation would be warranted. Based on the above analysis, and because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the nonradiological health impacts of NRC-authorized activities would be SMALL.

4.9 Radiation Exposure to Construction Workers

The sources of radiation exposure for construction workers during the construction phase of Fermi 3 include direct radiation exposure, exposure from discharges of liquid radioactive waste, and exposure from gaseous radioactive effluents from the existing Fermi 2. In addition, there would be potential exposure from the residual radioactive material contamination after the decommissioning of Fermi 1. The impacts of radiation exposure are described in the following sections and are summarized in Section 4.9.6. For the purposes of this discussion, construction workers are assumed to be members of the public rather than occupational workers; therefore, the dose estimates are compared to the dose limits for the public, pursuant to 10 CFR Part 20, Subpart D. Detroit Edison (Detroit Edison 2011a) noted that all major construction and preconstruction activities are expected to occur outside the current Fermi 2 protected area boundary but inside the exclusion area boundary.

4.9.1 Direct Radiation Exposures

In its ER (Detroit Edison 2011a), Detroit Edison identified four sources of direct radiation exposure from the Fermi site: (1) "skyshine"[(a)] from the nitrogen-16 (N-16) source present in the operating Fermi 2 main turbine steam cycle, (2) condensate storage tanks, (3) the onsite low-level waste storage facility, and (4) the Independent Spent Fuel Storage Installation (ISFSI). The ISFSI for Fermi 2 is located west of Fermi 2 about 820 ft away from the nearest construction area for Fermi 3. As of June 2012, construction of the ISFSI pad was complete and the preoperational dry run activities had begun. However, normal operations at the ISFSI had not yet started.

The doses from skyshine and the planned ISFSI are identified as the primary sources of direct radiation exposure to proposed Fermi 3 construction workers. The doses from direct radiation from condensate storage tanks and the onsite low-level waste storage facility are negligible when compared to the skyshine and ISFSI doses, because of the minimal activity in the storage tanks and the concrete shielding at the low-level waste storage facility. At certain times during construction, Detroit Edison would also receive, possess, and use specific radioactive byproduct, source, and special nuclear material in support of construction and preparations for operation. These sources of low-level radiation are required to be controlled by the applicant's radiation protection program and have very specific uses under controlled conditions. The Detroit Edison staff did not identify any additional sources of direct radiation during the site audit or during document reviews.

(a) Skyshine is the scattered radiation of a primary gamma radiation source generated by aerial dispersion.

Detroit Edison used onsite thermoluminescent dosimeters (TLDs) and environmental TLDs to measure direct radiation levels at locations in and around the Fermi site protected area (Detroit Edison 2011a). Environmental TLDs are located in multiple rings around the Fermi site, in an inner ring near the site boundary, and in additional rings at locations approximately 2, 5, and 10 mi from the plant (Detroit Edison 2009c, Table 3.12.1-1). All of these TLDs are read quarterly and measure the contribution to dose from any direct radiation source, including natural background, skyshine, the condensate storage tanks, and the low-level waste storage facility.

Detroit Edison estimated the total direct radiation exposure to construction workers by adding the measured TLD dose to the estimated dose from the planned ISFSI. The dose from the ISFSI was estimated by using the radiological data from other ISFSIs that have a facility design similar to that proposed for the Fermi site. The location with the highest direct radiation dose rate that a construction worker could receive from the ISFSI is located 820 ft from the ISFSI. At this distance, a construction worker would receive a maximum estimated dose of about 13.8 mrem/yr from the ISFSI, assuming a 2080-hr occupancy (i.e., a 2000-hr work year plus 4 percent overtime; Detroit Edison 2011a).

In estimating the direct radiation exposure to construction workers from sources other than the ISFSI, Detroit Edison evaluated 10 years of measured TLD data and selected the maximum annual TLD doses from the two locations that were closest to the expected construction site for Fermi 3 (Detroit Edison 2011a). The estimated dose using an average of two locations for a 2080-hr work year would be 56.3 mrem after the background radiation is subtracted (Detroit Edison 2011a). This calculation conservatively assumes that the construction worker is at this location for the entire work year. The dose to construction workers from byproduct, source, and special nuclear material is expected to have a negligible contribution to this value.

4.9.2 Radiation Exposures from Gaseous Effluents

The Fermi 2 site releases gaseous effluents via the radwaste building vent, reactor building vent, and turbine building vent (Detroit Edison 2011a). The Fermi 2 Visitors Center is near (within 0.5 mi of) the Fermi 3 construction site; therefore, it is assumed that the dose rates calculated from gaseous effluents at the Visitors' Center approximate the dose rates from gaseous effluents to the construction worker. Detroit Edison estimated the gaseous effluents component of the construction worker dose by using release data for the year 2001 (the year that resulted in the highest public exposure for the period from 1999 to 2008) (Detroit Edison 2011a). The estimated annual total effective dose equivalent to a construction worker from gaseous effluents would be 1.6 mrem/yr (assuming an occupancy of 2080 hr per year) (Detroit Edison 2011a). The dose to construction workers from gaseous effluent releases would be small when compared to the dose from direct radiation exposure.

4.9.3 Radiation Exposures from Liquid Effluents

Prior to 1995, Fermi 2 radioactive liquid effluent was released directly to Lake Erie through the circulating water reservoir blowdown line (Detroit Edison 2011a). The Fermi 2 discharge is located along the shoreline of Lake Erie, north of Fermi 2 (Detroit Edison 2011a); however, there has been no liquid radioactive effluent discharge reported from Fermi 2 since 1994 (Detroit Edison 2011a). Because Fermi 2 is currently a zero-liquid-radwaste-discharge plant (Detroit Edison 2011a), and because construction activities would occur away (at least 0.5 mi) from the liquid effluent release points (Detroit Edison 2011a), it is likely that construction workers would not receive any significant dose from liquid effluents.

4.9.4 Radiation Exposures from Decommissioned Fermi 1

Fermi 1 is scheduled to be decommissioned before the construction of Fermi 3. Construction activities for Fermi 3 would occur near the Fermi 1 site, and the construction workers would be exposed to any residual contamination from Fermi 1 (Detroit Edison 2009a). The residual levels of radioactive material that would be authorized to remain after Fermi 1 decommissioning would result in a dose of less than 25 mrem/yr to an average member of the critical group[(a)] (10 CFR 20.1402). The construction workers would not be exposed to all exposure pathways applicable to an average member of the critical group – represented by a hypothetical resident farmer after Fermi 1 is decommissioned. However, Detroit Edison used 25 mrem/yr as the bounding estimate of the dose to the construction worker from the decommissioned Fermi 1. The actual dose to the construction worker would be expected to be much less than 25 mrem/yr.

4.9.5 Total Dose to Construction Workers

The maximum annual dose to a construction worker was estimated to be 96.6 mrem, which is the sum of the four components described above: (1) direct radiation from existing sources (56.3 mrem), (2) direct radiation from the planned ISFSI (13.8 mrem), (3) exposure from gaseous effluents (1.6 mrem), and (4) exposure from the decommissioned Fermi 1 (25 mrem). The dose would primarily be the result of direct radiation. The maximum annual dose to a construction worker is overestimated because of the conservatism included in the four components of the dose discussed above. This maximum individual construction worker dose rate is much smaller than the approximately 311 mrem/yr that each worker would receive from natural background radiation (NCRP 2009). The estimated annual dose of 96.6 mrem is also less than the 100 mrem/yr annual dose limit to an individual member of the public found in 10 CFR 20.1301.

(a) The critical group is the group of individuals reasonably expected to receive the greatest exposure to residual activity for any applicable set of circumstances.

4.9.6 Summary of Radiological Health Impacts

The NRC staff concludes that the estimate of doses to construction workers during building of the proposed Fermi 3 are within NRC annual exposure limits (i.e., 100 mrem) designed to protect the public health. Based on information provided by Detroit Edison and the NRC staff's independent evaluation, the NRC staff concludes that the radiological health impacts on workers for Fermi 3 would be SMALL, and no further mitigation would be warranted. Radiation exposure from all NRC-licensed activities, including operation of Fermi 2, is regulated by the NRC. Therefore, the NRC staff concludes the radiological health impacts for NRC-authorized construction activities would be SMALL, and no further mitigation would be warranted.

4.10 Nonradioactive Waste Impacts

This section describes the environmental impacts that could result from the generation, handling, and disposal of nonradioactive waste during the building of Fermi 3. The types of nonradioactive waste that would be generated, handled, and disposed of during building activities would include construction debris, municipal waste, excavation spoils, and sanitary waste. The potential impacts from these different types of waste are assessed in the following subsections.

4.10.1 Impacts on Land

Building activities related to Fermi 3 would generate wastes, such as construction debris and spoils. The Fermi site has a recycling and waste minimization program in place for Fermi 2, and this program would be implemented for the building of Fermi 3 (Detroit Edison 2011a). Detroit Edison would not allow open burning of refuse, garbage, or any other waste material onsite. The solid waste would be taken to the nearest suitable landfill for disposal (Detroit Edison 2011a). Hazardous and nonhazardous solid wastes would be managed according to county and State handling and transportation regulations.

Suitable excavated materials from the power block and circulating water pipe trenches would be reused as backfill and structural fill. It is estimated that excess excavated material would amount to about 265,000 yd^3 and be disposed of in onsite construction laydown and parking areas and for filling in canals (Detroit Edison 2011a). Dredged materials removed during construction of the intake and discharge structure and barge slip in Lake Erie would be disposed of in the existing spoils disposal pond (Detroit Edison 2011a).

Wastes generated from building Fermi 3 would be handled according to county, State, and Federal regulations. County and State permits and regulations for the handling and disposal of solids and USACE permits for the disposal of dredged spoils would be obtained and implemented. The review team expects that solid waste impacts would be minimal and that additional mitigation would not be warranted.

4.10.2 Impacts on Water

Surface water runoff from site development activities would be controlled under the development and implementation of a SESC Plan (Detroit Edison 2011a). Water collected in this manner may then be discharged under an NPDES permit. As discussed in Section 4.2.3.1, stormwater runoff generated by site development activities could increase turbidity and sedimentation to North Lagoon, South Lagoon, the Quarry Lakes, and Lake Erie. The impacts would be minimized through the use of settling ponds and other BMPs that would be implemented under the SESC Plan. There would be an increase in the generation of sanitary wastewater at the Fermi site as a result of the presence of construction workers, but the additional sanitary wastewater could be managed in existing onsite sewage treatment facilities and through provision of portable toilets.

Based on the regulated practices for managing liquid discharges, including wastewater, and the plans for managing stormwater, the review team expects that impacts on water from nonradioactive effluents when building Fermi 3 would be minimal, and additional mitigation would not be warranted.

4.10.3 Impacts on Air

As discussed in Sections 4.4.1.3 and 4.7.1, fugitive dust generated during preconstruction and construction activities would need to be managed. Detroit Edison would develop a dust-control program in accordance with the State of Michigan's regulatory code prior to beginning construction and preconstruction activities (Detroit Edison 2011a).

The Construction Environmental Controls Plan would include air quality protection procedures to be used to minimize the generation of fugitive dust and the release of emissions from equipment and vehicles. These actions would include managing the use of unpaved roads (speed limits, use of dust suppression, and minimization of dirt tracking onto paved roads); covering haul trucks; phasing grading activities to minimize the exposed amount of disturbed soils; stabilizing roads and excavated areas with coarse material covers or vegetation; and performing proper maintenance of vehicles, generators, and other equipment.

Based on the regulated practices for managing air emissions from construction equipment and temporary stationary sources, best management practices for controlling fugitive dust, and vehicle inspection and traffic management plans, the review team expects that impacts on air from nonradioactive emissions from building Fermi 3 would be minimal. As discussed in Section 4.7, additional mitigation may be warranted, depending on the outcome of conformity applicability analyses being performed by the NRC and USACE pursuant to the Clean Air Act Section 176 (42 USC Section 7506) and 40 CFR Part 93, Subpart B.

4.10.4 Summary of Nonradioactive Waste Impacts

Solid, liquid, and gaseous wastes generated when building Fermi 3 would be handled according to county, State, and Federal regulations. Solid waste would be recycled or disposed of in existing, permitted landfills.

Sanitary wastes would be removed to an existing licensed sewage-treatment facility or discharged locally after being treated to the levels stipulated in the NPDES permit. A Storm Water Pollution Prevention Plan would specify the mitigation measures to be put in place to manage stormwater runoff.

To avoid any noticeable offsite air quality impacts, the use of BMPs to control dust and minimize vehicle emissions would be expected.

Based on information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that nonradioactive waste impacts on land, water, and air would be SMALL and that additional mitigation would not be warranted. Because NRC-authorized construction activities represent only a portion of the analyzed activities, the NRC staff concludes that the nonradioactive waste impacts of NRC-authorized construction activities also would be SMALL and that no further mitigation would be warranted.

4.11 Measures and Controls to Limit Adverse Impacts during Preconstruction and Construction

In its evaluation of the environmental impacts of building the proposed Fermi 3 reactor, the review team relied on Detroit Edison's compliance with the following measures and controls that would limit adverse environmental impacts:

- Compliance with applicable Federal, State, and local laws, ordinances, and regulations intended to prevent or minimize adverse environmental impacts (e.g., solid waste management, erosion and sediment control, air emissions, noise control, stormwater management, spill response and cleanup, hazardous material management);
- Compliance with applicable requirements of permits or licenses required for construction of Fermi 3 (e.g., USACE Section 404 Permit, NPDES permit);
- Compliance with existing Fermi 2 processes and/or procedures applicable to Fermi 3 construction environmental compliance activities for the Fermi site (e.g., solid waste management, hazardous waste management, and spill prevention and response);
- Incorporation of environmental requirements into construction contracts; and
- Identification of environmental resources and potential impacts during the development of the ER and the COL process.

Table 4-22 summarizes the measures and controls to limit adverse impacts when building Fermi 3 at the Fermi site based on a table supplied by Detroit Edison (2011a), as adjusted by the review team when considered to be appropriate. Some measures apply to more than one impact category.

4.12 Summary of Preconstruction and Construction Impacts

Impact category levels for construction and preconstruction activities associated with building Fermi 3 are summarized in Table 4-23. The impact category levels for NRC-authorized construction, and combined construction and preconstruction are denoted in the table as SMALL, MODERATE, or LARGE as a measure of their expected adverse environmental impacts. The bases for these determinations are provided in detail in Sections 4.1 through 4.10 of this EIS; a brief statement explaining the basis for the impact level for each major resource category is provided in the table. Some impacts, such as the addition of tax revenue from Detroit Edison for the local economies, are likely to be beneficial impacts on the community.

Table 4-22. Summary of Measures and Controls Proposed by Detroit Edison to Limit Adverse Impacts When Building Fermi 3

Affected Environment/Resource Area	Specific Measures and Control
Land Use Impacts	
Site and vicinity	• Conduct ground-disturbing activities in accordance with permit requirements. Implement erosion control measures described in the SESC Plan. • Limit vegetation removal to those areas designated for construction activities. Restore temporarily disturbed areas. • Remove hazardous wastes/spills in compliance with applicable regulations. Implement PIPP measures. • Restrict soil stockpiling and reuse to designated areas within the construction footprint on the Fermi site. • Use BMPs listed in the SESC Plan and minimize footprint of the designated construction area. Place dredged materials in the designated dredge spoils area. • Detroit Edison has obtained a Coastal Zone Consistency Determination for work in coastal zone.
Transmission line corridors and offsite areas	• The 345-kV transmission system and associated corridors are exclusively owned and operated by ITC*Transmission*. Detroit Edison has no control over the building or operation of the transmission system. The building impacts are based on publicly available information and reasonable expectations on the configurations and practices that ITC*Transmission* is likely to use based on standard industry practice. Such efforts are assumed to include transmission design considerations and industry-standard BMPs that would minimize the effects on land use.
Water-Related Impacts	
Hydrologic alterations	• Develop and implement the SESC Plan. This plan may require use of silt fences, straw bales, slope breakers, and other erosion prevention measures. • Obtain and adhere to all applicable Federal, State, and local permits regulating hydrological alterations.

Table 4-22. (contd)

Impact Category	Specific Measures and Control
Water use and quality	• Implement the construction SESC Plan to limit sedimentation of drainage to Lake Erie. • Implement dewatering plan to minimize the amount of water discharged. • Develop and implement a PIPP. • Comply with requirements of CWA Section 404 permit, Section 402(p) NPDES permit, Section 10 of the RHAA permit, and MDEQ Act 451 Parts 303 and 325 permit. • Comply with requirements of Clean Water Act Section 401 Water Quality Certification and Coastal Zone Management Act (CZMA) Certification.
Ecological Impacts	
Terrestrial and wetland resources	• Follow MDNR construction limitation recommendations for bald eagle nests. • Control fugitive dust through construction watering, and vehicle emissions by regularly scheduled maintenance. • Detroit Edison has developed its proposed Fermi 3 site layout to maximize use of developed and previously disturbed grounds where possible. Limit clearing to the smallest practicable quantity of land. Revegetate temporarily disturbed areas after facilities are built. • Comply with requirements of permits for RHAA Section 10, CWA Section 404, and MDEQ Act 451 Parts 303 and 325 to minimize and mitigate impacts on aquatic resources, including jurisdictional wetlands. Wetland mitigation would be developed in coordination with MDEQ (Detroit Edison 2012d) and USACE (Appendix K). • Detroit Edison has proposed to transplant American lotus out of areas of proposed disturbance. • Implement Habitat and Species Conservation Plan to mitigate building impacts on the eastern fox snake. • Develop NDCT lighting plans in consultation with the Federal Aviation Administration (FAA) and FWS to minimize avian impacts.
Aquatic resources	• Implement measures in the SESC permit and NPDES permit. • Implement measures in the PIPP. • Implement measures outlined in the RHAA Section 10 permit, CWA Section 404 permit, and MDEQ Act 451 Parts 303 and 325 permit.
Socioeconomic Impacts	
	• Implement standard noise control measures for construction equipment (silencers). • Limit the types of construction activities during nighttime and weekend hours.

Table 4-22. (contd)

Impact Category	Specific Measures and Control
	• Notify all affected neighbors of planned activities. • Establish a construction noise monitoring program. • Control fugitive dust through construction watering. • Control vehicle emissions by regularly scheduled maintenance. • Add surfacing on local roadways to prevent deterioration from construction vehicles. • Traffic control and management measures would reduce traffic congestion impacts. These would be developed in conjunction with MDOT, MCRC, and other appropriate agencies.
Environmental Justice	• No mitigating measures or controls required.
Historic Properties and Cultural Resources	• ITC*Transmission* would be expected to conform to regulatory requirements pertaining to historic and cultural resources that could be impacted by transmission line development. • Adverse effect of demolition of the one onsite historic property, NRHP-eligible Fermi 1, would be mitigated according to measures and plans developed during NRC's consultation with the Michigan SHPO and Detroit Edison. • The closest offsite above-ground historic resource within the indirect APE is located 0.5 mi from the construction site boundary, and all others are located 1 to 3.5 mi away. Visual impacts are not substantial, and no measures or controls are warranted.
Air Quality	• Implement BMPs to reduce vehicle and equipment exhaust emissions and fugitive dust in accordance with all applicable State and Federal permits and regulations.
Nonradiological Health	• Comply with Federal, State, and local regulations governing construction activities and construction vehicle emissions. • Comply with Federal and local noise-control ordinances. • Comply with Federal and State occupational safety and health regulations. • Implement traffic management plan.
Radiation Exposure to Construction Workers	• Doses to construction workers would be maintained below NRC public dose limits (10 CFR Part 20).
Nonradioactive Wastes	• Hazardous and nonhazardous solid wastes would be managed according to county, State, and Federal handling and transportation regulations. Implement recycling and BMPs to minimize waste generation.

Source: Detroit Edison 2011a

Table 4-23. Summary of Preconstruction and Construction Impacts for Proposed Fermi 3

Resource Area	Comments	NRC-Authorized Construction Impact Level	Construction and Preconstruction Impact Level
Land Use			
Site and vicinity	Building activities would take place within the existing boundaries of the Fermi site owned by Detroit Edison.	SMALL	SMALL
Offsite transmission line corridors	Approximately 10.8 mi of a 29.4-mi transmission line corridor would be along an undeveloped ROW.	Not applicable	SMALL
Water Resources			
Water use			
Surface water	Lake Erie water would be used for concrete batch plant operation, temporary fire protection, dust control, and sanitary needs.	SMALL	SMALL
Groundwater	Dewatering systems would depress the water table in the general vicinity, but the impacts would be localized and temporary.	SMALL	SMALL
Water quality			
Surface water	Hydrological alterations associated with building on and near the Fermi site include dredging, bedding placement, and cover material for the intake and discharge structures, altering the surface topography and hydrology (e.g., site grading, laydown areas, filling of onsite water bodies), culverting the south canal, and dewatering the excavation for construction of the nuclear facilities. Offsite alterations are associated with the proposed new or expanded transmission line corridors where they cross streams and wetlands. BMPs will be used to limit construction stormwater impacts and address potential spills or leaks of petroleum and other chemicals into surface water bodies.	SMALL	SMALL

Table 4-23. (contd)

Resource Area	Comments	NRC-Authorized Construction Impact Level	Construction and Preconstruction Impact Level
Groundwater	BMPs will prevent or mitigate the impacts of spills on groundwater.	SMALL	SMALL
Ecological Resources			
Terrestrial and wetlands resources	Loss or disturbance of upland and wetland habitat and associated plant and animal species onsite and along the transmission line corridor. Proposed wetland and wildlife habitat mitigation would offset some impacts. Potential impact on eastern fox snake (State-listed as threatened) and its habitat mitigated with implementation of Habitat and Species Conservation Plan.	SMALL to MODERATE (potential for MODERATE limited to eastern fox snake)	SMALL to MODERATE (potential for MODERATE limited to eastern fox snake)
Aquatic resources	Loss or disturbance of aquatic habitat and associated plant and animal species onsite and along the transmission line corridor. Increased runoff and sedimentation from the addition of impervious surfaces. BMPs will be used to limit construction stormwater impacts.	SMALL	SMALL
Socioeconomics			
Physical impacts	Small increases in noise and air emissions. Small impact on condition of road surfaces during construction period.	SMALL	SMALL
Demography	Minor increase in population resulting from in-migrating construction workforce.	SMALL beneficial	SMALL beneficial
Economy	Economic impact would be beneficial to local economies in the 50-mi region, especially in Monroe County.	SMALL beneficial in the region to LARGE beneficial in Monroe County	SMALL beneficial in the region to LARGE beneficial in Monroe County

Table 4-23. (contd)

Resource Area	Comments	NRC-Authorized Construction Impact Level	Construction and Preconstruction Impact Level
Taxes	Entire 50-mi region would receive beneficial changes to tax revenues, especially in Monroe County, where the impacts would be greatest (from Fermi 3 property taxes).	SMALL and beneficial in the region to LARGE and beneficial in Monroe County	SMALL and beneficial in the region to LARGE and beneficial in Monroe County
Infrastructure and community services	Recreation, housing, public services, and education are generally adequate for the influx of construction workers. Local traffic would increase during construction, resulting in increased congestion during the peak building employment period, when the traffic-related impact would be short-term and MODERATE.	SMALL (all categories except traffic) to short-term MODERATE traffic impacts during peak building employment	SMALL (all categories except traffic) to short-term MODERATE traffic impacts during peak building employment
Environmental Justice	No environmental pathways or preconditions exist that could lead to disproportionately high and adverse impacts on minorities or low-income populations.	SMALL	SMALL
Historic and Cultural Resources	Onsite preconstruction and construction activities would result in the demolition of recommended NRHP-eligible Fermi 1. Because new Fermi 3 facilities would be consistent with the landscape features within the existing setting of offsite historic resources, there would be no new significant visual (i.e., indirect) impacts on these resources. However, the approximately 11-mi portion of the proposed offsite transmission line route from the Sumpter-Post Road junction to the Milan Substation will require a new transmission line route and may result in direct and visual impacts on offsite historic and/or cultural resources. In the absence of more detailed information, these impacts cannot be evaluated with certainty.	MODERATE	MODERATE

Table 4-23. (contd)

Resource Area	Comments	NRC-Authorized Construction Impact Level	Construction and Preconstruction Impact Level
Air Quality	Vehicle and equipment exhaust emissions and fugitive dust emissions from operation of earthmoving equipment are sources of air pollution, but impacts would be temporary.	SMALL	SMALL
Nonradiological Health	Temporary public health impacts from exposure to fugitive dust and vehicular emissions, noise, and increased occupational injuries and traffic fatalities during the building phase.	SMALL	SMALL
Radiological Health	Doses to construction workers would be maintained below NRC public dose limits (10 CFR Part 20).	SMALL	SMALL
Nonradioactive Wastes	Hazardous and nonhazardous solid wastes would be managed according to county and State handling and transportation regulations. Implement recycling and waste minimization program.	SMALL	SMALL

4.13 References

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33 CFR Part 165. Code of Federal Regulations, Title 33, *Navigation and Navigable Waters*, Part 165, “Regulated Navigation Areas and Limited Access Areas.”

36 CFR Part 800. Code of Federal Regulations, Title 36, *Parks, Forests, and Public Property*, Part 800, "Protection of Historic Properties."

40 CFR Part 93. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 93, "Determining Conformity of Federal Actions to State or Federal Implementation Plans."

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5.0 Operational Impacts at the Proposed Site

This chapter examines environmental impacts associated with operation of the proposed new Enrico Fermi Unit 3 (Fermi 3) at the Enrico Fermi Atomic Power Plant (Fermi) site for an initial 40-year period, as described in the application for a combined license (COL) submitted by Detroit Edison Company (Detroit Edison). As part of its COL application, Detroit Edison submitted an Environmental Report (ER) that discussed the environmental impacts of station operation (Detroit Edison 2011a). In its evaluation of operational impacts, the review team, composed of U.S. Nuclear Regulatory Commission (NRC) staff, its contractor staff, and U.S. Army Corps of Engineers (USACE) staff, relied on operational details supplied by Detroit Edison in its ER and its responses to NRC Requests for Additional Information (RAIs), and the review team's own independent review. Also consulted were permitting correspondences between Detroit Edison and the USACE, a cooperating agency in this action.

This chapter is divided into 14 sections. Sections 5.1 through 5.12 discuss the potential operational impacts related to land use, water, terrestrial and aquatic resources, socioeconomics, environmental justice, historic and cultural resources, meteorology and air quality, nonradiological and radiological health effects, nonradioactive waste impacts, postulated accidents, and applicable measures and controls, respectively, that would limit the adverse impacts of station operation during the 40-year operating period. In accordance with Title 10 of the Code of Federal Regulations (CFR) Part 51, impacts have been analyzed and a significance level of potential adverse impacts (i.e., SMALL, MODERATE, or LARGE) has been assigned to each impact category. In the area of socioeconomics related to taxes, the impacts may be considered beneficial and are stated as such. The review team's determination of significance levels is based on the assumption that the mitigation measures identified in the ER or activities planned by various State and county governments, such as infrastructure upgrades, as discussed throughout this chapter, are implemented. Failure to implement these mitigation measures and upgrades might result in a change in significance level. Possible additional mitigation to further reduce adverse impacts is also presented, where appropriate. A summary of these impacts is presented in Section 5.13. The references cited in this chapter are listed in Section 5.14.

5.1 Land Use Impacts

Sections 5.1.1 and 5.1.2 contain information regarding land use impacts associated with operation of Fermi 3. Section 5.1.1 discusses land use impacts at the site and in the vicinity of the site. For the purposes of the analysis, the vicinity is defined as the area encompassed by a 7.5-mi radius around the existing Fermi site. Section 5.1.2 discusses land use impacts resulting from the proposed offsite transmission line corridors and other offsite areas.

5.1.1 The Site and Vicinity

Although approximately 301 ac of land onsite would be disturbed to build Fermi 3, only about 155 ac would be permanently occupied by the Fermi 3 facilities for the duration of the operational period (Detroit Edison 2011a). Operation of the facilities would be compatible with existing and readily foreseeable adjacent land uses. No additional land of the Fermi site would be occupied due to Fermi 3 operations. While there is the potential for icing, salt drift deposition, fogging, and noise from cooling tower operations to affect land areas close to an operating reactor (NRC 1996), review of the application for Fermi 3 suggests that these impacts would be negligible (see Sections 5.3.1.1 and 5.7.1) and therefore not adversely affect nearby land uses. Ambient noise level impacts from transformer operation would also be minimal (see Section 5.8.2). Operations are therefore expected to have only minimal impacts on forest, wetland, floodplain, maintained grassland, and developed land uses on or near the Fermi site. Although some prime farmland may remain onsite following initial development of Fermi 3, no crop production is expected to occur anywhere on the Fermi site during plant operation. Any alteration of prime farmland soils would take place while the proposed Fermi 3 facilities were being built, not during operations.

Although development of Fermi 3 would permanently remove approximately 19 ac of land from the Detroit River International Wildlife Refuge (DRIWR), operation of Fermi 3 is not expected to noticeably affect management of the remaining DRIWR lands on or near the Fermi site.

Spoils from maintenance dredging of the Fermi 3 intake and barge slip area would be disposed of in the existing Spoils Disposal Pond. Dredging for the Fermi 2 intake embayment has been performed every 4 years and has resulted in the removal of approximately 22,000 yd^3 of material (Detroit Edison 2011a). Based on Detroit Edison's experience with Fermi 2 spoils disposal, dredging to operate Fermi 3 is not expected to require any additional land outside of the existing Spoils Disposal Pond.

Soil erosion impacts on the site or the surrounding vicinity are unlikely during operation of Fermi 3. Vegetation stabilization measures would be in place to prevent erosion and sedimentation impacts on the site and vicinity, and erosion would be prevented through the use of erosion control measures identified in the existing Stormwater Pollution Prevention Plan (Detroit Edison 2011a).

Land throughout the Fermi site is designated as "industrial" by Monroe County and zoned as "public service" by Frenchtown Charter Township (Monroe County Planning Department and Commission 2010; James D. Anulewicz Associates, Inc. and McKenna Associates, Inc. 2003). No impacts on land use planning in Monroe County or Frenchtown Charter Township are expected as a result of the operation of Fermi 3. Operation of the facility is expected to be consistent with and comply with all applicable land use and zoning regulations of Monroe County and Frenchtown Charter Township, respectively. Regional and State land use plans do not contain measures that apply specifically to the Fermi site, and these plans would not be affected by Fermi 3 operation. Detroit Edison has not indicated that operation of Fermi 3 would interfere with any future land uses that it anticipates for the Fermi site.

The Fermi site and some areas in the vicinity of the site fall under the Coastal Zone Management Act, which is designed to ensure the reasonable use of coastal areas (see Section 3.1). As stated in Section 4.1.1, on January 24, 2012, the Michigan Department of Environmental Quality (MDEQ) issued Permit Number 10-58-0011-P to Detroit Edison (MDEQ 2012b). Issuance of this permit constitutes a coastal zone consistency determination from MDEQ. That consistency determination encompasses the entire anticipated operational life of the proposed Fermi 3 facilities.

As is true during the building of Fermi 3, some offsite land use changes could indirectly result from operation of Fermi 3. As discussed in Section 4.1.1, possible impacts include the conversion of some land in surrounding areas to housing developments (e.g., recreational vehicle parks, apartment buildings, single-family condominiums and homes, and manufactured home parks) and retail development to accommodate workers. Property tax revenue from the addition of Fermi 3 could induce additional growth in Monroe County as a result of infrastructure improvements (e.g., new roads and utility services). However, the employment offered during operations would generally be lower and less rapidly changing than during the building phase. Additional information on roads, housing, and construction-related infrastructure impacts is presented in Section 4.4.

Based on information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that the land use impacts of operation of Fermi 3 would be SMALL, and additional mitigation would not be warranted.

5.1.2 Transmission Line Corridors and Other Offsite Facilities

The activities associated with transmission line operations that could affect land use include maintenance, inspection, and vegetation management in the corridors and at the Milan Substation. Impacts would be seasonal and would occur within a 500-ft onsite corridor (included in the scope of the analysis in Section 5.1.1 above), a 300-ft-wide offsite corridor, and the Milan Substation. Occasional access to the transmission line corridors by maintenance vehicles may cause some temporary erosion and compaction along certain areas, especially if heavy vehicles are used in wet weather conditions and on any access roads that have gravel or other unpaved surfaces (Detroit Edison 2011a). Siltation of streams and wetlands and the disturbance of wildlife and wildlife habitat may also occur during maintenance activities where the corridor crosses floodplains and wetlands. Vegetative cover would be seeded to stabilize the soil exposed by corridor maintenance activities and prevent erosion, and water diversion measures would be used to direct water off the sides of the access roads and prevent erosion impacts (Detroit Edison 2011a). The review team expects that Detroit Edison and the

International Transmission Company (ITC*Transmission*) would be required in their operations to use best management practices (BMPs) outlined in a soil erosion and sedimentation control (SESC) plan or right-of-way (ROW) maintenance manual used by Detroit Edison and/or ITC*Transmission*.

Operation of the transmission facilities is not expected to interfere with adjacent land uses or with agricultural use of farmland spanned by transmission conductors.

It is expected that ITC*Transmission* would continue maintenance activities currently conducted on the existing transmission line corridors extending out from the Fermi site. It is expected that ITC*Transmission* would extend these same practices to the new corridor and substation facilities. These activities include periodic removal and trimming of trees, mowing of herbaceous and low woody vegetation and cutting of large shrubs, and the use of pesticides and herbicides applied with either ground or aerial spraying methods. The corridors would be periodically inspected by helicopter or ground-patrolled to ensure that they are in proper condition for safe operation of the transmission line (Detroit Edison 2011a). Vegetation clearing would be limited to the minimum needed to allow access for maintenance vehicles and to prevent the growth of trees and other vegetation that could interfere with the operation of the lines (Detroit Edison 2011a). Vegetation management on transmission line corridors is discussed in more detail in Section 5.3.

ITC*Transmission* is expected to implement BMPs involving minimal use of maintenance vehicles and access roads to the extent possible and limiting transmission line maintenance work during wet weather conditions (ITC*Transmission* 2010). Other BMPs would be outlined in a SESC plan or ROW maintenance manual used by ITC*Transmission*. Herbicides would be applied by licensed personnel in accordance with their labels, and only herbicides labeled for aquatic environments would be used in wetlands.

The review team concludes that the offsite land use impacts of operating Fermi 3 and its associated transmission lines would be SMALL, and additional mitigation would not be warranted.

5.2 Water-Related Impacts

This section discusses water-related impacts on the surrounding environment from operation of the proposed Fermi 3. The primary water-related impacts would be associated with Fermi 3's cooling water system. Details of the operational modes and cooling water systems associated with operation of the plant are presented in Section 3.2.2.

Managing water resources requires understanding and balancing the trade-offs between various, often conflicting, objectives. At the Fermi site, these objectives include navigation, recreation, visual aesthetics, a fishery, and a variety of beneficial consumptive uses of water.

The responsibility for regulating any structures or work in or affecting navigable waters of the United States is delegated to the USACE. The responsibility for regulating water use and water quality is delegated to MDEQ.

Water use and water quality impacts involved with operation of a nuclear plant are similar to the impacts associated with any large thermoelectric power generation facility, and Detroit Edison must obtain the same water-related permits and certifications as these other facilities. Permits and certifications needed would include the following:

- CWA Section 401 Certification. This water quality certification would be issued by MDEQ and would ensure that operation of the plant would not conflict with State water quality management programs. Permit Number 10-58-0011-P was issued to Detroit Edison on January 24, 2012 (MDEQ 2012b). Issuance of this permit constitutes the required State of Michigan 401 Water Quality Certification.
- CWA Section 402(p) National Pollutant Discharge Elimination System (NPDES) Discharge Permit. MDEQ administers the NPDES program for the U.S. Environmental Protection Agency (EPA) Construction General Permit and industrial discharge permits. These permits regulate point source stormwater and wastewater discharges. Permit Number MI0058892 was issued to Detroit Edison on February 6, 2012 (MDEQ 2012a). Issuance of this permit constitutes the required State of Michigan NPDES permit for operational discharges.
- CWA Section 404 Permit. This permit would be required for the discharge of any dredged and/or fill material into waters of the United States.
- CWA Section 316(a). This section regulates the cooling water discharges to protect the health of the aquatic environment. The scope will be covered under the NPDES permit with MDEQ.
- CWA Section 316(b). This section regulates cooling water intake structures to minimize the environmental impacts associated with their location, design, construction, and capacity. The scope will be covered under the NPDES permit with MDEQ.
- MDEQ Water Quality Standards Certification (Administrative Rule R 323.1041 *et seq.*). The regulations define the water quality standards in Lake Erie, the mixing zones, and the applicability of the standards. The standards include two temperature criteria for thermal discharge into Lake Erie.
- MDEQ Large Quantity Water Withdrawal Permit, issued under Part 327 of the Safe Drinking Water Act. This permit is required for water withdrawals of more than 5 million gallons per day (MGD) from the Great Lakes per MCL 324.32723(1)(a)-(b).
- MDEQ Water Withdrawal Registration. This permit is required for development of withdrawal capacities exceeding 100,000 gal per day under MCL 324.32705.

- MDEQ Natural Resources and Environmental Protection Act 451, Natural Resources and Environmental Protection Act, Part 325, Great Lakes Submerged Lands Permit. This permit is required for maintenance dredging activities in the Great Lakes. Permit Number 11-58-0055-P was issued to Detroit Edison on April 25, 2012, and authorizes activities under Part 325.
- Section 10 of the Rivers and Harbors Appropriation Act of 1899 Permit. This permit would be issued by USACE to regulate any structure or work in, over, under, or affecting waters of the United States, such as Lake Erie. Permit Number LRE-1988-10408 was issued to Detroit Edison on April 30, 2004, and authorizes maintenance dredging activities under Section 10 for the Fermi 2 water intake canal.
- Federal Coastal Zone Management Act of 1972 Certification. This concurrence of consistency with the State coastal program's policies would be issued by MDEQ. It applies to any activity that is on land or in water or that affects land use, water use, or any natural resource in the coastal zone, if the activity requires a Federal license or permit. Permit Number 10-58-0011-P (MDEQ 2012b) was issued to Detroit Edison on January 24, 2012 (see Section 4.1.2), and constitutes a coastal zone consistency determination from the MDEQ.

Section 5.2.1 discusses the hydrologic alterations in surface water and groundwater related to operation of Fermi 3. Water use impacts for surface water are discussed in Section 5.2.2.1 and for groundwater in Section 5.2.2.2. Water quality impacts for surface water are discussed in Section 5.2.3.1 and for groundwater in Section 5.2.3.2. Water monitoring for surface water is discussed in Section 5.2.4.1 and for groundwater in Section 5.2.4.2. Potential mitigation measures for operations-related water impacts are discussed in Section 5.2.5. The combined impacts of operating the proposed Fermi 3 along with the existing Fermi 2, as well as other activities in the surrounding environment, are discussed in Chapter 7 (Cumulative Impacts).

5.2.1 Hydrological Alterations

This section discusses the hydrological alterations and the resulting effects from operation of the proposed Fermi 3. Fermi site hydrological alterations would include a change in the local landscape and drainage patterns, which could cause increased runoff or erosion. Hydrological alterations to Lake Erie from operation of Fermi 3 would include increased water use, discharge of cooling water (thermal and chemical impacts), and maintenance dredging of the intake canal.

The proposed Fermi 3 power block would be placed on an elevated area, with drainage directed away from the facilities. Modifications of the land surface made during preconstruction and construction activities would alter the local hydrology. The proposed location of Fermi 3 is mostly within the Swan Creek watershed, and water running off of the Fermi 3 developed area would drain primarily to Swan Creek before entering Lake Erie. Drop inlets on the nuclear island will collect the stormwater runoff resulting from storm events and route it to Swan Creek via the North Lagoon. If storm drains on the nuclear island were blocked, runoff would drain off the elevated area in all directions, and some water would drain directly to Lake Erie. A Stormwater Pollution Prevention Plan (SWPPP) is contained in Fermi 3 NPDES Permit Number MI0058892 to manage stormwater runoff and prevent erosion (MDEQ 2012a). Specifically, surface water would be routed away from the nuclear plant through subgrade storm drains and off the slopes of the elevated area as needed.

In addition, groundwater infiltration areas would be reduced because of the increase in the amount of impervious surfaces at the site and the filling of some onsite water bodies. The aquifer beneath the Fermi site would be affected by the new hydrological conditions resulting from dewatering operations and the increased impervious surfaces for a period shortly after preconstruction and construction, but since the changes are limited to the site and dewatering is temporary, the effects would also be limited and temporary and water levels within the aquifer should stabilize at or near current conditions.

Discharge of cooling water blowdown into Lake Erie would occur approximately 1300 ft east of the shore. The discharge pipe would discharge approximately 1.5 ft above the bottom of the lake and would contain a three-port diffuser. The maximum velocity of the discharge water would be approximately 8.5 fps. The flow would be divided among the three ports to reduce possible scour. The diffuser would also mix the discharge, increasing the thermal and chemical mixing of the discharge into Lake Erie. Thermal plume modeling indicated that the Fermi 3 discharge would not reach the shoreline (Section 5.2.3). The existing Fermi 2 power plant has a restricted area that prohibits recreational activity and navigation. Consequently, the additional discharge of another reactor would not directly affect recreational uses, because recreation will not be allowed within the zone.

The intake structure for Fermi 3 would use the intake bay between the existing rock groins that extend 600 ft into the lake from the facility shoreline. Since the existing intake bay is being utilized, erosion and deposition in Lake Erie during operation would be relatively unchanged from the current condition. Maintenance dredging of the intake bay would be required periodically during operation of Fermi 3, and dredging would be within the same footprint and also be of similar volume and frequency to that done during operation of Fermi 2. Therefore, there is no change in impact from maintenance dredging.

Water use impacts on Lake Erie are evaluated in terms of total water use within the Lake Erie basin; these impacts are discussed in Section 5.2.2.

Groundwater would not be used during operation of Fermi 3. The hydrologic alterations of groundwater due to preconstruction and construction activities (e.g., site grading, changes in recharge, fill materials, excavation dewatering) are discussed in Section 4.2 of this environmental impact statement (EIS).

In summary, the hydrological alterations applicable to operations are limited to the intake of Lake Erie water, the discharge of blowdown water and associated waste streams to the lake, altered drainage patterns from landscape changes, and periodic dredging of the intake canal.

5.2.2 Water Use Impacts

A description of water use impacts on surface water and groundwater resources is presented in this section. The primary cooling-water source for Fermi 3 would be Lake Erie. Potable water used for drinking water and sanitary purposes at the plant would come from the Frenchtown Water Plant, which uses water from Lake Erie. Groundwater is not anticipated to be used for the operation of Fermi 3.

5.2.2.1 Surface Water Use Impacts

Lake Erie would be the only source of makeup water for the operation of the proposed Fermi 3. Almost all makeup water is supplied back to the cooling water system, where most consumptive losses occur due to evaporation and drift from the cooling towers. Maximum water use and loss during normal power operation would occur during the hottest summer months. Minimum usage and loss would occur during the winter months (January), and average usage and loss would occur during the spring and fall. Figure 5-1 presents a diagram of the water use for the proposed Fermi 3. Table 5-1 presents a summary of the water use for the proposed Fermi 3.

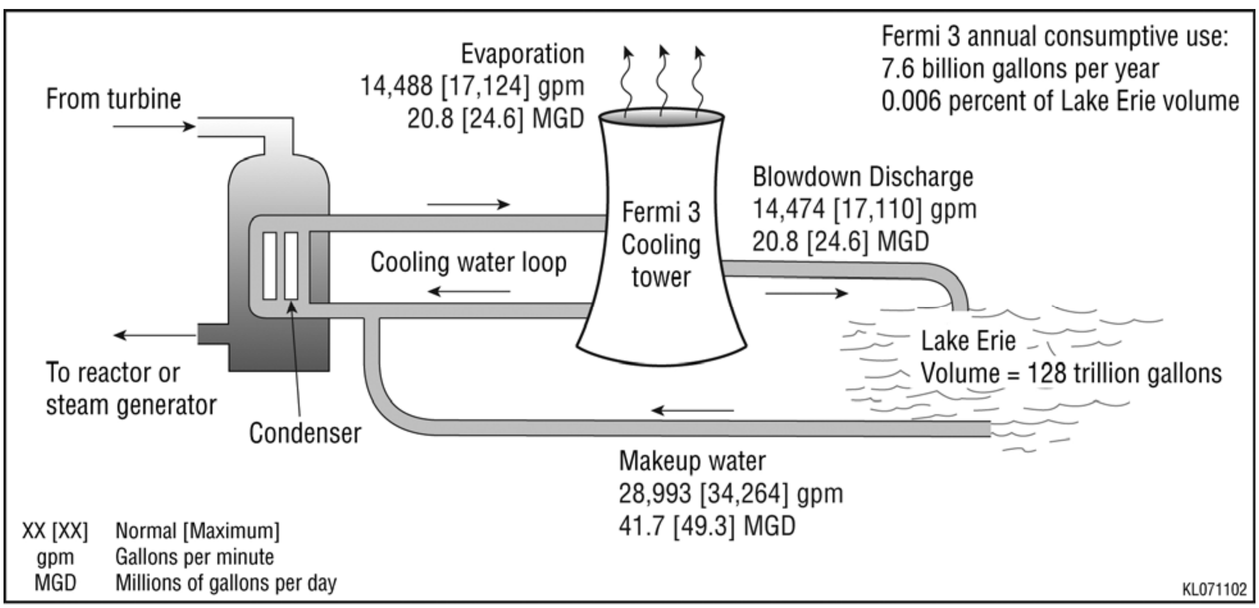

Figure 5-1. Fermi 3 Water Use Diagram

Table 5-1. Fermi 3 Water Use

Use	Average (gpm)	Maximum (gpm)
Intake	28,993	34,264
Discharge	14,474	17,110
Evaporation and Drift	14,488	17,124

Source: Detroit Edison 2011a

During the summer, Fermi 3 would withdraw a maximum of approximately 34,264 gpm from Lake Erie. Approximately 17,124 gpm of this inflow would be lost, and approximately 17,110 gpm would be returned to Lake Erie through the discharge pipe. Total water withdrawn would be a maximum of 49.3 MGD, and consumptive use would be a maximum of 24.6 MGD (Detroit Edison 2011a). During the spring and fall, the average water withdrawn would be 28,993 gpm (41.7 MGD); consumptive use would be about 14,488 gpm (20.8 MGD); and approximately 14,474 gpm (20.8 MGD) would be returned to Lake Erie. In the winter, the minimum water withdrawn from Lake Erie for makeup to the plant systems would be about 23,780 gpm (34.2 MGD); consumptive use would be about 11,882 gpm (17.1 MGD); and 11,868 gpm (17.1 MG) would be returned to the lake (Detroit Edison 2011a). The Great Lakes Compact of 2008 requires that any new water use of more than 5 MGD be subjected to a regional review, so Fermi 3 would be subject to such a review by the other Great Lakes States and provinces.

The Frenchtown Water Plant would be the source for potable, sanitary, and demineralized makeup water during operations. It is estimated that the monthly average potable water use by Fermi 3 would be approximately 35 gpm (Detroit Edison 2011a). The Frenchtown Water Plant has the capacity to supply Fermi 3 with the required water (Detroit Edison 2009a), as it has recently expanded its capacity from 4 MGD to 8 MGD. This expanded capacity is expected to be sufficient for Fermi 3 needs for at least 20 years (Detroit Edison 2011a).

The volume of Lake Erie is approximately 116 mi^3, or about 128 trillion gal (EPA 1995). The average annual consumptive use of water within the Lake Erie basin from all users is about 183 billion gal (GLC 2005a, b, c; 2006a, b; 2009a, b), and Fermi 3 would have an average consumptive use of approximately 7.6 billion gal per year. The incremental annual average withdrawal associated with operation of Fermi 3 would be approximately 0.006 percent of the volume of water in Lake Erie and 4.2 percent of the average consumptive water use in Lake Erie between 2000 and 2006; thus, it would represent a relatively minor change in lake water availability and cumulative consumption and result in no measurable effect on other users. The western basin of Lake Erie has a volume of approximately 6 mi^3, or about 6.6 trillion gal (Lee et al. 1996). The annual average withdrawal associated with operation of Fermi 3 would be approximately 0.115 percent of the volume of water in the western basin of Lake Erie. The review team concludes that there would be a SMALL impact on surface water resources in Lake Erie, and mitigation is not warranted.

5.2.2.2 Groundwater Use Impacts

No groundwater is planned to be used for operation of the proposed Fermi 3 (Detroit Edison 2011a). In addition, no dewatering-related pumping is planned to occur during the operation of Fermi 3. Therefore, the review team concludes that the impact on groundwater and groundwater users from operating Fermi 3 is SMALL, and mitigation is not warranted.

5.2.3 Water Quality Impacts

This section discusses the impacts on water quality that could result from the operation of proposed Fermi 3. Surface water impacts include thermal, chemical, and radiological wastes and physical changes in Lake Erie resulting from stormwater runoff and effluents discharged by the proposed plant. Section 5.2.3.1 discusses the impacts on surface water quality, and Section 5.2.3.2 discusses the impact on groundwater quality. The impacts of radiological liquid effluents are discussed in Section 5.9.

5.2.3.1 Surface Water Quality Impacts

During operation of Fermi 3, stormwater runoff to the receiving water bodies, the Quarry Lakes, Swan Creek, and Lake Erie, will be controlled by adherence to the SWPPP and design features as required by the NPDES permit. Adherence to the NPDES permit will reduce the impacts on the quality of surface water near the plant from stormwater runoff.

During normal operation of Fermi 3, cooling water blowdown from the natural draft cooling tower would be discharged to Lake Erie through a multi-port diffuser located approximately 1300 ft east of the shore. Surface water impacts associated with cooling tower blowdown include the chemical, thermal, and radiological effluents that would be discharged by the plant. Cooling water returned to Lake Erie would have higher chemical (mineral) content than the water withdrawn from Lake Erie for the cooling. Cooling towers concentrate solids and solutes from the raw makeup water during the process of evaporative heat loss. Cooling water is also treated prior to use to inhibit scale, growth of plant and animal life, and corrosion. These solids and solutes are contained in blowdown.

Makeup water to the station water system (SWS) would be treated with the biocide/algaecide sodium hypochlorite before it entered the pumps at the intake from Lake Erie (Detroit Edison 2011a). The SWS would supply water to the circulating water system (CIRC), plant service water system (PSWS), and fire protection system (FPS) (Detroit Edison 2011a). Biocide injection would remove plant and animal life, including the invasive zebra mussels, from the water (Detroit Edison 2011a). If mussels did reach the SWS, they could be removed through

either additional chlorination or thermal shock treatment (Detroit Edison 2011a). Additional chemicals injected into the CIRC water would include sodium silicate (a corrosion inhibitor) and a scale inhibitor (Detroit Edison 2011a). An additional chemical to disperse suspended solids would be injected into the PSWS when the water from Lake Erie was highly turbid (Detroit Edison 2011a). Before the water would be discharged into Lake Erie, sodium bisulfite would be added to the CIRC blowdown to remove chlorination from (dehalogenate) the water.
Table 3.3-1 of the ER presents the estimated quantities of each chemical to be injected into the CIRC and PSWS (Detroit Edison 2011a).

Estimated concentrations of chemicals in Fermi 3 discharge are presented in ER Table 3.6-2 (Detroit Edison 2011a). The NPDES permit for Fermi 3 does not include approval to discharge any treatment additives. Prior to discharge of any treatment additives, Detroit Edison would be required to obtain written approval from the MDEQ, which would specify the allowable concentrations of chemicals in the Fermi 3 discharge (MDEQ 2012a). MDEQ may require Detroit Edison to perform regular monitoring and reporting of the concentrations of these chemicals in the Fermi 3 discharge to evaluate compliance with the effluent limitations (Detroit Edison 2011a; MDEQ 2012a). As a result, the estimated impacts on water quality of Lake Erie from the proposed Fermi 3 discharges are expected to be minor.

Cooling water would be returned to Lake Erie at higher temperatures than it is withdrawn. Estimated monthly discharge temperatures and flow rates are presented in Table 5-2. These temperature values and discharge rates are referred to in the ER as the anticipated maximum

Table 5-2. Fermi 3 Monthly Discharge Rates and Temperatures

Month	Discharge Rate (gpm)	Discharge Temperature (°F)
January	12,035	55.0
February	12,360	55.3
March	13,260	59.4
April	14,460	66.0
May	15,560	72.7
June	16,640	78.4
July	16,910	81.5
August	16,860	80.8
September	16,260	76.3
October	14,960	68.8
November	13,910	62.7
December	12,660	56.6

Source: Detroit Edison 2011a

values (Detroit Edison 2011a). MDEQ enforces two standards related to thermal impacts in Lake Erie under Michigan Water Quality Standards Section R 323.1070. One of these standards is related to the change from ambient temperature, and the other is an absolute maximum temperature. Water that is 3°F above the ambient temperature of the lake is considered part of a thermal plume. Table 5-3 presents the estimated mean monthly ambient temperatures in Lake Erie in the vicinity of the discharge port and the difference between the ambient temperature and the discharge temperature. In addition, there are maximum monthly water temperatures that, when exceeded in Lake Erie, are considered part of a thermal plume; these are also presented in Table 5-3 along with the amount that these standards will be exceeded during each month. MDEQ allows the water quality standards to be exceeded within mixing zones per Michigan Water Quality Standards Section R 323.1041 *et seq*. The MDEQ defines the allowable size of a mixing zone within Lake Erie on a case-by-case basis. The allowable size for Fermi 3 would be determined during the permitting process. As described below, the simulated size of the maximum thermal plume was very small when compared to the area of the entire western basin of Lake Erie, and impacts from the thermal plume are expected to be minor.

Table 5-3. Temperature Increases within the Thermal Plume for Fermi 3

Month	Mean Ambient Lake Temperature (°F)[(a)]	Increase in Temperature (above Ambient) within Thermal Plume (°F)[(b)]	MDEQ Maximum Allowable Temperature (°F)[(c)]	Degrees Exceedance of MDEQ Maximum Allowable Temperature (°F)[(d)]
January	35.5	19.5	45.0	10.0
February	32.9	22.4	45.0	10.3
March	35.8	23.6	45.0	14.4
April	43.2	22.8	60.0	6.0
May	53.6	19.1	70.0	2.7
June	64.1	14.3	75.0	3.4
July	68.6	12.9	80.0	1.5
August	73.1	7.4	85.0	–
September	70.0	6.3	80.0	–
October	61.5	7.3	70.0	–
November	49.7	13	60.0	2.7
December	39.6	17	50.0	6.6

(a) Detroit Edison (2011a).
(b) Discharge that is over 3ºF above the mean ambient lake temperature is considered part of a thermal plume and defines the MDEQ-approved mixing zone.
(c) Michigan Water Quality Standards Section R 323.1041 *et seq*.
(d) Discharges above the MDEQ Maximum Allowable Temperature are considered part of a thermal plume and are required to be included within a MDEQ-approved mixing zone.

To investigate the potential impacts of discharged cooling water with elevated temperatures on Lake Erie, Detroit Edison used CORMIX, a hydrodynamic model that simulates mixing processes, to evaluate the impact and size of discharge thermal plumes (Detroit Edison 2011a). Detroit Edison performed a suite of steady-state simulations based on both of the MDEQ water quality standards to examine the size of thermal plumes. These scenarios evaluated the following:

- Compliance with MDEQ Water Quality Standards for Lake Temperature: The first set of simulations, described in the ER as Model Set 1, evaluated (1) monthly variations in the size of the plume that was 3°F or more than ambient lake water temperature and (2) monthly variations in the size of the thermal plume that exceeded the maximum allowable temperature (presented in Table 5-3).
- Sensitivity of Maximum Plume to Changes in Water Depth: A second set of simulations, described in the ER as Model Set 2, evaluated the sensitivity of the size of the thermal plume caused by a rise in ambient lake temperatures higher than 3°F to lake depth. This scenario was performed to evaluate the effects of extremely low water conditions caused by a wind-driven seiche. To be conservative, this analysis used the largest plume determined in the first set of simulations. This plume occurred in the month of May.
- Potential Impact of Plume on Cooling Water Intake Temperatures: A final simulation was performed to investigate the potential for a thermal plume to reach the shore and affect the temperature of water withdrawn from Lake Erie for cooling Fermi 3.

These scenarios are described in greater detail below and summarized in Table 5-4.

Compliance with MDEQ Water Quality Standards for Lake Temperature

The monthly simulations in Model Set 1 were performed to characterize the timing and size of potential thermal plumes created by Fermi 3 at different times of the year using conservative input parameters. Input data for the CORMIX simulations included discharge rate, discharge temperature, water depth, ambient lake temperature, and ambient lake current velocity and direction. Data were derived from the several sources shown in Table 5.3-3 of the ER (Detroit Edison 2011a). Both the ambient lake temperature and the ambient lake current inputs were derived from Lake Erie Operational Forecast System (LEOFS) model estimates. LEOFS is a National Oceanic and Atmospheric Administration (NOAA) project and is a part of the Great Lakes Operational Forecast System (GLOFS). Detroit Edison analyzed LEOFS results to determine the mean high and low monthly values of lake temperature and lake currents in the vicinity of the Fermi site (Detroit Edison 2011a). Ambient mean monthly lake depth was derived by using data from a NOAA gage located on a buoy offshore from Fermi 2 (Detroit Edison 2011a). Detroit Edison used the mean monthly wind velocity measured at the airport in Grosse Ile, Michigan, which is approximately 11 mi from the Fermi site (Detroit Edison 2011a). Wind speed data were also available from two heights at the Fermi site. The wind velocity data

Table 5-4. Summary of Model Scenarios, Parameters, and Results

Scenario Name and Description	Important Input Parameters: Parameter	Important Input Parameters: Value	Results
Model Set 1:			
Compliance with MDEQ Water Quality Temperature Standards (3°F above ambient limit)	Lake temperature	10th percentile monthly temperature predicted by LEOFS NOAA model	Largest plume of water greater than 3°F above ambient lake temperature occurs during May assuming maximum current velocity (29,500 ft^2).
	Fermi 3 discharge rate	Maximum discharge (Table 5-1)	
	Fermi 3 discharge temperature	Maximum discharge temperature (Table 5.2-2)	
	Water depth	Monthly averages measured at Fermi Power Plant	
	Current velocity	High (maximum) and low (10th percentile) values from LEOFS model	
Model Set 1:			
Compliance with MDEQ Water Quality Temperature Standards (total allowable maximum temperature)	Lake temperature	90th percentile monthly temperature predicted by LEOFS NOAA model	11 of 12 months exceeded the MDEQ maximum allowable temperature standard and would require a mixing zone.
	Fermi 3 discharge rate	Maximum discharge (Table 5.2-2)	
	Fermi 3 discharge temperature	Maximum discharge temperature (Table 5.2-2)	
	Water depth	Monthly averages measured at Fermi Power Plant	
	Current velocity	High (maximum) and low (10th percentile) values from LEOFS model	
Model Set 2:			
Sensitivity of Maximum Plume to Changes in Water Depth	Fermi 3 discharge temperature	Maximum discharge temperature (Table 5.2-2)	Use of 1st percentile depth (7 ft) increases plume size relative to May mean depth (8.5 ft) by 46 percent (from 29,500 ft^2 to 55,300 ft^2).
	Fermi 3 discharge rate	Maximum discharge (Table 5.2-2)	
	Current velocity	High (maximum current velocity near discharge output by LEOFS model)	
	Lake temperature	10th percentile monthly temperature predicted by LEOFS NOAA model	
	Water depths evaluated	8.5 ft (May mean from Model Set 1)	
		8 ft (20th percentile; once in 5-year depth for May)	
		7.6 ft (5th percentile; once in 20-year depth for May)	
		7 ft (1st percentile; once in 100-year depth for May)	

Table 5-4. (contd)

Scenario Name and Description	Important Input Parameters: Parameter	Important Input Parameters: Value	Results
Model Set 3:			
Potential Impact of the Plume on Cooling Water Intake Temperature	Water depth	8.5 ft	Plume dissipates 1300 ft from shore. No impact on intake temperature or shoreline.
	Direction of discharge	Single-port diffuser angled toward Fermi 3 intake	
	Current speed	High (1.5 times the maximum observed current velocity)	
	Current direction	West, toward the plant	
	Discharge temperature	Maximum discharge temperature (Table 5.2-2)	
	Discharge rate	Maximum discharge (Table 5.2-2)	
	Lake temperature	10th percentile monthly temperature predicted by LEOFS NOAA model	

from the Gross-Ile Michigan Airport presents average monthly wind velocity values that are between the average monthly values measured at the Fermi site at 10-m and 60-m heights. The review team found these to be acceptably conservative values for use in the CORMIX simulations. Within the CORMIX model, wind speed is a nondirectional quantity that only affects the thermal plume in the far-field zone, where the plume behaves as a positively buoyant surface density current. The wind velocity can affect the degree of heat transfer to the atmosphere in this zone, and it can affect the turbulence at the surface to cause increased mixing. In many cases, the thermal plume simulated to occur from Fermi 3 discharge was found to meet the regulatory criteria within the near-field zone, the region where wind speed is not factored into calculation of the size of the plume. In those cases, the wind speed has no effect on the size of the plume as defined by MDEQ regulations.

Detroit Edison first evaluated plumes caused by a rise in ambient temperature greater than 3°F. It investigated two scenarios: one with a low ambient current velocity and one with a high ambient current velocity. Detroit Edison assumed that the ambient temperature of Lake Erie for each month was in the 10th percentile of values simulated by LEOFS for that month (model simulated values used for temperature). The use of a low ambient temperature allowed for a conservative analysis of the impacts of high-temperature discharge on plume size for the maximum change in temperature simulations. The results of these simulations are presented in Table 5.3-12 of the ER (Detroit Edison 2011a).

Next, plumes that exceeded the maximum allowable temperature for each month were simulated. For these simulations, Detroit Edison assumed that the ambient temperature of Lake Erie for each month was in the 90th percentile of values simulated by LEOFS for that month. The use of a high ambient temperature allowed for a conservative analysis of the impacts of high-temperature discharge on plume size for the maximum allowable temperature simulations.

Two monthly scenarios were investigated: one with a low ambient current velocity and one with a high ambient current velocity. The results of these simulations are presented in Table 5.3-13 of the ER (Detroit Edison 2011a). Detroit Edison estimated that the largest plume would occur during the month of May as a result of the change in ambient temperature and high ambient current velocity, with an area of approximately 29,500 ft^2.

The technical review team reviewed and verified the model input values. The model results are presented in the text of the ER (Detroit Edison 2011a) and were provided to the technical review team as electronic files. The technical review team reviewed the files and found them to be acceptable.

Results of the thermal plume simulation were presented as rectangular areas in the ER (Detroit Edison 2011a). However, the plume would be shaped more like a triangle than a rectangle, so the values of the plume area would be lower than those calculated by multiplying the plume length and the plume width at the edge of the mixing zone. The values for the simulated plume were found to be smaller than the values presented by Detroit Edison (2011a); therefore, the review team found Detroit Edison's analysis to be conservative and acceptable.

Sensitivity of Maximum Plume to Changes in Water Depth

Detroit Edison examined the impacts of shallower water depths on the largest plume for Model Set 2. Detroit Edison examined the plume size that resulted from four alternate depth scenarios for the month of May (Detroit Edison 2011a). The depths used were the May mean depth of 8.5 ft (also used in the monthly simulations in Model Set 1), the 20th percentile depth of 8.0 ft (once-in-5-year depth for May), the 5th percentile depth of 7.6 ft (once-in-20-year depth for May), and the 1st percentile depth of 7.0 ft (once-in-100-year depth for May). Detroit Edison found that the largest plume covered an area of approximately 55,300 ft^2 and resulted from the shallowest simulated water depth of 7.0 ft.

Potential Impact of Plume on Cooling Water Intake Temperature

The final simulation was performed to investigate the potential for Fermi 3 thermal discharges to travel back toward the shore and affect the temperature of the intake cooling water. For this simulation, a high-velocity wind was assumed to blow in a westerly direction toward the Fermi site during the month of May. In addition, the problem was simulated in CORMIX by using only a single-port diffuser pointed toward Fermi 3. A water depth of 8.5 ft and a wind velocity of 1 fps were assumed. Detroit Edison calculated that the thermal plume would pose no threat to the shoreline, because it was estimated to dissipate 1300 ft east of the shoreline (Detroit Edison 2011a). The review team verified the simulations and determined that this analysis is conservative and acceptable.

Summary of Surface Water Quality Impacts

In summary, because the cooling water discharges have relatively low projected contaminant levels, which would be controlled through the permitting process and would be similar to an already permitted discharge, and given the review team's independent analysis of the thermal and chemical constituents in plant discharges to Lake Erie, the review team concludes that the impacts of the proposed Fermi 3 discharges on the water quality of Lake Erie would be SMALL, and additional mitigation is not warranted.

5.2.3.2 Groundwater Quality Impacts

The proposed Fermi 3 would not use groundwater during operations and would not discharge any liquids to groundwater during operations. Therefore, the review team concludes that the impacts on groundwater quality from operation of Fermi 3 would be SMALL, and mitigation is not warranted.

5.2.4 Water Monitoring

There are no water use or nonradiological water quality monitoring requirements imposed by the NRC. However, daily hydrological, thermal, and chemical monitoring of the proposed new discharge will be required by MDEQ as a part of NPDES Permit Number MI0058892 (MDEQ 2012a). Also, it is anticipated that measurements at the NOAA gauging station (ID 9063090) on Lake Erie in the vicinity of the Fermi 2 intake structure would continue to provide hourly Lake Erie water level measurements. Detroit Edison (2011a) has committed to following NRC guidance (NRC 2007a) for groundwater monitoring at the site. Section 2.3.1.2.4 of the ER (Detroit Edison 2011a) describes the current and planned groundwater monitoring programs. Groundwater elevations and radionuclide concentrations would be measured quarterly at upgradient and downgradient locations as part of the Radiological Environmental Monitoring Program (REMP) (Detroit Edison 2011a). Additional monitoring would be triggered by an accidental liquid release from Fermi 3, including monthly sampling both upgradient and downgradient from the release point (Detroit Edison 2011a). Monitoring during operations would establish the impacts from the plant and would detect any impacts that would result during operations.

5.3 Ecological Impacts

This section describes the potential impacts on ecological resources (terrestrial and aquatic ecosystems, including threatened and endangered species) from operation of Fermi 3 at the Fermi site, operation of the associated transmission line, and maintenance of the associated transmission line corridor. Evaluation of potential impacts on terrestrial and aquatic biota from radiological sources is discussed in Section 5.9.

5.3.1 Terrestrial and Wetland Impacts Related to Operation

Concern for possible impacts on terrestrial communities and species from operation of the proposed Fermi 3 facilities is mostly attributable to cooling system operations and transmission line operation and maintenance. Operation of cooling systems can potentially result in deposition of dissolved solids; increased local fogging, precipitation, or icing; increased noise levels; a greater risk of avian collision mortality; and shoreline alteration of Lake Erie (Detroit Edison 2011b; NRC 1996). Operation of Fermi 3 would also result in increased automotive traffic from additional employees at the site, which can result in the loss of wildlife. Possible impacts on terrestrial biota from operation and maintenance of a transmission line system include collision mortality and electrocution, electromagnetic fields, and the maintenance of vegetation within transmission line corridors.

5.3.1.1 Terrestrial Resources – Site and Vicinity

Cooling System Impacts on Vegetation

Concern for possible vegetation impacts from operation of Fermi 3 would be primarily associated with operation of the cooling system. As described in Chapter 3, the proposed cooling system for Fermi 3 consists of two primary components: the Normal Power Heat Sink and the Auxiliary Heat Sink (AHS). The Normal Power Heat Sink would be a hyperbolic natural draft cooling tower (NDCT). The AHS would consist of two linear mechanical draft cooling towers. The NDCT would be approximately 600 ft high (Detroit Edison 2011a). The heat would be transferred to the atmosphere in the form of water vapor and drift. In some cases, vapor plumes and drift from cooling towers can affect crops, ornamental vegetation, and native plants; water losses from cooling tower operation can affect shoreline habitat. In addition, bird collisions with tall structures, such as the NDCT, and noise-related impacts are possible (NRC 1996). The auxiliary towers would be much shorter than the NDCT, and the heat they would release would be orders of magnitude less. Because their impacts would be far smaller than impacts from the NDCT, discussion of potential impacts from operation of the cooling system is limited to the impacts of the NDCT.

Under certain conditions, native plants, ornamental plants, and agricultural crops can be affected by cooling tower drift, fogging, and increased humidity. Total dissolved solids (TDS), including salt, can stress vegetation after being deposited directly onto foliage or indirectly from accumulation in the soil (NRC 1996). The NDCT emits solids that are dissolved in the water droplets that are carried out of the cooling tower with the exhaust air. The guidance in NUREG-1555, Section 5.3.3.2 (NRC 2000a) indicates that deposition of salt drift from operation of cooling towers at rates of 1 to 2 kg/ha/mo is generally not damaging to plants. Conversely, deposition rates approaching or exceeding 10 kg/ha/mo in any month during the growing season could cause leaf damage in many species. Detroit Edison's analysis of solids deposition conservatively assumed that all TDSs were salt. The analysis indicated that the maximum predicted annual salt deposition rate at any receiving location would be approximately 1 kg/ha/mo (Detroit Edison 2011a). This value is within the range that NUREG-1555 considers to be generally not damaging to plants. Therefore, cooling tower operation impacts on vegetation are expected to be negligible both on the Fermi site and in the vicinity.

Detroit Edison's modeling of the operation of the NDCT predicts that no increased fogging would result from operation (Detroit Edison 2011a). Any event that may occur is likely to be coincident with a natural fog event and be transient, similar to what is seen with the existing NDCTs used by Fermi 2, and would result in less than 18 hr of fog per year. Any impact would be aesthetic and unlikely to affect ecological resources. Therefore, the impacts of cooling tower plume-induced fogging are anticipated to be minimal and to not warrant mitigation. Likewise, Detroit Edison's modeling also predicts that substantial ground-level icing from the NDCT would not occur (Detroit Edison 2011a). Localized icing may be possible from the operation of the AHS, but impacts are expected to be minimal and contained onsite and would therefore not warrant mitigation.

According to the ER (Detroit Edison 2011a), modeling results indicate the average hours per year of plume shadowing beyond the nearest property boundary (2765 ft) is predicted to be 92 hr per year (2.1 percent of the daylight hours per year) from the NDCT, considering all plume directions. The resulting hours per year of shadowing (especially at the nearest property boundary) are predicted to be an insignificant fraction of the total daylight hours needed for agricultural production. Additionally, shadowing events are not expected to occur at downwind agricultural or residential areas (Detroit Edison 2011a). Thus, the plume shadowing impacts are expected to be minimal and to not warrant mitigation.

Bird Collisions with Power Plant Structures

There is a risk for potential avian mortality from birds colliding with the proposed nuclear power plant structures. Typically, the cooling tower and the meteorological tower are the structures likely to pose the greatest risk. The potential for avian collisions increases as structure height increases (NRC 1996). The mechanical draft cooling towers are of little concern because of their relatively low height compared to existing and proposed structures onsite. The NDCT, however, would be 600 ft high. Avian collisions at existing Fermi facilities are not currently monitored by Detroit Edison, but dead birds are occasionally found around the Fermi 2 NDCTs (Detroit Edison 2011a). Typically, only a few birds are observed at any one time, but events during which more than a few birds have been killed by collisions with the cooling towers have been recorded infrequently. In September 1973, 15 dead birds were found (with as many as 50 potentially killed) at the Fermi 2 south cooling tower. More recently, 45 dead birds were found at the Fermi 2 south cooling tower, all occurring during a one-week period in October 2007 (Detroit Edison 2011a).

Because tower lighting design can affect the flight behavior of birds, Detroit Edison has consulted with the Federal Aviation Administration (FAA) about aviation safety requirements and will consult with the U.S. Fish and Wildlife Service (FWS) on the latest recommendations for obstruction lighting (Detroit Edison 2012a). According to consultations with FWS and FAA concerning structures requiring obstruction lighting, Detroit Edison (2012a) expects to implement lighting design features to minimize avian impacts, including the following:

- Using the minimum amount of pilot warning and obstruction avoidance lighting required by the FAA.
- Using only white (preferable) or red strobe lights at night unless otherwise required by the FAA.
- Employing the minimum number, minimum intensity, and minimum number of flashes per minute (longest duration between flashes) permitted by the FAA.
- Avoiding solid red or pulsating (beacon) red warning lights at night.

Design features specifically appropriate for Fermi 3 structures would be developed during consultations with the FAA and FWS, as discussed in the ER Section 1.2, prior to construction (Detroit Edison 2011a). As a result, the final design would incorporate the most up-to-date research and recommendations, minimizing impacts on migrating birds and other fauna while meeting aviation safety requirements.

In 10 CFR 51, Appendix B to Subpart A, Table B-1, it is stated that for nuclear power plant license renewal, bird collisions with cooling towers have not been found to be a frequent occurrence at operating nuclear power plants. Table B-1 further states that avian mortality resulting from collisions with cooling towers is of small significance. While acknowledging that some bird collisions with cooling towers take place, the NRC concluded in the generic environmental impact statement (GEIS) for license renewal (NRC 1996) that effects of bird collisions with existing cooling towers “involve sufficiently small numbers for any species that it is unlikely that the losses would threaten the stability of local populations or would result in a noticeable impairment of the function of a species within local ecosystems.” Thus, the impacts at Fermi 3 are expected to be minimal and would not warrant mitigation.

Cooling System Impacts on Waterfowl

Although some species of waterfowl are known to feed on quagga mussels (*Dreissena rostriformis bugensis*) and zebra mussels (*Dreissena polymorpha*), which can grow on water intake structures, there are few documented cases of impingement or entrainment of waterfowl feeding near the cooling system water intake (Nieder 2012). An episode of impingement of greater scaup (*Aythya marila*) and lesser scaup (*Aythya affinis*) in January of 2000 at the water intake for the Nine Mile Point Nuclear Station in Lycoming, New York was documented by the Niagara Mohawk Power Corporation (2000). The report stated that the maximum water velocity at the intake opening was 2 ft per second. The EPA (2011a) has proposed regulations to establish requirements for cooling water intake structures at existing facilities that allow for alternative measures to minimize impingement and entrainment. One alternative is to limit the through-screen velocity to 0.5 ft per second or less. According to the EPA, that velocity should allow most fish to swim away from the cooling water intake of the facility. The review team concludes that, given the relatively few documented cases of impingement of waterfowl and Detroit Edison's proposed maximum intake velocity, the likelihood that waterfowl would become impinged or entrained is low.

Shoreline Alteration

Periodic maintenance dredging of the intake bay is expected to potentially result in erosion and shoreline scouring. To offset this effect, rock groins extend into the lake, limiting the turbidity to the intake bay and protecting the shoreline from the zone of influence associated with the pumping activities. As a result, physical impacts on the shoreline area in the vicinity of the intake structure are anticipated to be minimal.

Noise

The predicted noise emissions from normal operation of the cooling tower would conform to NRC and EPA sound-level guidelines for minimizing noise impacts (see Section 5.8.2). During nighttime hours, the predicted noise increases at nearby noise-sensitive receptors over existing background (L_{90}) levels would be lower than about 3 dB, which is a barely discernible increase (NWCC 2002; Detroit Edison 2011a). One exception is a 6-dB increase at the nearest noise-sensitive receptor over the existing L_{90} values during a small portion of nighttime hours. The potential noise impacts due to the operation of Fermi 3 are, therefore, expected to be similar to background and current noise levels, to which local species have adapted. Accordingly, noise impacts on terrestrial ecosystems are expected to be minimal.

Impacts of Increased Vehicle Traffic

Increased traffic associated with operation of Fermi 3 has the potential to increase wildlife mortality caused by collisions (road kills). Detroit Edison (2011a) has estimated the Fermi 3 workforce to number approximately 900, which would approximately double the number of employees at the Fermi site. Additional work trips during peak hours would occur on the rural roads and highways in the vicinity. Local wildlife could decline if road-kill rates were to exceed the rates of reproduction and immigration. However, although roadkills occur frequently in the United States, they reportedly have minimal effect on wildlife populations (Forman and Alexander 1998). The review team concludes that these impacts would not be detectable beyond the local vicinity and would not destabilize regional wildlife populations.

Operational Impacts at the Proposed Site

The review team completed an individualized evaluation of the possibility of vehicular collisions with the eastern fox snake, a Michigan State-listed threatened species known to inhabit terrestrial habitats on and near the Fermi site. Since the eastern fox snake's preferred habitat is emergent wetlands, open areas not shaded by trees are not barriers to their movement (Hoving 2010). This species has been observed in developed and undeveloped sections of the Fermi site (Detroit Edison 2011a). It is reasonable to conclude, therefore, that the snakes would be likely to cross roads as they move about the Fermi site, possibly for thermoregulation, and that the increased traffic anticipated from operation of Fermi 3 could increase the risk of mortality for the eastern fox snake. However, Detroit Edison has proposed monitoring and mitigation efforts to reduce the risks to the eastern fox snake posed from operations (Detroit Edison 2012c). See Section 5.3.1.3 for additional discussion, including a discussion of proposed mitigation measures.

5.3.1.2 Terrestrial Resources – Transmission Lines

Electricity transmission systems have the potential to affect terrestrial ecological resources through corridor maintenance, bird collisions with transmission lines and towers, and electromagnetic fields (EMFs) (NRC 1996).

Vegetation

Operations impacts in the transmission line corridor, including the western 10.6 mi, would be mainly limited to vegetation maintenance. Maintenance of the corridor would be conducted in accordance with ITC*Transmission's* Transmission Vegetation Management Plan, which was developed in compliance with the North American Electric Reliability Council Reliability Standard FAC-003-1 – Transmission Vegetation Management Program. The work would likely consist of periodic removal of trees from uplands and wetlands to provide adequate clearance from the lines. Pesticides and herbicides may also be used selectively as needed to maintain the corridor. Selective removal of undesirable species through cutting by hand and/or by mowing, as needed, would likely be the practice routinely used; this would encourage the growth of vegetation types that provide low-growing ground cover, erosion control, treatment of invasive species, and wildlife habitat. Vegetation management in wetlands, including cutting or removal of woody vegetation, would indefinitely maintain the wetland in a shrub/scrub or emergent state.

The corridor would typically be inspected by helicopter and ground-patrolled periodically to ensure that the corridor is in proper condition for safe operation of the transmission line (Detroit Edison 2011a). There would be occasional vehicular traffic in the corridor for maintenance purposes, which could result in only minimal impacts on vegetation and soils and minor amounts of soil erosion within the immediate area of the transmission line corridor. Impacts on natural vegetation during maintenance of the Milan Substation would be minimal. Where access is needed to sensitive areas along the corridor, such as wetlands, matting would be used to avoid soil disturbance and minimize damage to plants.

Wildlife

Impacts of operating the transmission line system on wildlife (e.g., bird collisions and habitat loss) are expected to be minor. Section 4.5.6.2 of the GEIS for license renewal (NRC 1996) provides a thorough discussion of the topic and concludes that bird collisions associated with the operation of transmission lines do not typically cause long-term reductions in bird populations. The same document also concludes that the impacts on wildlife populations from continued ROW maintenance are not typically significant (NRC 1996).

The overall effect of operation of the new line on wildlife is expected to be minor because maintenance activities would be limited and because most of the corridor has been previously developed and, in less-maintained areas, there are existing disturbances such as farming, neighboring residences, and roadways. Because of these local conditions, it is expected that ITC*Transmission* would not implement any new wildlife management practices within the corridor.

Operation of the expanded substation at Milan would be expected to have minimal effect on wildlife in the area because area wildlife has adjusted to the existing substation, the substation expansion is confined to a relatively small area, and maintained grass and cropland habitat in the surrounding vicinity are already of low quality. The review team concludes that the overall impacts of transmission line maintenance, including maintence activities in the corridor, on terrestrial resources would be minimal.

Impact of Electromagnetic Fields on Flora and Fauna

EMFs are unlike other agents that have an adverse impact (e.g., toxic chemicals) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle, according to the NRC's GEIS conclusions (NRC 1996). As discussed in the GEIS, a careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures. Thus, the conclusion presented in the GEIS was that the impacts of EMFs on terrestrial flora and fauna were not significant at operating nuclear power plants, including transmission line systems with variable numbers of power lines. On this basis, the review team concluded that the incremental EMF impacts posed by possible additions of new power lines for Fermi 3 would be minimal.

5.3.1.3 Important Terrestrial Species and Habitats

This section discusses the potential impacts of operating Fermi 3 on Federally and State-listed species and on other important species and/or habitats (including wetlands) as defined by the

NRC (NRC 2000a). To meet responsibilities under Section 7 of the U.S. Endangered Species Act of 1973 (ESA), the review team prepared a Biological Assessment (BA) that evaluated potential impacts of preconstruction, construction, and operations on Federally listed threatened or endangered aquatic and terrestrial species (Appendix F).

Important Terrestrial Species – Fermi Site and Vicinity

The Federally and State-listed species that could occur on the Fermi site and nearby in Monroe County are described in Section 2.4.1.3 (Table 2-8). None of the Federally listed species identified by FWS are likely to be affected by operation of the Fermi facility. Operation of Fermi 3 would result in effects on wildlife similar to operation of Fermi 2, although the effects would occur over a wider area. The bald eagle (*Haliaeetus leucocephalus)* has adapted to the presence and operation of Fermi 2. Fermi 3 would be located farther from the lakeshore from where eagle nests had been located prior to January 2011. Operation of the Fermi 3 project is not expected to have impacts on Indiana bats (*Myotis sodalis*). The American lotus (*Nelumbo lutea*) appears to be thriving on wetlands on the Fermi site, but operation of Fermi 3 would not alter conditions for that species.

The eastern fox snake is State-listed as threatened and has been observed on the Fermi site in several locations at several times in recent years (Detroit Edison 2009b, 2011a). During operation of Fermi 3, increased traffic from a larger workforce would present the potential for increased impacts on this species. Detroit Edison has prepared Habitat and Species Conservation Plans addressing mitigation for possible eastern fox snake impacts during building and operations (Detroit Edison 2012b, c). The plans make provisions for mitigating impacts from initial development of the Fermi 3-related facilities and for mitigating potential impacts from operations, such as higher rates of mortality due to increased traffic.

An Endangered Species Specialist for the Michigan Department of Natural Resources (MDNR) reviewed Detroit Edison's proposed Fermi 3 Construction Habitat and Species Conservation Plan and Fermi 3 Operational Conservation and Monitoring Plan for the eastern fox snake. MDNR issued a letter to Detroit Edison on April 6, 2012, stating that the plans adequately address concerns for potential threatened and endangered species at the Fermi site (Sargent 2012). The plans include provisions for monitoring of the eastern fox snake population during and after building of Fermi 3, which would help determine whether the impacts from increased traffic warranted additional mitigation measures. An example of proposed mitigation for traffic mortality impacts is installing fences along roads to serve as barriers to the snake and reduce the likelihood of snakes being hit by vehicles. Monitoring and implementing any mitigation measures required by MDNR, as discussed in Section 5.3.1.1, could potentially reduce the effects on the eastern fox snake from project operation to minimal levels.

Operation of Fermi 3 would subject habitat and individual animals on the site to impacts similar to those that currently result from operation of Fermi 2 and related facilities, with the exception that onsite automotive traffic from employees would approximately double over current levels when Fermi 3 goes into operation. With implementation of the Operational Conservation and Monitoring Plan for the eastern fox snake, increased traffic would not cause new impacts on Federally or State-listed species. Game species such as white-tailed deer (*Odocoileus virginianus*) and a variety of waterfowl species are common inhabitants of the Fermi site. Increased noise levels near the cooling towers might cause these wildlife species to avoid the immediate area, and increased activity and traffic might also cause wildlife to avoid the habitats immediately adjacent to Fermi 3. Drift, fogging, and icing are expected to cause at most negligible impacts on terrestrial habitats and would not be expected to affect important game species. Although game might avoid habitats adjacent to the new facilities during operation, the Fermi property and surrounding landscape contain large expanses of terrestrial habitat to which these species could relocate. Thus, operational impacts on commercially and recreationally important species would be minimal and no mitigation would be warranted.

Important Terrestrial Habitats – Fermi Site and Vicinity

No areas of the Fermi property are designated as critical habitat for listed wildlife species. Other important habitats present on the property are discussed below.

The Fermi site includes wetlands, including emergent, forested, and shrub/scrub wetlands. Impacts on wetlands by preconstruction and construction are addressed in Section 4.3.1.3. Wetlands would not be adversely affected by Fermi 3 operations. One other important habitat on the Fermi site is a 29-ac restored prairie area in the onsite transmission line corridor along the north side of the existing facility approach road. As noted in Section 4.3.1.3, the restored prairie area would be permanently converted to use by Fermi facilities, and hence would not remain at the time of Fermi operations. The plan to convert the prairie restoration area resulted from the need to minimize impacts on high-quality forested wetlands.

Approximately 656 ac of the Fermi site is managed as part of the DRIWR. Much of DRIWR land consists of coastal wetlands, which are common in the areas surrounding the Great Lakes. Great Lakes coastal wetland systems contain morphological components of both riverine and lacustrine systems and can be described as “freshwater estuaries” (Detroit Edison 2011a). Much of the area included in the DRIWR is forested, emergent, or scrub/shrub wetland. Building the Fermi project would permanently convert approximately 19 ac of the refuge (see Section 4.3.1), which would reduce the refuge area on the Fermi site to approximately 637 ac.

Operation of Fermi 3 is not anticipated to create conditions that would negatively affect the DRIWR or other important habitats on the Fermi site or offsite. Stormwater runoff may increase due to an increase in impervious surfaces, but increased flows would be directed primarily to Lake Erie (see Section 5.2). Stormwater flows would be adequately controlled by design considerations and by the SWPPP contained within the NPDES permit. Adherence to the NPDES permit will ensure that any increase in sediment loading to Swan Creek and/or Lake Erie is adequately controlled to minimize water quality impacts. Only Lake Erie would be used for source water (Detroit Edison 2011a). Other sources of surface water and groundwater would not be used. As discussed in Section 5.3.1.1, salt deposition would be far below the levels that could cause damage to plants or soils. Operation of Fermi 3 is expected to have only minimal impact on any of these important habitats.

Important Terrestrial Species – Transmission Lines

Detroit Edison contacted the FWS and MDNR requesting information on known occurrences of Federally and State-listed protected species in the project vicinity (Detroit Edison 2011a). The review team has also researched Federal and State Web sites for information on Federal and State threatened and endangered species. Information available to the review team is summarized in Section 2.4.1.3. Based on information obtained from Web sites maintained by the FWS, there is currently no designated critical habitat for species listed under the ESA along the transmission line route (FWS 2010). According to information provided by ITC*Transmission* to Detroit Edison (Detroit Edison 2010b), ITC*Transmission* maintains access to a database of known occurrences of Federal and State threatened and endangered species obtained from the Michigan Natural Features Inventory (MNFI) to identify locations where seasonal constraints or other regulatory conditions affect vegetation management activities in habitats occupied by rare species. ITC*Transmission* also informed Detroit Edison that it operates in accordance with these seasonal constraints to the degree practicable.

Federally Listed Species

The FWS has identified four terrestrial species that are Federally listed as threatened or endangered with the potential to occur in Monroe, Washtenaw, and Wayne Counties, the counties through which where the new transmission line would be constructed. The species include the Indiana bat, the Karner blue butterfly (*Lycaeides melissa samuelis*), Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii*), and the eastern prairie fringed orchid (*Platanthera leucophaea*) (FWS 2009). Although the impacts of transmission line operation on Federally listed species are likely to be minimal, final corridor location information would have to be provided to FWS prior to ground disturbance for the transmission line in support of ITC*Transmission's* application for a CWA Section 404 wetlands permit. Site-specific biological surveys may also need to be conducted in coordination with threatened and endangered species review by the FWS.

State-Listed Species

The MNFI lists nearly 100 terrestrial plant and animal species listed by the State of Michigan as either endangered or threatened (see Table 2-9). As discussed above with respect to Federally listed species, however, final corridor location information would have to be provided to the MDNR prior to building the transmission line. Site-specific biological surveys would also need to be conducted in coordination with the state species review by the MDNR. Impacts of transmission line operation on State-listed species are likely to be minimal as long as

ITC*Transmission* adheres to all conditions that USACE and/or MDEQ may place on operations and management in the wetland permitting process.

Wetlands and Floodplains

Only minimal impacts on wetlands and floodplains are anticipated from operation of the new transmission lines and Milan Substation. Vegetation management actions may include, but are not limited to, pruning, wall trimming, tree removal, mowing, and herbicide application. Work would be conducted under the direct supervision of appropriately qualified personnel. Wetlands within the corridor that have the potential to regenerate in forest vegetation are expected to be manually cleared of woody vegetation periodically for line safety clearance, thereby being kept in a low-growing scrub/shrub or emergent wetland state. Access to these areas for maintenance would likely be on foot or by the use of matting for vehicle equipment, so as not to disturb the soil. Detroit Edison expects that ITC*Transmission* would minimize the use of pesticides in wetland portions of the transmission corridor (Detroit Edison 2010b). The review team therefore expects potential impacts on wetlands from the operation of the transmission line system to be minimal.

5.3.1.4 Terrestrial Monitoring during Operations

The Conservation and Monitoring Plan for operations proposed by Detroit Edison and accepted by MDNR (Detroit Edison 2012c) calls for periodic monitoring for eastern fox snake mortality during the operations period. There appears to be no need for other terrestrial monitoring activities related to operation of Fermi 3.

5.3.1.5 Potential Mitigation Measures for Operation-Related Terrestrial Impacts

Except for impacts on eastern fox snake habitat, impacts on terrestrial ecosystems resulting from operation of the proposed Fermi 3 facilities are expected to be minor, and no mitigation appears to be warranted. As for impacts to the eastern fox snake, Detroit Edison has developed a Conservation and Monitoring Plan for operations that has been approved by MDNR (Detroit Edison 2012c). The staff expects that the risk of possible mortality of eastern fox snakes would be mitigated according to Detroit Edison’s Conservation and Monitoring Plan (Detroit Edison 2012c), as incorporated into a State endangered species permit issued by the MDNR.

5.3.1.6 Summary of Operational Impacts on Terrestrial Resources

Given the information provided in the ER (Detroit Edison 2011a), the Habitat and Species Conservation Plans for operating activities (Detroit Edison 2012b), Detroit Edison’s responses to RAIs, interactions with State and Federal agencies, the public scoping process, and the review team’s independent assessment, the review team has concluded that impacts from operations on terrestrial resources would be SMALL to MODERATE. The potential for MODERATE impacts is limited to possible adverse effects on the eastern fox snake resulting from increased traffic on site roadways during operations. The staff's evaluation of the potential impacts on the eastern fox snake recognizes the potential for mitigation measures proposed by Detroit Edison (Detroit Edison 2012c) and approved by the MDNR to significantly reduce impacts on that species, thereby leading to SMALL impacts, but acknowledges the possibility of MODERATE impacts if proposed mitigation is not implemented as described in their plan. Additional mitigation measures beyond those identified in Section 5.3.1.5 would not be warranted.

5.3.2 Aquatic Impacts Related to Operation

This section discusses the potential impacts of operation of the proposed Fermi 3 on the aquatic ecosystems in water bodies on or adjacent to the Fermi site, including Lake Erie, and potential impacts on aquatic ecosystems from the operation and maintenance of associated transmission lines. Impacts on aquatic resources from operation of Fermi 3 would primarily be associated with withdrawal and consumption of water for cooling, discharge of cooling water, maintenance dredging, discharge of wastewater, and stormwater runoff. Transmission line impacts would primarily be associated with erosion from maintenance vehicles and other equipment and the effects of vegetation management activities on nearby water bodies.

5.3.2.1 Aquatic Resources – Site and Vicinity

This subsection evaluates impacts on aquatic resources that could occur on or in the vicinity of the Fermi site during operation of Fermi 3, including those in Lake Erie, the overflow canals, the Quarry Lakes, Swan Creek, and Stony Creek.

Lake Erie

During the operation of Fermi 3, aquatic habitats and biota in Lake Erie could be affected by cooling water withdrawal and consumption, discharge of heated effluent from the cooling water system, maintenance dredging, discharge of wastewater, and stormwater runoff at the Fermi site.

<u>Water Withdrawal and Consumption</u>

All cooling water for the operation of Fermi 3 would be withdrawn from Lake Erie, and impacts associated with operation of the water intake system would be limited to aquatic resources within Lake Erie. For aquatic resources, the primary concerns are related to the amount of water withdrawn and the amount of water consumed through evaporation and the potential for organisms to be impinged on the intake screens or entrained into the cooling water system. Impingement occurs when organisms are trapped against the intake screens by the force of the water withdrawn by the Cooling Water Intake Structure (CWIS) (NRC 1996). Impingement can result in starvation and exhaustion, asphyxiation (water velocity forces may prevent proper gill movement or organisms may be removed from the water for prolonged periods of time), and physical damage (NRC 1996). Entrainment occurs when organisms are small enough or fragile enough to be drawn through the intake screens into the proposed Fermi 3 cooling system. Organisms that become entrained are normally relatively small benthic, planktonic, and nektonic (organisms in the water column) forms, including early life stages of fish and shellfish, which often serve as prey for larger organisms (NRC 1996). As entrained organisms pass through the CWIS into the proposed plant's cooling system, they would be subject to mechanical, thermal, and toxic stresses, and survival is unlikely.

A number of factors, such as the type of cooling system, the design and location of the intake structure, and the amount of water withdrawn from the source water body greatly influence the degree to which impingement and entrainment affect aquatic biota. Detroit Edison has proposed that a closed cycle recirculating cooling system comprising a cooling basin and natural draft cooling tower be used for Fermi 3. Water loss from the cooling towers through evaporation, drift, and blowdown would be made up by water from Lake Erie. Closed-cycle recirculating cooling water systems can, depending on the quality of the makeup water, reduce water use by 96 to 98 percent of the amount that the facility would use if it employed a once-through cooling system (NRC 1996). This significant reduction in water withdrawal rate results in a substantial reduction in impingement and entrainment.

The intake design through-screen velocity is another factor that greatly influences the rate of impingement of fish and shellfish at a facility. In general, the higher the through-screen velocity, the greater the number of fish impinged. The EPA has established a national standard for the maximum design through-screen velocity of no more than 0.5 fps (66 FR 65256). The EPA determined that species and life stages evaluated in various studies could endure a velocity of 1.0 fps and then applied a safety factor of two to derive the threshold of 0.5 fps. Detroit Edison has stated that the proposed intake structure would be designed to have a through-screen velocity of 0.5 ft/s or less under all operating conditions (Detroit Edison 2011a). The resulting low through-screen velocity would reduce the probability of impingement because most fish can swim against such low flows to avoid or swim off of intake screens. Fish that enter the intake bay would be able return to the lake the same way they entered.

Under the proposed design, the cooling water intake for Fermi 3 would include a trash rack, travelling screens, and a fish return system. The trash rack, equipped with a trash rake, would be positioned at the inlet to the pump house structure to capture larger debris; trash collected from the trash racks would be disposed of. Three dual-flow traveling screens (mesh size 3/8 in.) would be arranged side by side behind the trash rack to further prevent debris from entering the pump house and to collect aquatic organisms large enough to be caught on the screens. Aquatic organisms would first be washed from the traveling screens using a low-pressure water spray followed by a high-pressure wash to remove remaining debris. Strainers would be in place to collect the organisms washed from the screens, and a strainer backwash would then be used to direct those organisms back to Lake Erie via a fish return system in a manner compatible with the limits of the applicable NPDES permit (Detroit Edison 2011a). With such a system in operation, most impinged fish would be returned alive to Lake Erie. The point of return for the fish return system would be outside the zone of influence of the intake bay (Detroit Edison 2011a).

The EPA indicated (66 FR 65256) that the optimal design requirement for the intake location is to place the inlet of the CWIS in an area of the source water body where impingement and entrainment of organisms are minimized by locating intakes away from areas with the potential for high productivity. The existing intake bay for Fermi 2 is formed by two rock groins that extend approximately 600 ft into Lake Erie. The intake bay is periodically dredged to maintain appropriate operating conditions; such dredging would limit the potential for the intake bay to support high-productivity habitat. The intake bay faces the open waters of Lake Erie; substrate outside the intake bay area consists of packed clay and sand, along with areas of soft sediments that would provide limited structure that could be used for cover or spawning by fish (AECOM 2009a; Detroit Edison 2010c). During surveys conducted from 2008 to 2009, fish numbers, fish species counts, and the density of benthic macroinvertebrates were found to be lower in the vicinity of the intake bay than in another nearby Lake Erie sampling location (AECOM 2009a). On this basis, the area of Lake Erie in the vicinity of the intake bay is unlikely to provide habitat with high levels of productivity. The intake structure for Fermi 3 would be located within the existing Fermi 2 intake bay.

Historical impingement and entrainment data were collected at the Fermi 2 intake over a 1-year period from October 1991 to September 1992 (Lawler, Matusky, and Skelly Engineers 1993). During the study, a total of 1944 fish representing 23 fish species and 9 families were collected during 53 sampling events. This resulted in an estimated annual impingement of 13,699 fish with a total biomass of approximately 725 lb. The dominant species impinged was gizzard shad (*Dorosoma cepedianum*), accounting for 71 percent of the total numbers of fish observed. Other prevalent species in the impingement samples included white perch (*Morone americana*, 7.1 percent), rock bass (*Ambloplites rupestris*, 3.3 percent), and freshwater drum (*Aplodinotus grunniens*, 3.2 percent). Ten of the 23 species impinged were considered sport fish species. Impingement rates varied seasonally, with greater numbers of fish impinged during the winter and fall and lesser numbers during the summer. The greater numbers of fish during the winter were represented primarily by gizzard shad (Lawler, Matusky, and Skelly Engineers 1993), which experience increased mortality when exposed to cold water temperatures (Bolsenga and Herdendorf 1993).

Entrainment of fish eggs and larvae was sampled at two different locations downstream of the two traveling screens for Fermi 2. A total of 13,547 eggs and larvae representing 15 fish species and 10 families were collected and it was estimated that approximately 2.9 million larvae and 72,000 eggs were entrained annually by Fermi 2 operations (Lawler, Matusky, and Skelly Engineers 1993). The dominant species collected were gizzard shad (59 percent), spottail shiner (*Notropis hudsonius*, 18 percent), yellow perch (*Perca flavescens*, 7 percent), and emerald shiner (*Notropis atherinoides*, 5 percent). Entrainment rates varied seasonally, with greater numbers collected during June and July and lesser numbers collected from October through February. Gizzard shad eggs and larvae made up the highest proportion of the entrained specimens during the summer, which corresponds with their peak spawning periods (Lawler, Matusky, and Skelly Engineers 1993).

A second impingement study, conducted from 2008 to 2009 at the Fermi 2 intake (AECOM 2009a), was summarized in Section 2.4.2.1 (Tables 2-10 and 2-11). Overall, it was estimated that 3102 individual fish representing 15 species were impinged in the study. Impingement information was not collected in April 2009 because of a large amount of debris in the sampling area. Thus the total number of fish impinged during the year may have been underestimated by several hundred individuals (AECOM 2009a). Similar to the previous study, samples collected from the 2008–2009 impingement study also contained high proportions of gizzard shad (35 percent) and white perch (10 percent) (Table 2-11). However, the recent study had a higher proportion of emerald shiner than the 1991–1992 study (34 percent versus 3 percent). In addition, the recent study identified the round goby (*Neogobius melanostomus*), a nonnative invasive species (Section 2.4.2.3) not collected during the earlier study. Based on the similarities in operational water withdrawal rates, locations of the intakes, intake designs, and flow-through velocities for Fermi 2 and Fermi 3, impingement rates are expected to be similar. The applicant determined the number of fish impinged per unit volume of water for Fermi 2 based on the impingement study and operational flow rates (AECOM 2009a). They then scaled the impingement losses to the expected flow rates for Fermi 3. The results of this analysis are presented in Table 5-5.

Entrainment sampling conducted from 2008 to 2009 (AECOM 2009a) at the Fermi 2 intake identified eggs and larvae from 13 fish species (Table 2-10). In comparison, studies conducted from 1991 to 1992 identified eggs and larvae of 28 species (Lawler, Matusky, and Skelly Engineers 1993). Overall, it was estimated that 62,566,649 fish (3,940,823 eggs and 58,625,825 larvae) were entrained at the Fermi 2 intake during the 2008–2009 study (AECOM 2009a). Compared to the 1991–1992 study, a comparable proportion of gizzard shad eggs and larvae, but a smaller proportion of white perch larvae, were entrained during the 2008–2009 study period. In addition, the 2008–2009 study found higher proportions of emerald shiner, bluntnose minnow (*Pimephales notatus*) and yellow perch in entrainment samples. From 1991 to 1992, lake whitefish (*Coregonus clupeaformis*; 2 percent of total entrainment) were collected during late March and April 1992, but no lake whitefish eggs or larvae were collected in the 2008–2009 study. The round goby was not collected during the 1991–1992 entrainment study, but accounted for more than 2 percent of the individual fish entrained by Fermi 2 from 2008 to 2009. Based on the entrainment rates for Fermi 2 from the AECOM (2009a) study and the maximum estimated intake water volume for Fermi 3, it was estimated that approximately 55 million fish eggs and larvae would be entrained annually by Fermi 3 (Table 5-6). Many of the species observed during entrainment studies are species that exhibit high fecundity and produce large numbers of eggs and larvae (Table 5-7) or that are common forage species (e.g., gizzard shad, emerald shiner, bluntnose minnow, brook silverside [*Labidesthes sicculus*]).

Table 5-5. Estimated Numbers of Fish that Would Have Been Impinged by the Proposed Fermi 3 Cooling Water Intake with the Intake Pumps at Maximum Capacity Based on Sampling at the Fermi 2 Intake from August 2008 through July 2009[(a)]

Common Name	Scientific Name	Jan	Feb	Mar	Apr[(b)]	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Percentage of Total
Gizzard shad	*Dorosoma cepedianum*	65									61	159	962	1247	35.0
Emerald shiner	*Notropis atherinoides*	97	87	589	295				25	24	30		64	1211	33.9
White perch	*Morone americana*		29	98	49				49	24	30	32	32	343	9.6
Bluegill	*Lepomis macrochirus*	32	29	131	66								32	290	8.1
Round goby	*Neogobius melanostomus*	32			15	30			25	24				126	3.5
Smallmouth bass	*Micropterus dolomieu*			33	17				25					75	2.1
Spottail shiner	*Notropis hudsonius*				15	30		26						71	2.0
Banded killifish	*Fundulus diaphanous*										30			30	0.8
Largemouth bass	*Micropterus salmoides*										30			30	0.8
Brook silverside	*Labidesthes sicculus*								25					25	0.7
Bluntnose minnow	*Pimephales notatus*									24				24	0.7
Channel catfish	*Ictalurus puctatus*									24				24	0.7
Freshwater drum	*Aplodinotus grunniens*						24							24	0.7
Green sunfish	*Lepomis cyanellus*									24				24	0.7
Rock bass	*Ambloplites rupestris*									24				24	0.7
Total		**226**	**145**	**851**	**456**	**60**	**24**	**26**	**149**	**168**	**181**	**191**	**1090**	**3567**	**100.0**

(a) Calculations based on measured impingement rates from August 2008 through July 2009 at the Fermi 2 intake (AECOM 2009a). Impingement rates for each species computed for unit volume of water and then estimated for Fermi 3 based on projected maximum withdrawal capacity of 32,264 gpm.

(b) Measured impingement values for April were unavailable because heavy debris prevented sample collection. April impingement values were estimated by averaging the estimates for March and May.

Table 5-6. Estimated Numbers of Fish Eggs and Larvae (in Millions) that Would Have Been Entrained by the Proposed Fermi 3 Cooling Water Intake with the Intake Pumps at Maximum Capacity Based on Sampling at the Fermi 2 Intake from August 2008 through July 2009[(a)]

		2008						2009								
Common Name	**Scientific Name**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec[(b)]**	**Jan[(b)]**	**Feb[(b)]**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Total**	**% of Total**
Gizzard shad	*Dorosoma cepedianum*	0.05										1.42	0.95	22.69	25.11	45.7
Emerald shiner	*Notropis atherinoides*	0.87	1.51								0.20	2.92	0.73	3.24	9.46	17.3
Bluntnose minnow	*Pimephales notatus*		0.06								0.03	4.77	0.45		5.31	9.7
Yellow perch	*Perca flavescens*										0.25	4.02	0.45		4.72	8.6
Unidentified spp.	–				4.23										4.23	7.7
Freshwater drum	*Aplodinotus grunniens*													1.91	1.91	3.5
Round goby	*Neogobius melanostomus*	0.05	0.41	0.11								0.75	0.17	0.06	1.55	2.8
Bigmouth buffalo	*Ictiobus cyprinellus*											1.24	0.34		1.58	2.9
Channel catfish	*Ictalurus punctatus*	0.36													0.36	0.7
Largemouth bass	*Micropterus salmoides*										0.11	0.09			0.20	0.4
Sunfish sp.	*Lepomis* spp.											0.14			0.14	0.3
White perch	*Morone americana*	0.10													0.10	0.2
Unknown Centrarchids	Family Centrarchidae												0.06		0.06	0.1
Brook silverside	*Labidesthes sicculus*											0.06			0.06	0.1
Total		**1.4**	**2.0**	**0.1**	**4.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.6**	**15.4**	**3.1**	**27.9**	**54.7**	**100.0**

(a) Calculations based upon entrainment rates measured from July 2008 through July 2009 at the Fermi 2 intake (AECOM 2009a) and a projected maximum withdrawal capacity of 32,264 gpm for Fermi 3.

(b) Entrainment sampling was not conducted during December, January, and February. Estimates are based on samples collected during November and March. The numbers of eggs and larvae are expected to be low during these months because it is outside the normal spawning period for most Lake Erie fish species (AECOM 2009a).

Table 5-7. Reported Fecundity of Fish Species Identified during the 2008–2009 Entrainment Study

Common Name	Estimated Annual Entrainment[(a)]	Reported Fecundity (eggs per female)	Source
Gizzard shad	25,106,522	22,000–544,000	Bodola (1965)
Emerald shiner	9,461,244	868–8733	Texas State University (2010)
Bluntnose minnow	5,306,690	1112–4195	Gale (1983)
Yellow perch	4,720,370	12,641–135,848	Sztramko and Teleki (1977)
Freshwater drum	1,909,922	127,000	Bur (1984)
Round goby	1,546,530	84–606	MacInnis and Corkum (2000)
Bigmouth buffalo	1,579,402	Up to 400,000	ODNR (2007)
Channel catfish	357,910	4000–100,000	Bolsenga and Herdendorf (1993)
Largemouth bass	198,706	5000–43,000[(b)]	MDNR (2004)
White perch	102,260	64,480–388,736	Bur (1986)
Brook silverside	57,862	73–785	Eakins (2010)

(a) Estimated entrainment based on measured impingement rates from August 2008 through July 2009 at the Fermi 2 intake and a projected maximum withdrawal capacity of 32,264 gpm for Fermi 3 (AECOM 2009a).
(b) Based on the numbers of eggs per nest (MDNR 2004).

Based on the planned low through-screen intake velocity, the use of closed-cycle cooling, the location and design of the intake bay, and the historic low impingement rates during operations of the existing Fermi 2, the review team concludes that impacts on fish populations from impingement during Fermi 3 operations would be minor. Removing impinged biota from the screens and operating the fish return system would further reduce this impingement impact by returning most impinged fish alive to Lake Erie. Based on the small proportion of water that would be withdrawn from Lake Erie relative to the volume of water in the western basin, the use of closed-cycle cooling to reduce water withdrawals, the location of the intake bay away from sensitive or productive habitats, the historic entrainment rates for Fermi 2, and the relatively high fecundities exhibited by the species that experience the highest entrainment rates, the review team concludes that impacts on fish populations from entrainment for Fermi 3 would also be minor. The EPA 316(b) Phase I regulations established location- and capacity-based limits on proportional intake flow. The regulation states that "for lakes or reservoirs, intake flow may not disrupt natural thermal stratification or turnover patterns (where present) of the source water body." Because of the large quantity of water in the western basin of Lake Erie and the relatively small hydraulic zone of influence of the intake withdrawal, the review team has determined that the operation of Fermi 3 would have no detectable effect on thermal stratification in Lake Erie.

Cooling Water Discharge System

Cooling tower blowdown from Fermi 3 would be discharged directly into Lake Erie via a three-port diffuser system located approximately 1300 ft from shore. The preliminary design of the diffuser assumes that the ports would be elevated 1.6 ft above the lake bed and angled at 20 degrees above the horizontal pointing to the east away from shore. Sections 3.2.2.2 and 5.2.3.1 discuss the location, design, and operation parameters for the discharge structure. This section evaluates potential thermal, chemical, and physical impacts on the Lake Erie aquatic ecosystem from the operation of the cooling water discharge system.

Thermal Impacts. Potential thermal impacts on aquatic organisms could include heat stress, cold shock, and the creation of favorable conditions for invasive species.

Heat Stress. Thermal conditions influence the health of aquatic ecosystems by influencing water chemistry (e.g., dissolved oxygen levels) and an array of ecological processes such as feeding rate, metabolic rate, growth, reproduction, development, distribution, and survival. Aquatic biota are often able to persist (e.g., grow, reproduce, and survive) under a range of thermal conditions. While many species have similar temperature tolerances, optimal growth and survival are linked to optimal thermal conditions that are driven by species-specific requirements (Kellogg and Gift 1983).

The thermal tolerance for aquatic organisms is defined in different ways. Some definitions relate to the temperature that causes fish to avoid the thermal plume; other definitions relate to the temperature that fish prefer for spawning; and others relate to the temperatures (upper and lower) that may cause mortality. Spatially, thermal pollution may exist at the local site level, or it may include larger extents (i.e., lake or watershed). Temporally, conditions resulting in water temperatures that exceed ambient levels may be more pronounced during certain time periods (i.e., winter). Finally, the consequences of thermal pollution within aquatic ecosystems may be confined to individual species and, depending on ecosystem conditions, may include a population-level response (Coutant 1976).

Section 5.2.3.1 describes the estimated cooling water discharge rates and temperatures that would occur as a result of the operation of Fermi 3 and evaluates the characteristics of the thermal plume that would result, including the likely increases in ambient water temperature and the dimensions of the thermal plume. As described in Section 5.2.3.1, MDEQ would specify allowable characteristics of the thermal plume through the NPDES permitting process. Thermal plume simulation modeling was conducted by Detroit Edison (2011a) and independently confirmed by the review team. Based on the expected volumes and water temperatures of cooling water blowdown discharged from Fermi 3, the estimated maximum extent of the thermal plume (i.e., where ambient water temperatures would be increased by 3°F or more) would encompass an area of no more than approximately 55,300 ft^2 (1.3 ac) during any period of the year (Detroit Edison 2011a). It was also estimated that the portion of the plume that would be equal to or exceed the temperature standard established by MDEQ for Lake Erie for each month would encompass an area of 188 ft^2 or less during any period of the year (Detroit Edison 2011a). MDEQ would define the allowable area and characteristics of the thermal plume mixing zone in the NPDES permit based, in part, on the areas where temperatures would be elevated. Based on these results, it is concluded that the area of the thermal plume would be small relative to the large extent of similar open water habitat in the immediate area. Because of the small area affected by the thermal plume, it is unlikely that fish migration or spawning efforts would be significantly hindered; however, some fish species may avoid the area altogether in the summer when maximum lake temperatures are reached. During winter months, the thermal plume may act as an aggregation point for some species that prefer warmer water temperatures (e.g., gizzard shad).

The largest increases in ambient water temperatures would occur during wintertime when ambient lake water temperatures decline. Maximum absolute lake water temperatures would occur in summer months and could result in water temperatures approaching the reported critical thermal maximum for some cool or coldwater fish species in the immediate vicinity of the discharge diffusers. Ambient water temperatures during summer months have been documented to exceed 76°F (Detroit Edison 2011a). However, even during such periods, it is estimated that the area that would exceed ambient temperatures by 3°F or more would be 188 ft^2 or less based on modeling for the thermal plume (Detroit Edison 2011a), and most fish species would be capable of detecting and avoiding the affected area; consequently, it is concluded that impacts on populations of aquatic organisms would be minor.

Based on the foregoing evaluation, the review team concludes that the impacts of heat stress on Lake Erie fish populations from the discharge of cooling water blowdown from Fermi 3 would be minor and additional mitigation, aside from compliance with conditions established in NPDES permits developed by MDEQ, would not be warranted.

Cold Shock. Another factor related to thermal discharges that may affect aquatic biota is cold shock. Cold shock occurs when aquatic organisms that have been acclimated to warm water, such as fish in a power plant's thermal plume, are exposed to a sudden temperature decrease that exceeds their ability to acclimate and results in mortality. This sometimes occurs when power plants shut down suddenly in winter. As described above, some species with particular temperature preferences (e.g., gizzard shad) would be likely to aggregate in the areas of warmer water near the Fermi 3 discharge in Lake Erie. Overall, it is anticipated that cold shock mortality would be rare because sudden power plant shutdowns are infrequent, and because the thermal plume would encompass a relatively small area, the numbers of individual fish that could be affected by such events would not significantly affect populations of fish species in Lake Erie. In the NPDES permit for Fermi 3 (or a combined NPDES permit for the Fermi site), MDEQ could require gradual reduction of effluent discharge to Lake Erie during winter months to reduce the potential for fish mortality due to cold shock. The existing NPDES permit for the Fermi site requires that cessation of cooling water inputs to Lake Erie occur gradually during the winter months in order to avoid fish mortality from cold shock, and Detroit Edison reported that there have been no observations of fish kills during wintertime shutdowns for Fermi 2. Based on the foregoing, the review team recommends that if a shutdown of Fermi 3 were planned during the winter months, the discharge of cooling water should be gradually reduced as mitigation. Assuming the implementation of this mitigation measure, the review team concludes that the thermal impacts on fish populations due to cold shock would be minor

Chemical Impacts. Section 5.2.3.1 describes the chemical additions that would be made to the cooling system water both prior to and after use for cooling. Sodium hypochlorite would be added to the intake water as a biocide/algaecide to control the proliferation of organisms in the cooling system, including zebra and quagga mussels. Additional treatment, including chlorination or thermal shock, could be used to control invasive mussels if deemed necessary. Additional chemicals would be used to control corrosion and scale deposits, and to disperse sediment (if needed). Chlorine would be removed from cooling water (i.e., dehalogenated) with sodium bisulfate before the water is discharged into Lake Erie. The use of sodium bisulfate for dehalogenation avoids the use of phosphorus-containing compounds (e.g., phosphoric acid) that could contribute to nutrient enrichment and development of algal blooms in Lake Erie (Detroit Edison 2011a).

The concentrations of chemicals in the effluent from Fermi 2 are regulated by an existing NPDES permit from MDEQ. The chemical concentrations at the thermal discharge outfall for Fermi 2 have consistently complied with the permitted NPDES limits, and no impacts on the aquatic ecology of Lake Erie from Fermi 2 discharges have been reported. Effluent limits identified in the NPDES permit for Fermi 3 will be developed in accordance with EPA ambient water quality criteria. Ambient water quality criteria were developed on the basis of numerous toxicity studies to aid in determining appropriate limit levels to prevent facility effluents from harming natural resources, including aquatic biota. The levels identified in the existing NPDES permit for Fermi 2 are set well below documented lethal levels for indicator organisms to ensure protection of organisms in the receiving water body (Detroit Edison 2011a).

The chemical concentrations in Fermi 3 discharges (1) would be expected to be relatively low, (2) would be similar to those in Fermi 2 discharges, and (3) would be established and controlled through the NPDES permitting process. In addition, Detroit Edison has stated that it would not use phosphorus-containing corrosion and scale inhibitors for Fermi 3, replacing them with two non-phosphorus-containing water treatment chemicals (Detroit Edison 2010c). On this basis, the review team concludes in Section 5.2.3.1 that the impacts of Fermi 3 discharges on water quality would be SMALL. Similarly, it is concluded that the impacts on aquatic biota from the chemical concentrations in the proposed Fermi 3 discharge would be minor, and no additional mitigation is warranted.

Physical Impacts. Physical impacts associated with discharge from the Fermi 3 site could include shoreline erosion, effects on lake stratification, and bottom scour in the location of the diffuser, which could result in increased turbidity and siltation.

There is likely no potential for benthic scouring in the immediate vicinity of the discharge outfall. Proposed design features such as the presence of riprap around the submerged discharge port and orientation of the discharge ports in an upward direction are intended to reduce scouring (Detroit Edison 2011a). Given the small areal extent of the thermal plume from operation of Fermi 3, effects on existing stratification patterns in Lake Erie in the vicinity of the Fermi site would be negligible. Consequently, physical changes in aquatic habitat and impacts on aquatic organisms from scouring and thermal stratification would be minor. Because the discharge ports would be located at least 1300 ft from the shoreline and would direct water upward, shoreline erosion is not expected to result from the discharge of cooling water.

Based on the analysis of the potential for physical impacts on the aquatic ecosystem from the discharge of cooling water to Lake Erie, the review team concludes that the physical impacts from cooling water discharges from Fermi 3 would be minor, and no further mitigation would be warranted.

Operational Impacts at the Proposed Site

Maintenance Dredging

It is anticipated that maintenance dredging activities and the volume of dredged sediments at the Fermi site would remain similar after Fermi 3 operations commence because the intake areas for Fermi 2 and Fermi 3 would be collocated within the intake bay. Under existing operations at the Fermi site, the intake bay is dredged approximately every 4 years to maintain appropriate operating conditions. Such dredging, which is currently authorized under permits from the USACE and MDEQ (Section 5.2), results in the mortality of benthic invertebrates and other organisms associated with the accumulated sediments that are removed and a temporary localized increase in turbidity in the vicinity of the intake bay. Dredged material is expected to be disposed of in the Spoil Disposal Pond, where sediment would be allowed to settle out prior to discharge of the water back into Lake Erie as allowed and managed under existing NPDES permit regulations. The periodic dredging of the intake bay would result in minor impacts on aquatic biota and habitats in Lake Erie, and no mitigation measures beyond those identified in the appropriate permits would be warranted.

Stormwater Drainage

During the period of operation, onsite streams and wetlands could be affected by stormwater drainage. Stormwater from the finished grade at Fermi 3 would be directed to a sump that would discharge to the north canal via an outlet pipe. The north canal would discharge to the North Lagoon, which is hydrologically connected to Swan Creek, and eventually to Lake Erie. Stormwater may also run off directly either to the North Lagoon or to the South Lagoon. The South Lagoon is hydrologically connected to Lake Erie. Detroit Edison has stated that the Fermi 3 SWPPP and design features would be used to control stormwater runoff and sediment loading to Lake Erie (Detroit Edison 2011a).

On the basis of the planned implementation of a SWPPP similar to that currently in place for Fermi 2, the review team concludes that impacts on aquatic resources from stormwater drainage to Lake Erie due to the operation of Fermi 3 would be minor.

North and South Canals and Swan Creek

During Fermi 3 operations, aquatic habitats in Swan Creek could be affected by stormwater drainage. Stormwater from the finished grade at Fermi 3 would be directed to a sump that would discharge to the north canal via an outlet pipe. The north canal discharges to Swan Creek via the North Lagoon; water draining into Swan Creek eventually reaches Lake Erie. Uncontrolled stormwater runoff may also travel directly either to the North Lagoon or to the South Lagoon. Water entering the south canal would be discharged to the South Lagoon and eventually would discharge to Lake Erie through an outfall near the southern boundary of the Fermi site. Historically, stormwater runoff to these areas has been managed and controlled through Detroit Edison's existing SWPPP, and diverse aquatic communities have been maintained in these areas.

On the basis of the planned implementation of a SWPPP similar to that currently in place for Fermi 2, the review team concludes that impacts on aquatic resources in Swan Creek and the north and south canals from stormwater runoff due to the operation of Fermi 3 would be minor and no mitigation measures beyond those identified in the SWPPP and in applicable NPDES permits would be warranted.

Quarry Lakes

There are no plans to withdraw water from the Quarry Lakes as part of Fermi 3 operations. Stormwater runoff from areas surrounding the Quarry Lakes will continue to drain into the Quarry Lakes via NPDES-permitted outfalls (Outfall 004, Outfall 005, and Outfall 007, as shown in Figure 2-6). This would include runoff originating from buildings and landscaping associated with the proposed multiple-level parking garage, Fermi 3 simulator facility, and the joint Fermi 2/Fermi 3 administration building, as shown in Figure 3-1. On the basis of the planned implementation of a SWPPP for the Fermi site similar to that currently in place, the review team concludes that impacts on aquatic resources from permitted stormwater runoff drainage to the Quarry Lakes would be minor, and no additional mitigation beyond that required in the associated NPDES permits would be warranted.

Stony Creek

The Stony Creek watershed is entirely outside the Fermi site. There are no plans to discharge stormwater runoff from Fermi 3 facilities into the Stony Creek watershed, and no water withdrawals or releases associated with operation of Fermi 3 would affect water quantity or water quality in Stony Creek. Consequently, there would be no operation-related impacts on aquatic resources within Stony Creek, and no mitigation would be warranted.

5.3.2.2 Aquatic Resources – Transmission Lines

Transmission lines from Fermi 3 would be owned by Detroit Edison up to the point of their interconnection with the proposed Fermi 3 switchyard. Outward from interconnection with the Fermi 3 switchyard, ITC*Transmission* would own the lines and other transmission system equipment. Although Detroit Edison will maintain ownership and control of the land in the new onsite transmission corridor, Detroit Edison expects to contract with ITC*Transmission* to maintain the transmission towers and lines located on Detroit Edison property (Detroit Edison 2011a). Accordingly, the impacts from operation and maintenance of transmission lines discussed in this EIS are based on publicly available information and reasonable expectations of the configurations and practices that ITC*Transmission* would likely follow based on standard industry practice. The operation and maintenance of electricity transmission systems have the potential to affect aquatic ecological resources primarily through corridor maintenance activities, such as vegetation management, which would affect shorelines or could introduce sediment from erosion or contaminants from vehicles or herbicide treatments into waterways. As identified in Section 4.3.2.2, the identified transmission line route crosses about 30 wetlands or other waters that may be regulated by MDEQ and/or USACE. The 18.6-mi existing eastern section of the transmission line route crosses 12 narrow agricultural drains and small streams, and the currently undeveloped 10.8-mi western section of the route crosses nine agricultural drains and small streams.

Maintenance activities along the proposed 345-kV transmission line corridor could lead to periodic temporary impacts on waterways crossed by the transmission lines. However, BMPs currently employed by ITC*Transmission* for the existing Fermi 2 facility transmission line corridors would likely be applied to the proposed transmission line corridor to limit the potential for impacts (Detroit Edison 2011a). As described in Section 5.3.1.3 for wetlands and floodplains, it is anticipated that vegetation clearing in proximity to waterways would be limited to the minimum needed to allow access by maintenance vehicles and to keep the transmission lines free from intrusion of trees that could interfere with safe, reliable operation. To the extent practicable, existing access roads are expected to be used for ROW maintenance in the portion of the proposed corridor that already has existing transmission facilities and existing roads, and new access roads would be used for the currently undeveloped 10.4-mi segment of the proposed transmission line corridors. However, as described in Section 5.3.1.2, there would be occasional vehicular traffic in the corridor for maintenance purposes, which could result in minor amounts of soil erosion within the immediate area of the transmission line corridor.

ITC*Transmission* is a member of the EPA's voluntary Pesticide Environmental Stewardship Program (PESP). PESP members adopt risk reduction strategies and undertake specific steps toward reaching their goals of pesticide practices that reduce risks to humans and the environment (Detroit Edison 2011a). As described for wetlands and floodplains in Section 5.3.1.3, it is anticipated that the application of pesticides and herbicides in riparian areas near waterways would be minimized to the greatest extent possible to protect ecological resources (Detroit Edison 2011a).

Because of the periodic nature and typically small areas being maintained at any one time, the limited number of aquatic habitats that would be crossed by the proposed transmission corridor for Fermi 3, and the anticipated implementation of maintenance protocols similar to those in effect for the existing Fermi 2 transmission line corridor (Detroit Edison 2011a), the effects of ROW area maintenance on aquatic resources are expected to be minor during operation of Fermi 3, and additional mitigation beyond that described above would not be warranted.

5.3.2.3 Important Aquatic Species and Habitats

This section describes the potential impacts of the operation of Fermi 3 and associated 345-kV transmission lines on important aquatic species and habitats, including any species that have been listed under the ESA, species that are listed by the State, and commercially and recreationally important species. The general biology, status, and habitat requirements of important aquatic species, along with the potential for species to occur in the vicinity of the Fermi site are presented in Section 2.4.2. Potential impacts on important aquatic species from operation of Fermi 3 would primarily be associated with intake and consumption of water for cooling, discharge of cooling water, maintenance dredging, discharge of wastewater, and stormwater runoff. Transmission line impacts would primarily be associated with erosional effects from use of vehicles and other equipment and physical and chemical vegetation management activities that occur in the vicinity of aquatic habitats.

Operations of Fermi 3 have a potential to affect populations of important aquatic species due to impingement and entrainment mortality, as well as effect changes in water quality (including water temperatures) associated with the cooling water intake and discharge systems. The magnitude of impacts from operations of Fermi 3 would depend on the susceptibility of a species to impingement and entrainment at the intake structure, sensitivity of a species to water quality changes (including temperature changes) associated with the cooling water discharge structure and stormwater runoff, species-specific habitat requirements, critical time periods in a species' life cycle, and the intensity and duration of the disturbance.

Commercially and Recreationally Important Species

Commercially and recreationally important species that could occur in the vicinity of the Fermi site are identified in Section 2.4.2.3, along with information about their habitat requirements and life histories. In addition to the waters of Lake Erie, commercially and recreationally important species may also use nearshore ponds, marshes, and streams as spawning, nursery, or adult habitat. Consequently, the analysis of potential effects considered those species that could be present in aquatic habitats that could be reasonably affected by Fermi 3 operations including Lake Erie, the north and south canals, North and South Lagoons, Swan Creek, and streams that would be crossed by the proposed transmission line route. As identified in Section 5.3.2.1, impacts from Fermi 3 operations on aquatic resources present in the Quarry Lakes or other onsite aquatic habitats or on aquatic resources in Stony Creek are expected to be SMALL.

Eight fish species that are considered commercially or recreationally important in Lake Erie (bigmouth buffalo, channel catfish, freshwater drum, gizzard shad, largemouth bass, smallmouth bass, white perch, and yellow perch) were entrained or impinged during studies conducted at the Fermi 2 intake in 2008 and 2009 (Tables 5-5 and 5-6). Based on those studies, it is estimated that 24 to 1247 individuals of seven of these species (gizzard shad, white perch, bluegill, smallmouth bass, largemouth bass, channel catfish, and freshwater drum) would be impinged (Table 5-5) and approximately 100,000 to 25 million eggs and larvae of these species (Table 5-6) would be entrained annually at the cooling water intake for Fermi 3 with the intake pumps at full capacity. Considering the large numbers of these species that are commercially and recreationally harvested each year in Michigan waters of the western basin of Lake Erie, impingement mortality at the estimated levels would represent a negligible impact on populations of these species. The commercially and recreationally important species observed during entrainment studies are species that exhibit high fecundity and produce large numbers of eggs and larvae (Table 5-7), and the gizzard shad is a common forage species in the western basin of Lake Erie. Based on the low proportion of water that would be withdrawn from Lake Erie relative to the volume of water in the western basin, the use of closed-cycle cooling to minimize water withdrawals, the location of the intake bay away from any known sensitive spawning or nursery habitats, the historic impingement and entrainment rates for the existing Fermi 2, and the relatively high fecundities exhibited by the commercially and recreationally important species that are likely to be impinged or entrained, the review team concludes that impacts on commercially and recreationally important fish populations from impingement and entrainment during Fermi 3 operations would be minor.

During operation of Fermi 3, aquatic habitat in Lake Erie near the discharge would be affected by altered water quality, especially increased water temperature, in the vicinity of the cooling water discharge. As described in Section 5.3.2.1, the thermal and chemical impacts on aquatic habitats and biota from cooling water discharge due to Fermi 3 operations would be SMALL, because the thermal impacts would be confined to a small mixing zone area (1.3 ac or less) where water temperatures would exceed ambient temperatures, and because MDEQ would regulate the allowable thermal and chemical characteristics of the discharged waters through the NPDES permitting process. Scouring or other physical impacts due to cooling water discharge would also be limited (see Section 5.3.2.1). For these reasons, the review team concludes that impacts on commercially and recreationally important fish populations from the discharge of cooling water by Fermi 3 would be negligible.

As identified in Section 5.3.2.1, periodic maintenance dredging of the intake bay and permitted discharges of effluent and stormwater at the Fermi site could temporarily alter water quality in the vicinity of the intake bay. These are areas that have been periodically dredged as part of the maintenance activities at the Fermi site. Although the presence of some commercially and recreationally important fish species has been documented within the intake bay and in the area that would be affected during periodic maintenance dredging for the Fermi site (AECOM 2009a), it is anticipated that most individuals of commercially and recreationally important species would temporarily move away during dredging activities because of noise and increased turbidity. While this would result in temporary short-term displacement of individuals, it is anticipated that population-level impacts on commercially and recreational fish species would be negligible.

Stormwater from the finished grade at Fermi 3 would be directed to a sump that would discharge to the north overflow canal via an outlet pipe. The overflow canal would discharge to the North Lagoon, which discharges to Swan Creek and eventually to Lake Erie. Stormwater may also travel directly either to the North Lagoon or to the South Lagoon. The South Lagoon also discharges to Lake Erie. Detroit Edison has stated that the Fermi 3 SWPPP and design features would be used to control stormwater runoff to the receiving water bodies to ensure that any increase in sediment loading to Swan Creek and/or Lake Erie is adequately controlled to minimize water quality impacts (Detroit Edison 2011a). On the basis of the planned implementation of a SWPPP similar to that currently in place for Fermi 2, the review team concludes that impacts from Fermi 3 operations on commercially and recreationally important aquatic species due to stormwater runoff would be SMALL and that no additional mitigation would be warranted.

As described in Section 2.4.2.2, there are no important commercial or recreational fisheries present within the assumed transmission line route because of the small sizes of the drainages crossed by the transmission line corridor. However, some of the streams to be crossed by the proposed transmission lines support some commercially or recreationally important species. Maintenance of transmission lines could periodically and temporarily affect individuals in the vicinity of stream crossings because of erosion of soils and deposition of sediment via runoff, potential pollutant discharge from maintenance equipment, and temporary disturbance and/or displacement of aquatic biota. As described in Section 5.3.2.2, it is anticipated that the proposed transmission line corridor would be operated and maintained by ITC*Transmission* in the same fashion as the existing transmission line corridor for Fermi 2 (Detroit Edison 2011a). Vegetation clearing is expected to be limited to the minimum needed to allow access by maintenance vehicles and to keep the transmission lines free from intrusion of trees that could interfere with safe, reliable operation (Detroit Edison 2011a), thereby reducing the potential for impacts on commercially or recreationally important species resulting from erosion, sedimentation, and disturbance.

As described in Section 5.3.2, pesticides and herbicides are expected to be used selectively, in accordance with specified labeling, and only where needed, thus minimizing the potential for significant impact on aquatic resources. Because of the periodic nature and typically small areas being maintained at any one time and the limited number of aquatic habitats that would be crossed by the proposed transmission line corridor for Fermi 3, the effects of ROW maintenance on commercially and recreationally important aquatic resources are expected to be SMALL during operation of Fermi 3.

On the basis of an evaluation of information presented in the ER and other existing information, the review team concludes that impacts on commercially and recreationally important species due to the operation of Fermi 3 and the associated transmission line corridors would be minor, and no additional mitigation would be warranted. Implementation of BMPs and other mitigation measures stipulated in required permits would further reduce impacts.

Federally and State-Listed Aquatic Species

This section evaluates the potential for Federally and State-listed aquatic species to be affected by operation of Fermi 3. Federally and State-listed species that could occur in the counties (Monroe, Wayne, and Washtenaw Counties) within which activities related to operation of Fermi 3 would occur were identified in Section 2.4.2.3, along with information about their habitat requirements and life histories.

Based on habitat requirements, current distributions, and survey data, aquatic species with a potential to occur in the vicinity of the Fermi site or the proposed transmission line route were identified in Section 2.4.2.3 (see Table 2-13). Three species of freshwater mussels that are Federally listed as endangered (northern riffleshell [*Epioblasma torulosarangiana*]; rayed bean [*Villosa fabilis*]; and snuffbox mussel [*E. triquetra*]) were identified as having the potential to occur in Monroe, Washtenaw, or Wayne Counties, Michigan. None of these species have ever been documented either on the Fermi site or along the proposed transmission line route, and only the rayed bean and the snuffbox mussel have a potential to occur on the Fermi site based on information about the current status of populations, records of occurrence, and habitat preferences (Section 2.4.2.3). The northern riffleshell is considered unlikely to occur on or adjacent to the Fermi site because of the lack of suitable stream habitat; it is unknown whether there could be suitable habitat for the northern riffleshell in portions of streams that would be crossed by the proposed transmission line route within Monroe or Wayne Counties, although the species has not been reported from the streams that would be crossed.

Including the Federally listed species identified above, all of which are also listed as endangered by the State of Michigan, State-listed species that have been observed or that have a potential to occur on or adjacent to the Fermi site include three mussel species (rayed bean, salamander mussel [*Simpsonaias ambiqua*], and snuffbox mussel) and three fish species (pugnose minnow [*Opsopoeodus emiliae*], sauger [*Sander canadensis*], and silver chub [*Macrhybopsis storeriana*]) (Section 2.4.2.3; Table 2-13). Of these species, only the silver chub is known to occur at the Fermi site (Table 2-13).

The only known existing population of the white catspaw (*Epioblasma obliquata perobliqua*), a freshwater mussel that is Federally and State-listed as endangered, occurs in one stream drainage in Ohio; the species is considered extirpated from Michigan. As a consequence, it is believed that this species would not be present near the Fermi site or in streams that would be crossed by the proposed transmission line corridor and that it would not be affected by operation of Fermi 3, and additional evaluation was not included in the FEIS or the BA.

There are other State-listed mussel and fish species (as shown in Table 2-13) that are considered unlikely to occur at the Fermi site but have a potential to occur in streams that would be crossed by the proposed transmission line corridor in Monroe, Wayne, or Washtenaw Counties. Currently there is insufficient information to determine whether any of those species are present in the streams that would be crossed.

Maintenance of transmission lines could affect listed organisms in the vicinity of stream crossings because of erosion of soils and deposition of sediment via runoff, potential for pollutant discharge from maintenance equipment and vehicles, and temporary disturbance and/or displacement of individuals. As described in Section 5.3.2.2, it is assumed that BMPs employed by ITC*Transmission* for the existing Fermi 2 facility transmission line corridors would also be applied to the proposed transmission line corridor (Detroit Edison 2011a) to limit the potential for impacts on aquatic species, including listed species. ITC*Transmission* maintains a database of known occurrences of threatened and endangered species obtained from the MNFI to identify locations where seasonal constraints or other regulatory conditions need to be considered for vegetation management activities in habitats occupied by rare species (Detroit Edison 2010b). Because of the periodic nature of maintenance, the typically small areas being maintained at any one time, and the limited number of aquatic habitats that would be crossed by the proposed transmission line corridor for Fermi 3, the effects of ROW area maintenance on Federally and State-listed species are expected to be small during operation of Fermi 3.

Potential impacts on Federally and State-listed species that were deemed to have a potential to occur in the waters on or in the immediate vicinity of the Fermi site or in streams that would be crossed by the proposed transmission line corridor are evaluated in more detail in the following subsections.

Northern Riffleshell (*Epioblasma torulosa rangiana*)

The northern riffleshell is Federally listed as endangered and is also listed as endangered by the State of Michigan. Because there is no suitable habitat for the northern riffleshell on the Fermi site or in adjacent waters of Lake Erie (Section 2.4.2.3), operation of Fermi 3 would have no impact on this species. Although suitable habitat for the northern riffleshell could be present in some of the streams that would be crossed by the proposed transmission line corridor, it is not expected to occur along the transmission line route because extant populations of this species in Michigan are known to be present only in the Black River in Sanilac County and the Detroit River in Wayne County (Carman and Goforth 2000). Even if the northern riffleshell is present in streams crossed by the transmission line corridors, impacts on it from maintenance of transmission lines are unlikely, provided that BMPs identified in permits for the transmission lines are implemented. Additional regulatory review and permitting of proposed plans for maintenance of the transmission lines (e.g., for annual vegetation management plans) would be required prior to implementation (Detroit Edison 2011a). On the basis of this information, the review team concludes that operation of Fermi 3 would have no effect on the northern riffleshell.

Operational Impacts at the Proposed Site

Pugnose Minnow (*Opsopoeodus emiliae*)

The pugnose minnow is listed as endangered by the State of Michigan and has the potential to occur in streams in Monroe and Wayne Counties. Although there is a potential for suitable habitat for the pugnose minnow to be present in the vicinity of the Fermi site, especially in weedy aquatic habitats such as those present in the North Lagoon or Swan Creek, no individuals were collected during recent surveys on the Fermi site and none were reported in past biological surveys of Stony Creek or the Swan Creek estuary near the Fermi site (AECOM 2009a; MDEQ 1996, 1998; Francis and Boase 2007). If individuals are occasionally present in the North Lagoon or near the mouth of Swan Creek, there is a potential for adverse effects due to water quality changes and increased turbidity from stormwater runoff during operation of Fermi 3. Detroit Edison has stated that the Fermi 3 SWPPP and design features would be used to control stormwater runoff to ensure that any increase in sediment loading to Swan Creek and/or Lake Erie is adequately controlled to minimize water quality impacts (Detroit Edison 2011a). No suitable habitat is present for the pugnose minnow in the vicinity of the intake bay or the location of the outlet for the proposed cooling water discharge. Consequently, impacts from impingement, entrainment, thermal effects, or water quality changes associated with those structures are unlikely. On the basis of the planned implementation of a SWPPP similar to that currently in place for Fermi 2, the review team concludes that impacts from Fermi 3 operations on the pugnose minnow would be minor, and no additional mitigation would be required.

Rayed Bean (*Villosa fabalis*)

The rayed bean is Federally listed as endangered and is also listed as endangered by the State of Michigan. If present, threats to the survival of the rayed bean include siltation, dredging, and channelization of inhabited areas and the introduction of exotic species, such as Asian clams (*Corbicula fluminea*), quagga mussels (*Dreissena rostriformi*), and zebra mussels (*Driessena polymorpha*) (FWS 2002). As identified in Section 2.4.2.3, there are no streams on the Fermi site with conditions suitable for the rayed bean; no extant populations are known to occur in the stream drainages that would be crossed by the proposed transmission line route; and it is believed that the species is unlikely to be present in Lake Erie near the Fermi site. Because the intake bay would be periodically dredged, it is unlikely that the substrate would be suitable for the rayed bean to become established in this area.

As eggs, native unionid mussels are not likely to be affected by entrainment through the cooling water intake because they are not free-floating, but rather develop into larvae within the female. The glochidial stage, during which juvenile mussels attach to a suitable fish host, may be indirectly vulnerable through impingement and entrainment of host species. Post-glochidial and adult stages are not likely to be susceptible to entrainment because they bury themselves in sediment. As identified in Section 2.4.2.3, fish hosts for the glochidia of the rayed bean could include the Tippecanoe darter (*Etheostoma tippecanoe*), greenside darter (*Etheostoma* *blennioides*), rainbow darter (*Etheostoma caeruleum*), mottled sculpin (*Cottus bairdi*), and largemouth bass (*Micropterus salmoides*). Of these potential host species, only the largemouth bass was observed in fish collections in Lake Erie near the intake structure or near the discharge from the South Lagoon, and based on impingement studies conducted at the existing Fermi 2 intake in 2008 and 2009, it is estimated that small numbers of largemouth bass individuals (approximately 30) would be impinged annually with the intake pumps for Fermi 3 at full operating capacity (AECOM 2009a).

It is anticipated that operation of Fermi 3 would not result in water quality unsuitable for the rayed bean if a population were present in Lake Erie near the Fermi site. Thermal effects associated with cooling water discharge during operation of Fermi 3 would be unlikely to affect mussels, because the discharge ports would direct water upward and not toward the lake bottom. In addition, it is anticipated that suitable water quality would be maintained because (1) the NPDES permit for Fermi 3 would specify allowable concentrations of chemicals in the Fermi 3 discharge and would require regular testing to evaluate compliance, and (2) Detroit Edison has stated that the Fermi 3 SWPPP and design features would be used to control stormwater runoff to ensure that sediment loading to Swan Creek and/or Lake Erie is adequately controlled to minimize water quality impacts (Detroit Edison 2011a).

The operation and maintenance of transmission lines for Fermi 3 are not expected to affect the rayed bean because the species has not been reported from the streams that would be crossed by the proposed transmission line corridor, because structures requiring maintenance (e.g., transmission towers) would not be placed in aquatic habitats that are crossed by the corridor, and because BMPs would be implemented to protect water quality in aquatic habitats during maintenance activities such as vegetation management (Detroit Edison 2011a). On the basis of the above information, the review team concludes that of the operation of Fermi 3 would have no effect on the rayed bean.

Salamander Mussel (*Simpsonaias ambigua*)

The salamander mussel is listed as endangered by the State of Michigan and has the potential to occur in Monroe and Wayne Counties. Although there are no suitable stream habitats for the species on the Fermi site, there is the potential for suitable habitat and the mudpuppy (*Necturus maculosus)* host required by this species to occur in Lake Erie near the Fermi site (see Section 2.4.2.3). Because no suitable habitat for this species (i.e., medium to large rivers or lakes) would be crossed by the proposed transmission line corridor, operation and maintenance of the proposed transmission lines would have a negligible impact on this species.

Salamander mussels are not known from areas on or near the site that would be affected by the cooling water intake or discharge, by periodic maintenance dredging during the operation of Fermi 3, or by stormwater runoff. Identified threats to the survival of the salamander mussel include siltation and runoff from human activities and the introduction of exotic species such as Asian clams, quagga mussels, and zebra mussels (Section 2.4.2.3).

The areas in Lake Erie that would be disturbed by modification and dredging of the intake bay, development of a barge slip within the intake bay, and placement of the discharge structure for the facility either have been previously disturbed by periodic maintenance dredging (Detroit Edison 2011a) or have been identified as containing a clay hardpan substrate (Detroit Edison 2010c) and not the silt and sand substrate preferred by this species. Consequently, there is only a small potential for the species to be present in the area. Because the intake bay would be periodically dredged, it is unlikely that the substrate would be suitable for the salamander mussel to become established in this area.

As eggs, native unionid mussels are not likely to be affected by entrainment through the cooling water intake because they are not free-floating, but rather develop into larvae within the female mussel. The glochidial stage, during which juvenile mussels attach to a suitable host, may be indirectly vulnerable through impingement and entrainment of host species. Post-glochidial and adult stages are not likely to be susceptible to entrainment because they bury themselves in sediment. As identified in Section 2.4.2.3, the identified host for the glochidia of the salamander mussel is the mudpuppy. The mudpuppy was not observed during impingement studies conducted in 2008 and 2009 at the Fermi 2 intake, and it is considered highly unlikely that mudpuppies would occur within the intake bay because of the lack of suitable cover such as submerged rocks or logs.

It is anticipated that operations of Fermi 3 would not result in water quality unsuitable for the salamander mussel if a population was present in Lake Erie near the Fermi site. Thermal effects associated with cooling water discharge during operation of Fermi 3 would be unlikely to affect mussels because the discharge ports would direct water upward and not toward the lake bottom. In addition, it is anticipated that suitable water quality would be maintained because (1) the NPDES permit for Fermi 3 would specify allowable concentrations of chemicals in the Fermi 3 discharge and would require regular testing to evaluate compliance, and (2) Detroit Edison has stated that the Fermi 3 SWPPP and design features would be used to control stormwater runoff to ensure that sediment loading to Swan Creek and/or Lake Erie is adequately controlled to minimize water quality impacts (Detroit Edison 2011a).

On the basis of the above information, the review team concludes that the impacts of Fermi 3 operations on the salamander mussel would be minor.

<u>Sauger (*Sander canadensis*)</u>

The sauger is considered a species of special concern by the State of Michigan and has the potential to occur in Lake Erie. However, the last reported occurrence of sauger in Monroe County was in 1996, and no individuals were collected during recent surveys on the Fermi site, Stony Creek, or the Swan Creek estuary (AECOM 2009a; MDEQ 1996, 1998; Francis and Boase 2007). If present in nearshore areas of Lake Erie, sauger could be affected by Fermi 3 operations because of impingement or entrainment at the intake structure, by changes in water temperatures associated with the cooling water discharge, by maintenance dredging, or by water quality changes associated with discharges and stormwater runoff from Fermi 3. Because no sauger were observed during impingement and entrainment studies conducted during 1991 and 1992 (Lawler, Matusky, and Skelly Engineers 1993) or during 2008 and 2009 (AECOM 2009a) at the Fermi 2 intake, it is considered unlikely that significant numbers would be affected by the intake of cooling water for operation of Fermi 3. As with most fish, it is anticipated that sauger in the project area would temporarily move away during dredging activities because of increased noise and turbidity levels, resulting in temporary displacement but negligible levels of mortality. As described in Section 5.3.2.1, MDEQ would specify allowable characteristics of the thermal plume and chemical concentrations associated with the cooling water discharge for Fermi 3 through the NPDES permitting process and Detroit Edison would implement a SWPPP to control stormwater runoff, thereby limiting the potential for water quality impacts on the sauger if individuals were to be present in the vicinity of the Fermi site. The small streams that would be crossed by the proposed transmission line corridor do not provide suitable habitat for sauger, and this species would not be affected by operation and maintenance of the transmission lines for Fermi 3. On the basis of this information, the review team concludes that impacts on the sauger from Fermi 3 operations would be minor, and no additional mitigation is warranted.

Silver Chub (*Macrhybopsis storeriana*)

The silver chub is considered a species of special concern by the State of Michigan. A single silver chub specimen was collected in July 2009 during monthly fish surveys conducted near the mouth of Swan Creek from 2008 to 2009 (AECOM 2009a). This species is typically found in deep waters of low-gradient streams and rivers and also in lakes. Little is known about the life history of the silver chub, especially its tolerance of siltation and turbidity (Derosier 2004). While some researchers have suggested that silver chub are intolerant of turbidity and silt, others note that silver chubs are found in silty rivers (Derosier 2004). If present in nearshore areas of Lake Erie, silver chubs could be affected by Fermi 3 operations because of impingement or entrainment at the intake structure, by changes in water temperatures associated with the cooling water discharge, by maintenance dredging, or by water quality changes associated with discharges and stormwater runoff from Fermi 3. Because no silver chubs were observed during impingement and entrainment studies conducted during 1991 and 1992 (Lawler, Matusky, and Skelly Engineers 1993) or during 2008 and 2009 (AECOM 2009a) at the Fermi 2 intake, it is considered unlikely that significant numbers would be affected by the intake of cooling water for operation of Fermi 3. It is anticipated that silver chub in the project area would temporarily move away during maintenance dredging activities because of increased noise and turbidity levels, resulting in temporary displacement but negligible levels of mortality. As described in

Section 5.3.2.1, MDEQ would specify allowable characteristics of the thermal plume and chemical concentrations associated with the cooling water discharge for Fermi 3 through the NPDES permitting process, and Detroit Edison would implement a SWPPP to control stormwater runoff to Swan Creek and Lake Erie, thereby limiting the potential for water quality impacts on silver chub if individuals were present in the vicinity of the Fermi site.

Although suitable habitat for the silver chub could be present in some of the streams that would be crossed by the proposed transmission line corridor, it is currently unknown whether any populations are present. Even if the silver chub is present, impacts on it from the operation and maintenance of transmission lines for Fermi 3 are not anticipated because structures requiring maintenance (e.g., transmission towers) would not be placed in aquatic habitats that are crossed by the corridor and because BMPs would be implemented to protect water quality in aquatic habitats during maintenance activities such as vegetation management (Detroit Edison 2011a). On the basis of the available information, the review team concludes that impacts on the silver chub from Fermi 3 operations would be minor, and no additional mitigation is warranted.

Snuffbox Mussel (*Epioblasma triquetra*)

The snuffbox mussel, which is Federally listed as endangered and is also listed as endangered by the State of Michigan, has the potential to occur in Monroe, Wayne, and Washtenaw Counties. Although there are no suitable stream habitats on the Fermi site, there is potential for suitable habitats in Lake Erie, and the host required by this species (logperch, *Percina caprodes*) has been collected from the Fermi site at sampling locations in Swan Creek and in Lake Erie near the South Lagoon (see Section 2.4.2.3). The intake bay would be periodically dredged, and it is unlikely that the substrate would be suitable for the snuffbox mussel to become established in this area.

As eggs, native unionid mussels are not likely to be affected by entrainment through the cooling water intake because they are not free-floating, but rather develop into larvae within the female. The glochidial stage, during which juvenile mussels attach to a suitable fish host, may be indirectly vulnerable through impingement and entrainment of host species. Post-glochidial and adult stages are not likely to be susceptible to entrainment because they bury themselves in sediment. As identified in Section 2.4.2.3, fish hosts for the snuffbox mussel include the logperch, which was observed in fish collections in Lake Erie near the discharge from the South Lagoon and in Swan Creek. Based on impingement studies conducted during 1991 and 1992, Lawler, Matusky, and Skelly Engineers (1993) estimated that approximately 31 logperch were impinged annually by the Fermi 2 cooling water intake. However, impingement studies conducted during 2008 and 2009 at the Fermi 2 intake did not observe impingement of any logperch (AECOM 2009a). Together, these two impingement studies suggest that small numbers of logperch could be impinged by the operation of the cooling water intake for Fermi 3.

It is anticipated that operation of Fermi 3 would not result in water quality unsuitable for the snuffbox mussel if a population were present in Lake Erie near the Fermi site. Thermal effects associated with cooling water discharge during operation of Fermi 3 would be unlikely to affect mussels, because the discharge ports would direct water upward and not toward the lake bottom. In addition, it is anticipated that suitable water quality would be maintained because (1) the NPDES permit for Fermi 3 would specify allowable concentrations of chemicals in the Fermi 3 discharge and would require regular testing to evaluate compliance, and (2) Detroit Edison has stated that the Fermi 3 SWPPP and design features would be used to control stormwater runoff to ensure that sediment loading to Swan Creek and/or Lake Erie is adequately controlled to minimize water quality impacts (Detroit Edison 2011a).

It is not known whether suitable stream habitats for, or populations of, the snuffbox mussel occur along the proposed transmission line corridor. Even if the species were present, impacts on the snuffbox mussel from the operation and maintenance of transmission lines for Fermi 3 are not anticipated because structures requiring maintenance (e.g., transmission towers) would not be placed in aquatic habitats that are crossed by the corridor, and BMPs would be implemented to protect water quality in aquatic habitats during maintenance activities such as vegetation management (Detroit Edison 2011a). On the basis of the above information, the review team concludes that the operation of Fermi 3 would have no effect on the snuffbox mussel.

Summary of Operational Impacts on Federally and State-Listed Aquatic Species

Based on information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that impacts of Fermi 3 operation on aquatic threatened and endangered species would be minor. For the three Federally listed mussel species, the review team determines that there would be no effect from operation of Fermi 3. Impacts on listed aquatic species from degradation of water quality would be limited by the implementation of BMPs that would be identified in the required NPDES discharge permit to be issued by MDEQ and in the SWPPP to be developed by Detroit Edison.

In compliance with Section 7 of the ESA, the NRC began informal consultation with the FWS in a letter dated December 23, 2008 (NRC 2008). The review team completed a BA assessing how building and operating Fermi 3 would impact three Federally protected freshwater mussel species potentially or historically known from the geographic area of interest. The BA's conclusions on potential impacts are provided above. A copy of the BA is included in Appendix F of this FEIS. The BA was forwarded to the FWS on March 30, 2012 (NRC 2012a). In a letter dated June 8, 2012 (FWS 2012), the FWS concurred with the review team's determination that operating Fermi 3 would have no effect on the three freshwater mussel species that are Federally protected as endangered species.

Critical Habitats

There are no areas designated as critical habitat for aquatic species in the vicinity of the Fermi site or along the route of the proposed transmission line.

Invasive Nuisance Organisms

Invasive nuisance organisms that have been found or are presumed to occur in Lake Erie in the vicinity of the Fermi site include lyngbya (*Lyngbya wollei*), fishhook water flea (*Cercopagis pengoi*), spiny water flea (*Bythotrephes longimanus*), quagga mussel, zebra mussel, sea lamprey (*Petromyzon marinus*), and round goby (*Neogobius melanostomus*) (Section 2.4.2.3). None of these species are considered abundant in the vicinity of the Fermi site. While it is not clear that any of these species rely upon thermal refuge to tolerate the ambient wintertime water temperatures in Lake Erie, it is anticipated that the area of the thermal plume from Fermi 3 would not be large enough to provide substantial thermal refuge for invasive nuisance organisms. Detroit Edison reported that there has been no excessive growth of algae observed in the vicinity of the water discharge for Fermi 2.

The review team specifically evaluated the potential for algal blooms caused by species such as *Microcystis* spp., *Anabaena* spp., *Aphanisomenon* spp., and more recently, lyngbya. In addition, there have been extensive growths of *Cladophora* spp., an attached green alga, in the western basin of Lake Erie. The principal contributor to the development of algal blooms has long been attributed to increased nutrient levels (especially phosphorus concentrations) resulting from changes in land use practices, altered hydrology, and food web changes.

Large shoreline mats of lyngbya were first seen in western Lake Erie in Maumee Bay in 2006 (Bridgeman and Penamon 2010). Life history information for lyngbya is provided in Section 2.4.2.3. The review team considered the effects of temperature, nutrients, substrate type, and irradiance on lyngbya blooms and examined the history of algal blooms associated with the discharge for Fermi 2. Overall, it appears that the potential for excessive growth of lyngbya is related to the amount of light penetration into the water column (a function of water turbidity), water depth, nutrient availability, and the type of substrate that is present (Bridgeman and Penamon 2010; LaMP Work Group 2008). Additionally, it is thought that increased water temperatures could exacerbate the potential for algal blooms to occur.

Operation of Fermi 3 is not expected to alter turbidity levels or light penetration in the vicinity of the site compared to existing conditions. Although maintenance dredging activities could result in infrequent, temporary, and localized increases in turbidity, the frequency of dredging and the areas affected by dredging would be the same as for Fermi 2. Therefore, maintenance dredging during Fermi 3 operations would not alter the potential for algal blooms to occur.

As stated above, algal blooms have long thought to be controlled by the concentrations of specific nutrients in Lake Erie. Phosphorus has been identified as a nutrient that can affect the frequency and occurrence of algal blooms. Blooms of lyngbya in Maumee Bay have been primarily attributed to increased nutrient loading due to agricultural runoff and urbanization. The principal limiting nutrient responsible for controlling algal blooms in Lake Erie is phosphorus, although nitrogen is also important as one of the limiting nutrients. The review team examined historic water quality information for Maumee Bay and recent water quality information for Lake Erie near the Fermi site and found that levels of nutrients such as nitrate, orthophosphate, and total phosphorus reported from Maumee Bay (Moorhead et al. 2007) were substantially higher than those reported for the Fermi site (AECOM 2009b). Detroit Edison has stated that it would not use phosphorus-containing corrosion and scale inhibitors for Fermi 3, replacing them with two non-phosphorus-containing water treatment chemicals (Detroit Edison 2010c). Therefore, operation of Fermi 3 is not expected to measurably increase nutrient levels that could affect algal blooms in the vicinity of the site.

Lake Erie already retains relatively high concentrations of calcium due to natural basin characteristics, and its levels of dissolved calcium are normally at or near the saturation point. Even though the concentration of calcium in the water from the Fermi 3 discharge will be higher than in ambient Lake Erie water due to evaporative losses during cooling, this would not result in any mass addition of calcium to Lake Erie. The design of the diffusers for the proposed Fermi 3 discharge would result in rapid mixing of the effluent with ambient water. Because of this, the dissolved calcium levels outside the area delineated by the discharge plume would be unlikely to be measurably higher than dissolved calcium levels that would be present without operation of the discharge, and the levels of calcium would not be measurably altered in Lake Erie near the Fermi site, in the Western Basin of Lake Erie, or in Lake Erie as a whole. Therefore, calcium in the effluent of the Fermi 3 discharge would not have a measurable effect on the growth of algae in the general vicinity of the proposed Fermi 3 discharge or in the western basin of Lake Erie.

The review team concluded that the substrate in the vicinity of the Fermi site is, in general, similar to the substrates upon which lyngbya was found growing in the vicinity of Maumee Bay and other areas of the western basin of Lake Erie (Bridgeman and Penamon 2010). Although the substrate may be suitable for algae growth, no algal blooms of lyngbya or other species have been reported from the Fermi site. The nearest reported observation of lyngbya in the western basin was near Sterling State Park, approximately 5 mi south-southwest of the Fermi site.

The review team also considered the possibility that thermal discharge from Fermi 3 could affect the frequency of algal blooms, including lyngbya, at the Fermi site. Because Fermi 3 would use a closed cycle cooling system, the amount of heated effluent is significantly reduced compared to a once-through plant, such as the plants located near the mouth of the Maumee River. Additionally, the heated effluent would be discharged offshore through a three-port diffuser with the flow directed upwards toward the surface. Such a system facilitates rapid mixing of the thermal plume and minimizes the effects on the benthic environment. Therefore, the review team concludes that the heated discharge from Fermi 3 would not significantly increase the potential for development of algal blooms.

In addition, no significant algal blooms have been reported in the vicinity of the discharge from Fermi 2, which has been operating commercially since 1988.

NOAA has been developing an experimental tool for predicting the potential for *Microcystis* spp. blooms in Lake Erie based upon satellite imagery and has been issuing experimental forecasts of potential harmful algal blooms since July of 2009 (NOAA 2012a). Those forecasts have periodically identified a potential for blooms of *Microcystis* spp. in the western basin of Lake Erie during summer months. Generally, the areas with the highest predicted potential for algal blooms tend to occur in the southwestern portion of the western basin in the vicinity of Maumee Bay. However, areas with elevated predicted potential occasionally extend northward along the shoreline of Lake Erie as far as the mouth of the Detroit River (located approximately 7.5 mi northwest of the Fermi site) for short periods of time (NOAA 2012a). When areas with elevated predicted potential (based upon the experimental forecasting procedure) extend this far northward along the western shoreline of Lake Erie, areas near the Fermi site are occasionally included. However, although the forecasting system indicates where there may be an elevated potential for algal blooms, the actual presence or formation of algal blooms has not been confirmed by water sampling at the Fermi 3 site. Water sampling to confirm the presence of harmful algal species in areas where a high potential for occurrence has been predicted by the experimental system has generally not been conducted northward of Brest Bay, near Sterling State Park (approximately 5 mi south-southwest of the Fermi site) (NOAA 2012b). Given the absence of reported blooms in the vicinity of the proposed Fermi 3 discharge, and that Fermi 3 is not expected to measurably increase nutrient levels or calcium concentrations in the site vicinity, the NOAA experimental forecasts do not indicate that Fermi 3 operations would result in any significant increase in the potential for *Microcystis* spp. blooms in Lake Erie.

Based on the analysis of the potential for impacts on the aquatic ecosystem of Lake Erie and an independent assessment of the discharge from Fermi 3, the review team concludes that the impacts of the operation of Fermi 3 would not appreciably increase the potential for establishment or survival of nuisance species in Lake Erie.

5.3.2.4 Aquatic Monitoring during Operation

No monitoring of water quality or aquatic ecosystems is imposed by the NRC. However, hydrological, thermal, and chemical monitoring of the proposed new discharge would likely be required by MDEQ as a part of the NPDES permit. Detroit Edison has not identified any plans to conduct formal monitoring of aquatic ecosystems during operations (Detroit Edison 2011a). Ecological monitoring of aquatic resources during operations could be required as a condition of permits issued by various regulatory agencies. For example, MDEQ could request monitoring of specific ecological attributes as part of the NPDES permit (although such monitoring is not required by the existing NPDES permits for Fermi 2) or its permit authorizing dredging. In addition, USACE could, as a condition of a permit authorizing dredging, require a silt containment system during dredging and no excessive turbidity outside the system. Water quality monitoring may be conducted voluntarily by Detroit Edison to ensure permit condition compliance.

5.3.2.5 Potential Mitigation Measures for Operation-Related Aquatic Impacts

The review team recommends that if a shutdown of the proposed Fermi 3 were to be planned during the winter months, the discharge of cooling water should be gradually reduced to prevent cold shock.

5.3.2.6 Summary of Operational Impacts on Aquatic Resources

Based on information provided in the ER (Detroit Edison 2011a), Detroit Edison's responses to requests for additional information, interactions with State and Federal agencies, the public scoping process, and the review team's independent assessment, the review team concludes that impacts from operation of Fermi 3 and associated transmission lines on aquatic resources would be SMALL and additional mitigation measures beyond those identified in Section 5.3.2.5 and any potential permit conditions would not be warranted.

5.4 Socioeconomic Impacts

This section describes the socioeconomic impacts that may occur as a result of the operation of Fermi 3. Detroit Edison plans to begin commercial operation in 2021, and its operating license would extend for 40 years. Detroit Edison estimates the workforce needed to operate Fermi 3 to be 900 full-time and contract employees. Workers would be employed in multiple shifts in order to operate the plant 24 hr per day, all days of the year (Detroit Edison 2011a).

In addition to the full-time and contract workforce of 900, an estimated 1200 to 1500 additional workers would be employed at Fermi 3 during scheduled outages. During these scheduled outages, contract labor would be hired by Detroit Edison to carry out fuel-reloading activities, equipment maintenance, and other projects associated with the outage. These workers would increase the transient population in the local area approximately every 24 months for a period of 30 days (Detroit Edison 2011a). Workers who do not currently reside in the region would be housed in temporary, short-term accommodations for the duration of the scheduled outage.

The review team expects most of the socioeconomic impacts related to demographics, economy and taxes, and infrastructure and community services to occur in the general vicinity of Fermi 3 and in the communities in which the majority of the new workers recruited for operation of Fermi 3 (i.e., in-migrating workers) reside. The review team expects that characteristics of the workers recruited from outside the region with respect to choices and preferences (e.g., commute distance, available amenities) to be similar to those of the current workforce and that they will reside primarily in Monroe and Wayne Counties, Michigan, and Lucas County, Ohio. More than 87 percent of the current Fermi 2 workforce resides in these three counties. Therefore, the review team expects that most of the operations workforce relocating into the area for employment at Fermi 3 would also reside in these three counties.

As discussed in Chapter 2.5, no more than 3.2 percent of the current Fermi 2 workforce resides in any one county outside Monroe, Wayne, and Lucas Counties. In addition, the current and projected populations of the regional area are so large that the current workforce at the Fermi site represents less than 1 percent of the total population in any of the counties or locations where these employees reside. Therefore, the review team expects that impacts beyond the three counties will be minor. The following discussion focuses on the three-county area.

Section 5.4.1 presents a summary of the physical impacts of the project. Section 5.4.2 provides a description of the demographic impacts. Section 5.4.3 describes the economic impacts, including impacts on the economy and tax revenue, and Section 5.4.4 describes the impacts on the infrastructure and community services. Section 5.4.5 summarizes the socioeconomic impacts.

5.4.1 Physical Impacts

Operation of Fermi 3 will cause physical impacts, including noise, odors, exhausts, thermal emissions, and visual intrusions. The review team believes these impacts would be mitigated but not eliminated through operation of the facility in accordance with all applicable Federal, State, and local environmental regulations and site-specific permit conditions. This section addresses potential physical impacts that may affect people, buildings, and roads.

5.4.1.1 Workers and the Local Public

The Fermi site is located along the relatively straight Lake Erie coastline, which extends from the Fermi site approximately 20 mi southwest toward the Michigan-Ohio border and approximately 10 mi northeast toward the mouth of the Detroit River. To the east of this coastline lie the open waters of Lake Erie. To the west of the site, the land is used predominantly for agriculture. Development within a 10-mi radius of the Fermi site is concentrated in the City of Monroe, which is about 8 mi southwest of the site, and along the Lake Erie shoreline in several beachfront communities. The community nearest to the Fermi site, Stony Point, is located 2 mi south of the site. Residential areas are also located in portions of Berlin Township and Frenchtown Charter Township. Relatively recent housing developments are present just south of Pointe Aux Peaux Road (the Fermi site's southern boundary).

The nearest designated recreational areas are the beaches at Stony Point (2 mi south of the site) and Estral Beach (2 mi northeast of the site). Nearby State recreational areas include Point Mouillee State Game Area (3.1 mi to the northeast) and Sterling State Park (4.8 mi to the south-southwest). Scattered industrial facilities are located west and southwest of the Fermi site along the I-75 corridor and near the City of Monroe. Commercial development is present along major road corridors, including Dixie Highway, Telegraph Road, and I-75, and within the City of Monroe.

All activities related to operation of Fermi 3 would occur within the Fermi site boundary and would be performed in compliance with Occupational Safety and Health Administration (OSHA) standards, BMPs, and other applicable regulatory and permit requirements. While approximately 89,198 people live within 10 mi of the site, physical impacts attenuate rapidly with distance, intervening foliage, and terrain. Therefore, people who would be most exposed to noise, air emissions, and gaseous emissions resulting from operation of Fermi 3 would be the onsite workforce. People working or living immediately adjacent to the Fermi site, transient populations such as people using recreational facilities, or temporary employees of other businesses in the area would be minimally affected because of lack of access to the site and distance from the site, which would limit the effects of operational activities.

Operations workers would receive safety training and would be required to use personal protective equipment to minimize health and safety risks. Emergency first aid care would be available at the site, and regular health and safety monitoring would be conducted. People working onsite or living near the Fermi site would not experience any physical impacts greater than those that would be considered an annoyance or nuisance.

5.4.1.2 Noise

Primary noise sources associated with operation of Fermi 3 would be transformers, the cooling system, and transmission lines (Detroit Edison 2011a). Noise would be buffered by the distance between the plant and residences or recreational areas offsite, such that the ambient sound level should not increase appreciably. The review team expects average day-night noise levels from the Fermi 3 cooling towers will be less than 65 dBA at the nearest noise-sensitive receptor. Noise along the transmission lines would be very low, except possibly directly below the line on a quiet, humid day (Detroit Edison 2011a). Therefore, the review team concludes that physical impacts from noise will be minimal. Projected noise impacts from operation of Fermi 3 are discussed in further detail in Section 5.8.2.

5.4.1.3 Air Quality

Air emissions associated with operation of Fermi 3 would include stationary source emissions from two standby diesel generators (SDGs), two ancillary diesel generators (ADGs), an auxiliary boiler, and two diesel-driven fire pumps (FPs). These emissions sources would be small, would be used infrequently, and would be permitted for use by MDEQ. The cooling tower would emit small amounts of particulate matter, which would be minimized further by drift eliminators. Emissions from worker vehicles, onsite support vehicles and heavy equipment, and vehicles used in delivery of materials and fuels would also occur (Detroit Edison 2011a). However, emissions from these sources would be expected to minimally affect nearby residences and recreational areas offsite. Therefore, the review team concludes that physical impacts on air quality will be minimal. Projected air emissions and impacts on air quality from operation of Fermi 3 are discussed in further detail in Section 5.7.

5.4.1.4 Buildings

Activities associated with operation of Fermi 3 would not affect offsite buildings. Noise levels would not increase appreciably and would not affect building structures offsite. Onsite buildings are designed to withstand any impact from operational activities. Consequently, the review team determines the operations impacts on onsite and offsite buildings would be minimal.

5.4.1.5 Roads

This EIS assesses the impact of workers commuting to and from the Fermi site from three perspectives: socioeconomic impacts resulting from congestion and reductions in levels of service (LOS),[a] the air quality impacts resulting from the emissions from vehicles used to transport workers to and from the site, and the potential health impacts caused by additional traffic-related accidents. Only the physical impacts are addressed here. The socioeconomic impacts are addressed here and in Section 5.4.4.1. The air quality impacts from vehicle emissions are addressed in Section 5.7, and human health impacts are addressed in Sections 5.8 and 5.9.

Use of area roadways by commuting workers could contribute to physical deterioration of roadway surfaces. However, some or all of the mitigation measures incorporated during the building phase will remain in place during the operation of the Fermi 3 plant. Given the much smaller volume of traffic on the roads during operations than during building, the review team determines that the overall impacts on road quality would be less than the impacts on road quality from building activities. Therefore, the operations-related impacts on road quality would be minimal.

5.4.1.6 Aesthetics

Fermi 3 would be located within the developed area of the Fermi site, along its eastern boundary by Lake Erie. Surrounding the developed area are 656 ac of wetlands, open water, and forested land that are included within the DRIWR and that buffer the view of the developed area from public roadways.

(a) LOS is a designation of operational conditions on a roadway or intersection, ranging from A (best) to F (worst). LOS categories as defined in the *Highway Capacity Manual* are listed on Table 2-40.

The review team expects visual impacts from grade-level operations activities to be limited. Surrounding land use is predominantly agricultural, with a few residential areas that are within the viewshed of the plant site. The area around the Fermi site is a security zone as defined in 33 CFR Part 165. In this security zone, boat traffic or other public use of the waters within a 1-mi circumference of the plant is prohibited. Views of the plant grade-level operational activities from the water would therefore also be limited. Therefore, the review team determines that aesthetics impacts from grade level activities would be minimal.

Two 400-ft-tall natural draft cooling towers are currently the predominant visible structures on the Fermi site, and these are visible from outside the site property boundaries in all directions. Several small beach communities are located along the Lake Erie shoreline within 5 mi of the Fermi site, including Estral Beach, Stony Point, Detroit Beach, and Woodland Beach. The proposed 600-ft cooling tower for Fermi 3 and a steam plume associated with operation of Fermi 3 would also be visible from locations within these communities and along the beaches and other recreational facilities (marinas, docks) along Lake Erie. Although taller than the existing cooling towers, the new 600-ft cooling tower would be consistent with the existing views of the Fermi site, and the review team expects a minor impact on visual aesthetics from operation of Fermi 3.

5.4.1.7 Summary of Physical Impacts

Based on the information provided by Detroit Edison, review team interviews with local public officials, and NRC's own independent review, the review team concludes that all the physical impacts of operation of Fermi 3 would be SMALL. Thus, additional mitigation measures beyond those identified by Detroit Edison are not warranted.

5.4.2 Demography

Detroit Edison expects the workforce needed to operate Fermi 3 to be 900 full-time and contract employees (Detroit Edison 2011a). Given the size of the labor force in the region (which includes portions of the Detroit and Toledo metropolitan areas), the range of operations jobs needed, and the specialized nature of nuclear power plant operations, the review team expects approximately 70 percent of the operations workforce, or approximately 630 workers, would be drawn from within a 50-mi radius of the Fermi site and the remaining 30 percent of the operations workforce, or approximately 270 workers, would need to be recruited from outside the region.

For the same reasons that formed the basis for the review team's anticipated residential distribution of building-related in-migrating workers in Section 4.4.2, the review team expects that characteristics of the workers recruited from outside the region with respect to choices and preferences (e.g., commute distance, available amenities, etc.) will be similar to those of the current workforce. Consequently, the review team could also assume the in-migrating workforce would move into the 50-mi region in the same proportions as the current operations workforce; with 87 percent residing in the three-county economic impact area and the remaining 13 percent outside of Monroe, Wayne, and Lucas Counties, but within a 50-mi radius of Fermi 3. The settlement distribution of the in-migrating workers needed for operation of Fermi 3 is shown in Table 5-8.

Table 5-8. Counties Where In-Migrating Operations Workforce Would Reside

County	In-migrating Operations Workforce in 2020	Percentage of In-migrating Workforce	
		By County[a]	Cumulative
Monroe	155	57.5	57.5
Wayne	51	19.0	76.5
Lucas	29	10.7	87.2
All others within 50-mi region	35	12.8	100.0
Total	**270**		

(a) Percentage of workforce by county is based on the residential distribution of the current Fermi 2 workforce (Detroit Edison 2008a).

The review team also assumed that workers drawn from outside the region move with their families and that each worker would have an average household size of 2.6 persons, based on the national average household size in the U.S. Census Bureau's 2010 population estimate (USCB 2010). Based on this assumption and the proportional settlement pattern shown in Table 5-9, the review team estimates that approximately 403 persons (155 operations workers and 248 additional family members) would relocate to Monroe County, approximately 133 persons (51 operations workers and 82 family members) would relocate to Wayne County, and approximately 75 persons (29 operations workers and 46 family members) would relocate to Lucas County. Thirty-five operations workers and an additional 91 family members would move into the remainder of the 50-mi region. Projected population increases are shown in Table 5-9.

The projected increase in population in Monroe, Wayne, and Lucas Counties associated with in-migrating workers and their families is less than 1 percent of the projected 2020 population for any of these counties. As discussed in Section 2.5, Wayne and Lucas Counties are projected to experience population losses through 2020. Therefore, the projected increase in population associated with workers relocating for work at Fermi 3, would have a minor beneficial impact on the two counties, because the population loss currently being experienced in Wayne and Lucas Counties, primarily due to the economy, could be lessened. While Monroe County is projected to have a modest population increase through 2020, the additional increase associated with the in-migrating operations workforce would be minimal.

Table 5-9. Potential Increase in Population Associated with In-Migrating Operations Workforce

County	Workforce Relocating from Outside Region	As Percentage of Total Relocating Workforce	Estimated Increase in Population (number of workers × 2.6 persons per household)[(a)]	Projected 2020 Population[(b)]	Estimated Increase as Percentage of Projected 2020 Population
Monroe	155	57.4	403	159,461	0.3
Wayne	51	18.9	133	1,812,593	0.007
Lucas	29	10.7	75	434,650	0.02
All others within region	35	13.0	91	–	–
Total	**270**		**702**		

(a) National average household size as of 2010 population data (USCB 2010).

(b) Monroe and Wayne Counties 2020 and 2030 projections were provided by the Southeast Michigan Council of Governments (SEMCOG) in April 2008 (SEMCOG 2008). For Lucas County, projections are provided by the Ohio Department of Development (2003). Projected populations are not provided for other counties within the 50-mi region. Given the small number of workers in-migrating to counties outside of Monroe, Wayne, and Lucas Counties, the impact on projected populations for any one jurisdiction would not be noticeable.

Given the size of the regional population projected for 2020 of 6,130,056 persons within a 50-mi radius of the Fermi site (see Table 2-25), the projected increase associated with the in-migrating operations workforce would be minimal within the region or local area.

In addition to the full-time and contract workforce of 900, an estimated 1200 to 1500 additional workers would be employed at Fermi 3 during scheduled outages. These workers would increase the transient population in the local area approximately every 24 months for a period of 30 days (Detroit Edison 2011a). Workers who do not currently reside in the region would be housed in temporary, short-term accommodations for the duration of the scheduled outages. The size of the contract labor for the scheduled outages for Fermi 3 is similar to the size of the workforce for scheduled outages at Fermi 2. However, Detroit Edison would not schedule outages for Fermi 2 and Fermi 3 at the same time. Therefore, the projected increase in the transient population would not be greater with operation of Fermi 3, but would result in an increase in transient population occurring more frequently in the local communities around the Fermi plant site.

Based on the review team's analysis, the in-migrating workers and their families would increase the populations in Monroe, Wayne, and Lucas counties by less than 1 percent. As discussed in Section 2.5, Wayne and Lucas Counties are projected to experience population losses through 2020. Therefore, the projected increase in population associated with operations workforce would have a beneficial impact on the two counties, because the population loss currently being experienced in Wayne and Lucas Counties, primarily due to the economy, would be partially offset by the in-migrating workers. While Monroe County is projected to have a modest population increase through 2020, the additional increase associated with the in-migrating operations workforce would be minimal. Therefore, the review team determines the three-county economic impact area would experience a SMALL and beneficial demographic impact from operations at Fermi 3.

In addition, a small number of operations workers would in-migrate to counties outside of Monroe, Wayne, and Lucas Counties. Therefore, their impact on any one jurisdiction would not be noticeable. The current and projected populations of the regional area are so large that the in-migrating operations workforce for Fermi 3 would represent less than 1 percent of the total population in any of the counties where these employees would reside. Therefore, the review team concludes that the demographic impacts of operation on the remainder of the region would also be SMALL and beneficial.

5.4.3 Economic Impacts on the Community

This section evaluates the economic impact of operation of Fermi 3 on the 50-mi region around the Fermi site, focusing primarily on Monroe, Wayne, and Lucas Counties. Detroit Edison plans to start commercial operation of Fermi 3 in 2021.

5.4.3.1 Economy

Operation of Fermi 3 would have a positive impact on the local and regional economy through direct employment of the operations workforce, purchase of materials and supplies for operation, and maintenance of the plant and any capital expenditures that occur within the region.

Detroit Edison estimates direct employment for Fermi 3 to be 900 full-time and contract employees (Detroit Edison 2011a). In addition, Detroit Edison would employ an estimated 1200 to 1500 workers at Fermi 3 during scheduled outages, which would occur every 24 months and require workers for a period of 30 days (Detroit Edison 2011a).

The types of workers that Detroit Edison expects to employ for Fermi 3 operations are shown in Table 2-31 and Table 5-10. As shown in Table 5-10, the average annual salary, based on 2008 U.S. Bureau of Labor Statistics (USBLS) data for the types of occupations that would be needed for Fermi 3, would range from $22,100 (security guard) to $111,340 (general or operations manager). For purposes of analysis, the review team estimated the overall payroll based on an average salary of approximately $63,625. For an annual workforce of 900 full-time and contract employees, Detroit Edison would expend an estimated $57.3 million on payroll each year during the 40-year operating license of Fermi 3. In addition, every 24 months, Detroit Edison would expend an additional $6.3 to $7.9 million in payroll for the outage workforce for Fermi 3.

Table 5-10. Wage Estimates for Occupations of the Operations Workforce in the Economic Impact Area[a] (2008)

Occupation Title	Mean Annual Wages[b] Monroe, Michigan MSA	Detroit-Livonia-Dearborn, Michigan Metropolitan Division	Toledo, Ohio MSA
General and Operations Managers	$91,240	$111,340	$97,920
Accountants and Auditors	$52,420	$68,850	$65,020
Computer Software Engineers, Applications	–[c]	$88,420	$68,720
Computer Software Engineers, Systems Software	–	$82,250	$72,940
Network and Computer System Administrators	$55,390	$67,090	$57,970
Chemical Engineers	–	$79,940	$72,570
Civil Engineers	$64,270	$70,810	$68,330
Electrical Engineers	$79,960	$80,480	$61,180
Mechanical Engineers	$67,620	–	$68,380
Nuclear Technicians	$66,910[d]	$66,910[d]	$66,910[d]
Security Guards[e]	$22,100	$27,230	$23,420
Office and Administration Support	$30,190	$34,980	$30,440
Nuclear Power Reactor Operators[d]	$73,510[d]	73,510[d]	$73,510[d]
Power Distributors and Dispatchers	–	–	$61,410
Power Plant Operators	–	$58,350	$62,070
Stationary Engineers and Boiler Operators	–	$56,630	$50,160

Source: USBLS 2008

(a) Data are presented according to the USBLS metropolitan areas, which include the counties identified as the economic impact area.

(b) Annual wages have been calculated by multiplying the hourly mean wage by a "year-round, full-time" figure of 2080 hours. Wages include base rate pay, cost-of-living allowances, guaranteed pay, hazardous-duty pay, incentive pays such as commissions and production bonuses, tips, and on-call pay. Wages do not include back pay, jury duty pay, overtime pay, severance pay, shift differentials, nonproduction bonuses, employer costs for supplementary benefits, and tuition reimbursements.

(c) "–" indicates this occupation is not reported in this metropolitan area.

(d) The mean annual wage for "Nuclear Technician" and for "Nuclear Power Reactor Operator" is a national mean annual wage; the mean annual wage for these occupations in the economic impact area was not available.

(e) The review team recognizes that the wages of security workers at nuclear power plants are higher than the average wage of all security workers.

Employees would also receive nonwage compensation, which would be for supplementary pay (i.e., premium pay for overtime and work on holidays and weekends), retirement benefits, insurance, and legally required benefits (i.e., worker's compensation, Social Security, etc.) A portion of the nonwage compensation (e.g., overtime pay) may also be expended in the local area.

The review team estimates that approximately 70 percent of the operations workforce, or approximately 630 workers, would be drawn from within a 50-mi radius of the Fermi site. The review team assumes that a portion of the workers drawn from the regional area would be unemployed. As discussed in Section 2.5, the overall rate of unemployment in Monroe, Wayne, and Lucas Counties in 2010 ranged between 11.3 percent (Lucas County) and 14.8 percent (Wayne County). Although employment in the local area is likely to change by the time building activities commence, the review team calculated an average of the 2010 unemployment rates for Monroe, Wayne, and Lucas Counties (13 percent) to estimate the number of workers that would likely be drawn from the ranks of the unemployed. The review team estimates that 13 percent of the 630 workers, or approximately 82 workers, would be drawn from the ranks of the unemployed. The review team expects approximately 30 percent of the annual workforce (approximately 270 workers) to relocate from outside the region.

New workers (i.e., in-migrating workers and those previously unemployed) would have an additional indirect effect on the local economy, because these new workers would stimulate the regional economy by their spending on goods and services in other industries. A model developed by the DOC, Bureau of Economic Analysis (BEA), called the Regional Input-Output Modeling System (RIMS II), quantifies this "ripple" effect through the use of regional industrial multipliers specific to a local economy. Each new direct job in the "utility sector" stimulates employment and results in additional (indirect) job creation in other industry sectors, such as services. This stimulus reflects additional economic activity from interdependent suppliers and vendors. The ratio of total jobs (direct plus indirect) to the number of new direct jobs is called the "employment multiplier." Operations workers who already live and work in the local area are a part of the baseline and, therefore, are not included in the calculation of new indirect effects.

In the three-county economic impact area, BEA RIMS II estimates that for every new worker, an additional 1.4 jobs would be created (Detroit Edison 2011a). Based on the employment multiplier, the 352 new workers (i.e., in-migrating workers and those previously unemployed) would create an additional 493 new jobs, for a total of 1393 new direct and indirect jobs (Table 5-11).

As stated above, an estimated $57.3 million (2008 dollars) would be expended in wages annually over the 40-year licensing period, based on an average annual salary of $63,625 for 900 workers. A regional multiplier was applied to the earnings of new workers to determine the effect of the direct earnings on the local economy. For every dollar of wages earned by new

Table 5-11. Average Annual Direct and Indirect Employment for Fermi 3 during Operations

		Calculation	Number of Workers
A	Direct employment[(a)]		900
B	Reside in region	A × 70%	630
C	(Otherwise employed at time of hire for Fermi 3)	B × 87%	(548)
D	(Unemployed at time of hire for Fermi 3)	B × 13%	(82)
E	Relocate from outside region	A × 30%	270
F	Indirect employment	(D + E) × 1.4	492
G	**Total annual employment**	**A + F**	**1392**
	Total annual new employment	**D + E + F**	**844**

(a) Indirect impacts associated with the outage workforce have not been included.

operations workers on Fermi 3, BEA estimates that an additional $0.50 of wages would be created in the local economy (Detroit Edison 2011a). For an estimated $57.3 million in new direct wages, an estimated $28.7 million in indirect wages would be created, for an annual total of about $86 million.

Purchase of materials and supplies for operation and maintenance of the plant and any capital expenditures that occur within the region would also have direct and indirect effects on the regional economy. Detroit Edison estimates that purchases of material and supplies for operation and maintenance of Fermi 2 and capital expenditures averaged $60.4 million per year between the years 2002 to 2007, of which approximately 23 percent ($13.9 million) is purchased from local vendors and suppliers (Detroit Edison 2011a). The review team expects that purchases of material and supplies for operation and maintenance and any capital expenditures for Fermi 3 would be similar to those for Fermi 2, although some economies of scale may result in a reduction in total expenditures for the two operating plants.

The review team concludes, based on its own independent review of the likely economic effects of the proposed action, that minor beneficial economic impacts would be experienced throughout the 50-mi region during the 40-year licensing period, including (1) 1393 direct and indirect jobs, (2) $86 million in direct and indirect annual wages, (3) an additional $7.9 million in wages during scheduled refueling outages every 24 months, and (4) $13.9 million spending on purchases of materials and supplies from local vendors and suppliers.

5.4.3.2 Taxes

The tax structure of the region is discussed in Section 2.5 of this EIS. Several tax revenue categories would be affected by operation of Fermi 3. These include (a) State and local taxes on worker incomes, (b) State sales taxes on worker expenditures; (c) State sales taxes on the purchase of materials and supplies for operation and maintenance of the plant, (d) State sales taxes on consumer purchases of electricity, (e) State business taxes, and (f) local property taxes.

State and Local Income Taxes

The States of Michigan and Ohio would receive additional income tax revenue from the income tax on wages of new workers. Table 5-12 summarizes the estimated new annual income tax revenue that would be received by each State. However, determining the exact amount of income tax revenue relies on a number of factors such as income tax rates, residency status, deductions taken, and other factors.

Table 5-12. Estimated New State Income and Sales Tax Revenue Associated with the Operations Workforce

New Workers and Revenue (in millions of US$)	Michigan	Ohio
New Operations Workers	232	38
Workers relocating from outside region		
Previously unemployed workers	71	11
Total new operations workers	**303**	**49**
Tax Revenue		
Estimated annual income (at $63,625 per year)	$19.3	$3.1
Estimated annual State income tax revenue	$0.8[(a)]	$0.1[(b)]
Estimated annual spending on goods and services[(c)]	$5.4	$0.9
Estimated annual sales tax revenue[(d)]	$0.3	$0.05
Total estimated annual new tax revenue	**$1.1**	**$0.15**

(a) As discussed in Section 2.2, the income tax rate in Michigan will be set at 3.9 percent in 2015.
(b) Ohio's tax rate for an income between $40,000 and $80,000 is $1056.40 plus 4.109 percent of excess over $40,000.
(c) Based on 28 percent of income before taxes (USBLS 2010).
(d) The Michigan sales tax rate is 6 percent, and the Ohio sales tax rate is 5.5 percent.

New workers are those drawn from the ranks of the unemployed and those who relocate from outside the States of Michigan or Ohio. As discussed in Section 5.4.2, approximately 70 percent of the annual workforce, or an average of 630 workers annually, are expected to be drawn from the region. Workers recruited for the operations workforce at Fermi 3 who already live and work in the region are already contributing to State income and sales tax revenue. However, approximately 13 percent of the 630 workers, or approximately 82 workers, would live in the area but would be unemployed. Those workers would contribute to new State tax revenue as they become employed at Fermi 3. Approximately 30 percent of the operations workforce, or approximately 270 workers, are expected to relocate from outside the region.

If all in-migrating workers move to the region from outside the States of Michigan and Ohio, they would also provide new tax revenue. To estimate the income tax revenue for the State of

Michigan and State of Ohio, the review team assumed a similar residential distribution to the current Fermi 2 workforce. Based on the current residential distribution of the Fermi 2 workforce, approximately 86 percent of the total workforce resides in Michigan and 14 percent resides in Ohio (both within and outside of the economic impact area) (fewer than 1 percent reside in Canada and are not included in this analysis). Assuming the in-migrating workers and previously unemployed workers are divided between Michigan and Ohio in the same proportion as the current Fermi 2 workforce, approximately 86 percent of the new workers would pay taxes in the State of Michigan and 14 percent would pay taxes in the State of Ohio. Therefore, the estimated new state income tax revenue would be approximately $0.8 million annually for the State of Michigan (2008 dollars) based on an average annual salary for the new workers of $63,625 and a 40-hour work week, and approximately $0.1 million annually for the State of Ohio.

As discussed in Section 2.5, several municipalities in Wayne and Lucas County impose taxes on income. Depending on the residential location of in-migrating workers, municipalities in Wayne County and Lucas County may also benefit from increased income associated with the operation of Fermi 3.

State and Local Sales Taxes on Worker Expenditures

The States of Michigan and Ohio and some of the local jurisdictions in Ohio would also receive sales tax revenue on expenditures made by the new workers. An estimated $0.3 million ($300,000) in new sales tax revenue would be received by the State of Michigan and $0.05 million ($50,000) by the State of Ohio, based on national averages for consumer spending on goods and services.

In addition, Detroit Edison would employ an estimated 1200 to 1500 workers at Fermi 3 during scheduled outages, which would occur every 24 months and require workers for a period of 30 days (Detroit Edison 2011a). During the outages, these workers would purchase local goods and services, generating additional but minimal sales tax revenue for the State of Michigan.

The review team determined that the impact of additional income taxes at the State level would be positive but minimal – less than 1 percent of each State’s total sales tax revenues.

In Michigan, local jurisdictions have taxing authority for selected sales revenue (i.e., hotel accommodations and stadium and convention facilities), and counties in Ohio may levy a general sales tax revenue. Therefore, local jurisdictions would also benefit from expenditures of goods and services.

State and Local Sales Taxes on Commercial (Non-Safety Related) Materials and Supplies

The States of Michigan and Ohio would receive sales tax revenue from the purchase of material and supplies for operation and maintenance of Fermi 3. Based on its reported average annual operations expenditures for Fermi 2 between the years 2002 to 2007, Detroit Edison spent about $60.4 million annually for materials and supplies, of which approximately 23 percent ($13.9 million) was purchased from local vendors and suppliers (Detroit Edison 2011a). Assuming expenditures for Fermi 3 will be similar to those for Fermi 2, the review team has estimated that Detroit Edison would expend approximately $13.9 million annually for the local purchase of non-safety related material and supplies for operation and maintenance of Fermi 3. A detailed analysis of the sources for these materials and supplies has not been conducted.

For purposes of analysis, the review team assumed 60 percent of the locally purchased materials and supplies would be purchased from within the State of Michigan (e.g., $8.3 million) and 40 percent from within the State of Ohio (e.g., $5.6 million). Based on a state sales tax rate in Michigan of 6 percent, an estimated $0.5 million in sales tax revenue would be received by the State of Michigan annually. Based on a state sales tax rate in Ohio of 5.5 percent, an estimated $0.3 million in sales tax revenue would be received by the State of Ohio annually from the purchase of materials and supplies for operation and maintenance of Fermi 3.

The review team determined that the impact of additional sales tax revenue from the purchase of materials and supplies for operation and maintenance of Fermi 3 would be beneficial but minimal – less than 1 percent of each State's total annual sales tax revenue.

In Michigan, local jurisdictions have taxing authority for selected sales revenue (i.e., hotel accommodations and stadium and convention facilities), and counties in Ohio may levy a general sales tax revenue. Therefore, local jurisdictions would also benefit from purchases of good and supplies for operation and maintenance of Fermi 3.

State Sales Taxes on Purchases of Electricity

The State of Michigan would benefit from increased sales taxes on consumer purchases of electricity generated by Fermi 3. As discussed in Section 2.5, the State of Michigan receives an estimated $208 million in sales tax revenue based on 2009 residential, industrial, and commercial purchases of electricity from Detroit Edison's ten electrical generating facilities in Michigan (DOE/EIA 2009). The review team estimates that sales tax revenue from purchase of electricity from Fermi 3 would be proportional to one-tenth the total sales tax revenue of the ten operating facilities, which would be an estimated $21 million annually.

Business Taxes

In 2007, Detroit Edison paid $149 million in combined federal and state corporate income tax (Detroit Edison 2008b). With increased income from the sale of electricity from Fermi 3, the review team expects Detroit Edison to pay additional beneficial but minimal corporate income taxes.

Local Property Taxes

The assessed value of the Fermi plant site would increase in value with the completion of the Fermi 3 plant for operation. Local jurisdictions would benefit from the increased property value with the corresponding increased property tax revenue. For purposes of analysis, the review team recognizes that the full estimated construction cost of $6.4 billion for a nuclear power plant of 1605 MW(e) as discussed in Section 4.4.3.1 may not be the actual assessed value for property tax purposes. However, for comparative purposes in the alternative sites analysis, the review team based its conclusions upon this construction cost estimate.

In 2009, the assessed value of property owned by Detroit Edison in Monroe County was $821 million (Monroe County Finance Department 2009), approximately 13.3 percent of the total county taxable assessed value. Consequently, with completion of the construction of Fermi 3, the total assessed property value in the county would be increased by about 100 percent. The review team recognizes that this would be an upper boundary to the assessed value of the property and that a fee in lieu of agreement or other considerations may significantly reduce that assessed value. However, the review team believes that the property tax impact on Monroe County would be substantial and beneficial.

The estimated annual property tax revenue in Table 5-13 is based on current millage rates and the full construction cost of Fermi 3. Therefore, the information in Table 5-13 should be considered an upper boundary to the actual property taxes that would be paid by Detroit Edison for Fermi 3.

Table 5-13. Estimated Annual Property Tax Revenue from Fermi 3 Assessed Property Value Based on 2009 Millage Rates

Jurisdiction	Millage (2009)	Total Estimated Annual Property Tax Revenue (in millions)
Monroe County – operation	4.8	$30.7
Monroe County – senior citizens	0.5	$3.2
Monroe County Community College	2.18	$14.0
Monroe County Library	1.0	$6.4
Monroe Intermediate School District	4.75	$30.4
Frenchtown Charter Township	6.8	$43.5
Jefferson schools	18.5	$118.4
State education tax	6.0	$38.4
Resort Authority	2.8	$17.9
Total millage	47.33	$302.9

5.4.3.3 Summary of Economic Impacts

Based on the information provided by Detroit Edison and the review team's evaluation, the review team concludes that the impact of operation of Fermi 3 on the economy would be SMALL and beneficial throughout the 50-mi region. For tax revenues, the review team determined the impacts of operations would be LARGE and beneficial in Monroe County and SMALL and beneficial elsewhere. An estimated 270 new workers would relocate into the area, and 82 unemployed workers would be employed. Tax revenue to local jurisdictions would accrue through personal income, sales, and property taxes and would have the largest benefit on the local jurisdictions within Monroe County.

5.4.4 Infrastructure and Community Services

Infrastructure and community services include traffic, recreation, housing, public services, and education. Operation of Fermi 3 would affect the transportation network as the additional workforce uses the local roads to commute to and from work, and possibly additional truck deliveries are made to support operation of the plant. These same commuters could also potentially affect recreation in the area. As the workforce in-migrates and settles in the region, there may be impacts on housing, education, and public sector services.

5.4.4.1 Traffic

Existing transportation routes would be affected by an increase in commuter traffic to and from the Fermi site associated with the operations workforce for Fermi 3.

The interstate highways and local roadways described in Section 2.5.2.3 would be used by operations workers to commute to and from work. Traffic associated with the operations workforce would be most concentrated on local roadways near the site, lessening as workers disperse in various directions on regional interconnecting roadways and highways.

Traffic volumes associated with the Fermi site are shown in Table 5-14. Operation of Fermi 3 would result in a near doubling of the workforce at the Fermi site, with operations workers for both Fermi 2 and Fermi 3. These workers would be divided into multiple shifts such that the plant would be staffed 24 hr per day, all days of the year. However, peak traffic volumes would occur during the morning commute to the site from 5:30 a.m. to 7:30 a.m. (0.49 vehicles per employee) and the afternoon commute from the site from 2:30 p.m. to 5:30 p.m. (0.44 vehicels per employee) (Mannik and Smith Group, Inc. 2009).

Table 5-14. Actual (2009) and Projected (2020) Peak Traffic Volumes – Fermi Site

Workforce	A.M. Peak (vehicles)	P.M. Peak (vehicles)
Current Fermi 2 workforce (2009)	466	418
Projected Fermi 3 workforce (2020)	441	396
Total Fermi 2 and Fermi 3 workforce	**907**	**814**
Outage workforce for Fermi 3 (2020)	732	436
Total Fermi 3 outage workforce + Fermi 2 workforce	**1198**	**854**

Source: Mannik and Smith Group, Inc. 2009

Detroit Edison conducted a traffic study to evaluate the effect of the operations workforce on the LOS of local roadways, incorporating a traffic projection growth rate for background traffic levels that was developed by SEMCOG in its traffic forecasting model. The analysis focused on seven local roadway intersections and three interstate (I-75) interchanges, which are listed below:

- N. Dixie Highway and Stony Creek Road
- N. Dixie Highway and Pointe Aux Peaux Road
- N. Dixie Highway and Leroux Road
- N. Dixie Highway and Enrico Fermi Drive
- N. Dixie Highway and Post Road
- Leroux Road and Toll Road
- Enrico Fermi Road and Leroux Road
- I-75 and N. Dixie Highway
- I-75 and Nadeau Road
- I-75 and Swan Creek Road/Newport Road

The LOS analysis was conducted in accordance with the Transportation Research Board's *Highway Capacity Manual* to evaluate the operational efficiency at each intersection and its approaching roadways.

The traffic analysis indicates that unsatisfactory traffic conditions (LOS of E or F) would occur at several intersections during both the peak-hour morning and afternoon commutes of the operations workforce. Some of these intersections are already operating under unsatisfactory conditions (see Tables 5-15 and 5-16) and were also determined to operate under unsatisfactory traffic conditions during the peak construction period (see Tables 4-12 and 4-13). These conditions could be alleviated primarily by roadway or traffic flow improvements, including signalization, lane use modification, and signal timing/phasing optimization, some of

Table 5-15. Impacts on Area Roadways during Peak Morning Operations Workforce Commute

Intersection	Approach/Movement	Existing (2009) Level of Service	Projected (2020) Level of Service	Potential Improvement Alternatives
Northbound I-75 ramps and Nadeau Rd.	Northbound ramp left turn	F	F	• Signalization • Lane use modification
Northbound I-75 ramps and Swan Creek Rd.	Northbound ramp left turn	D	D	
Southbound I-75 ramps and Newport Rd.	Southbound approach	C	D	
N. Dixie Hwy. and Stony Creek Rd.	Stony Creek Rd. eastbound	C	E	
N. Dixie Hwy. and Pointe Aux Peaux Rd.	N. Dixie Hwy. northeastbound	B	F	• Signal timing/phasing optimization
N. Dixie Hwy. and Enrico Fermi Dr.	N. Dixie Hwy. northbound	A	A	• Signal timing/phasing • Northbound/southbound turn lanes on N. Dixie Hwy. • Additional access point • Westbound lane use/storage
	N. Dixie Hwy. southbound	A	F	
	Enrico Fermi Dr. westbound	C	B	

Source: Mannik and Smith Group, Inc. 2009

Table 5-16. Impacts on Area Roadways during Peak Afternoon Operations Workforce Commute

Intersection	Approach/Movement	Existing (2009) Level of Service	Projected (2020) Level of Service	Potential Improvement Alternatives
Northbound I-75 ramps and Nadeau Rd.	Northbound ramp left turn	F	F	• Signalization • Lane use modification
Northbound I-75 ramps and Swan Creek Rd.	Northbound ramp left turn	E	E	• Signalization • Lane use modification
Southbound I-75 ramps and Newport Rd.	Southbound I-75 ramp northbound approach	E	F	• Signalization • Lane use modification
	southbound approach	D	E	
N. Dixie Hwy. and Stony Creek Rd.	Stony Creek Rd. eastbound	C	E	• Signalization • Eastbound Stony Creek left/right turn lanes
N. Dixie Hwy. and Pointe Aux Peaux Rd.	N. Dixie Hwy. southwestbound	C	F	• Signal timing/phasing optimization
N. Dixie Hwy. and Enrico Fermi Dr.	N. Dixie Hwy. northbound	A	B	• Signal timing/phasing optimization
	N. Dixie Hwy. southbound	B	B	
	Enrico Fermi Dr. westbound	B	E	• Northbound/southbound turn lanes on N. Dixie Hwy. • Additional access point • Westbound lane use/storage

Source: Mannik and Smith Group, Inc. 2009

which may be incorporated during the construction period. The Monroe County Road Commission (MCRC) and Michigan Department of Transportation (MDOT) will be responsible for reviewing and approving site plans because the plans affect area roadways during the site plan review and approval process for a building permit within Frenchtown Charter Township (Assenmacher 2011; Ramirez 2011). At that time, these agencies may require that a traffic impact study in accordance with Traffic and Safety Note 607C, "Traffic Impact Studies" (MDOT 2009) be conducted, and improvements to local roadways may focus on those roadways that are affected during both construction and operation. Recommendations for improvements to the I-75 interchanges will require approval of MDOT. All other roadway and intersection improvements will require the approval of MCRC.

During Fermi 2 or Fermi 3 scheduled outages, unsatisfactory traffic conditions would be further exacerbated. During scheduled outages, Detroit Edison hires contract labor to carry out fuel-reloading activities, equipment maintenance, and other projects associated with the outage. Detroit Edison employs approximately 1200 to 1500 workers for 30 days during every outage, which occurs every 18 months for Fermi 2 and would occur every 24 months for Fermi 3.

Estimated traffic generated by the Fermi site during scheduled outages is shown in Table 5.4-7. However, these conditions would exist only for the length of the outage (approximately 30 days); they would not represent normal conditions. Detroit Edison will not schedule an outage for Fermi 3 during the same time as an outage for Fermi 2.

Overall, with the exception of a few intersections/interchanges, impacts on area roadways associated with the operations workforce for Fermi 3 would be minor, because the existing traffic volumes on local roadways in the vicinity of the Fermi site are generally below the capacity of the roads, and beyond the local roadways, the traffic associated with the operations workforce would be widely dispersed on a widely developed regional roadway network.

During Fermi 3 outages an additional 1200–1500 workers would commute to the site, in addition to the 1627 operations workers (727 for Fermi 2 and 900 for Fermi 3), for a total of about 3127 workers on local roadways each day. This number is similar to the maximum number of workers on local roadways during the peak employment period of construction (3627), which formed the basis of the review team's MODERATE impact on traffic near the plant. Therefore, the review team concludes from the information provided by Detroit Edison, interviews with local planners and officials, and the review team's independent evaluation, that the offsite impacts on road traffic from operation of Fermi 3 would be minor during normal operations and noticeable but not destabilizing during outages. Detroit Edison has committed in the ER to working with MDOT and MCRC to determine possible mitigation measures closer to the time of operation (Detroit Edison 2011a).

5.4.4.2 Recreation

Recreational resources in Monroe, Wayne, and Lucas Counties may be affected by operations of Fermi 3. Impacts may include increased user demand associated with the projected increase in population with the in-migrating workforce and their families, an impaired recreational experience associated with the views of the proposed 600-ft cooling tower and steam plume, or access delays associated with increased traffic from the operations workforce on local roadways.

Impacts associated with the increased use of the recreational resources in the vicinity and region would be minimal. Based on the projected increase in population in Monroe, Wayne, and Lucas Counties, the review team determined the operations would not affect the availability and use of recreational resources in the area, especially considering that Wayne and Lucas Counties have experienced and are projected to continue to experience population losses through 2020.

Additional demand on recreational resources would occur during the scheduled outage periods that would occur every 24 months. Detroit Edison identified the number of short-term accommodations within 50 mi of the City of Monroe. These accommodations would be used by people using recreational areas and by other visitors/tourists to the region, and may also be used by a portion of the outage workforce over the 30 days during scheduled outage periods. More than 375 establishments, including hotels and motels, bed and breakfasts, cabins and cottages, condominiums, historic inns, and recreational vehicle (RV) parks and campgrounds, are located within 50 mi of the City of Monroe. With the large number of establishments and the expectations that only a portion of the outage workers would be from outside the region and that the need for housing would be short term, the review team expects that the availability and use of recreational accommodations for other visitors/tourists in the region would be minimally affected.

Users of recreational resources in the immediate vicinity of the Fermi site may have a diminished recreational experience due to the view of the 600-ft cooling tower and a steam plume that would exist during operation of Fermi 3. Several small beach communities are located along the Lake Erie shoreline within 5 mi of the Fermi site, including Estral Beach, Stony Point, Detroit Beach, and Woodland Beach. Several public and private beaches are located along the Lake Erie shoreline in Monroe and Wayne Counties. Many small marinas and docks also are located along the Lake Erie shoreline within the vicinity of the Fermi site. The cooling tower would also be visible from Point Mouillee State Game Area (3.1 mi to the northeast), Sterling State Park (4.8 mi to the south-southwest), and Lake Erie. Although taller than the existing cooling towers, the new 600-ft cooling tower and associated steam plume would be consistent with the existing views of the Fermi site, and the review team determines there would be no discernible adverse impacts on recreational users from the operation of the Fermi 3 cooling tower.

People using recreational facilities near the site may experience traffic congestion on the roads during the morning and afternoon commutes of the operations workforce and during the scheduled outages. However, measures to mitigate traffic delays at selected intersections and I-75 interchanges have been recommended following a traffic analysis of local roadways, which would alleviate impacts on users of recreational facilities as well as on members of the general public using local roadways. Given the high capacity of local roadways and the limited times when Fermi 3-related traffic would compete for access, along with the presence of traffic-mitigating measures implemented to facilitate building-related traffic during the construction phase, the review team expects that the accessibility of recreational accommodations for other visitors/tourists in the region would be minimally affected.

5.4.4.3 Housing

As discussed above, the review team expects 70 percent of the operations workforce would be local workers who currently reside within approximately 50 mi of the Fermi site and would not affect the housing market. The review team expects the remaining 30 percent of the operations workforce, or approximately 270 workers, to relocate into the region, 235 of whom would move into Monroe, Wayne, and Lucas Counties, and to rent or purchase housing. About 35 workers would choose to relocate elsewhere in the 50-mi region and would not affect housing availability because of the large metropolitan area from which housing could be selected. The review team expects that the residential distribution of the in-migrating workforce in the three-county economic impact area will be similar to the residential distribution of the current Fermi 2 workforce. Table 5-17 compares the available housing to the number of in-migrating operations workers.

Table 5-17. Impact on Housing Availability within Monroe, Wayne, and Lucas Counties

	Monroe	Wayne	Lucas
Workforce relocating from outside the region	155	51	29
Vacant housing units	4632	135,385	23,659
Estimated housing as a percentage of housing availability	3.3	0.04	0.1

Given the relatively large size of the regional housing market, the increased demand for housing by relocating workers and their families would have no noticeable impact on the availability or price of housing. As presented in Section 2.5, the U.S. Census Bureau (USCB) data indicated that more than 1 million housing units were located in Monroe, Wayne, and Lucas Counties in 2010, of which more than 300,000 were rental units. The vacancy rate within the three counties ranged from 2.4 percent to 4.4 percent for owner-occupied housing and from 9.1 percent to 11.3 percent for rental units; 146,048 housing units were vacant. SEMCOG reported 68 mobile home parks and 15,835 mobile home sites in Wayne County, and 29 mobile home parks and 7452 mobile home sites in Monroe County (SEMCOG 2008), of which 17.2 percent surveyed in Monroe County were vacant in 2006.

Substandard housing units are being demolished by Wayne and Monroe County, and this has resulted in a net loss of housing units in Wayne County. However, the review team has also considered that a large number of housing units are in foreclosure, population in the local area is declining, and additional housing units also are being approved for construction, and these factors have resulted in a net gain in housing units in Monroe County. Despite the changes that are expected to occur in the housing market, the review team expects that the overall number of housing units will be more than sufficient to accommodate workers relocating from outside the local area.

Given the large supply of housing and the size of the Detroit and Toledo metropolitan areas relative to the 270 in-migrating families, the review team expects sufficient housing to be available for workers relocating to the area without affecting the housing supply or prices in the local area or stimulating new housing construction.

Demand for short-term housing would occur during the scheduled outages that would occur every 24 months. Workers who do not currently reside in the region would be housed in temporary, short-term accommodations for the duration of the scheduled outages.

Detroit Edison identified the number of short-term accommodations within 50 mi of the City of Monroe. These accommodations would be occupied by people using recreational areas and by other visitors/tourists to the region (as discussed above) and also by a portion of the outage workforce over the 30 days when scheduled outages occur. More than 375 establishments, including hotels and motels, bed and breakfast establishments, cabins and cottages, condominiums, historic inns, and RV parks and campgrounds, are located within 50 mi of the City of Monroe. With the large number of establishments and the expectation that only a portion of the outage workers would be from outside the region and that the need for housing would be short term, the availability of short-term accommodations would be minimally affected.

The operation of Fermi 3 could affect housing values in the vicinity of the Fermi site. Based on previous studies that have been done (Bezdek and Wendling 2006; Clark et al. 1997; Farber 1998), and as discussed in Section 4.4.4.3, the review team determined that the impact on housing values from the operations of Fermi 3 would be minor.

5.4.4.4 Public Services

This section discusses the impacts on existing water supply and wastewater treatment and police, fire response, and health care services in Monroe, Wayne, and Lucas Counties.

Water Supply and Wastewater Treatment Services

The in-migrating operations workforce for Fermi 3 would increase the demand for water supply and wastewater treatment services within the communities where they choose to reside; the size of the total operations workforce would increase the demand for water supply and wastewater treatment services at the Fermi site.

The review team expects that approximately 70 percent of the operations workforce would be local workers currently served by water supply and wastewater treatment services within the communities in which they reside.

The review expects the remaining 30 percent of the operations workforce, or approximately 270 workers, would increase demand on water supply and wastewater treatment services within the communities in which they choose to reside.

Given that 270 workers and their families would relocate from outside the area into a large housing market, the review team expects these workers would obtain housing within the existing housing market rather than stimulate new housing construction. Therefore the in-migrating operations workers would not expand existing water supply or wastewater treatment services to new areas. Potable water is available to the existing housing market through wells or municipal water supplies, as discussed in Section 2.5.2.6, and residents have access to municipal wastewater collection and treatment systems or have individually owned onsite wastewater disposal (septic) systems.

The estimated demand for water supply and wastewater treatment services in Monroe, Wayne, and Lucas Counties is shown in Table 5-18.

Table 5-18. Estimated Increase in Demand for Water Supply and Wastewater Treatment Services in Monroe, Wayne, and Lucas Counties from In-Migrating Operations Workforce

Factor	Monroe	Wayne	Lucas
Estimated increase in population[(a)]	403	133	75
Estimated increase in residential daily water demand[(b)]	0.05 MGD	0.02 MGD	0.01 MGD
Estimated increase in residential daily wastewater flow[(c)]	0.03 MGD	0.01 MGD	0.01 MGD

(a) Approximately 35 workers would choose to relocate elsewhere in the 50-mi region, which would result in a total increase of 91 persons in the population outside of Monroe, Wayne, and Lucas Counties. An increase of 91 persons is not expected to affect water supply or wastewater treatment services, because the metropolitan area in which these persons would settle is large.

(b) Average daily water use per person is estimated to be 135 gal per day, based on the planning criteria used by the Detroit Water and Sewerage Department (DWSD) in June 2004 (DWSD 2004).

(c) Average daily wastewater flow per person is estimated to be 77 gal per day based on the planning criteria used by the DWSD in October 2003 (DWSD 2003).

The review team expects the increase in demand for water supply from in-migrating workers and their families will have a minor impact on municipal water suppliers in the local area because the projected increase in population is small and the in-migrating population would be served by a number of municipalities and jurisdictions.

In Monroe County, the largest municipal water supplier is the City of Monroe. The treatment plant in the City of Monroe is designed to treat 18 MGD, and its average daily water demand is 7.8 MGD (Monroe County Planning Department and Commission 2010). Other municipal water suppliers in Monroe County may also provide water supply to the in-migrating population, including the Frenchtown Charter Township; the City of Milan, Michigan; the City of Toledo, Ohio; and the Detroit Water and Sewerage Department (DWSD), which also serves portions of Monroe County. Therefore, the estimated water demand of 0.05 MGD for the additional people choosing to reside in Monroe County would have a minor impact on water suppliers.

Wayne County is serviced by DWSD, which has a treatment capacity of 1720 MGD. The average daily water demand for DWSD is 622 MGD (Ellenwood 2010). Therefore, the estimated water demand of 0.02 MGD for the additional people choosing to reside in Wayne County would have a minor impact on DWSD.

The largest municipal water supplier in Lucas County is the City of Toledo, which also services the northeastern portion of the county, where workers are more likely to settle. Its plant has a treatment capacity of 120 MGD, with an average daily demand of 73 MGD (Leffler 2010). Therefore, the estimated water demand of 0.01 MGD for the additional people choosing to reside in Lucas County is expected to have a minor impact on the municipal water suppliers in Lucas County.

The review team expects the increase in demand for wastewater treatment to have a minor impact on wastewater treatment plants in the local area because of the number of jurisdictions providing wastewater collection and treatment services in the local area compares favorably to the size of the population increase associated with Fermi 3.

In Monroe County, the largest wastewater treatment plant is operated by the City of Monroe. It is designed to treat 24 MGD wastewater flows, and its average daily wastewater flow is 15.9 MGD (MDEQ 2011). In addition, wastewater treatment services are provided by a number of municipalities in Monroe County, including the townships of Bedford, Berlin, Ida and Raisinville; the cities of Milan, Petersburg, and Luna Pier; and the villages of Dundee, Carleton, and Maybee. Therefore, the review team expects that the estimated wastewater treatment flows of 0.03 MGD for the additional people choosing to reside in Monroe County would have a minor impact on wastewater treatment capability.

Wayne County is served by two large wastewater treatment facilities: the DWSD, which has a treatment capacity of 930 MGD and treats an average wastewater flow of 727 MGD (Ellenwood 2010), and the Downriver Treatment Plant, which has a treatment capacity of 125 MGD and treats an average wastewater flow of 52 MGD. In addition, Gross Ile Township, City of Rockwood, and City of Trenton maintain wastewater treatment facilities. Therefore, the estimated wastewater treatment flows of 0.01 MGD for the population choosing to reside in Wayne County would have a minor impact on wastewater treatment capability.

Operational Impacts at the Proposed Site

The City of Toledo's wastewater treatment plant is the largest in Lucas County. The plant has a treatment capacity of 195 MGD, with an average daily demand of 71 MGD (McGibbeny 2010). Therefore, the estimated wastewater treatment flows of 0.01 MGD for the population choosing to reside in Lucas County are expected to have a minor impact on wastewater treatment capability.

The operations workforce would place additional demands on the municipal potable water supply to the Fermi site and on wastewater treatment services provided for the site. Detroit Edison plans to connect to the City of Monroe Township municipal water system and to the Monroe Metropolitan Wastewater Treatment Facility.

Surface water withdrawn directly from Lake Erie would provide the water supply for cooling and other operational uses. Wastewater from operation of the plant would be treated at an onsite wastewater treatment facility, and treated nonradiological wastewater would be discharged to Lake Erie. Impacts associated with the surface water withdrawal and discharge are discussed in Section 5.2.

For a full-time and contract workforce of 900 at Fermi 3, the potable water demand onsite would increase by an estimated 0.09 MGD, based on a standard institutional water consumption planning rate of 100 gal/person/day (Metcalf and Eddy, Inc. 1972). During a scheduled outage, with a temporary workforce of 1200 to 1500, potable water demand onsite would increase by an estimated 0.12 to 0.15 MGD over the 30-day outage period. The average daily and maximum daily water demands for Frenchtown Charter Township in 2005 were 2.1 MGD and 3.9 MGD, respectively. The plant doubled its capacity from 4 MGD to 8 MGD in 2006, which is projected to be sufficient for a minimum of 20 years (Monroe County Planning Department and Commission 2010). Therefore, the review team expects operation of Fermi 3 to have a minimal impact on the Frenchtown Township municipal water supply service.

For a full-time and contract workforce of 900 at Fermi 3, the review team estimates the sanitary wastewater flow onsite would increase by 0.07 MGD, or 80 percent of the estimated water consumption (Metcalf and Eddy, Inc. 1972). The Monroe Metropolitan Wastewater Treatment Facility is designed to treat 24 MGD wastewater flows, and its average daily wastewater flow is 15.9 MGD (MDEQ 2011). Therefore, the review team expects that operation of Fermi 3 would have a minimal impact on the wastewater treatment capabilities of the Monroe Metropolitan Wastewater Treatment Facility.

The review team concludes from the information provided by Detroit Edison, interviews with local planners and officials, and the review team's independent evaluation that the operation of Fermi 3 would have minimal impacts on local water supply and wastewater treatment facilities.

Police, Fire Response, and Health Care Services

The operations workforce for Fermi 3 would increase the demand for police, fire response, and health care services within the communities where they reside and at the Fermi site.

The review team expects that approximately 70 percent of the operations workforce currently reside within an approximately 50-mi radius of the Fermi site and are currently served by the police, fire response, and health care services within their communities. Although the commute from residence to place of work would change, demand for police, fire response, or health care services would not be appreciably different from that of the baseline population served by any one jurisdiction.

The review team expects that the in-migrating operations workers would increase the demand on police, fire response, and health care services within the communities in which they chose to reside.

As discussed in Section 5.4.2, the projected population increase associated with in-migrating workers, based on an average household size of 2.6 persons, is 702 persons. Based on the existing distribution pattern of the Fermi 2 operational workforce, an estimated 403 persons would relocate to Monroe County; an estimated 133 persons would relocate to Wayne County; and an estimated 75 persons would relocate to Lucas County. Approximately 91 persons would relocate elsewhere in the region. As shown in Table 5-19, the projected increase in population would have no measurable effect on the ratio of police officers, firefighters, or health care workers per 1000 residents in Monroe, Wayne, or Lucas Counties, based on the 2010 population as presented in Section 2.5.

Fermi 3 operations may result in an increase in demand for police, fire response, or health care services onsite, especially in the event of workplace injury or accidents. Police, fire response, and other emergency response personnel may encounter traffic congestion on local roadways when responding to calls during the commutes of the operations workforce (and temporarily, during the scheduled outages) to the site. However, the area around the Fermi site is sparsely populated, and the review team does not expect that there would be a high demand for police, fire response, or other emergency response personnel. In addition, measures to mitigate traffic delays at selected intersections and I-75 interchanges that are being considered would reduce the impacts on emergency responders as well as members of the general public using local roadways. During the site plan review and approval process, Frenchtown Charter Township will require, as necessary, that the project be reviewed by MCRC and MDOT. These agencies may require that a traffic impact study in accordance with Traffic and Safety Note 607C (MDOT 2009) be conducted, and improvements to local roadways would be considered by Detroit Edison at that time.

Table 5-19. Changes Associated with Fermi 3 Operations in Population Served by Law Enforcement Personnel, Firefighters, and Health Care Workers in Monroe, Wayne, and Lucas Counties

		Existing Conditions		Conditions with In-Migrating Operations Workers and Families	
Public Service	**Number of Officers/Firefighters/ HealthCare Workers**	**Population Served**	**Officers/Firefighters/ Health Care Workers per 1000 Residents**	**Population Served[(a)]**	**Officers/Firefighters/ Health Care Workers per 1000 Residents**
County Sheriff and Municipal Law Enforcement Personnel					
Monroe	277	152,021	1.8	152,671	1.8
Wayne	6957	1,820,584	3.8	1,820,800	3.8
Lucas	973	441,815	2.2	441,937	2.2
Firefighters					
Monroe	606	152,021	4.0	1532,671	4.0
Wayne	3407	1,820,584	1.9	1,820,800	1.9
Lucas	1195	441,815	2.7	441,937	2.7
Health Care Workers					
Monroe, Michigan MSA	2770	152,021	18.2	152,527	18.2
Detroit-Livonia-Dearborn Metropolitan Division	69,030	4,296,250	16.1	4,296,533	16.1
Toledo, Ohio MSA	34,600	651,429	53.1	651,551	53.1

Sources: FBI 2009; FEMA 2010; USBLS 2008

(a) 2010 ACS population data plus the projected population increase associated with relocating workers and their families.

Fire suppression equipment and a first aid station are available onsite, and Detroit Edison has existing agreements with local emergency response organizations (Detroit Edison 2011a). Because of these offsite and onsite safety strategies, the review team expects the impact of operations on the demand for local emergency room service personnel would be minimal.

5.4.4.5 Education

The in-migrating operations workforce for Fermi 3 would increase the demand for educational services.

The review team expects that 70 percent of the operations workforce would currently reside within 50 mi of the Fermi site and would not make any additional demands on educational services in the region.

The review team expects the in-migrating operations workforce would increase school enrollments by about 82 in Monroe County, 27 in Wayne County, and 15 in Lucas County (Table 5-19).

During the 2008–2009 school year, enrollment in the nine public school districts in Monroe County was 23,283, and in Wayne County's 35 public school districts enrollment was 276,862. During the same year, enrollment in Lucas County's eight school districts was 57,263 (Table 5-20). The review team determined that the impact of the projected increase in population associated with the operations workforce for Fermi 3 on local schools would be negligible because the households associated with the relocated workers would be dispersed in numerous public schools throughout these school districts, as well as among numerous private, parochial, and alternative schools (Table 5-21).

Table 5-20. Estimated Number of School-Age Children Associated with In-Migrating Workforce for Fermi 3 Operations

Factor	Monroe	Wayne	Lucas
Estimated number of operations workers in-migrating to county	155	51	29
Estimated increase in population[(a)]	403	133	75
Estimated increase in number of school-age children[(b)]	82	27	15

(a) Based on 2.6 persons per household (USCB 2010).
(b) Based on the 2010 Census data for the country, which shows that 20.4 percent of the population is between the ages of 5 and 19 years (USCB 2010).

Table 5-21. Changes Associated with Fermi 3 Operations in Student/Teacher Ratio for School Districts in Monroe, Wayne, and Lucas Counties

	Existing Conditions			Conditions with In-Migrating Workers and Families	
County	Total Countywide Number of Teachers	Total Countywide Student Enrollment	Student/ Teacher Ratio throughout County	Total Countywide Student Enrollment[(a)]	Student/ Teacher Ratio throughout County
Monroe	1254	23,283	18.6	23,995	18.8
Wayne	15,853	276,862	17.5	292,552	17.8
Lucas	3716	57,263	15.4	58,883	15.8

Source: U.S. Department of Education 2010

(a) Population served includes the 2008–2009 countywide school enrollment plus the projected number of school-age children associated with in-migrating workers.

5.4.4.6 Summary of Infrastructure and Community Services

Based on information supplied by Detroit Edison, review team interviews conducted with and information solicited from public officials, and the review team evaluation of data concerning the current availability of services, the review team concludes that the impacts of Fermi 3 operations on regional infrastructure and community services, including recreation, housing, water and wastewater facilities, police, fire and medical facilities, and education, would be SMALL and mitigation would not be warranted (Peven 2010). Although the traffic associated with the operations workforce would result in a SMALL impact on area roadways, the traffic associated with Fermi 3 outages would result in a MODERATE impact.

5.4.5 Summary of Socioeconomic Impacts

The review team has assessed the activities related to operation of Fermi 3 and the potential socioeconomic impacts in the region and local area. Physical impacts on workers and the general public include those on noise levels, air quality, existing buildings, roads, and aesthetics. The review team concludes that all physical impacts from operation of Fermi 3 would be SMALL.

On the basis of information supplied by Detroit Edison and the review team interviews conducted with public officials, the review team concludes that impacts from operation of Fermi 3 on the demographics of the entire 50-mi region would be beneficial and SMALL. Economic impacts, including impacts on tax revenues, would be beneficial and LARGE in Monroe County and beneficial and SMALL elsewhere.

Infrastructure and community services impacts span issues associated with traffic, recreation, housing, public services, and education. Impacts from operation of Fermi 3 on recreation, housing, public services, and education would be SMALL. Traffic-related impacts on local roadways near the Fermi site would be SMALL during normal operations and MODERATE during outages. Impacts on traffic would be mitigated by implementation of roadway improvements either during the construction period or as recommended by MCRC or MDOT following a review of the site development plan.

5.5 Environmental Justice Impacts

Environmental justice refers to a Federal policy under which each Federal agency identifies and addresses disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations of interest. On August 24, 2004, the Commission issued its policy statement on the treatment of environmental justice matters in licensing actions (69 FR 52040). Section 2.6 discusses the locations of minority or low-income populations of interest within 50 mi of the site.

The review team evaluated whether minority or low-income populations of interest could experience disproportionately high and adverse impacts from operation of a new reactor at the proposed site. To perform this assessment, the review team used the process described in Section 4.5.

5.5.1 Health Impacts

The results of normal operation dose assessments (see Section 5.9) indicate that the maximum individual radiation dose was found to be insignificant, that is, well below the NRC and EPA regulatory guidelines in Appendix I of 10 CFR Part 50 and the regulatory standards of 10 CFR Part 20.

Section 5.9 further concludes that radiological health impacts on the operational staff and the public for the proposed Fermi 3 would be SMALL. Section 5.8 of this EIS assesses the nonradiological health effects on the public from operation of the cooling system, noise generated by Fermi 3 operations, EMFs, and transporting of operations and outage workers. In Section 5.8, the review team concludes that the potential impacts of nonradiological effects resulting from the operation of the proposed Fermi 3 would be SMALL. The review team did not identify evidence of unique characteristics or practices in minority or low-income population that may result in different radiological or nonradiological health impacts compared to the general population. Therefore, there would be no disproportionately high and adverse impact on minority or low-income members of the operational staff or the general public as a result of operations.

5.5.2 Physical and Environmental Impacts

For the physical and environmental considerations described in Section 2.6.1, the review team determined through literature searches and consultations that (1) the impacts on the natural or physical environment would not be significant or result in any significant impacts on any population of interest; (2) there would be no disproportionately high and adverse impacts on minority or low-income populations of interest; and (3) the environmental effects would not occur on any minority or low-income populations that are already being affected by cumulative or multiple adverse exposures from environmental hazards. Sections 5.5.2.1 through 5.5.2.4 summarize the physical and environmental effects on the general population, and Section 5.5.2.5 provides an assessment of the potential for disproportionately high and adverse physical and environmental impacts on minority or low-income populations of interest.

The review team determined that the physical and environmental impacts from operation of Fermi 3 would attenuate rapidly with distance, intervening foliage, and terrain. There are four primary pathways in the environment: soil, water, air, and noise. The following four subsections discuss each of these pathways in greater detail.

5.5.2.1 Soil

The review team did not identify any pathway by which operations-related impacts on soils at the Fermi site would impose a disproportionately high and adverse impact on any population of interest. The review team considers the risk of soil salinization from cooling towers to be low and limited to a distance less than the nearest population of interest. Maintenance of the transmission lines would require some vehicular traffic in the transmission line corridor. However, impacts on soils along the transmission line corridors would be minimal and are not expected to affect any offsite communities. The review team identified no other environmental pathways related to soils.

5.5.2.2 Water

Operation of Fermi 3 would affect the water quality in Swan Creek and Lake Erie and water use of Lake Erie. Water quality impacts would result from increased stormwater runoff from the impervious surfaces of Fermi 3, thermal and chemical constituents in the cooling water discharges, and maintenance dredging of the intake canal. As discussed in Sections 5.2 and 5.3.2, operation of Fermi 3 would generate a small thermal plume from cooling water discharge piping into Lake Erie. Solutes in the effluent discharged would be diluted by the large water volume of the western basin of Lake Erie. In addition, discharges would be required to comply with limits imposed by permits. Consequently, the increase in temperature and concentration of these chemicals in Lake Erie would be negligible outside of the mixing zone of the discharge plume, and would have a negligible impact on aquatic biota or the general public (see

Section 5.3.2.1). The discharge would be in a restricted area that would not be used for recreational activities such as swimming, diving, and other water sports.

Operation of Fermi 3 would require a withdrawal of approximately 34,000 gpm from Lake Erie, and approximately 17,000 gpm would be discharged to Lake Erie. As discussed in Section 5.2, the consumptive losses of water during normal Fermi 3 plant operations would result in no measurable effect on other users.

5.5.2.3 Air

Air emissions sources associated with operation of Fermi 3 would include two SDGs, two ADGs, an auxiliary boiler, and two diesel-driven FPs. These emissions sources would be small, would be used infrequently, and would be permitted for use by MDEQ. The cooling tower would emit small amounts of particulate matter, which would be further minimized by drift eliminators. Emissions from worker vehicles, onsite support vehicles and heavy equipment, and vehicles used in delivery or materials and fuels would also occur (Detroit Edison 2011a). However, emissions from these sources would be expected to minimally affect ambient air quality in offsite communities in the region. Therefore, the review team determines there is no air-related pathway by which minority or low-income populations of interest could receive a disproportionately high and adverse impact.

5.5.2.4 Noise

Primary noise sources associated with operation of Fermi 3 would be the cooling towers, transformers, and transmission lines. As noted in Section 5.8.2, noise from the transformers and cooling tower would be buffered by the distance of the plant from residences such that the ambient sound level should not increase appreciably. Day-night noise levels from the Fermi 3 cooling towers are anticipated to be less than 65 dBA at the nearest noise-sensitive receptor. Noise along the transmission lines would be very low, except possibly directly below the line on a quiet, humid day (Detroit Edison 2011a).Therefore, the review team determines there is no noise-related pathway by which minority or low-income populations of interest could receive a disproportionately high and adverse impact.

5.5.2.5 Summary of Physical and Environmental Impacts on Minority or Low-Income Populations

The review team's investigation and outreach did not reveal any unique characteristics or practices among minority or low-income populations that could result in physical or environmental impacts different from impacts on the general population.

As discussed in Section 2.6, most of the census block groups classified as minority or low-income lie to the north and south of the Fermi site, in Wayne and Lucas Counties, within and near Detroit and Toledo. One census block group located approximately 5 mi from the Fermi site within Monroe County qualifies as both a minority and a low-income population of interest. This census block group would not be affected by any physical or environmental impact because of the distance of this area from the site. No impacts would be expected on migrant farm workers if they were to be employed in transient farming activity near the Fermi site, and no subsistence activities are known to occur near the Fermi site.

Based on information provided by Detroit Edison and the review team's independent review, the review team finds no pathways from soil, water, air, and noise that would lead to disproportionately high and adverse impacts on minority or low-income populations of interest.

5.5.3 Socioeconomic Impacts

Socioeconomic impacts (discussed in Section 5.4) were reviewed to evaluate whether any operational activities could have a disproportionately high and adverse effect on minority or low-income populations of interest. With the exception of traffic, any adverse socioeconomic impacts associated with the operation of Fermi 3 are expected to be SMALL. While there likely would be adverse MODERATE impacts on traffic during outages, these impacts are not expected to be disproportionately high for low-income and minority populations of interest.

5.5.4 Subsistence and Special Conditions

The NRC's environmental justice evaluation methodology includes an assessment of populations of particular interest or unusual circumstances, such as minority communities exceptionally dependent on subsistence resources or identifiable in compact locations, such as Native American settlements.

As discussed in Section 2.6.3, access to the Fermi site is restricted, which reduces any impact on plant-gathering, hunting, and fishing activities at the site. Detroit Edison and the review team interviewed community leaders in Monroe County with regard to subsistence practices, and no such practices were identified in the vicinity of the Fermi site. There is no documented subsistence fishing in Lake Erie, Swan Creek, or Stony Creek, and no documented subsistence plant-gathering or hunting in the vicinity of the Fermi site. The review team determines there are no operational activities that would have a disproportionately high and adverse impact on minority or low-income populations of interest related to subsistence activities.

5.5.5 Summary of Environmental Justice Impacts

The review team has evaluated the proposed Fermi 3 operational activities and the potential environmental justice impacts in the vicinity and region. The review team determines there are no environmental pathways by which the identified minority or low-income populations in the 50-mi region would be likely to experience disproportionately high and adverse human health, environmental, physical, or socioeconomic effects as a result of operation of Fermi 3; therefore, environmental justice impacts would be SMALL.

5.6 Historic and Cultural Resource Impacts from Operation

The National Environmental Policy Act of 1969 as amended (NEPA) requires Federal agencies to take into account the potential effects of their undertakings on the cultural environment, which includes archaeological sites, historic buildings, and traditional places important to local populations. The National Historic Preservation Act of 1966 as amended (NHPA) also requires Federal agencies to consider impacts on those resources if they are eligible for listing on the *National Register of Historic Places* (NRHP) (such resources are referred to as "Historic Properties" in NHPA). As outlined in 36 CFR 800.8, "Coordination with the National Environmental Policy Act of 1969," the NRC is coordinating compliance with Section 106 of the NHPA in meeting the requirements of NEPA. For specific historic and cultural resources on the Fermi site, see Section 2.7.

Operating a new nuclear unit can affect either known or undiscovered cultural resources and/or historic properties. In accordance with the provisions of NHPA and NEPA, the NRC and the USACE are required to make a reasonable and good faith effort to identify historic properties in the area of potential effects (APE) and permit area, respectively, and, if historic properties are present, determine whether significant impacts are likely to occur. Identification of historic properties is to occur in consultation with the State Historic Preservation Officer (SHPO), American Indian Tribes, interested parties, and the public. If significant impacts are possible, then efforts should be made to mitigate them. As part of the NEPA/NHPA integration, even if no historic properties (i.e., places listed or eligible for listing on the NRHP) are present or affected, the NRC and the USACE are still required to notify the SHPO before proceeding. If it is determined that historic properties are present, the NRC and the USACE are required to assess and resolve adverse effects of their respective authorized activities for the undertaking.

During the operation of Fermi 3, the cooling tower vapor plume would be visible within the visual setting of the other 21 architectural resources that have been determined or recommended eligible for listing in the NRHP. The existing visual setting of these properties, which are all located offsite but within the indirect APE, currently includes existing vapor plumes from the active Fermi 2 power plant facilities on the Fermi property and from the active Monroe County coal-fired power plant to the south along the Lake Erie shoreline. Therefore, the Fermi 3 cooling tower plume would be consistent with the existing visual settings and views from these 21 architectural resources, and there would be no new significant visual impacts that would affect their NRHP eligibility determination or recommendations for their eligibility (Demeter et al. 2008). As such, indirect visual impacts resulting from operating Fermi 3 would be consistent with, and would not result in significant changes to, offsite historic properties within the indirect APE.

Operational Impacts at the Proposed Site

For the purposes of NHPA Section 106 consultation (36 CFR 800.8), based on (1) the measures that Detroit Edison would take to avoid or limit adverse impacts on significant cultural resources, (2) the review team's cultural resource analysis and consultation, and (3) Detroit Edison's commitment to follow its procedures should ground-disturbing activities discover cultural and historic resources, the review team concludes with a finding of no historic properties affected by operation. Section 4.6 concludes with a finding of historic properties affected from construction activities.

For the purposes of the review team's NEPA analysis of the operation of Fermi 3, based on information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that the impacts of Fermi 3 operation on historic and cultural resources within the Fermi 3 APE would be SMALL, because indirect visual impacts resulting from operating Fermi 3 would be consistent with, and would not result in significant changes to, offsite historic properties within the indirect APE.

The review team has considered impacts related to operation of the proposed transmission lines. Detroit Edison has indicated that operation of the transmission lines would be the responsibility of ITC*Transmission*, an intrastate transmission company. As such, any further investigations to identify the presence of cultural and historic resources and to evaluate the NRHP eligibility of such resources would be the responsibility of ITC*Transmission*, which would conduct such investigations in accordance with applicable regulatory and industry standards to assess impacts of operation (Detroit Edison 2011a).

According to 10 CFR 50.10(a)(2)(vii), transmission lines are not included in NRC's definition of construction and are not an NRC-authorized activity. Therefore, the NRC considers the offsite proposed transmission lines to be outside the NRC's APE and therefore not part of the NRC's consultation.

For the purposes of the review team's NEPA analysis, based on the review team's cultural resources analysis, operational impacts associated with proposed transmission lines are likely to be limited to maintenance of transmission lines, corridors, and access roads, and are not likely to result in new significant impacts on cultural resources or historic properties, once the transmission lines have been built. Impacts from operating the proposed transmission lines would be SMALL if there are no new significant alterations to the cultural environment. If these operating activities result in significant alterations to the cultural environment, the impacts could be greater.

Section 2.7.3 contains a description of cultural resources in the transmission line corridors. Cultural resource impacts related to construction of the proposed transmission lines are discussed in Sections 4.6, 10.2.1, and 10.4.1.5. Operational impacts of the proposed transmission lines on cultural resources are also discussed in Section 10.2.2, and cumulative transmission line cultural resource impacts are discussed in Section 7.5.

5.7 Meteorological and Air Quality Impacts

The primary impacts of operation of the proposed Fermi 3 on local meteorology and air quality would be from releases to the environment of heat and moisture from the primary cooling system, operation of auxiliary equipment (e.g., generators and a boiler), and mobile emissions (e.g., worker vehicles) (Detroit Edison 2011a). The potential impacts of releases from operation of the cooling system are discussed in Section 5.7.1. Section 5.7.2 discusses potential air quality impacts from nonradioactive effluent releases from Fermi 3, and Section 5.7.3 discusses the potential air quality impacts associated with transmission lines during plant operation.

5.7.1 Cooling System Impacts

The proposed cooling system for Fermi 3 is a NDCT. The proposed NDCT removes excess heat by evaporating water. Upon exiting the tower, water vapor would mix with the surrounding air, and this process would generally lead to condensation and formation of a visible plume, which would have aesthetic impacts. Other meteorological and atmospheric impacts include fogging, icing, drift deposition from dissolved salts and chemicals found in the cooling water, cloud formation, plume shadowing, additional precipitation, and increased humidity. In addition, plumes from the NDCT could interact cumulatively with emissions from other sources and the Fermi 2 cooling towers. Two four-cell mechanical draft cooling towers (MDCTs) will be used to dissipate heat from the Plant Service Water System usually during plant shutdown (Detroit Edison 2011a). The heat dissipated by the MDCTs is orders of magnitude less than that dissipated by the NDCT, and its impacts are bounded by the impacts of the NDCT and are not discussed further.

The Electric Power Research Institute's SACTI (Seasonal/Annual Cooling Tower Impact) prediction computer code was used by Detroit Edison to estimate impacts associated with operating the NDCT. Site-specific, tower-specific, and circulating water-specific engineering data were used as input to the SACTI model. Five years (2003–2007) of onsite meteorological data combined with meteorological data from the Detroit Metropolitan Airport and mixing height data from White Lake, Michigan, were used (Detroit Edison 2011a). The NDCT was simulated by using a height of 600 ft and a top exit diameter of 292 ft.

5.7.1.1 Visible Plumes

Results from the SACTI analysis, as reported in the ER (Detroit Edison 2011a), indicated that, on average, the longest plumes would occur in the winter and the shortest in the summer. The model predicts an average plume length of about 1.5 mi in the winter and 0.24 mi in the summer. On an annual basis, SACTI predicts the plume lengths from the NDCT will be less than 3281 ft about half the time. For comparison, the nearest plant boundary is 2766 ft from the NDCT. The highest probability of a visible plume at the distance of the nearest plant boundary is 7.33 percent in any particular direction. The frequency of occurrence of long cooling tower plumes from the NDCT in a given direction is expected to be low and does not warrant mitigation.

Ground-level fogging occurs when a visible plume from a cooling tower contacts the ground. As noted in the ER (Detroit Edison 2011a), the SACTI model, based on studies of actual NDCTs, assumes that the occurrence of fogging is an insignificant event due to the height of the NDCTs and does not estimate their occurrence. However, meteorological conditions favoring natural fogs also favor cooling tower fogging. Natural fogging in the Fermi region occurs about 18 days per year on average (NCDC 2010). Any plume-induced event would thus be infrequent and likely to occur concurrently with a natural fog. Thus, the impacts of plume-induced fogging from the NDCT are expected to be negligible and would not warrant mitigation.

5.7.1.2 Icing

Icing may occur when the cooling tower plume comes in contact with the ground (i.e., fogging occurs) at below-freezing temperatures. There are about 130 days per year with a minimum temperature at or below freezing in the area (NCDC 2010). Icing would thus be less frequent than fogging because about one-third of fogging occurs in nonfreezing months. Thus, the impacts of plume-induced icing from the NDCT are expected to be negligible and would not warrant mitigation.

5.7.1.3 Drift Deposition

The NDCT would use drift eliminators to minimize the loss of cooling water from the tower via drift, but some droplets would still escape from the tower along with the moving airstream and would be deposited on the ground. Cooling water is also treated prior to discharge to reduce salt concentration. The SACTI model predicted maximum deposition rates of 0.0001 kg/ha/mo annually between 13,779 and 30,840 ft and 0.0002 kg/ha/mo during the winter between 14,436 and 30,840 ft east-northeast of the NDCT (Detroit Edison 2011a). These maximum impacts are well below the levels considered acceptable in NUREG-1555 (NRC 2000a) (i.e., deposition of salt drift at rates of 1 to 2 kg/ha/mo), which are generally not damaging to plants. Thus, the impacts of salt deposition on vegetation are expected to be negligible, and no further mitigation is warranted.

5.7.1.4 Cloud Formation and Plume Shadowing

Cloud formation due to NDCTs has been observed at several power plants (Detroit Edison 2011a). Plume shadowing from cloud development or from the cooling tower plume itself is predicted by the SACTI model by calculating the average number of hours the visible plume would shadow the ground. Maximum shadowing would occur 656 ft north of the NDCT for an average of 348 hr per year. Beyond the nearest property boundary, the average hours of plume shadowing would be about 92 hr per year, 2.1 percent of the annual daylight hours, which would be insignificant in terms of effects on agricultural production. Thus, the impacts of plume shadowing are expected to be minimal and would not require mitigation.

5.7.1.5 Additional Precipitation

Occasional light drizzle and snow have been observed within a few hundred meters of cooling towers. These events are localized and should have no effect beyond the plant boundaries (Detroit Edison 2011a). The SACTI model assesses additional precipitation as water deposition. The SACTI model predicted maximum water deposition of 5.9 $kg/km^2/mo$ between 15,000 ft and 31,000 ft east-northeast of the Fermi 3 NDCT with an average deposition of 2.2 $kg/km^2/mo$ within the 31,000-ft distance (considering all wind directions of plume travel). This maximum deposition is about 0.0001 percent of the average driest monthly rainfall and at most 0.000003 hundredths of an inch of additional ice accumulation in the Fermi area.

Meteorological conditions conducive to induced snowfall can occur at the Fermi site. Observed snowfall accumulations associated with operating cooling towers have been less than 1 in. of very light, fluffy snow and have been only a small fraction of the snowfalls (about 44 in.) typical for the area (NCDC 2010). Thus, impacts of additional precipitation from the Fermi 3 NDCT are expected to be minimal and would not require mitigation.

5.7.1.6 Humidity Increases

Both the absolute and relative humidity aloft would increase in the vicinity of the NDCT vapor plume, as shown by the presence of a visible plume predicted by the SACTI model (Detroit Edison 2011a). However, ground-level increases in absolute humidity would be smaller. Increases in relative humidity could be larger in colder weather due to relatively low moisture-bearing capacities of cold air. Any increases in humidity should be localized and short-lived as the plume disperses and mixes with the far larger volume of surrounding air. Thus, increases in ground-level humidity are expected to be minimal and would not warrant mitigation.

5.7.1.7 Interaction with Other Pollutant Sources

The existing Fermi 2 NDCTs are located about 0.58 and 0.73 mi northeast of the planned location of the Fermi 3 NDCT (Detroit Edison 2011a). The plumes would usually travel in parallel, rather than in intersecting directions. Potential cumulative interaction of existing and new cooling tower plumes is expected to be insignificant, given the large separation distance and the fact that the plumes would travel along nonintersecting paths most of the time.

Existing combustion sources such as diesel generators and boilers currently operate infrequently at the Fermi site (not typically during normal plant operations); combustion sources that would be associated with Fermi 3 would similarly operate for limited periods. With the exception of particulates, these combustion sources emit pollutants (such as nitrogen oxides

[NO_x], sulfur dioxide [SO_2], and carbon monoxide [CO]) that are different from those produced by cooling towers (i.e., small amounts of particulate matter as drift). Interaction among pollutants emitted from these sources and the cooling tower plumes would be intermittent and would not have a significant impact on air quality. Based on the above considerations and the assumption that cooling towers associated with Fermi 3 would be similar to existing cooling towers used at other nuclear sites, the review team concludes that the cooling tower impacts on air quality would be minimal and additional mitigation of air quality impacts would not be warranted.

5.7.1.8 Summary of Cooling System Impacts

On the basis of the analysis presented by Detroit Edison in the ER and the review team's independent evaluation of that analysis, the review team concludes that atmospheric impacts of cooling tower operation would be minor and that no further mitigation is warranted.

5.7.2 Air Quality Impacts

Section 2.9 describes the meteorological characteristics and air quality of the Fermi site. Sources of air emissions (Detroit Edison 2011a) include stationary combustion sources (two SDGs, two ADGs, two diesel-driven FPs, and an auxiliary boiler), cooling towers (an NDCT and two MDCTs), and mobile sources (worker vehicles, onsite heavy equipment and support vehicles, and delivery of materials and disposal of wastes). Stationary combustion sources would operate only for limited periods, often for periodic maintenance testing. The NDCT would operate for the entire year, while the two four-cell MDCTs would operate during limited operating scenarios and during shutdown.

5.7.2.1 Criteria Pollutants

Air pollutants emitted from stationary combustion sources (e.g., particulates, sulfur oxides, carbon monoxide, volatile organic compounds [VOCs], and nitrogen oxides) and from cooling towers (particulates as drift) associated with Fermi 3 operations would be permitted in accordance with MDEQ and Federal regulatory requirements. Shown in Table 5-22 are Detroit Edison's estimated annual emissions for stationary combustion sources during operation of Fermi 3, which are based on the anticipated number of units, power rating, and hours of operation: 48 hr per year for two SDGs and two diesel-driven FPs; 8 hr per year for two ADGs; and 720 hr per year for an auxiliary boiler. In addition, $PM_{2.5}$ (particulate matter with an aerodynamic diameter of less than or equal to 2.5 μm) emissions for cooling towers were estimated based on continuous operation for the entire year at the maximum water flow rate.

Monroe County has been designated nonattainment for $PM_{2.5}$ and maintenance for 8-hr ozone (EPA 2010a). In July 2011, the MDEQ submitted a request asking the EPA to redesignate southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011). In July 2012,

Table 5-22. Estimated Annual Emissions of $PM_{2.5}$, NO_x, VOCs, SO_2, and CO_2 Associated with Operation of Fermi 3

Source Category	Annual Emissions (tons/yr)				
	$PM_{2.5}$	**NO_x**	**VOCs**	**SO_2**	**CO_2**
Stationary combustion sources[(a)]	0.85	9.91	0.94	0.11	7734
NDCT[(b)]	6.63	NA[(c)]	NA	NA	NA
MDCT[(b)]	1.84	NA	NA	NA	NA
Worker vehicles[(d)]	0.18	5.63	6.47	0.13	14,419
Onsite heavy equipment and support vehicles	0.01	0.19	0.17	0.00[(e)]	228
Delivery of materials and disposal of wastes[(f)]	0.00	0.18	0.03	0.00	32
Total	**9.51**	**15.9**	**7.61**	**0.24**	**22,413**

Source: Detroit Edison 2011a, 2012d

(a) Includes emissions from two SDGs, two ADGs, two diesel-driven FPs, and an auxiliary boiler.

(b) It is conservatively assumed that the NDCT and one of the two MDCTs would continuously operate for the entire year at the maximum water flow rate. Typically, the two MDCTs would operate during plant shutdown conditions only, which normally last one month.

(c) NA = Not applicable.

(d) It is assumed that operation workers would travel through the nonattainment/maintenance area to and from the Fermi site with a roundtrip distance of 39.3 mi.

(e) 0.00 denotes less than 0.005.

(f) It is assumed that delivery trucks would travel from the Fermi site to the farthest point within the nonattainment/maintenance area with a roundtrip distance of 184 mi.

the EPA issued a proposed rule designating southeastern Michigan as having attained both the 1997 annual $PM_{2.5}$ NAAQS and the 2006 24-hour $PM_{2.5}$ NAAQS, based on 2009–2011 ambient air monitoring data (77 FR 39659, dated July 5, 2012), but the final determination has yet to be made. If this designation is eventually approved, Monroe County would then become a maintenance area for $PM_{2.5}$. In either case, facility operations for Fermi 3 are subject to conformity analysis under 40 CFR Part 93, Subpart B. Thus, Detroit Edison provided estimates for project-related direct and precursor emissions of $PM_{2.5}$ and ozone ($PM_{2.5}$, NO_x, VOCs, and SO_2). PM_{10} (particulate matter with an aerodynamic diameter of less than or equal to 10 μm) emissions from operation were not estimated to determine the applicability of conformity requirements for operations because the area is designated as an attainment area for PM_{10}.

Table 5-22 presents Detroit Edison's estimated annual emissions associated with operations of Fermi 3. Annual emissions from operation of Fermi 3 would be up to about 0.15 percent (for $PM_{2.5}$) of total emissions in Monroe County and up to 0.03 percent (for $PM_{2.5}$) of total emissions in all neighboring counties that are currently designated as $PM_{2.5}$ nonattainment or as an ozone maintenance area (EPA 2010b).

All the estimated annual emissions shown in Table 5-22 are well below the 100 tons/yr conformity determination thresholds for direct and precursor emissions for $PM_{2.5}$ and ozone.

Therefore, a general conformity determination is unlikely to be needed for facility operations of the Fermi 3 based on Detroit Edison's emissions estimate.

New or modified sources of air pollution are considered to be a major source and need to undergo a new source review (NSR) before construction if they emit or have the potential to emit (PTE)[(a)] 100 tons/yr or more of any criteria air pollutant. The review team has estimated the Fermi 3 PTE for NO_x to be about 116 tons/yr (EPA 1995; MDEQ 2005), which exceeds the major source threshold. To avoid being a major source, Fermi 2 and Fermi 3 would need to limit their combined PTE to be eligible as a "synthetic minor" (or "opt-out") source.[(b)] Fermi 2 has a synthetic minor permit with a NO_x limit of 89.4 tons/yr based on a 12-month rolling time period, a limit that is met by monitoring monthly fuel usage and calculating the associated NO_x emissions. Detroit Edison has not initiated an application to the Air Quality Division of MDEQ for a Permit to Install for the proposed Fermi 3.

The SDGs, ADGs, and FPs would be required to comply with the requirements of the "National Emission Standards for Hazardous Air Pollutants" given in 40 CFR 63.6603 and 63.6604. These regulations specify emission limits and, for nonemergency diesels, performance tests, limitations on fuel sulfur content, and operating limitations. In addition, depending on when the engines are built and installed, there may be additional requirements under the "Standards of Performance for Stationary Compression Ignition Internal Combustion Engines" (40 CFR Part 60, Subpart IIII). These Federal requirements would be administered by the State and included in the Permit to Install. No open burning would occur during operations.

Given the small size and infrequent operation of combustion equipment, their impact on offsite air quality is expected to be minimal. The NDCT, which emits particulate matter only as drift, would be equipped with drift eliminators to limit drift to 0.001 percent or less of total water flow. The tabulated $PM_{2.5}$ emissions from the NDCT and MDCTs would account for about 89 percent of total emissions from Fermi 3 operations, but potential particulate matter (PM) impacts at the ground level outside the Fermi property would be minimal due to the tall height of the tower, which allows for good dispersion of the drift.

(a) PTE is defined as the maximum capacity of a stationary source to emit a pollutant under its physical and operation design. Typically, PTE is the maximum amount of air pollutants that the facility could emit if it continuously operates 24 hr/day and 365 days/yr at its full design capacity with air pollution control equipment being turned off (but only if the operation of the device is required by a legally enforceable permit condition, rule, or compliance/enforcement document) (MDEQ 2005). To estimate PTE in this analysis, it is assumed that SDGs, ADGs, and diesel-driven FPs would operate 500 hr/yr each and an auxiliary boiler would operate 8760 hr/yr (EPA 1995; MDEQ 2005).

(b) A synthetic minor source is a facility that can operate as a major source, but for which the applicant is voluntarily requesting a Federally enforceable limit on one or more parameters (e.g., throughput or operating time) such that the PTE of the facility remains below major source thresholds. The legally enforceable permit conditions should contain a monitoring/recordkeeping requirement that can be used to demonstrate compliance with the permit.

There are no mandatory Class I Federal areas where visibility is an important value within a 275-mi radius of the Fermi 3 site. Considering the distance to the Class I areas and the minor nature of air emissions from the Fermi 3 site, there is little likelihood that activities at the Fermi 3 site could adversely affect air quality and air quality-related values (e.g., visibility or acid deposition) in any of the Class I areas.

Given the significant distance between the operations area and offsite sensitive receptors, no offsite impacts from fugitive dust are expected during operation (Detroit Edison 2011a). However, Detroit Edison notes that watering, reseeding, or paving of areas used for construction could be used if fugitive dust problems develop. Commitments to using these measures are expected to be included in the application for the Permit to Install submitted to MDEQ.

Based on the information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that the air quality impacts of criteria pollutants would not be noticeable and additional mitigation would not be warranted, given Detroit Edison's commitment to manage and mitigate emissions in accordance with applicable regulations.

5.7.2.2 Greenhouse Gases

The operation of a nuclear power plant involves emissions of some greenhouse gases (GHGs), primarily CO_2. Table 5-22 shows Detroit Edison's site-specific estimates of 22,413 tons/yr of CO_2 during operations of Fermi 3, about 7734 tons/yr from combustion sources and 14,679 tons/yr from mobile sources (Detroit Edison 2011a, 2012d). This amounts to about 0.008 percent of the total projected GHG emissions in Michigan during 2010 at 253,800,000 metric tons of gross[a] CO_2 equivalent (CO_2e)[b] in 2010 (CCS 2008). This also equates to about 0.0004 percent of total CO_2 emissions in the United States during 2009, at 5.5 billion metric tons (EPA 2011b). Workforce transportation accounts for about 64 percent of the total CO_2 emissions shown in Table 5-22. Measures to mitigate transportation impacts, such as encouraging car pooling, would reduce CO_2 emissions.

Another estimate of the relative size of the Fermi 3 operation emissions can be made based on the information in Appendix L, which provides the review team's estimate of emissions for a generic 1000-MW(e) nuclear power plant. Plant operations and operation workforce emissions for the generic 1000-MW(e) nuclear power plant totaled about 353,000 tons (320,000 metric tons) over 40 years, or about 8800 tons/yr. The NRC staff used a scaling factor of 1.535 to

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(a) Excluding GHG emissions removed due to forestry and other land uses and excluding GHG emissions associated with exported electricity.

(b) A measure to compare the emissions from various GHGs on the basis of their global warming potential (GWP), defined as the ratio of heat trapped by one unit mass of the GHG to that of one unit mass of CO_2 over a specific time period.

adjust the differences in power generation capacity [1000 MW(e) versus 1535 MW(e)] between the reference plant and Fermi 3. Scaled plant operations and operations workforce emission estimates equate to about 13,500 tons/yr for Fermi 3. This also amounts to a small percentage of projected GHG emissions for Michigan and the United States.

Based on the small amount of Fermi 3 CO_2 emissions compared to the total Michigan and United States GHG emissions, the review team concludes that the atmospheric impacts of GHG emissions from plant operations would not be noticeable and additional mitigation would not be warranted.

EPA promulgated the Prevention of Significant Deterioration (PSD) requirements and Title V GHG Tailoring Rule on June 3, 2010 (75 FR 31514). This rule states that, among other items, new and existing sources not already subject to a Title V permit, or that have the potential to emit at least 100,000 tons/yr (or 75,000 tons/yr for modifications at existing facilities) CO_2e, will become subject to the PSD and Title V requirements effective July 1, 2011. The rule also states that sources with emissions (PTE) below 50,000 tons/yr CO_2e will not be subject to PSD or Title V permitting before April 30, 2016. Note that using the emission factors presented in ER Section 3.6.3.1 and assuming the SDGs, ADGs, and FPs operate 500 hr/yr each and the auxiliary boiler operates 8760 hr/yr, a combined CO_2 PTE of about 92,900 tons/yr was estimated. However, as discussed in Section 5.7.2.1, Fermi 3 could be exempted from GHG-related PSD or a Title V permit if it is eligible and chooses to be considered a "synthetic minor" source, which could significantly reduce the PTE emissions.

5.7.2.3 Summary of Air Quality Impacts

The review team has considered the timing and magnitude of atmospheric releases related to operation of Fermi 3, the existing air quality around the Fermi site, the distance to the closest Class I area, and the Detroit Edison commitment to manage and mitigate emissions in accordance with applicable regulations. On these bases, the review team concludes that the air quality impacts of operation of Fermi 3 would not be noticeable. Based on its assessment of the carbon footprint of plant operations, the review team concludes that the atmospheric impacts of GHGs from plant operations would not be noticeable.

5.7.3 Transmission Line Impacts

Impacts of existing transmission lines on air quality are addressed in the GEIS (NRC 1996). Small amounts of ozone and even smaller amounts of oxides of nitrogen are produced by transmission lines. The production of these gases was found to be insignificant for 745-kV transmission lines (the largest lines in operation) and for a prototype 1200-kV transmission line. In addition, it was determined that potential mitigation measures, such as burying transmission lines, would be very costly and would not be warranted.

Three new 345-kV transmission lines would be constructed between the Fermi 3 switchyard and the Milan Substation to accommodate the new power generating capacity (Detroit Edison 2011a). This size is well within the range of transmission lines evaluated in NUREG-1437 (NRC 1996). The review team therefore concludes that air quality impacts from the transmission lines would not be noticeable and mitigation would not be warranted.

5.7.4 Summary of Meteorological and Air Quality Impacts

The review team evaluated potential impacts on air quality associated with criteria pollutants and GHG emissions from operating Fermi 3. The review team also evaluated potential impacts of cooling system emissions and transmission lines. In each case, the review team determined that the impacts would be minimal. On this basis, the review team concludes that the impacts of operation of Fermi 3 on air quality from emissions of criteria pollutants, CO_2 emissions, and cooling system emissions would be SMALL and that no additional mitigation is warranted.

5.8 Nonradiological Health Impacts

This section addresses the nonradiological health impacts of operating the proposed new Fermi 3 at the Fermi site. Health impacts on the public from operation of the cooling system, noise generated by operations, EMFs, transport operations, and transport of outage workers are discussed. Health impacts from these same sources on workers at Fermi 3 are also evaluated. Health impacts from radiological sources during operations are discussed in Section 5.9.

5.8.1 Etiological Agents

Operation of the proposed Fermi 3 would result in a thermal discharge to Lake Erie (Detroit Edison 2011a). Such discharges have the potential to increase the growth of etiological agents, both in the circulating water system and the lake. Etiological agents include enteric pathogens (such as *Salmonella* spp.), *Pseudomonas aeruginosa*, thermophilic fungi, bacteria (such as *Legionella* spp.), and free-living amoeba (such as *Naegleria fowleri* and *Acanthamoeba* spp.). These microorganisms could result in potentially serious human health concerns, particularly at high exposure levels.

The proposed discharge pipe from Fermi 3 would be located southeast of Fermi 2, extend approximately 1300 ft into Lake Erie, and include a high-rate effluent diffuser for enhanced mixing of the thermal effluent with the receiving waters (Detroit Edison 2011a). On the basis of a thermal plume analysis for the worst-case scenario, it is estimated that the total plume surface area would be only approximately 55,300 ft^2 (Detroit Edison 2011a). The heated effluent discharge from Fermi 3 would be in a restricted industrial area that would not be used for recreation activities, such as boating, swimming, diving, and other water sports. The thermal plume would be approximately 1291 ft from the shoreline (Detroit Edison 2011a) and thus offer only a very limited chance that people on the shoreline would contact the warm water that could support etiological agents. The NRC staff conducted an independent analysis of the thermal discharge (see Section 5.2.3.1), and that analysis demonstrated that all State of Michigan requirements for thermal discharge would be met.

Available data assembled by the U.S. Centers for Disease Control and Prevention (CDC) for the years 2000 to 2008 (CDC 2002, 2003, 2004, 2005, 2006, 2007, 2008a, 2009, 2010) were reviewed for outbreaks of Legionellosis, Salmonellosis, or Shigellosis. Outbreaks that occurred in Michigan were within the range of national trends in terms of cases per populations of 100,000 and in terms of total cases per year, and the outbreaks were associated with pools, spas, or lakes. According to the Detroit Edison correspondence with Michigan Department of Community Health (MDCH) in April 2008, the department did not record any major waterborne disease outbreaks within Michigan in the last 10 years (Detroit Edison 2010d). The CDC Council of State and Territorial Epidemiologists Naegleria Work Group, after reviewing the data from different sources, identified 121 fatal cases of primary amebic meningoencephalitis (PAM, caused by *Naegleria fowleri*) in the United States from 1937 to 2007. Most cases occurred in southern States during the months of July and September (CDC 2008b).

The standard practices for operating cooling towers include adding biocides to the water to limit growth of microorganisms inside the towers and providing appropriate protective equipment for workers who enter the cooling towers for maintenance operations. Detroit Edison would use biocides to reduce the levels of microbial populations in the cooling tower and condenser and would comply with OSHA standards for Fermi 3 operational workers, as is currently done for Fermi 2 (Detroit Edison 2011a). The biocides in the water entering the cooling towers would limit microbial growth and minimize the potential for any aerosol releases. The use of biocides in various water systems for the proposed Fermi 3 is discussed in Section 3.4.2.4 of the EIS. No outbreaks of Legionnaires' disease, PAM, or any other waterborne disease associated with Fermi 2 operations have been reported in the past. The use of biocides would likely minimize the exposure of personnel to Legionella in the cooling water system.

Because of the historical low incidence of diseases from etiological agents in Michigan (Detroit Edison 2010d), the small and limited increase in temperature in Lake Erie expected as a result of operating Fermi 3, the currents around the proposed discharge structure, the distance of the discharge structure from the shore, and the relative absence of swimming or other activities that result in water immersion in the vicinity of the proposed discharge structures, the review team concludes that the impacts on human health would be SMALL and that further mitigation would not be warranted.

5.8.2 Noise

In NUREG-1437 (NRC 1996), the NRC staff discusses the environmental impacts of noise at existing nuclear power plants. Common sources of noise from plant operation include cooling towers and transformers, with intermittent contributions from loud speakers and auxiliary equipment such as diesel generators and vehicle traffic.

The existing Fermi 2 at the Fermi site uses primarily two NDCTs. Fermi 3 would use one NDCT to reject the waste heat from the system. Addition of the proposed cooling system could increase the noise level over the existing cooling system, which is considered in the noise study (Detroit Edison 2011a) as part of the ambient noise level. The ER (Detroit Edison 2011a) presented noise modeling results that included the noise sources from normal station operation, including cooling systems, transformers, and onsite and nearby offsite transmission lines. The switchyard was not modeled because it is not a significant noise source, and equipment in enclosures, such as diesel generators were not modeled, either. Predicted noise levels were compared with existing L_{90} values (i.e., noise levels that are exceeded 90 percent of the time and commonly used as the background level) with Fermi 2 in operation at the seven noise-sensitive receptor locations (residences) within 1.5 mi of the site. Noise levels resulting only from Fermi 3 operation are predicted to be relatively low, with a maximum of 37 dBA at the nearest residence, which is about 1900 ft north-northeast of the proposed Fermi 3 switchyard and 3200 ft north-northwest of the proposed Fermi 3 cooling tower. Sound-level increases over existing L_{90} values due to Fermi 3 operation would range between 0 and 2 dBA at six residences, a range that is lower than a barely discernible increase of about 3 dB (NWCC 2002). One exception is an expected 6-dB increase over the existing L_{90} value at the same nearest residence. This increase would occur during a small portion of nighttime hours and would be a noticeable change over existing L_{90} levels. However, combined (including background) day-night average sound levels (L_{dn}) modeled at three residences ranged between 54 and 63 dBA, indicating there was no increase over existing L_{dn} levels.

According to NUREG-1437 (NRC 1996), noise levels below 60 to 65 dBA as the day-night average noise level (DNL or L_{dn}) are considered to be of small significance. More recently, the impacts of noise were considered in NUREG-0586, Supplement 1 (NRC 2002). The criterion for assessing the level of significance was not expressed in terms of sound levels but based on the effect of noise on human activities and on threatened and endangered species. The criterion in NUREG-0586, Supplement 1, is stated as follows:

> The noise impacts [...] are considered detectable if sound levels are sufficiently high to disrupt normal human activities on a regular basis. The noise impacts [...] are considered destabilizing if sound levels are sufficiently high that the affected area is essentially unsuitable for normal human activities, or if the behavior or breeding of a threatened and endangered species is affected.

For Fermi 3 operations, the maximum predicted noise increase of 6 dBA over the existing L_{90} would occur at the nearest residence during a small portion of nighttime hours. However, during other times of day and night and at other nearby residences, predicted noise levels would not represent a significant increase over existing L_{90} levels. In addition, no increases of the L_{dn}

would be expected at any of the noise-sensitive residences. Given the postulated noise levels for Fermi 3, the review team concludes that the noise increases would be SMALL and that mitigation would not be warranted.

5.8.3 Acute Effects of Electromagnetic Fields

Electric shock resulting from either direct access to energized conductors or induced charges in metallic structures is an example of an acute effect from EMFs associated with transmission lines (NRC 1996). In the ER, Detroit Edison (2011a) stated that three new transmission lines and a separate switchyard would be required to connect Fermi 3 to the existing transmission system. Onsite transmission lines that would connect Fermi 3 to the proposed new Fermi 3 switchyard would be constructed and owned by Detroit Edison (Detroit Edison 2011a). Transmission lines that serve Fermi 3 offsite would be created and operated by ITC*Transmission* (Detroit Edison 2011a), which also operates and manages the existing Fermi 2 transmission system at the Fermi site (Detroit Edison 2011a). The existing ITC*Transmission* system meets National Electric Safety Code (NESC) criteria for induced currents (Detroit Edison 2011a). Detroit Edison stated that all transmission lines would comply with applicable regulatory standards and that the design and construction of the proposed Fermi 3 substation and transmission circuits would comply with NESC provisions (Detroit Edison 2011a). ITC*Transmission* would ensure that the electric field strength under the new transmission lines would conform to NESC guidelines (less than 7.5 kV/m maximum within the ROW and less than 2.6 kV/m maximum at the edge of the ROW) (Detroit Edison 2011a).

Knowing that Detroit Edison is committed to ensuring that the design of new transmission lines meet NESC criteria, the review team concludes that the impact on the public from the acute effects of EMFs would be SMALL and that additional mitigation is not be warranted.

5.8.4 Chronic Effects of Electromagnetic Fields

Power transmission lines in the United States operate at 60 Hz. The EMFs resulting from 60-Hz power transmission lines fall under the category of nonionizing radiation and are considered to be extremely low frequency (ELF) EMFs. Research on the potential for chronic effects from 60-Hz EMFs from energized transmission lines was reviewed by the NRC and is addressed in NUREG-1437 (NRC 1996). At the time of that review, research results were not conclusive. The National Institute of Environmental Health Sciences (NIEHS) directs related research through the DOE. An NIEHS report (NIEHS 1999) contains the following conclusion:

> The NIEHS concludes that ELF-EMF (extremely low frequency-electromagnetic field) exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is

warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

The staff reviewed available scientific literature on chronic effects to human health from ELF-EMFs published since the NIEHS report and found that several other organizations reached the same conclusions (AGNIR 2006; WHO 2007a). Additional work under the auspices of the World Health Organization (WHO) updated the assessments of a number of scientific groups that reflected the potential for transmission line EMFs to cause adverse health impacts in humans. The monograph summarized the potential for ELF-EMFs to cause diseases such as cancers in children and adults; depression; suicide; reproductive dysfunction; developmental disorders; immunological modifications; and neurological disease. The results of the review by WHO (2007b) found that the extent of scientific evidence linking these diseases to EMF exposure is not conclusive.

These conclusions by four national and international groups are in agreement. The current scientific evidence regarding the chronic effect of ELF-EMFs does not conclusively link ELF-EMFs to adverse health impacts. The staff will continue to follow developments in this area.

5.8.5 Occupational Health

In general, occupational health risks for new units are expected to be dominated by occupational injuries (e.g., falls, electric shock, asphyxiation) to workers engaged in activities such as maintenance, testing, and plant modifications. The 2008 annual incidence rates (the number of injuries and illnesses per 100 full-time workers) for electrical power generation, transmission, and distribution workers for the State of Michigan and the United States are 3.7 and 3.2, respectively (USBLS 2009a, b). Historically, actual injury and fatality rates at nuclear reactor facilities have been lower than the average U.S. industrial rates, with a 2008 average incidence rate of 0.7 per hundred workers (USBLS 2009a). Based on the assumption of a total operations workforce of 900 (Detroit Edison 2011a), these rates suggest that operation of Fermi 3 would be associated with approximately 6 occupational injuries and illnesses per year. However, these are gross estimates and do not take into account risks workers would face if they are employed somewhere other than the Fermi 3. Occupational injury and fatality risks are reduced by strict adherence to NRC and OSHA safety standards (29 CFR Part 1910), practices, and procedures. Appropriate State and local statutes must also be considered when the occupational hazards and health risks associated with new nuclear unit operation are being assessed. The staff assumes adherence to NRC, OSHA, and State safety standards, practices, and procedures during Fermi 3 operations.

Additional occupational health impacts may result from exposure to hazards such as noise, toxic or oxygen-replacing gases, etiological agents in the condenser bays, and caustic agents.

Detroit Edison (2011a) reports that it maintains a health and safety program to protect workers from industrial safety risks at the operating units and would implement the program for the proposed new units. Health impacts on workers from nonradiological emissions, noise, and EMFs would be monitored and controlled in accordance with the applicable OSHA regulations and would be SMALL.

5.8.6 Impacts of Transporting Operations Personnel to the Proposed Site

The general approach used to calculate nonradiological impacts from fuel and waste shipments was the same as that used to calculate the impacts from transport of operations and outage personnel to and from the Fermi site. However, the only data available for estimating these impacts were from preliminary estimates. The assumptions made to provide reasonable estimates of the parameters needed to calculate nonradiological impacts are discussed below.

- The average number of workers needed for operations was given as 900 in the ER (Detroit Edison 2011a), which also stated that a peak refueling staff of 1200 to 1500 temporary workers was required every 24 months. It was assumed that no sharing of personnel with Fermi 2 operations staff would occur. With approximately 10 percent of the workforce expected to carpool (Detroit Edison 2011a), there would be about 855 vehicle roundtrips per day for operations workers if two persons shared a ride for those who carpooled. For refueling outages, it was assumed that there would be an additional 1425 vehicle roundtrips per day during an outage because of the extra 1500 temporary workers estimated by using the same carpooling assumption.
- The average commute distance for operations and outage workers was assumed to be 23.5 mi one way (Detroit Edison 2011a).
- To develop representative commuter traffic impacts, a source was located that provided Michigan-specific accident, injury, and fatality rates for all traffic in the surrounding counties (Lenawee, Monroe, Washtenaw, and Wayne) for the years 2004 to 2008 (MDSP 2005, 2006, 2007, 2008, 2009).

The estimated impacts of transporting permanent operations personnel and temporary outage workers to and from the Fermi 3 site are shown in Table 5-23. The total annual traffic fatalities during operations, including both operations and outage personnel, represents about a 0.7 percent increase above the average 23 traffic fatalities/yr that occurred in Monroe County, Michigan, from 2004 to 2008 (MDSP 2005, 2006, 2007, 2008, 2009). This represents a small increase relative to the current traffic fatality risk in the area surrounding the proposed Fermi 3 site.

On the basis of the information provided by Detroit Edison, the review team's independent evaluation, and the fact that this increase would be small relative to the number of current traffic

Table 5-23. Nonradiological Impacts of Transporting Workers to and from the Fermi 3 Site

Type of Workers	Accidents per Year	Injuries per Year	Fatalities per Year
Permanent	4.3	12	0.14
Outage	3.0	0.85	0.0094

fatalities in the surrounding area, the review team concludes that the nonradiological impacts of transporting personnel to the Fermi 3 site would be minimal and that mitigation is not warranted.

5.8.7 Summary of Nonradiological Health Impacts

The staff evaluated health impacts on the public and workers from operation of the Fermi 3 cooling system, noise generated by Fermi 3 operations, acute and chronic impacts of EMFs from transmission lines, transport operations, and the transport of outage workers to and from Fermi 3. Health risks to workers are expected to be dominated by occupational injuries at rates below the average U.S. industrial rates. Health impacts on the public and workers from etiological agents, noise generated by Fermi 3 operations, and acute impacts of EMF are expected to be minimal. On the basis of the information provided by Detroit Edison and the review team's independent review, the review team concludes that the potential nonradiological health impacts resulting from the operation of Fermi 3 would be SMALL and that mitigation would not be warranted. Scientific evidence regarding the chronic impacts of EMFs on public health is inconclusive.

5.9 Radiological Impacts of Normal Operations

This section addresses the radiological impacts from normal operations of the proposed Fermi 3, including a discussion of the estimated radiation dose to a member of the public and to the biota inhabiting the area around the Fermi site. Estimated doses to workers from Fermi 3 operations are also discussed. The determination of radiological impacts was based on the General Electric-Hitachi Nuclear Energy Americas, LLC (GEH) Economic Simplified Boiling Water Reactor (ESBWR) design and the liquid and gaseous radiological effluent rates discussed in Section 3.4.2.3.

Revision 2 of Detroit Edison's ER incorporates Revision 7 of the Design Control Document (DCD); therefore, the COL application and evaluation of radiological impacts of normal operations presented here are based on Revision 7 of the DCD (GEH 2010a). Subsequently, GEH has submitted Revision 9 of the ESBWR DCD. However, in the new DCD, liquid and gaseous effluent rates have not changed (GEH 2010f).

5.9.1 Exposure Pathways

The public and biota would be exposed to increased ambient background radiation from Fermi 3 via the liquid effluent, gaseous effluent, and direct radiation pathways. Detroit Edison estimated the potential exposures to the public and biota by evaluating exposure pathways typical of those surrounding a nuclear unit at the Fermi site. Detroit Edison considered pathways that could cause the highest calculated radiological dose on the basis of the use of the environment by the residents located around the site (Detroit Edison 2011a). For example, factors such as the location of homes in the area, consumption of meat, fish, and shellfish from the area, and consumption of vegetables grown in area gardens were considered.

For the liquid effluent release pathway, Detroit Edison (2011a) considered the following exposure pathways in evaluating the dose to the maximally exposed individual (MEI): ingestion of aquatic food (i.e., fish and invertebrates); ingestion of drinking water; ingestion of meats, vegetables, and milk (using irrigation water contaminated by liquid effluent); and direct radiation exposure from shoreline activities, swimming, and boating (Figure 5-2). The analysis for population dose considered the same exposure pathways as those used for the individual dose assessment.

As discussed in the Final Safety Analysis Report (FSAR), the design of Fermi 3 includes a number of features to prevent and mitigate leakage from system components such as pipes and tanks that may contain radioactive material (Detroit Edison 2011b). In addition, Detroit Edison (2011b) committed to use the guidance in the *Generic FSAR Template Guidance for Life-Cycle Minimization of Contamination*, developed by the Nuclear Energy Institute (NEI 2009), to the extent practicable in the development of operating programs and procedures. However, the potential still exists for leaks of radioactive material such as tritium into the ground. Based on the discussion above, the NRC staff expects that the impacts from such potential leakage from Fermi 3 would be minimal.

For the gaseous effluent release pathway, Detroit Edison (2011a) considered the following exposure pathways in evaluating the dose to the individual: immersion in the radioactive plume, direct radiation exposure from deposited radioactivity, inhalation of airborne activity, ingestion of garden fruit and vegetables, and ingestion of meat and milk. For population doses from gaseous effluents, Detroit Edison (2011a) used the same exposure pathways as those used for the individual dose assessment. For calculations of the population dose, it was assumed that all agricultural products grown within 50 mi of Fermi 3 would be consumed by the population within 50 mi of Fermi 3.

Detroit Edison (2011a) states that the reactor buildings would be the primary sources of direct radiation exposure to the public from Fermi 3. However, Detroit Edison asserts that contained sources of radiation at Fermi 3 would be shielded and would not contribute significantly to the

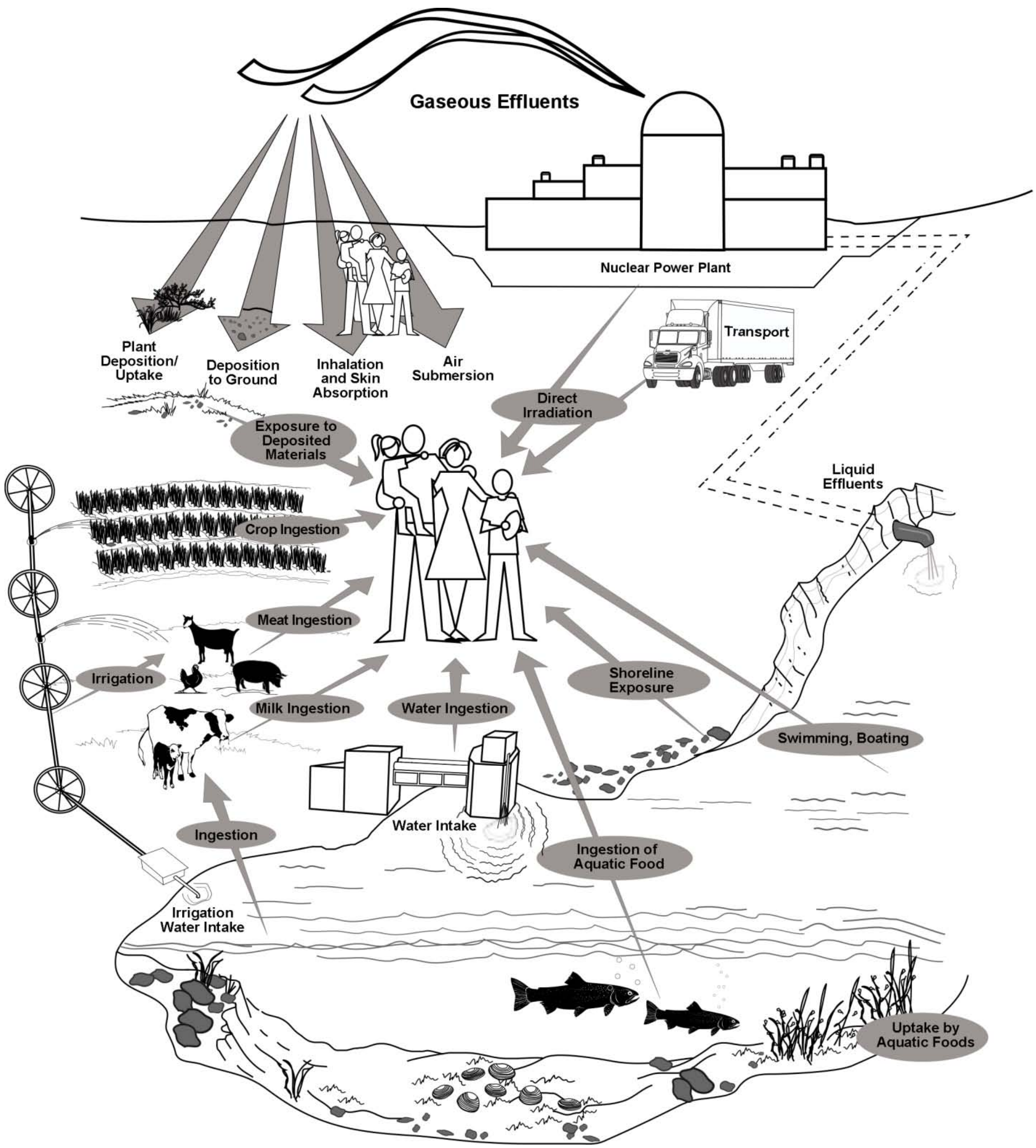

Figure 5-2. Exposure Pathways to Man (adapted from Soldat et al. 1974)

external dose to the MEI or the population. This assumption of a negligible contribution from direct radiation beyond the site boundary is supported by the DCD (GEH 2010a).

Exposure pathways considered by Detroit Edison in the ER (Detroit Edison 2011a) in evaluating the dose to the biota are shown in Figure 5-3 and include:

- Ingestion of aquatic foods
- External exposure from water immersion and shoreline sediments
- Inhalation of airborne radionuclides
- External exposure to immersion in gaseous effluent plumes
- Surface exposure from deposition of iodine and particulates from gaseous effluents (NRC 1977).

The NRC staff reviewed the exposure pathways for the public and nonhuman biota identified by Detroit Edison (2011a) and, on the basis of a documentation review, a tour of the site and surrounding areas, and interviews with Detroit Edison staff and contractors during a site visit in February 2009, found them to be appropriate.

5.9.2 Radiation Doses to Members of the Public

Detroit Edison calculated the dose to the MEI and the population living within a 50-mi radius of the site from both the liquid and gaseous effluent release pathways (Detroit Edison 2010a). As discussed in the Section 5.9.1, direct radiation exposure to the MEI from sources of radiation at Fermi 3 would be negligible.

5.9.2.1 Liquid Effluent Pathway

Liquid pathway doses to the MEI were calculated by using the LADTAP II computer program (Strenge et al. 1986). The following activities were considered in the dose calculations: (1) consumption of drinking water contaminated by liquid effluents; (2) consumption of fish, shellfish, or other aquatic organisms from water sources contaminated by liquid effluents; and (3) direct radiation from swimming in, boating on, and shoreline use of water bodies contaminated by liquid effluents. Detroit Edison stated that water from Lake Erie is not used for irrigation in the vicinity of Fermi 3 (Detroit Edison 2011a).

The liquid effluent releases used in the estimates of dose are found in Table 12.2-19b of the DCD (GEH 2010a). Other parameters used as inputs to the LADTAP II program – including the effluent discharge rate, dilution factor for discharge, transit time to receptor, and liquid pathway consumption and usage factors (i.e., shoreline usage, fish consumption, and drinking water consumption) – are found in Tables 5.4-1 and 5.4-2 of the ER (Detroit Edison 2011a).

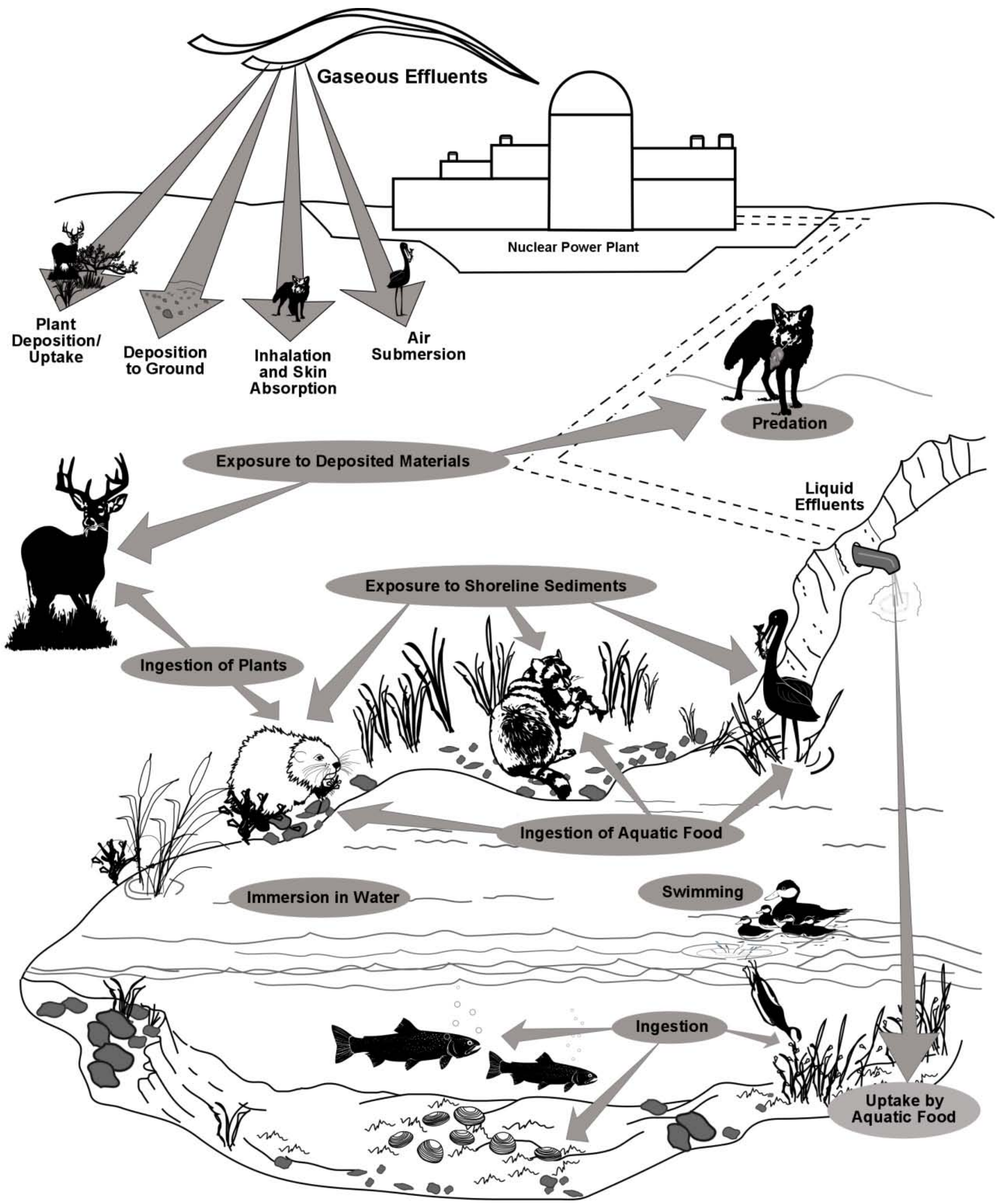

Figure 5-3. Exposure Pathways to Biota Other than Man (adapted from Soldat et al. 1974)

Detroit Edison calculated liquid pathway doses to the MEI; these dose estimates are shown in Table 5-24. The MEI is an adult for whom the majority of the dose comes from fish ingestion. The maximally exposed organ is the bone of a child, and the majority of the dose is from fish ingestion.

Table 5-24. Doses to the MEI for Liquid Effluent Releases from Fermi 3

Pathway	Total Body (mrem/yr)	Thyroid (mrem/yr)	Bone (mrem/yr)
Drinking water	0.000605	0.0263	0.000592
Fish	0.00541	0.00219	0.0827
Invertebrate	0.000571	0.000188	0.00449
Shoreline (includes water recreation)	0.000101	0.000101	0.000101
Total	0.00648	0.0263	0.0877
Age group receiving maximum dose	Adult	Infant	Child

Source: Table 12.2-20bR in Detroit Edison (2011b) and Table 5.4-4 in Detroit Edison (2011a)

The NRC staff recognizes the LADTAP II computer program as being an appropriate method for calculating the dose to the MEI for liquid effluent releases. The staff performed an independent evaluation of liquid pathway doses by using input parameters from the ER, and results were similar to those in the ER. The NRC staff judged all input parameters used in Detroit Edison's calculations to be appropriate. Results of the staff's independent evaluation are presented in Appendix G.

5.9.2.2 Gaseous Effluent Pathway

Gaseous pathway doses to the MEI were calculated by Detroit Edison by using the GASPAR II computer program (Strenge et al. 1987) at the nearest individual receptors in various directions (residence, garden, milk- and meat-producing animals, and the exclusion area boundary). The GASPAR II computer program was also used to calculate annual population doses. The following activities were considered in the dose calculations: (1) direct radiation from immersion in the gaseous effluent cloud and from particulates deposited on the ground, (2) inhalation of gases and particulates, (3) ingestion of contaminated meat and milk from animals eating contaminated grass, and (4) ingestion of garden vegetables contaminated by gases and particulates. The gaseous effluent releases used in the estimate of dose to the MEI and population are found in Table 12.2-16 of the DCD (GEH 2010a) for noble gases and other fission products and in Table 12.2-206 of the FSAR (Detroit Edison 2011b) for iodines. Other parameters used as inputs to the GASPAR II program – including population data, atmospheric dispersion factors, ground deposition factors, receptor locations, and consumption factors – are found in Tables 5.4-2 and 5.4-3 of the ER (Detroit Edison 2011a). Gaseous pathway doses to the MEI calculated by Detroit Edison are found in Table 5-25.

Table 5-25. Doses to the MEI for Gaseous Effluent Releases from Fermi 3

Pathway and Location	Age Group	Total Body Dose (mrem/yr)	Thyroid Dose (mrem/yr)	Bone Dose (mrem/yr)	Skin Dose (mrem/yr)
Plume (0.48 mi NNW)	All	1.42×10^{-1}	1.42×10^{-1}	1.42×10^{-1}	3.35×10^{-1}
Ground (0.59 mi NW)	All	4.95×10^{-1}	4.95×10^{-1}	4.95×10^{-1}	5.81×10^{-1}
Inhalation (0.59 mi NW)	Adult	2.81×10^{-3}	1.85×10^{-1}	1.74×10^{-3}	1.14×10^{-3}
	Teen	2.72×10^{-3}	2.40×10^{-1}	2.41×10^{-3}	1.16×10^{-3}
	Child	2.23×10^{-3}	2.93×10^{-1}	3.23×10^{-3}	1.02×10^{-3}
	Infant	1.29×10^{-3}	2.68×10^{-1}	2.20×10^{-3}	5.87×10^{-4}
Vegetable[(a)] (0.60 mi NW)	Adult	1.73×10^{-1}	3.89	4.81×10^{-1}	5.38×10^{-2}
	Teen	2.07×10^{-1}	5.41	6.96×10^{-1}	9.03×10^{-2}
	Child	3.37×10^{-1}	10.5	1.68	2.20×10^{-1}
Meat [(a)] (2.95 mi NNW)	Adult	1.61×10^{-3}	4.93×10^{-3}	6.67×10^{-3}	1.29×10^{-3}
	Teen	1.27×10^{-3}	3.72×10^{-3}	5.62×10^{-3}	1.09×10^{-3}
	Child	2.22×10^{-3}	6.02×10^{-3}	1.05×10^{-2}	2.05×10^{-3}
Goat milk (2.21 mi WNW)	Adult	1.68×10^{-2}	3.48×10^{-1}	2.38×10^{-2}	2.39×10^{-3}
	Teen	1.86×10^{-2}	5.53×10^{-1}	4.32×10^{-2}	4.34×10^{-3}
	Child	2.24×10^{-2}	1.10	1.05×10^{-1}	1.05×10^{-2}
	Infant	3.48×10^{-2}	2.67	1.88×10^{-1}	2.19×10^{-2}
Cow milk (2.09 mi WNW)	Adult	8.56×10^{-3}	2.84×10^{-1}	1.76×10^{-2}	2.53×10^{-3}
	Teen	1.13×10^{-2}	4.52×10^{-1}	3.22×10^{-2}	4.64×10^{-3}
	Child	1.86×10^{-2}	9.00×10^{-1}	7.80×10^{-2}	1.13×10^{-2}
	Infant	3.28×10^{-2}	2.18	1.46×10^{-1}	2.37×10^{-2}

Source: Detroit Edison 2011b

(a) No infant doses were calculated for the vegetable or meat pathway because the doses that infants receive from this diet would be bounded by the dose calculated for the child.

The NRC staff recognizes the GASPAR II computer program as an appropriate tool for calculating dose to the MEI and population from gaseous effluent releases. The staff performed an independent evaluation of gaseous pathway doses and obtained similar results to those in

the ER. All input parameters used in Detroit Edison's calculations were judged by the staff to be appropriate. Results of the staff's independent evaluation are found in Appendix G.

5.9.3 Impacts on Members of the Public

This section describes the Detroit Edison's evaluation of the estimated impacts from radiological releases and direct radiation from Fermi 3. The evaluation addresses the dose from operations to the MEI located at the Fermi site boundary and the population dose (collective dose to the population within 50 mi) around Fermi 3.

5.9.3.1 Maximally Exposed Individual

Detroit Edison (2011a) states that total body and organ dose estimates to the MEI from liquid and gaseous effluents from Fermi 3 would be within the dose design objectives of 10 CFR Part 50, Appendix I. Total body doses and maximum organ doses at Lake Erie from liquid effluents were well within the Appendix I dose design objectives of 3 mrem/yr and 10 mrem/yr, respectively. Doses at the exclusion area boundary from gaseous effluents were well within the Appendix I dose design objectives of 10 mrad/yr air dose from gamma radiation, 20 mrad/yr air dose from beta radiation, 5 mrem/yr to the total body, and 15 mrem/yr to the skin. In addition, the dose to the thyroid was within the 15-mrem/yr Appendix I dose design objective. Table 5-26 compares the dose estimates for Fermi 3 to the Appendix I dose design objectives. The NRC staff completed an independent evaluation of the doses for comparison with Appendix I dose design objectives and found similar results, as shown in Appendix G.

Table 5-26. Comparisons of MEI Annual Dose Estimates from Liquid and Gaseous Effluents to 10 CFR Part 50, Appendix I, Dose Design Objectives

Radionuclide Releases/Doses	Detroit Edison Assessment	Appendix I Dose Design Objectives
Liquid effluents[(a)]		
Total body dose	0.006 mrem	3 mrem
Maximum organ dose (child bone)	0.088 mrem	10 mrem
Gaseous effluents (noble gases only)		
Beta air dose	0.26 mrad	20 mrad
Gamma air dose	0.22 mrad	10 mrad
Total body dose	0.98 mrem	5 mrem
Skin dose	1.15 mrem	15 mrem
Gaseous effluents (radioiodines and particulates)		
Maximum organ dose (child thyroid)	11.3 mrem	15 mrem

Source: Detroit Edison 2011a

(a) Total body dose is for an adult and maximum organ dose is for a child.

Detroit Edison (2011a) compared the combined dose estimates from direct radiation and gaseous and liquid effluents from the existing Fermi 2 and the proposed Fermi 3 against the 40 CFR Part 190 standards (Detroit Edison 2011a). Detroit Edison (2011a) states that the total body and organ dose estimates to the MEI from liquid and gaseous effluents for Fermi 3 are below the design objectives of 10 CFR Part 50, Appendix I. As stated in Section 5.9.2, exposure at the site boundary from direct radiation sources at Fermi 3 would not contribute significantly to the MEI dose. The routine thermoluminescent dosimeter (TLD) measurements (representative of direct radiation exposure) from operation of Fermi 2 at the site boundary are at background levels (Detroit Edison 2011a). Table 5-27 shows Detroit Edison's assessment that the total doses to the MEI from liquid and gaseous effluents at the Fermi site are well below the 40 CFR Part 190 standards. The staff completed an independent evaluation of the site total dose (cumulative dose) for comparison with 40 CFR Part 190 standards and found similar results, as shown in Appendix G.

Table 5-27. Comparison of MEI Doses (mrem/yr) to 40 CFR Part 190 Dose Standards

	Fermi 2	Fermi 3				
Dose Site	**Combined Liquid and Gaseous**	**Liquid**	**Gaseous**	**Combined**	**Fermi Site Total**	**40 CFR Part 190 Standards**
Total body	4.68	0.006	0.976	0.98	5.66	25
Thyroid	2.66	0.026	11.3	11.33	13.99	75
Other organ – child bone	0.05	0.088	2.18	2.27	2.32	25

Source: Detroit Edison 2011a

5.9.3.2 Population Dose

Detroit Edison estimated the collective total body dose within a 50-mi radius of the Fermi 3 site to be 14.9 person-rem from liquid effluents (Detroit Edison 2011a) and 6.7 person-rem/yr from gaseous effluents (Detroit Edison 2011a) using the population estimate for 2060. The estimated collective dose to the same population from natural background radiation is estimated to be 2,400,000 person-rem/yr. The dose from natural background radiation was calculated by multiplying the 50-mi population estimate for 2060 of approximately 7,710,000 people by the annual background dose rate of 311 mrem/yr (NCRP 2009).

The collective dose from the gaseous and liquid effluent pathways was estimated by using the GASPAR II and LADTAP II computer codes, respectively. The staff performed an independent evaluation of population doses and obtained similar results (see Appendix G).

Radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response relationship is used to describe the relationship between radiation dose and detriments, such as cancer induction. The recent BEIR VII report by the National Research Council (2006) reconfirms the linear, no-threshold dose response model. Simply stated, any increase in dose, no matter how small, results in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, though it recognizes that the model probably overestimates those risks. On the basis of this method, the NRC staff estimated the risk to the public from radiation exposure by using the nominal probability coefficient for total detriment. The value of this coefficient is 570 fatal cancers, nonfatal cancers, and severe hereditary effects per 1,000,000 person-rem (10,000 person-Sv), which is equal to 0.00057 effect per person-rem. The coefficient is taken from International Commission on Radiological Protection (ICRP) Publication 103 (ICRP 2007).

Both the National Council on Radiation Protection and Measurements (NCRP) and ICRP suggest that when the collective effective dose is smaller than the reciprocal of the relevant risk detriment (i.e., less than 1/0.00057, which is less than 1754 person-rem), the risk assessment should note that the most likely number of excess health effects is zero (NCRP 1995; ICRP 2007). The estimated collective whole body dose to the population living within 50 mi of Fermi 3 is 21.6 person-rem/yr (Detroit Edison 2011a), which is less than the value of 1754 person-rem that the ICRP and NCRP suggest would most likely result in zero excess health effects (NCRP 1995; ICRP 2007).

In addition, at the request of the U.S. Congress, the National Cancer Institute (NCI) conducted a study and published the results in *Cancer in Populations Living near Nuclear Facilities* (NCI 1990). This report included an evaluation of health statistics around all nuclear power plants as well as several other nuclear-fuel-cycle facilities in operation in the United States in 1981. It found “no evidence that an excess occurrence of cancer has resulted from living near nuclear facilities” (NCI 1990).

5.9.3.3 Summary of Radiological Impacts on Members of the Public

The NRC staff evaluated the health impacts from routine gaseous and liquid radiological effluent releases from Fermi 3. On the basis of the information provided by Detroit Edison and NRC’s independent evaluation, the NRC staff concludes there would be no observable health impacts on the public from normal operation of Fermi 3, the health impacts would be SMALL, and additional mitigation is not warranted.

5.9.4 Occupational Doses to Workers

At the Fermi site, the annual occupational collective dose for 2006 through 2008 averaged 137 person-rem for the existing Fermi 2 (Lewis and Hagemeyer 2010). The estimated annual occupational collective dose for the GE-Hitachi ESBWR advanced reactor design, including the GE-Hitachi ESBWR at the Fermi 3 site, was 84.52 person-rem (GEH 2010a), which is less than the annual occupational collective dose of 129 person-rem for current boiling-water reactors (BWRs) for calendar year 2008 (Lewis and Hagemeyer 2010).

The licensee of a new plant would need to maintain individual doses to workers within 0.05 Sv (5 rem) annually, as specified in 10 CFR 20.1201, and incorporate as low as is reasonably achievable (ALARA) provisions to maintain doses below this limit.

The NRC staff concludes that the health impacts from occupational radiation exposure would be SMALL based on individual worker doses being maintained within 10 CFR 20.1201 limits and collective occupational doses being typical of doses found in current operating LWRs. Additional mitigation would not be warranted because the operating plant would be required to maintain doses ALARA.

5.9.5 Impacts on Biota Other than Humans

Detroit Edison estimated doses to biota in the environs of Fermi 3 by using surrogate species. The surrogates used in the ER are well-defined and provide an acceptable method for evaluating doses to the biota. Surrogate analyses were performed for aquatic species, such as fish, invertebrates, and algae, and for terrestrial species, such as muskrats, raccoons, herons, and ducks. Aquatic species on the site are represented by surrogates as follows: (1) various mussel and mollusk species and crayfish are represented by invertebrates; (2) darter, shiner, catfish, whitefish, yellow perch, largemouth bass, and striped bass are represented by fish; and (3) aquatic plants are represented by algae. Terrestrial species on the site are represented by surrogates as follows: (1) white-tailed deer, raccoon, gray squirrel, red squirrel, eastern cottontail rabbit, coyotes, red fox, striped skunk, prairie deer mouse, meadow vole, and muskrat are represented by raccoon and muskrat; (2) ducks and geese are represented by duck; and (3) bald eagle, shorebirds, and wading birds are represented by heron. Exposure pathways considered in evaluating dose to the biota were discussed in Section 5.9.1 and shown in Figure 5-3. The NRC staff reviewed the Detroit Edison (2011a) calculations and performed an independent evaluation of fish, invertebrates, algae, muskrat, raccoon, duck, and heron. The staff's independent evaluation found similar results, as shown in Appendix G.

5.9.5.1 Liquid Effluent Pathway

Detroit Edison (2011a) used the LADTAP II computer code to calculate doses to the biota from the liquid effluent pathway. In estimating the concentration of radioactive effluents in Lake Erie, Detroit Edison (2011a) used a transit dilution model. Liquid pathway doses were higher for biota than humans because of the bioaccumulation of radionuclides, ingestion of aquatic plants, ingestion of invertebrates, and increased time spent in water and shoreline associated with biota. The liquid effluent releases used in estimating the biota dose are given in Table 12.2-19b of the DCD (GEH 2010a). Estimates of the total body doses to the surrogate species from the liquid pathway are shown in Table 5-28.

Table 5-28. Detroit Edison Estimates of the Annual Dose (mrad/yr) to Biota from Fermi 3

	Detroit Edison Biota Dose Estimates		
Biota	**Liquid Pathway**	**Gaseous Pathway**	**Total Body Biota Dose All Pathways**
Fish	2.31	0	2.31
Invertebrate	7.65	0	7.65
Algae	11.9	0	11.9
Muskrat	14.8	11.2	26.0
Raccoon	0.43	11.2	11.6
Heron	6.87	11.2	18.0
Duck	14.8	11.2	26.0

Source: Detroit Edison 2011a

5.9.5.2 Gaseous Effluent Pathway

Gaseous effluents would contribute to the total body dose of the terrestrial surrogate species (i.e., muskrat, raccoon, heron, and duck). The exposure pathways include inhalation of airborne radionuclides, external exposure because of immersion in gaseous effluent plumes, and surface exposure from deposition of iodine and particulates from gaseous effluents. The dose calculated to the MEI from gaseous effluent releases in Table 5-25 would also be applicable to terrestrial surrogate species, but with a doubling of the ground deposition factor because terrestrial species are closer to the ground than humans. The gaseous effluent releases used in estimating the dose are found in Table 12.2-16 of the DCD (GEH 2010a) for noble gases and other fission products and in Table 12.2-206 of the FSAR (Detroit Edison 2011b) for iodines. Detroit Edison used doses calculated by the GASPAR II code at 0.25 mi from the proposed Fermi 3 site in estimating terrestrial species doses (Detroit Edison 2011a). Estimates of the total body doses to the surrogate species from the gaseous pathway are shown in Table 5-28.

5.9.5.3 Impact on Biota Other Than Humans

Radiological doses to nonhuman biota are expressed in units of absorbed dose (mrad) because the dose equivalent (mrem) applies only to human radiological doses. The ICRP (ICRP 1977, 1991, 2007) states that if humans are adequately protected, other living things are also likely to be sufficiently protected. The International Atomic Energy Agency (IAEA 1992) and the NCRP (1991) reported that a chronic dose rate of no more than 10 mGy/day (1000 mrad/day) to the MEI in a population of aquatic organisms would ensure protection of the population. IAEA (1992) also concluded that chronic dose rates of 1 mGy/day (100 mrad/day) or less do not appear to cause observable changes in terrestrial animal populations.

Table 5-29 compares estimated the total body dose rates to surrogate biota species that would be produced by releases from Fermi 3 to the IAEA/NCRP biota dose guidelines (IAEA 1992; NCRP 1991). None of the surrogate species had daily dose rates that exceeded the IAEA guidelines. Moreover, the biota dose estimates for Fermi 3 are conservative, because they do not consider decay of liquid effluents during transit. Actual doses to the biota are likely to be much less.

Table 5-29. Comparison of Biota Doses from Fermi 3 to IAEA/NCRP Guidelines for Biota Protection

Biota	Detroit Edison Estimate of Dose to Biota (mrad/day)[(a)]	IAEA/NCRP Guideline for Protection of Biota Populations (mrad/day)[(b)]
Fish	0.0063	1000
Invertebrate	0.021	1000
Algae	0.033	1000
Muskrat	0.071	100
Raccoon	0.032	100
Heron	0.049	100
Duck	0.071	100

Source: IAEA 1992

(a) Total dose from liquid and gaseous effluents in Table 5-25. For comparison purposes, Detroit Edison's reported dose in mrad/yr was converted to mrad/day by dividing by 365 days/yr. Published guidelines reported doses in mGy/day (1 mGy = 100 mrad).

(b) Guidelines in IAEA and NCRP reports expressed in Gy/day (1 mGy = 100 mrad).

The maximum total dose from both liquid and gaseous pathways from the bounding calculation is about 26.0 mrad/yr, or about 0.07 mrad/day. Thus, doses to biota calculated by Detroit Edison are far below the IAEA (1992) guidelines of 100 mrad/day (0.1 rad/day) for terrestrial biota and 1 rad/day for aquatic biota.

On the basis of the information provided by Detroit Edison and the NRC's independent evaluation, the NRC staff concludes that the radiological impact on biota from the routine operation of the proposed Fermi 3 would be SMALL and additional mitigation is not warranted.

5.9.6 Radiological Monitoring

An REMP has been in place for the Fermi site since Fermi 2 operations began in 1985, with preoperational sample collection activities beginning in 1978 (Detroit Edison 2011a). The REMP includes monitoring of the airborne exposure pathway, direct exposure pathway, water exposure pathway, aquatic exposure pathway from Lake Erie, and ingestion exposure pathway in a 5-mi radius of the station, with indicator locations near the plant perimeter and control locations at distances greater than 10 mi. An annual survey is conducted for the area surrounding the site to verify the accuracy of the assumptions used in the analyses. The REMP program includes the collection and analysis of samples of air particulates, precipitation, crops, milk, soil, well water, surface water, fish, and silt as well as the measurement of ambient gamma radiation. Radiological releases are summarized in an annual report, the most recent of which is *Fermi 2 – 2010 Radioactive Effluent Release Report* (Detroit Edison 2011b). The limits for all radiological releases are specified in the Offsite Dose Calculation Manual (ODCM) for Fermi 2, which is also provided in this report (Detroit Edison 2011b).

Fermi 3 construction would include a new protected area fence enclosing Fermi 2 and 3. Depending on the location of the new protected area fence, new near-field thermoluminescent dosimeter locations would be established to provide adequate monitoring for both Fermi 2 and Fermi 3 (Detroit Edison 2011a). To the greatest extent practical for other monitoring, the REMP for Fermi 3 would use the procedures and sampling locations used for Fermi 2. The staff reviewed the documentation for the existing REMP, the ODCM, and recent monitoring reports from the Fermi site and determined that the current operational monitoring program is adequate to establish the radiological baseline for comparison with the environmental impacts expected from the construction and operation of Fermi 3.

The annual radioactive effluent release report for 2010 summarized the results of the groundwater sampling performed by Detroit Edison in various locations around the plant under the NEI groundwater protection initiative (Detroit Edison 2011b). The sporadic and variable trace quantities of tritium (maximum concentration observed was 1950 pCi/L) were detected in the few shallow groundwater wells downwind from the Fermi 2 stack. Detroit Edison attributed this to the recapture of tritium in precipitation from the plant's gaseous effluent (Detroit Edison 2009c). The detected tritium concentrations were far below the EPA drinking water standard of 20,000 pCi/L (41 FR 28402). Detroit Edison has indicated that any proposed changes in groundwater monitoring to support the NEI initiative for operation of Fermi 3 (see Section 2.11 for a description of the initiative) would be made prior to fuel loading for Fermi 3 (Detroit Edison 2009c).

5.10 Nonradioactive Waste Impacts

This section describes the potential impacts on the environment that could result from the generation, handling, and disposal of nonradioactive waste and mixed waste during the operation of Fermi 3. As discussed in Section 3.4.4, the types of nonradioactive waste that would be generated, handled, and disposed of during operational activities at Fermi 3 include solid wastes, liquid effluents, and air emissions. Solid wastes include municipal waste, dredge spoils, sewage treatment sludge, and industrial wastes. Liquid waste includes NPDES-permitted discharges (such as effluents that contain chemicals or biocides), wastewater effluents, site stormwater runoff, and other liquid wastes (such as used oils, paints, and solvents that require offsite disposal). Air emissions would primarily be generated by vehicles, diesel generators, and combustion generators. In addition, small quantities of hazardous waste and of mixed waste, which is waste that has both hazardous and radioactive characteristics, may be generated during plant operations. The assessment of potential impacts resulting from these types of wastes is presented in the following subsections.

5.10.1 Impacts on Land

The operation of Fermi 3 would generate solid and liquid wastes similar to those already generated by the current operation of Fermi 2. Although the total volume of solid and liquid wastes would increase at the Fermi site, no new solid or liquid waste types are expected to result from the operation of the new Fermi 3 (Detroit Edison 2011a).

Detroit Edison has indicated it would continue to use recycling and waste minimization practices in place at the Fermi site for the nonradioactive solid waste that would be generated from the operation of Fermi 3. Solid wastes – such as used oils, antifreeze, scrap metal, lead-acid batteries, and paper – that could be recycled or reused would be managed through the approved and licensed contractor. The solid waste that could not be recycled or reused would be transported to the licensed offsite commercial disposal sites (Detroit Edison 2011a). Spoils from maintenance dredging of the water intake canal and cleaning of the pump house intakes would be accumulated in the onsite Spoils Disposal Pond. Subject to MDEQ and USACE review, dredged material from the disposal pond could be used as fill material or sold for use as topsoil (Detroit Edison 2011a). Debris collected on trash screens at the water intake structure would be disposed of offsite in accordance with State regulations.

The wastewater generated from the operation of Fermi 3 would be treated in a manner similar to that for the wastewater from existing Fermi 2 (Detroit Edison 2011a). Sanitary waste generated from the operation of Fermi 3 would be collected onsite and discharged to the Monroe Metropolitan Wastewater Treatment Facility for treatment under the site sanitary industrial use permit (Detroit Edison 2011a). Because effective practices for recycling and minimizing waste are already in place for Fermi 2 and because the plans are to manage Fermi 3 solid and liquid wastes in a similar manner in accordance with applicable Federal, State, and local requirements and standards, the review team expects that impacts on land from nonradioactive wastes generated during the operation of Fermi 3 would be minimal and that no further mitigation is warranted.

5.10.2 Impacts on Water

Effluents containing chemicals or biocides from the operation of Fermi 3 would be discharged mainly to Lake Erie. Discharge sources would include cooling tower blowdown, chemical and nonchemical metal-cleaning wastes, service water screen backwash, stormwater runoff, settled water from the Spoils Disposal Pond, and chemicals used to control zebra mussels (Detroit Edison 2011a).

Detroit Edison anticipates that it may be necessary to revise or apply for a new NPDES permit to accommodate increased discharges to Lake Erie resulting from the operation of Fermi 3 (Detroit Edison 2011a). In either case, discharges would be subject to limitations contained in the site's NPDES permit.

To properly manage stormwater flow, Detroit Edison would update its existing SWPPP to reflect the increase in impervious surfaces and changes in onsite drainage patterns (Detroit Edison 2011a). Sections 5.2.3.1 and 5.2.3.2 discuss impacts on the quality of the surface water and groundwater from operation of Fermi 3. Nonradioactive liquid effluents that would be discharged to Lake Erie would be regulated by MDEQ and subject to limitations contained in the site's NPDES permit.

Because there are regulated practices for managing liquid discharges containing chemicals or biocide and other wastewater and because there are plans for managing stormwater, the review team concludes that impacts on water from nonradioactive effluents during the operation of Fermi 3 would be minimal and that no further mitigation is warranted.

5.10.3 Impacts on Air

Operations of Fermi 3 would result in gaseous emissions from the intermittent operation of emergency diesel generators, an auxiliary boiler, and diesel fire pumps. In addition, increased vehicular traffic associated with the personnel needed to operate Fermi 3 would increase vehicle emissions in the area. Impacts on air quality are discussed in detail in Section 5.7.2. Increases in air emissions from operation of Fermi 3 would be in accordance with permits issued by MDEQ that would ensure compliance with the Federal, State, and local air quality control laws and regulations. Because there are regulated practices for managing air emissions from stationary sources, the review team concludes that impacts on air from nonradioactive emissions during the operation of Fermi 3 would be minor and that no further mitigation is warranted.

5.10.4 Mixed Waste Impacts

Mixed waste contains both low-level radioactive waste and hazardous waste. The generation, storage, treatment, and disposal of mixed waste is regulated by the Atomic Energy Act of 1964, the Solid Waste Disposal Act of 1965 as amended by the Resource Conservation and Recovery Act (RCRA) in 1976, and the Hazardous and Solid Waste Amendments (which amended RCRA in 1984).

Each reactor at the Fermi site is expected to produce on the order of 0.5 m^3/yr of mixed waste. Mixed waste generated at Fermi 2 in the last few years ranged from 200 to 2000 lb/yr (Detroit Edison 2011a). Mixed waste can be reduced through decay, stabilization, neutralization, filtration, or chemical decontamination or treatment. Detroit Edison stated that the mixed waste that cannot be treated onsite will be temporarily stored at a remote monitored structure until it is shipped for offsite disposal at an approved facility. Existing Detroit Edison procedures for the storage of mixed wastes would be used to limit any occupational exposure or accidental spill (Detroit Edison 2011a). Fermi 3 would also claim an exemption under a state of Michigan low-level mixed waste exemption (Fermi 2 currently operates under this exemption) that would allow Detroit Edison to store an unlimited quantity of mixed waste for a long time if the mixed waste exemption conditions are met.

Because effective practices for minimizing waste are already in place for Fermi 2 and because the plans are to manage Fermi 3 mixed wastes in a similar manner in accordance with all applicable Federal, State, and local requirements and standards, the review team concludes that impacts from the generation of mixed waste at Fermi 3 would be minimal and that no further mitigation is warranted.

5.10.5 Summary of Nonradioactive Waste Impacts

Solid, liquid, gaseous, and mixed wastes generated during the operation of Fermi 3 would be handled according to county, State, and Federal regulations. Required county, State, and Federal permits for the handling and disposal of dredged material and solid waste would be obtained. A revised SWPPP for surface-water runoff and NPDES permits for permitted releases of cooling and auxiliary system effluents would ensure compliance with the Federal Water Pollution Control Act (Clean Water Act) and MDEQ water quality standards. Wastewater discharge would be required to comply with NPDES limitations. Air emissions from Fermi 3 operations would be compliant with air quality standards as permitted by MDEQ. Impacts from the generation, storage, and disposal of mixed waste during operation of Fermi 3 would be compliant with requirements and standards. On the basis of (1) information provided by Detroit Edison, (2) effective practices for recycling, minimizing, managing, and disposing of wastes already in use at the Fermi site, (3) the review team’s expectation that regulatory approvals will be obtained to regulate the additional waste that would be generated during Fermi 3 operations, and (4) the review team’s independent evaluation, the review team concludes that the potential impacts from nonradioactive waste resulting from the operation of Fermi 3 would be SMALL and further mitigation is not warranted.

Cumulative impacts on water and air from nonradioactive emissions and effluents are discussed in Sections 7.2.2.1 and 7.5, respectively. For the purposes of Chapter 9, the staff concludes that (1) there would be no substantive differences between the impacts from nonradioactive waste at the Fermi site and those at the alternative sites, and (2) no substantive cumulative impacts warrant further discussion beyond those discussed for the alternative sites in Section 9.3.

5.11 Environmental Impacts of Postulated Accidents

The NRC staff considered the radiological consequences on the environment from potential accidents at the proposed Fermi 3. Detroit Edison based its COL application on the proposed installation of an ESBWR design for the proposed Fermi 3. Detroit Edison's application references Revision 9 of ESBWR DCD. The NRC staff issued a final design approval for the ESBWR on March 9, 2011 (76 FR 14437) and has begun the process of design certification rulemaking for the ESBWR (76 FR 16549).

The term "accident" as used in this section refers to any off-normal event not addressed in Section 5.9 that results in release of radioactive materials into the environment. This review focuses on events that could lead to releases substantially in excess of permissible limits for normal operations. Normal release limits are specified in 10 CFR Part 20, Appendix B, Table 2.

Numerous features combine to reduce the risk associated with accidents at nuclear power plants. Safety features in the design, construction, and operation of the plants, which make up the first line of defense, are intended to prevent the release of radioactive materials from the plant. The design objectives and the measures for keeping levels of radioactive materials in effluents to unrestricted areas ALARA are specified in 10 CFR Part 50, Appendix I. Additional measures are designed to mitigate the consequences of failures in the first line of defense. These measures include the NRC's reactor site criteria in 10 CFR Part 100, which require the site to have certain characteristics that reduce the risk to the public and reduce the potential impacts of an accident, and emergency preparedness plans and protective action measures for the site and environs, as set forth in 10 CFR 50.47, 10 CFR Part 50, Appendix E, and NUREG-0654/FEMA-REP-1 (NRC 1980). All these safety features, measures, and plans make up the defense-in-depth philosophy to protect the health and safety of the public and the environment.

On March 11, 2011, and for an extended period thereafter, several nuclear power plants in Japan experienced the loss of important equipment necessary to maintain reactor cooling after the combined effects of severe natural phenomena: an earthquake followed by a tsunami. In response to these events, the Commission established a task force to review the current regulatory framework in place in the United States and to make recommendations for improvements. On July 12, 2011, the task force reported the results of its review (NRC 2011) and presented the recommendations to the Commission on July 19, 2011. As part of the short-term review, the task force concluded that, while improvements are expected to be made as a result of the lessons learned, the continued operation of nuclear power plants and licensing activities for new plants do not pose an imminent risk to public health and safety. In addition, a number of areas were recommended to the Commission for long-term consideration.

Collectively, these recommendations are intended to clarify and strengthen the regulatory framework for protection against severe natural phenomena, for mitigation of the effects of such events, for coping with emergencies, and for improving the effectiveness of NRC programs. Because of the passive design and inherent 72-hour coping capability for core, containment, and spent fuel pool cooling with no operator action required, the ESBWR design has many of the design features and attributes necessary to address the Task Force Recommendations (NRC 2011).

On March 12, 2012, the NRC issued three Orders and a request for information (RFI) to holders of U.S. commercial nuclear reactor licenses and construction permits to enhance safety at U.S. reactors based on specific lessons learned from the event at Japan's Fukushima Dai-ichi nuclear power plant as identified in the task force report. The first and third Orders apply to every U.S. commercial nuclear power plant, including recently licensed new reactors. The first Order requires a three-phase approach for mitigating beyond-design-basis external events. Licensees are required to use installed equipment and resources to maintain or restore core, containment and spent fuel pool cooling during the initial phase. During the transition phase, licensees are required to provide sufficient, portable, onsite equipment and consumables to maintain or restore these functions until they can be accomplished with resources brought from off site. During the final phase, licensees are required to obtain sufficient offsite resources to sustain those functions indefinitely (77 FR 16091). The second Order requires reliable hardened vent systems at boiling water reactor facilities with "Mark I" and "Mark II" containment structures (77 FR 16098). The third Order requires reliable spent fuel pool level instrumentation (77 FR 16082). The RFI addressed five topics: (1) seismic reevaluations; (2) flooding reevaluations; (3) seismic hazard walkdowns; (4) flooding hazard walkdowns, and; (5) a request for licensees to assess their current communications system and equipment under conditions of onsite and offsite damage and prolonged station blackout and perform a staffing study to determine the number and qualifications of staff required to fill all necessary positions in response to a multi-unit event (NRC 2012b, c). The RFI requested reactor licensees to reevaluate seismic and flooding hazards using present day methods to determine if the plant's design basis needs to be changed.

The NRC staff issued RAIs to Detroit Edison requesting information to address the requirements of the first and third Orders, and information sought in the first and fifth RFI topics (NRC 2012d, e, f). The ESBWR containment design differs from those identified in the second Order; therefore, the actions addressed in this order are not applicable to Fermi 3. NRC's evaluation of Detroit Edison's responses is addressed in the NRC's Final Safety Evaluation Report, and any changes to the COL application that are deemed necessary will be incorporated into the applicant's FSAR.

The severe accident evaluation presented later in this section draws from the analyses developed in the staff's safety review, which includes consideration of severe accidents initiated by external events and those that involve fission product releases. The staff evaluation discusses the environmental impacts of severe accidents in terms of risk, which considers both the likelihood of a severe accident and its consequences. For several reasons discussed below, the staff has determined that the Fukushima accident and the NRC's subsequent Orders and requests for information do not change the staff's conclusions on the environmental impacts of design basis accidents or severe accidents.

Each new reactor application evaluates the natural phenomena that are pertinent to the site for the proposed reactor design by applying present-day regulatory guidance and methodologies. This includes the determination of the characteristics of the flood and seismic hazards. With respect to flooding, Detroit Edison documented the flood hazard in the FSAR consistent with present-day guidance and methodologies. This analysis sufficiently addressed the considerations involved in the second topic in the March 2012 RFI. The NRC staff performed a confirmatory review of the flood hazard analysis and has affirmed in Section 2.4 of the NRC's Final Safety Evaluation Report that the analysis was adequate and meets all applicable regulatory requirements (NRC 2012g). The staff evaluated all flood-causing mechanisms and concluded that none would exceed the referenced ESBWR standard plant site parameter for the maximum flood (or tsunami) level or affect the structures, systems, and components (SSCs) important to safety. This conclusion is based on the Fermi site topography, which shows that the SSCs important to safety are at elevations higher than maximum flood hazard. In addition, the staff concludes the likelihood of an extreme flooding event similar to what occurred at the Fukushima Dai-ichi site is low since neither the applicant nor the staff has identified any mechanisms for creating a flooding event at the Fermi site that is at all comparable with the extreme flooding event that occurred at the Fukushima Dai-ichi site.

With respect to the consideration of severe accidents initiated by seismic events, Detroit Edison is currently developing its response to the staff's seismic hazard RAI, which included the considerations of the first topic in the March 2012 RFI (NRC 2012d). In this RAI, the applicant was requested to evaluate the impacts of the newly released CEUS-SSC model, as documented in NUREG-2115, on the Fermi 3 site specific seismic hazard calculation. This model considers the latest seismic source information for the Central and Eastern United States. The applicant will need to demonstrate and the NRC staff will confirm that the ESBWR seismic design response spectra are acceptable at the Fermi 3 site. However, the applicant's accident analyses should not be affected because the applicant would be required to modify the plant design to assure any change in the seismic hazard can be accounted for without a reduction in design margin.

In addition to the above considerations for seismic and flooding, the safety features of the ESBWR design further support the conclusion that the Fukushima accident does not warrant a change in the environmental risks of severe accidents considered in the Fermi 3 FEIS analysis. In particular, the potential design-related vulnerabilities raised by the event at Fukushima, such as the impact of the extended loss of alternating and/or direct current electric power on core cooling systems, would not materially affect the analysis of severe accidents for Fermi 3 because the ESBWR has been designed to withstand such a loss of power and prevent and mitigate severe accidents. As previously noted in the task force report, the ESBWR passive safety systems would remove the decay heat from the reactor core on the loss of alternating and/or direct current electric power and operate to maintain adequate core cooling for a period of 72 hours without further operator action, unlike the facilities at the Fukushima site. This core cooling by the passive safety systems can be sustained for an extended period beyond 72 hours where the only operator action is to re-fill the internal pool that provides the source of water for the passive safety systems. Additional details are provided in the staff's Safety Evaluation Report for the ESBWR design certification. The NRC staff's design certification review (76 FR 14437) regarding the safety of the ESBWR design concluded that the design has a very high capacity to withstand beyond design basis events.

In sum, none of the information the staff has identified about the Fukushima accident or the steps taken by the NRC to date to implement the task force recommendations suggests that the seismic and flooding hazards or the available mitigation capability (i.e., passive safety systems) assumed in the Fermi EIS analysis of severe accidents would be affected. For these reasons, the NRC's analysis of the environmental impacts of design basis and severe accidents presented herein remains valid.

This section discusses the (1) types of radioactive materials, (2) paths to the environment, (3) relationship between radiation dose and health effects, and (4) environmental impacts of reactor accidents – both design-basis accidents (DBAs) and severe accidents. The environmental impacts from accidents during the transportation of spent fuel are discussed in Chapter 6.

The potential for dispersion of radioactive materials in the environment depends on the mechanical forces that physically transport the materials and on the physical and chemical forms of the material. Radioactive material exists in a variety of physical and chemical forms. The majority of the material in the fuel is in the form of nonvolatile solids. However, there is a significant amount of material that is in the form of volatile solids or gases. The gaseous radioactive materials include the chemically inert noble gases (e.g., krypton and xenon), which have a high potential for release. Radioactive forms of iodine, which are created in substantial quantities in the fuel by fission, are volatile. Other radioactive materials formed during the operation of a nuclear power plant have lower volatilities and therefore have lower tendencies to escape from the fuel than do the noble gases and isotopes of iodine.

Radiation dose to individuals is determined by their proximity to radioactive material, the duration of their exposure, the extent to which they are shielded from the radiation, and the extent to which radioactive material is ingested or inhaled. Pathways that lead to radiation dose include (1) external radiation from radioactive material in the air, on the ground, and in the water; (2) inhalation of radioactive material; and (3) ingestion of food or water containing material initially deposited on the ground and in water.

Radiation protection experts assume that any amount of radiation exposure may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold response model is used to describe the relationship between radiation dose and detriments such as cancer induction. The recent BEIR VII report (National Research Council 2006) supports the linear, no-threshold dose response model as a basis for estimating the risks from low doses. This approach is accepted by the NRC as a conservative method for estimating health risks from radiation exposure, while it also recognizes that the model may overestimate those risks.

Physiological effects are clinically detectable if individuals receive radiation exposure resulting in a dose of more than about 25 rad over a short period of time (hours). Untreated doses of about 250 to 500 rad received over a relatively short period (hours to a few days) can be expected to cause some fatalities.

5.11.1 Design-Basis Accidents

Detroit Edison evaluated the potential consequences of postulated accidents to demonstrate that an ESBWR could be constructed and operated at the Fermi site without undue risk to the health and safety of the public (Detroit Edison 2011a). These evaluations used DBAs for the ESBWR design being considered for the Fermi site and site-specific meteorological data. The set of accidents covers events that range from those having a relatively high probability of occurrence with relatively low consequences to those having a relatively low probability of occurrence with high consequences.

The DBA review focuses on the ESBWR design at the Fermi site. The bases for analyses of postulated accidents for this design are well established because they have been considered as part of the NRC's reactor design certification process. Potential consequences of DBAs are evaluated following procedures outlined in regulatory guides and standard review plans. The potential consequences of accidental releases depend on the specific radionuclides released, amount of each radionuclide released, and meteorological conditions. The source terms for the ESBWR and methods for evaluating potential accidents are based on guidance in Regulatory Guide 1.183 (NRC 2000b).

For environmental reviews, consequences are evaluated by assuming realistic meteorological conditions. Meteorological conditions are represented in these consequence analyses by an atmospheric dispersion factor, which is also referred to as χ/Q. Acceptable methods of calculating χ/Q for DBAs from meteorological data are set forth in Regulatory Guide 1.145 (NRC 1983).

Table 5-30 lists χ/Q values pertinent to the environmental review of DBAs for the Fermi 3 site (Detroit Edison 2011a). Smaller χ/Q values are associated with greater dilution capability. The first column lists the time periods and boundaries for which χ/Q and dose estimates are needed.

Table 5-30. Atmospheric Dispersion Factors for Fermi 3 Site DBA Calculations

Time Period and Boundary	χ/Q (s/m^3) [(a)]
0 to 2 hr or worst 2-hr period, exclusion area boundary	5.7×10^{-5}
0 to 8 hr, low-population zone	3.1×10^{-6}
8 to 24 hr, low-population zone	2.7×10^{-6}
1 to 4 days, low-population zone	2.0×10^{-6}
4 to 30 days, low-population zone	1.3×10^{-6}

Source: Detroit Edison (2011a).
(a) Values are rounded to two significant digits

For the exclusion area boundary, the postulated DBA dose and its atmospheric dispersion factor are calculated for a short term (i.e., 2 hr). For the low-population zone, they are calculated for the course of the accident (i.e., 30 days, composed of four time periods). The second column lists the χ/Q values for the Fermi site, using the site-specific meteorological information discussed in ER Section 2.7.4-4, and the exclusion area boundary and low-population zonedistances (Detroit Edison 2011a). In ER Section 2.7.6.1, Detroit Edison calculated the χ/Q values listed in Table 5-30 by using 6 years of onsite meteorological data (2002 through 2007) for the Fermi site and assuming the release point is located at ground level.

The NRC staff reviewed the meteorological data used by Detroit Edison and the method used to calculate the atmospheric dispersion factors. Based on these reviews, the staff concludes that the atmospheric dispersion factors for the Fermi site are acceptable for use in evaluating potential environmental consequences of postulated DBAs for the ESBWR design at the Fermi site.

Detroit Edison calculated site-specific consequences of DBAs in the ER on the basis of analyses performed for design certification of an ESBWR design with adjustment for Fermi 3 site-specific χ/Q characteristics. Table 5-31 presents the list of DBAs considered by Detroit Edison and the estimate of the environmental consequences of each accident in terms of the total effective dose equivalent (TEDE). TEDE is estimated by the sum of the committed effective dose equivalent from inhalation and the effective dose equivalent from external exposure. Dose conversion factors from Federal Guidance Report 11 (Eckerman et al. 1988) were used to calculate the committed effective dose equivalent. Similarly, dose conversion factors from Federal Guidance Report 12 (Eckerman and Ryman 1993) were used to calculate the effective dose equivalent.

The staff reviewed Detroit Edison's selection of DBAs by comparing the accidents listed in the COL application with the DBAs considered in the ESBWR DCD (GEH 2010e), which has been reviewed and approved in the design certification process. The staff confirmed that the DBAs in the ER are the same as those considered in the design certification; therefore, the staff

Table 5-31. Design-Basis Accident Doses for an ESBWR at Fermi Site

	Total Effective Dose Equivalent (rem)[a]			
Accident	**Standard Review Plan Section[b]**	**Exclusion Area Boundary**	**Low Population Zone**	**Review Criterion**
Main steam line break	15.6.4			
Pre-incident iodine spike		0.074	0.0032	25 [(c)]
Equilibrium iodine spike		0.0057	0.0016	2.5[(d)]
Loss-of-coolant accident	15.6.5	0.64	0.89	2.5 [(c)]
Feedwater line break	15.2.8			
Pre-incident iodine spike		0.51	0.027	25[(c)]
Equilibrium iodine spike		0.031	0.0016	2.5 [d)]
Reactor water cleanup water line break				
Pre-incident iodine spike		0.20	0.011	25 [(c),]
Equilibrium iodine spike		0.011	0.0016	2.5 [(d)]
Failure of small lines carrying primary coolant outside containment	15.6.2			
Pre-incident iodine spike		0.0097	0.0043	2.5 [(c)]
Equilibrium iodine spike		0.0028	0.0043	2.5 [(d)]
Fuel handling	15.7.4	0.12	0.0064	6.3 [(d)]

(a) To convert rem to Sv, divide by 100. Values are rounded to two significant digits.
(b) NUREG-0800 (NRC 2007b).
(c) 10 CFR 52.79(a)(1), and 10 CFR 100.21 criteria.
(d) SRP criteria, Table 1 in SRP Section 15.0.3.

concluded that the set of DBAs is appropriate. In addition, the staff reviewed the calculation of the site-specific consequences of the DBAs and found the results of the calculations to be reasonable for use in the evaluation of environmental consequences of DBAs.

There are no environmental criteria related to the potential consequences of DBAs. Consequently, the review criteria used in the staff's safety review of DBA doses are included in Table 5-31 to illustrate the magnitude of the calculated environmental consequences (TEDE). In all cases, the calculated TEDE values are considerably smaller than the TEDE limits used as safety review criteria.

The NRC staff reviewed the Detroit Edison DBA analysis in the ER, which is based on analyses performed for design certification of the ESBWR design with adjustment for Fermi site-specific characteristics. The NRC staff also performed an independent DBA analysis. The results of the Detroit Edison and the NRC staff analyses indicate that the environmental consequences associated with DBAs, if an ESBWR design were to be located at the Fermi site, would be small. On this basis, the staff concluded that the environmental consequences of DBAs at the Fermi site would be SMALL for an ESBWR.

5.11.2 Severe Accidents

Section 7.2 of the ER (Detroit Edison 2010b, 2011a) considers the potential consequences of severe accidents for single ESBWR at the Fermi site. Three pathways are considered: (1) atmospheric pathway, in which radioactive material is released to the air; (2) surface-water pathway, in which airborne radioactive material falls out on open bodies of water; and (3) groundwater pathway, in which groundwater is contaminated by a basemat melt-through, with subsequent contamination of the surface water by the groundwater.

Detroit Edison's consequence assessment is based on the Revision 4 of the probabilistic risk assessment (PRA) for the ESBWR design (GEH 2009). GEH subsequently updated the PRA model to Revision 6 (GEH 2010c). The NRC staff evaluated the current PRA model and its results, and concluded that the Revision 6 results are an acceptable basis for evaluating severe accidents and strategies for mitigating them. The applicant discussed the extent to which the ESBWR PRA bounds the effects of site-specific internal and external flooding in Appendix AA of Chapter 19 of the FSAR (Detroit Edison 2012e). The NRC staff has reviewed this information, and as discussed in its safety evaluation of the information in Chapter 19 of the FSAR, considers the certified design PRA results incorporated by reference to be bounding. Detroit Edison is required by regulation to upgrade and update the PRA before initial fuel loading. At that time, the NRC staff expects that the PRA will be site-specific and that it will no longer use the bounding assumptions of the design-specific PRA.

Detroit Edison's evaluation of the potential environmental consequences for the atmospheric and surface-water pathways incorporates the results of the MELCOR Accident Consequence Code System (MACCS2) computer code (Chanin et al. 1990; Chanin and Young 1998; Jow et al. 1990) run that used ESBWR source term information and site-specific meteorology, population, and land use data. Detroit Edison provided copies of the input and output files for the MACCS2 code runs (Detroit Edison 2011a). The NRC staff reviewed Detroit Edison's input and output files, made confirmatory calculations, and determined that Detroit Edison's results were reasonable.

The MACCS computer code was developed to evaluate the potential offsite consequences of severe accidents for the sites covered by NUREG-1150 (NRC 1990). The MACCS2 code evaluates the consequences of atmospheric releases of material following a severe accident. The pathways modeled include exposure to the passing plume, exposure to material deposited on the ground and skin, inhalation of material in the passing plume and resuspended from the ground, and ingestion of contaminated food and surface water.

Three types of severe accident consequences were assessed in the MACCS2 analysis: (1) human health, (2) economic costs, and (3) land area affected by contamination. Human health effects are expressed in terms of the number of early fatalities, latent cancers, and other diseases that might be expected if a severe accident were to occur. These effects are directly related to the cumulative radiation dose received by the general population. MACCS2 estimates both early fatalities and latent cancer fatalities. Early fatalities are related to high doses or dose rates and expected to occur within a year of exposure (Jow et al. 1990).

Latent fatalities are related to exposure of a large number of people to low doses and dose rates and expected to occur after a latent period of several (2 to 15) years. Population health-risk estimates are based on the population distribution within a 50-mi radius of the site. Economic costs of a severe accident include the costs associated with short-term relocation of people; decontamination of property and equipment; interdiction of food supplies, land, and equipment use; and condemnation of property. The affected land area is a measure of the areal extent of the residual contamination following a severe accident. Farm land decontamination is an estimate of the area that has an average whole body dose rate for the 4-year period following the release that would be more than 0.5 rem/yr if not reduced by decontamination and that would have a dose rate following decontamination of less than 0.5 rem/yr. Decontaminated land is not necessarily suitable for farming.

Risk is the product of the frequency and the consequences of an accident. For example, the probability of a severe accident resulting from internal events at power and without loss of containment for an ESBWR design at the Fermi site is estimated to be 1.5×10^{-8} per reactor-year (Ryr) (see Table 5-32). The cumulative population dose associated with a severe accident without loss of containment at the Fermi site is calculated to be about 146,700 person-rem (Detroit Edison 2011a). The population dose risk for this class of accidents is the product of 1.5×10^{-8} per Ryr and 146,700 person-rem, or 2.2×10^{-3} person-rem/Ryr (see Table 5-32).

The following sections discuss the estimated risks associated with each pathway. The risks presented in the tables that follow are risks per year of reactor operation.

5.11.2.1 Air Pathway

The MACCS2 code directly estimates consequences associated with releases to the air pathway. Detroit Edison used the MACCS2 code to estimate consequences to a projected population in 2060 on the basis of meteorological data for calendar years 2002 through 2007. The results of the MACCS2 runs are presented in Table 5-32 for an ESBWR at the Fermi site (Detroit Edison 2011a). The values presented in this table are based on using the 2002 meteorological data that resulted in the highest consequences. The core damage frequencies (CDFs) given in these tables are for internally initiated accident sequences while the plant is at power. Internally initiated accident sequences include sequences that are initiated by human error, equipment failures, loss of offsite power, etc. The CDFs used by Detroit Edison are those from Revision 4 of the ESBWR PRA submitted as part of the application for certification of the ESBWR design (GEH 2009). GEH has updated these frequencies in the ESBWR PRA Revision 6 (GEH 2010c). The core damage frequencies in ESBWR PRA Revision 6 are similar to those in Revision 4.

Table 5-32. Mean Environmental Risks from ESBWR Internal Events At-Power Severe Accidents at the Fermi Site

			Environmental Risk					
	Release Category Description (Accident Class)	Core Damage (frequency/ Ryr)[(a)]	Population Dose (person-rem/Ryr)[(b)]	Fatalities per Ryr: Early[(c)]	Fatalities per Ryr: Latent[(d)]	Cost[(e)] ($/Ryr)	Land Requiring Decontamination[(f)] (ac/Ryr)	Population Dose from Water Ingestion (person-rem/Ryr)[(b)]
TSL	Containment leakage at technical specification limit	1.5×10^{-8}	2.2×10^{-3}	0.0	1.3×10^{-6}	0.50	4.2×10^{-6}	4.8×10^{-3}
CCIW	Containment fails due to core concrete interaction; lower drywell debris bed covered	2.9×10^{-12}	2.5×10^{-5}	1.3×10^{-13}	1.5×10^{-8}	0.071	3.2×10^{-7}	3.9×10^{-7}
EVE	Ex-vessel steam explosion fails containment	1.1×10^{-9}	2.5×10^{-2}	3.4×10^{-9}	1.5×10^{-5}	92.0	2.2×10^{-4}	1.2×10^{-3}
FR	Release through controlled (filtered) venting from suppression chamber	9.2×10^{-11}	4.2×10^{-4}	1.5×10^{-14}	2.5×10^{-7}	0.47	3.3×10^{-6}	2.1×10^{-6}
CCID	Containment fails due to core concrete interaction; lower drywell debris bed uncovered	1.5×10^{-12}	3.2×10^{-5}	3.7×10^{-12}	2.0×10^{-8}	0.12	3.2×10^{-7}	3.9×10^{-7}
OPW2	Containment fails due to late (>24 hr) loss of containment heat removal	8.5×10^{-12}	1.2×10^{-5}	0.0	7.0×10^{-9}	0.0021	1.8×10^{-8}	3.6×10^{-8}
BOC	Break outside of containment	7.9×10^{-11}	2.6×10^{-3}	2.3×10^{-9}	1.8×10^{-6}	8.7	1.5×10^{-5}	1.5×10^{-4}
BYP	Containment bypassed because of containment isolation system failure with large (>12 in. hole) opening; lower drywell debris bed covered	5.7×10^{-11}	1.7×10^{-3}	5.4×10^{-10}	1.4×10^{-6}	3.5	9.9×10^{-6}	1.9×10^{-5}
OPVB	Containment fails due to failure of vapor suppression system (vacuum breaker) function	2.1×10^{-12}	1.3×10^{-5}	2.6×10^{-14}	7.6×10^{-9}	0.030	1.5×10^{-7}	1.2×10^{-7}
OPW1	Containment fails due to early (<24 hr) loss of containment heat removal	2.0×10^{-12}	1.2×10^{-5}	7.6×10^{-17}	7.3×10^{-9}	0.030	1.5×10^{-7}	1.3×10^{-7}
Total		**1.7×10^{-8}**	**3.2×10^{-2}**	**6.3×10^{-9}**	**2.0×10^{-5}**	**1.1×10^{2}**	**2.6×10^{-4}**	**1.3×10^{-3}**

Source: Detroit Edison 2011a

(a) Detroit Edison used core damage frequencies from ESBWR PRA Revision 4 (GEH 2009). GEH has updated these frequencies in the ESBWR PRA Revision 6 (GEH 2010c). The core damage frequencies in ESBWR Revision 6 are similar to those of Revision 4 values.

(b) To convert rem to Sv, divide rem by 100.

(c) Early fatalities are fatalities related to high doses or dose rates that generally can be expected to occur within a year of the exposure (Jow et al. 1990).

(d) Latent fatalities are fatalities related to low doses or dose rates that could occur after a latent period of several (2 to 15) years.

(e) Cost risk includes costs associated with short-term relocation of people, decontamination, interdiction, and condemnation. It does not include costs associated with health effects (Jow et al. 1990).

(f) Land risk is the area where the average whole body dose rate for the 4-year period following the accident exceeds 0.5 rem/yr but can be reduced to less than 0.5 rem/yr by decontamination. To convert acres to hectares, divide by 2.47.

Core damage frequencies for other at-power events (external events) and lower power or shutdown are discussed in the ESBWR PRA (GEH 2010c) and summarized in Section 19.2.3.2 of the ESBWR DCD (GEH 2010d). Detroit Edison incorporates by reference these analyses in the Fermi 3 COL application. Section 19.2.3.2.4 of the DCD discusses a seismic margins analysis in which PRA-based methods are used to identify potential vulnerabilities in the design so corrective measures can be taken to reduce risk. Similarly, Sections 19.2.3.2.1 through 19.2.3.2.3 address risks associated with external fires, external flooding, and high winds. Section 19.2.4 of the DCD addresses risks during plant shutdown. The total environmental risks from shutdown and power operations, including internal events, fires, high winds, and floods, are presented in Table 5-33.

Table 5-33 presents the probability-weighted consequences (i.e., the risks of severe accidents) for an ESBWR located on the Fermi site. This table shows the risks are small for all risk categories considered. The presented risks are for a projected population in calendar year 2060 in the surrounding 50-mi of the Fermi site. For perspective, Tables 5-34 and 5-35 compare the health risks from severe accidents for an ESBWR at the Fermi site with the risks for current-generation reactors at various sites.

In Table 5-34, the health risks estimated for an ESBWR at the Fermi site are compared with health risk estimates for the five reactors considered in NUREG-1150 (NRC 1990). Although risks associated with both internally and externally initiated events were considered for the Peach Bottom and Surry reactors in NUREG-1150, only risks associated with internally initiated events are presented in Table 5-34. The health risks shown for an ESBWR at the Fermi site are significantly lower than the risks associated with current-generation reactors presented in NUREG-1150.

The last two columns of Table 5-34 provide average individual fatality risk estimates. To put these estimated fatality risks into context for the environmental analysis, the NRC staff compared these estimates to the safety goals. The Commission has set safety goals for average individual early fatality and latent cancer fatality risks from reactor accidents in the Safety Goal Policy Statement (51 FR 30028). These goals are presented here solely to provide a point of reference for the environmental analysis and do not serve the purpose of a safety analysis. This statement expressed the Commission's policy regarding the acceptance level of radiological risk from nuclear power plant operation as follows:

- Individual members of the public should be provided a level of protection from the consequences of nuclear power plant operation such that individuals bear no significant additional risk to life and health.
- Societal risks to life and health from nuclear power plant operation should be comparable to or less than the risks of generating electricity by viable competing technologies and should not be a significant addition to other societal risks.

Table 5-33. Total Environmental Risks from ESBWR Severe Accidents at the Fermi Site

Event Types	Core Damage Frequency (Ryr^{-1})[a]	Environmental Risk: Population Dose (person-rem/Ryr)[b]	Fatalities per Ryr: Early[c]	Fatalities per Ryr: Latent[d]	Cost[e] ($/Ryr)	Land Requiring Decontamination[f] (ac/Ryr)	Population Dose from Water Ingestion (person-rem/Ryr)[b]
At Power Internal Events (see Table 5-32)	1.7×10^{-8}	0.032	6.3×10^{-9}	2.0×10^{-5}	110	2.6×10^{-4}	1.3×10^{-3}
At Power Fire	1.2×10^{-8}	0.040	1.2×10^{-8}	3.2×10^{-5}	83	5.2×10^{-4}	2.4×10^{-4}
At Power High Wind	8.6×10^{-9}	0.032	1.0×10^{-8}	2.6×10^{-5}	65	3.8×10^{-4}	1.9×10^{-4}
At Power Internal Flood	6.9×10^{-9}	0.092	2.8×10^{-8}	7.5×10^{-5}	180	1.0×10^{-3}	5.5×10^{-4}
Shutdown Internal Events	1.7×10^{-8}	0.51	1.6×10^{-7}	4.2×10^{-4}	1100	5.7×10^{-3}	3.0×10^{-3}
Shutdown Fire	9.6×10^{-9}	0.29	9.1×10^{-8}	2.4×10^{-4}	590	3.2×10^{-3}	1.7×10^{-3}
Shutdown High Wind	4.0×10^{-8}	1.2	3.8×10^{-7}	9.8×10^{-4}	2400	1.3×10^{-2}	6.9×10^{-3}
Shutdown Flood	5.2×10^{-9}	0.16	5.0×10^{-8}	1.3×10^{-4}	320	1.7×10^{-3}	9.1×10^{-4}
Total	**1.2×10^{-7}**	**2.3**	**7.4×10^{-7}**	**1.9×10^{-3}**	**4900**	**2.7×10^{-2}**	**1.4×10^{-2}**

(a) Core damage frequencies from ESBWR PRA Revision 6, Tables 10.3-3a, 10.3-3b, and 10.3-3c (GEH 2010c).
(b) To convert rem to Sv, divide rem by 100.
(c) Early fatalities are fatalities related to high doses or dose rates that generally can be expected to occur within a year of the exposure (Jow et al. 1990).
(d) Latent fatalities are fatalities related to low doses or dose rates that could occur after a latent period of several (2 to 15) years.
(e) Cost risk includes costs associated with short-term relocation of people, decontamination, interdiction, and condemnation. It does not include costs associated with health effects (Jow et al. 1990).
(f) Land risk is the area where the average whole body dose rate for the 4-year period following the accident exceeds 0.5 rem/yr but can be reduced to less than 0.5 rem/yr by decontamination. To convert acres to hectares, divide by 2.47.

Table 5-34. Comparison of Environmental Risks for an ESBWR at the Fermi 3 Site with Risks for Current-Generation Reactors at Five Sites Evaluated in NUREG-1150[(a)]

	Core Damage (frequency/ Ryr)	50-mi Population Dose Risk (person-rem/Ryr)[(b)]	Fatalities per Ryr		Average Individual Fatality Risk per Ryr	
			Early	Latent	Early	Latent Cancer
Grand Gulf[(c)]	4.0×10^{-6}	$5 \times 10^{+1}$	8×10^{-9}	9×10^{-4}	3×10^{-11}	3×10^{-10}
Peach Bottom[(c)]	4.5×10^{-6}	$7 \times 10^{+2}$	2×10^{-8}	5×10^{-3}	5×10^{-11}	4×10^{-10}
Sequoyah[(c)]	5.7×10^{-5}	$1 \times 10^{+3}$	3×10^{-5}	1×10^{-2}	1×10^{-8}	1×10^{-8}
Surry[(c)]	4.0×10^{-5}	$5 \times 10^{+2}$	2×10^{-6}	5×10^{-3}	2×10^{-8}	2×10^{-9}
Zion[(c)]	3.4×10^{-4}	$5 \times 10^{+3}$	4×10^{-5}	2×10^{-2}	9×10^{-9}	1×10^{-8}
ESBWR[(d)] at Fermi 3 site	1.2×10^{-7}	$2.3 \times 10^{+0}$	7.4×10^{-7}	1.9×10^{-3}	2.8×10^{-11}	3.9×10^{-11}

(a) Source: NRC 1990
(b) To convert rem to Sv, divide by 100.
(c) Risks were calculated using the MACCS code presented in NUREG-1150 (NRC 1990).
(d) Total environmental risks for an ESBWR at the Fermi 3 site from Table 5-33.

Table 5-35. Comparison of Environmental Risks from Severe Accidents for an ESBWR at the Fermi Site with Risks Initiated by Internal Events for Current Plants Undergoing Operating License Renewal Review

Risk	Core Damage (frequency per Ryr)	50-mi Population Dose Risk (person-rem per Ryr)[(a)]
Current reactor maximum[(b)]	2.4×10^{-4}	69
Current reactor mean[(b)]	2.7×10^{-5}	16
Current reactor median[(b)]	1.6×10^{-5}	13
Current reactor minimum[(b)]	1.9×10^{-6}	0.34
ESBWR[(c)] at Fermi	1.2×10^{-7}	2.3

(a) To convert person-rem to person-Sv, divide by 100.
(b) Based on MACCS and MACCS2 calculations for 76 current plants at 44 sites.
(c) Total environmental risks for an ESBWR at the Fermi 3 site from Table 5-33.

The following quantitative health objectives are used to determine whether the safety goals are achieved:

- The risk to an average individual in the vicinity of a nuclear power plant of prompt fatalities that might result from reactor accidents should not exceed one-tenth of 1 percent (0.1 percent) of the sum of prompt fatality risks resulting from other accidents to which members of the U.S. population are generally exposed.
- The risk to the population in the area near a nuclear power plant of cancer fatalities that might result from nuclear power plant operation should not exceed one-tenth of 1 percent (0.1 percent) of the sum of cancer fatality risks resulting from all other causes.

These quantitative health objectives are translated into two numerical objectives as follows:

- The individual risk of a prompt fatality from all "other accidents to which members of the U.S. population are generally exposed," is about 4×10^{-4} per year, including a risk of 1.3×10^{-4} per year associated with transportation accidents (NSC 2010). One-tenth of 1 percent of these figures implies that the individual risk of prompt fatality from a reactor accident should be less than 4×10^{-7} per Ryr.
- "The sum of cancer fatality risks from all other causes" for an individual is taken to be the cancer fatality rate in the United States, which is about 1 in 500 or 2×10^{-3} per year (ACS 2008). One-tenth of 1 percent of this implies that the risk of cancer to the population in the area near a nuclear power plant because of its operation should be limited to 2×10^{-6} per Ryr.

MACCS2 calculates average individual early fatality and latent cancer fatality risks. The average individual early fatality risk is calculated by using the population distribution within 1 mi of the plant boundary. The average individual latent cancer fatality risk is calculated by using the population distribution within 10 mi of the plant. For the plants considered in NUREG-1150, these risks were well below the Commission's safety goals. Risks calculated for the ESBWR design at the Fermi site are lower than the risks associated with the current-generation reactors considered in NUREG-1150 and are well below the Commission's safety goals.

The NRC staff compared the CDF and population dose risk estimate for an ESBWR at the Fermi site with statistics summarizing the results of contemporary severe accident analyses performed for 76 reactors at 44 sites. The results of these analyses are included in the final site-specific Supplements 1 through 37 to the GEIS, NUREG-1437 (NRC 1996) and in the ERs included with license renewal applications for those plants for which supplements have not been published. All of the analyses were completed after publication of NUREG-1150 (NRC 1990), and the analyses for 72 of the reactors used MACCS2, which was released in 1997. Table 5-35 shows that the CDFs estimated for the ESBWR are significantly lower than those of current-generation reactors. Similarly, the population doses estimated for an ESBWR at the Fermi site are well below the mean and median values for current-generation reactors undergoing license renewal.

Finally, the total population dose risk (2.3 person-rem per Ryr, see Table 5-33) from an ESBWR severe accident at the Fermi site may be compared with its dose risk from normal operations at the site (see Section 5.9.3.2). The population dose risk from normal operation (doses from liquid and gaseous effluents) of an ESBWR at Fermi is about 22 person-rem/Ryr (see Subsection 5.9.3.2 of this EIS). Thus, the population dose risk associated with severe accidents is about one order of magnitude lower than the risk from the liquid and gaseous effluents during normal operations. Comparatively, the population dose risk for a severe accident is small.

5.11.2.2 Surface Water Pathways

Surface-water pathways are an extension of the air pathway. These pathways cover the effects of radioactive material deposited on open bodies of water and include ingestion of water, and aquatic foods as well as external radiation from submersion in water and activities occurring near the water. Of these surface-water pathways, the MACCS2 code evaluates only the ingestion of contaminated water. The risks associated with this surface-water pathway calculated for the Fermi site are included in the last column of Table 5-33. The total water-ingestion dose risk of about 1.4×10^{-2} person-rem per Ryr is small compared with the total dose risk of 2.3 person-rem per Ryr.

Although surface water pathways beyond water ingestion are not considered in the MACCS2 code, they have been examined in NUREG-1437. Detroit Edison relied on generic analyses in NUREG-1437 (NRC 1996) for surface water pathways related to swimming and shoreline activities, and to aquatic food consumption. NUREG-1437 reiterates the conclusions set forth in the final EIS for Fermi 2 operations, NUREG-0769 (NRC 1981), which indicate that doses from shoreline activities and swimming are much smaller than either water ingestion doses or aquatic food ingestion doses.

Surface-water bodies within the 50-mi region of the Fermi site that are accessible to the public include Lake Erie, River Raisin, Huron River, Maumee River, Lake St. Clair, Detroit River, and other smaller water bodies. In NUREG–1437, the NRC evaluated doses from the aquatic food pathway (fishing) for the current fleet of nuclear reactors, including Fermi 2 (NRC 1996). The cumulative population dose from the aquatic food pathway for Fermi 2 severe accidents was estimated to be approximately 1400 person-rem per Ryr.

If a severe accident occurred at a reactor located at the Fermi site, it is likely that Federal, State, and local officials would take various measures, including limiting access to contaminated areas and interdiction of drinking water and fishing to reduce exposures. Actual dose-risk values would be expected to be significantly reduced due to these actions (NRC 1996). Considering the likelihood of interdiction, NRC staff concluded that the population dose risk from the surface water pathways at the Fermi site would likely be small compared to air pathway dose risk.

5.11.2.3 Groundwater Pathway

The groundwater pathway involves a reactor core melt, reactor vessel failure, and penetration of the floor (basemat) below the reactor vessel. Ultimately, core debris reaches the groundwater where soluble radionuclides are transported with the groundwater. MACCS2 does not evaluate the environmental risks associated with severe accident releases of radioactive material to groundwater. In the NUREG-1437, NRC staff assumed that the probability of occurrence of a severe accident with a basemat penetration was 1×10^{-4} per Ryr and concluded that the groundwater contribution to risk is generally a small fraction of the risk attributable to the atmospheric pathway. The Detroit Edison ER (Detroit Edison 2011a) summarizes the discussion in NUREG–1437 and reaches the same conclusion.

NRC staff has reevaluated its assumption of a 1×10^{-4} per Ryr probability of a basemat melt-through. The staff believes that the 1×10^{-4} probability is too large for new reactor designs. New reactor designs include features to minimize the potential for core debris to reach groundwater in the event of a core melt accident. The ESBWR design includes a basemat internal melt arrest and coolability (BiMAC) device to cool the core debris and prevent basemat melt-through. Furthermore, the probability of core melt with basemat melt-through should be no larger than the total CDF estimate for the reactor.

Table 5-33 gives a total CDF estimate of 1.2×10^{-7} per Ryr for an ESBWR design. NUREG-1150 (NRC 1990) indicates that the conditional probability of a basemat melt-through ranges from 0.05 to 0.25 for current-generation reactors. The ESBWR severe-accident release sequences that might be expected to involve core-concrete interactions have frequencies on the order of 1×10^{-10} per Ryr. GEH has estimated a failure probability of 0.0003 for the BiMAC to function. On this basis, the NRC staff determined that a basemat melt-through probability on the order of 1×10^{-10} per Ryr is reasonable and still conservative.

The groundwater pathway is more tortuous and affords more time for implementing protective actions; it thus results in a lower risk to the public. As a result, the NRC staff concludes that the risks associated with releases to groundwater are sufficiently small that they would not have a significant effect on the overall plant risk.

5.11.2.4 Summary of Severe Accident Impacts

The NRC staff has reviewed the severe accident risk analysis in the ER and conducted a confirmatory analysis of the probability-weighted consequences of severe accidents for the proposed Fermi 3 using the MACCS2 code. The results of both Detroit Edison's analysis and the NRC staff's analysis indicate that the environmental risks associated with severe accidents if an ESBWR were to be located at the Fermi site would be small when compared with the risks associated with operation of the current-generation reactors at other sites. These risks are well within the NRC safety goals. On these bases, the staff concludes that the probability-weighted consequences of severe accidents at the Fermi site would be SMALL for an ESBWR reactor.

5.11.3 Severe Accident Mitigation Alternatives

Detroit Edison has applied for a license to construct and operate an ESBWR at the Fermi site. The ESBWR design incorporates many features intended to reduce severe accident CDFs and the risks associated with severe accidents. The effectiveness of ESBWR design features in reducing risk is evident in Tables 5-34 and 5-35, which compare CDFs and severe accident risks for the ESBWR with CDFs and risks for current-generation reactors. CDFs and risks have generally been reduced by a factor of 100 or more when compared to the currently operating nuclear power units.

The purpose of the evaluation of severe accident mitigation alternatives (SAMAs) is to determine whether there are severe accident mitigation design alternatives (SAMDAs) or procedural modifications or training activities that can be justified to further reduce the risks of severe accidents (NRC 2000b). Consistent with the direction from the Commission to consider the SAMDAs at the time of certification, GEH has considered 177 design alternatives for an ESBWR at a generic site (GEH 2010b).

The ESBWR design already has numerous plant features designed to reduce CDF and risk. As a result, the benefits and risk reduction potential of any additional plant improvements are significantly reduced from those of existing reactors. This is true for both internally and externally initiated events. The NRC staff does not expect that improvements in either modeling or data would change the conclusions.

In Section 7.3 of the ER, Detroit Edison references the SAMDAs that were considered in the ESBWR (GEH 2007).[(a)] Detroit Edison reasserts the reactor vendor's claim that there are no SAMDAs that will be cost-beneficial. In order to reassess this claim, Detroit Edison reevaluated the potential monetary values for averted costs of eliminating total CDF by using the Fermi site-specific dose and consequence risk information. Using procedures set forth in NUREG/BR-0184 (NRC 1997), Detroit Edison determined that the maximum averted cost risk for a single ESBWR reactor at the Fermi site is so low that none of the SAMDAs are cost-beneficial. A more realistic assessment would show that the potential reductions in cost risk are substantially less than the maximum averted cost risk because no single SAMDA can reduce the remaining risk to zero.

SAMDAs are a subset of the SAMA review. The other attributes of the SAMA review – namely, procedural modifications and training activities – have not been addressed by Detroit Edison or the GEH for design certification (GEH 2010b). However, Detroit Edison is committed (COM ER-7.3-002) to addressing these procedural modifications as stated below (Detroit Edison 2011a):

> A SAMA analysis to comply with 40 CFR 1502.16(h) shall be conducted of the administrative and procedural measures applicable to Fermi 3 and considered for implementation prior to fuel load if the associated cost does not exceed the maximum value associated with averting all risk of severe accidents.

Appendix I contains a detailed review of the GEH and Detroit Edison's SAMA analyses, and it presents the NRC staff's conclusions related to Fermi's site-specific analysis. After reviewing the Detroit Edison analysis (Detroit Edison 2011a), the NRC staff concluded that there are no ESBWR SAMDAs that would be cost-beneficial at the Fermi site.

As discussed in Appendix I, because the maximum attainable benefit is so low, a SAMA based on procedures or training for an ESBWR at the Fermi site would have to reduce the CDF or risk to near zero to become cost-beneficial. Based on its evaluation, the NRC staff concludes that it is unlikely that any of the SAMAs based on procedures or training would reduce the CDF or risk that much. Therefore, the NRC staff further concludes it is unlikely that these SAMAs would be cost-effective. In addition, based on statements by Detroit Edison (Detroit Edison 2011a), the NRC staff expects that the applicant will consider risk insights in the development of procedures and training. However, this expectation is not crucial to the NRC staff's conclusions because the staff already concluded procedural and training SAMAs would be unlikely to be cost effective. Therefore, the NRC staff concludes that SAMAs have been appropriately considered.

(a) The conclusion remained unchanged in the ESBWR SAMDA Report Revision 4 (GEH 2010b).

5.11.4 Summary of Postulated Accident Impacts

The NRC staff evaluated the environmental impacts from DBAs and severe accidents for an ESBWR design at the Fermi site. On the basis of the information provided by GEH, Detroit Edison, and NRC's own independent review, the staff concluded that the potential environmental impacts (risks) from a postulated accident from the operation of the proposed Fermi 3 would be SMALL and that no further mitigation is warranted.

5.12 Measures and Controls to Limit Adverse Impacts during Operation

In its evaluation of the environmental impacts of operating the proposed Fermi 3 reactor at the Fermi site, the review team relied on Detroit Edison's compliance with the following measures and controls that would limit adverse environmental impacts:

- Compliance with applicable Federal, State, and local laws, ordinances, and regulations intended to prevent or minimize adverse environmental impacts (e.g., solid waste management, erosion and sediment control, air emissions, noise control, stormwater management, spill response and cleanup, and hazardous material management)
- Compliance with applicable requirements of permits or licenses required for operation of Fermi 3 (e.g., Section 10 of the Rivers and Harbors Appropriation Act of 1899 [RHAA] and CWA Section 404 permits, NPDES permit)
- Compliance with existing Fermi 2 processes and/or procedures applicable to Fermi 3 operational environmental compliance activities for the Fermi site (e.g., solid waste management, hazardous waste management, and spill prevention and response)
- Incorporation of environmental requirements into construction contracts
- Implementation of BMPs.

Table 5-36 summarizes the measures and controls for limiting adverse impacts during operation of Fermi 3 at the Fermi site, based on the table supplied by Detroit Edison (2011a), as adjusted by the review team when considered to be appropriate. Some measures apply to more than one impact category. Fuel cycle impacts, including the radioactive waste system impacts, transportation of radioactive materials, and decommissioning, are discussed in Chapter 6 of this EIS.

5.13 Summary of Operational Impacts

The staff's evaluation of the environmental impacts of operations is summarized in Table 5-37. Impact level categories are denoted in the table as SMALL, MODERATE, or LARGE as a

Table 5-36. Summary of Measures and Controls Proposed by Detroit Edison to Limit Adverse Impacts When Operating Fermi 3

Affected Environment/Resource Area	Specific Measures and Control
Land Use Impacts	
The site and vicinity	• Adhere to applicable zoning regulations of Frenchtown Charter Township as well as Monroe County land use plans. • Minimize potential impacts through use of BMPs and compliance with SWPPP requirements. • Detroit Edison designed the onsite facilities to minimize the need for new roads; however, some new roads must unavoidably be built. • Incorporate drift eliminators into the design of the cooling towers to minimize the potential for salt deposition, especially on nearby agricultural lands. Salt drift mitigation beyond the proposed drift eliminators is not required. • Monitor natural draft and mechanical draft cooling towers and the heat dissipation system during operation under rules and regulations governing these systems.
Transmission line corridors and offsite areas	• The 345-kV transmission system and associated corridors would be exclusively owned and operated by ITC*Transmission*. Detroit Edison has no control over building or operation of the transmission system. The operational impacts are based on publicly available information and reasonable expectations on the configurations and practices that ITC*Transmission* is likely to use based on standard industry practice. Such efforts are assumed to include industry-standard BMPs that would minimize the operational effects on land use.
Water-Related Impacts	
Hydrologic alterations	• Develop and implement the SWPPP to manage stormwater runoff and prevent erosion. Surface water would be routed away from the nuclear plant through subgrade storm drains and off the slopes of the elevated area, as needed.
Water use and quality	• Comply with MDEQ Large Quantity Water Withdrawal Permit requirements. • Use Best Available Technology to reduce evaporative losses from cooling towers. • Develop and implement the SWPPP to manage stormwater runoff and prevent erosion. • Develop and implement a Pollution Incident Prevention Plan (PIPP).

Table 5-36. (contd)

Affected Environment/Resource Area	Specific Measures and Control
	• Comply with requirements of CWA Section 404 permit, Section 402(p) NPDES permit, RHAA Section 10 permit, and MDEQ Act 451 Part 303 and 325 permit. • CWA Section 401 water quality certification and Coastal Zone Management Act certification. • Design cooling water discharge diffuser to minimize the size of the thermal mixing zone, in both lateral and vertical extent. • Design the cooling water discharge diffuser to minimize bottom scour and associated turbidity. Riprap may be required to reduce bottom scour. • Locate and orient the discharge structure to minimize siltation resulting from turbidity at the diffuser ports. Diffuser design would reduce concentrated silt buildup through discharge points spaced approximately 17 ft apart.
Ecological Impacts	
Terrestrial and wetland resources	• Implement Operational Conservation and Monitoring Plan to mitigate operational impacts on the eastern fox snake, including measures to reduce traffic-induced mortality. • Implement measures in the SWPPP, PIPP, and permits for RHAA Section 10, CWA Section 404, and MDEQ Act 451 Parts 303 and 325 to minimize and mitigate impacts on aquatic resources, including jurisdictional wetlands. Wetland mitigation would be developed in consultation with MDEQ and USACE (Appendix K). • Develop and implement the SWPPP to manage stormwater runoff and prevent erosion. • Develop and implement a PIPP. • Use drift eliminators to keep solids deposition (assumed as salt) from cooling towers below NUREG-1555 significance level. • Develop NDCT lighting plans in coordination with the FAA and FWS to minimize avian impacts. • Although not under Detroit Edison's control, ITC*Transmission* would be expected to conform to industry-standard BMPs for transmission ROW maintenance to reduce impacts on terrestrial and wetland systems.
Aquatic resources	• Implement measures in the SWPPP, PIPP, and permits for RHAA Section 10, CWA Section 404, and MDEQ Act 451 Parts 303 and 325. • Use a closed cycle cooling system to reduce impingement and entrainment of aquatic organisms. • Maintain a low intake velocity (≤0.5 fps).

Table 5-36. (contd)

Affected Environment/Resource Area	Specific Measures and Control
	• Design intake screens with appropriate mesh size and include a trash rack. Regular washing of the intake screens will minimize impingement mortality. • Use a backwash system that would remove impinged organisms from intake screens and return them to the lake alive using a fish return system to Lake Erie outside the intake bay area. • If a shutdown of the proposed facility is planned during winter months, reduce the discharge of cooling water gradually in order to reduce the potential for cold shock to aquatic organisms. • Design cooling water discharge diffuser to minimize the size of the thermal mixing zone in both lateral and vertical extent. • Compliance with NPDES permit effluent limits and use of one Lake Erie outfall for Fermi 3 would minimize chemical impacts. • Avoid the use of phosphorus-containing corrosion and scale inhibitors in order to reduce nutrient loading that could contribute to algal blooms. • Minimize scouring through the use of riprap around the submerged discharge port, if necessary, and use an upward orientation of discharge ports. • Although not under Detroit Edison's control, ITC*Transmission* would be expected to conform to industry-standard BMPs that are protective of aquatic systems for transmission ROW maintenance. • Design transmission lines to avoid wetlands or other water bodies to the maximum extent possible. Any unavoidable impacts would be subject to regulatory permit conditions.
Socioeconomic Impacts	
	• Sound attenuation measures as part of the standard mechanical draft cooling tower should be sufficient to limit the noise impact. Infrequent operation of the mechanical draft cooling towers would further reduce noise impacts. • Although most operational noise is expected to be similar to ambient noise levels, employees would be trained and appropriately protected to reduce their risk of noise exposure. Comply with all relevant OSHA regulations during operations of Fermi 3
Environmental Justice	• No mitigating measures or controls required.

Table 5-36. (contd)

Affected Environment/Resource Area	Specific Measures and Control
Historic Properties and Cultural Resources	• Operations are unlikely to affect archaeological sites. Appropriate controls would be used during post-construction excavation activities to ensure compliance with the NHPA. • Formal inadvertent discovery procedures would be in place to minimize impacts on potential onsite historic resources. • The closest offsite above-ground historic resource in the indirect area of potential effect is located approximately 1 mi from the proposed location of Fermi 3, and all others are located approximately 1.5 to 4.5 mi distant. Visual impacts are not substantial, and no measures or controls are necessary. • The Fermi site contains an existing power plant with two cooling towers. Operations would not introduce a new element that would contribute to the loss of historic integrity of historic above-ground resources in the site vicinity, and no measures or controls are necessary. • Although not under Detroit Edison's control, ITC*Transmission* would be expected to conform to regulatory requirements pertaining to historic and cultural resources that could be affected by transmission line operations.
Air Quality and Meteorology	• Comply with Federal, State, and local air permits; use cooling-tower drift eliminators; water, reseed, or pave areas used for construction. • Treat cooling water prior to discharge to reduce salt released into the atmosphere.
Nonradiological Health	• Use of biocides to reduce the levels of microbial populations in the cooling tower and condenser. • Comply with OSHA standards for Fermi 3 operational workers. • Control vehicle emissions by regularly scheduled maintenance. • Use standard sound attenuation measures for mechanical draft cooling towers. These should be sufficient to limit the noise impact. Infrequent operation of the mechanical draft cooling towers would further reduce noise impacts. • Monitor the release of nonradiological waste emissions and effluents.
Radiological Impacts of Normal Operations	
Radiation doses to members of the public	• Calculated radiation doses to members of the public within NRC and EPA standards (10 CFR Part 20, Appendix I of 10 CFR Part 50, and 40 CFR Part 190). • Radiological effluent and environmental monitoring programs would be implemented.

Table 5-36. (contd)

Affected Environment/Resource Area	Specific Measures and Control
Occupational radiation doses	• Estimated occupational doses are within NRC standards (10 CFR Part 20) • Program would be implemented to maintain occupational doses ALARA (10 CFR Part 20).
Radiation doses to biota other than humans	• Calculated doses to biota are well within NCRP and IAEA guidelines. • Radiological environmental monitoring program would be implemented.
Nonradioactive Wastes	• All releases from Fermi 3, including discharges to waste and discharges to air, would be in compliance with applicable regulations, permits, and procedures. • All wastes transferred offsite would be managed in licensed facilities in compliance with applicable regulations, permits, and procedures. • All hazardous wastes would be accumulated onsite in accordance with all applicable regulations and transferred offsite to licensed/permitted facilities in compliance with applicable regulations, permits, and procedures. • A recycling and waste minimization program would be implemented.
Impacts of Postulated Accidents	
Design-basis accidents	• Calculated dose consequences of design-basis accidents for the ESBWR at the Fermi site were found to be within regulatory limits.
Severe accidents	• Calculated probability-weighted consequences of severe accidents for the ESBWR at the Fermi site were found to be lower than the probability-weighted consequences for currently operating reactors.

Source: Detroit Edison 2011a

Table 5-37. Summary of Fermi 3 Operational Impacts

Resource Area	Comments	Impact Level
Land Use		
Site and vicinity	Permanent dedication of approximately 155 ac of onsite land for operation of one new onsite unit. Possible new housing and retail space in the vicinity.	SMALL
Offsite transmission line corridors	Permanent dedication of unused 10.8-mi, 393-ac ROW to transmission line use and unused 19 ac to expanded Milan substation. The remainder of offsite transmission line will occupy approximately 676 ac of existing transmission line ROW (total of approximately 1069 ac of transmission line ROW).	SMALL
Water Resources		
Water use		
Surface water	Average consumptive use of approximately 7.6 billion gal/yr from Lake Erie.	SMALL
Groundwater	No groundwater use or dewatering during operations.	SMALL
Water quality		
Surface water	Discharge of thermal, chemical, and radiological wastes from normal operations. Physical changes in Lake Erie resulting from stormwater runoff, blowdown discharge, and maintenance dredging.	SMALL
Groundwater	No unavoidable adverse impacts on groundwater quality are anticipated during operations.	SMALL
Ecological Resources		
Terrestrial and wetlands resources	Potential impact on eastern fox snake (State-listed as threatened) from vehicle-related mortality could be mitigated with implementation of Operational Conservation and Monitoring Plan. Salt drift and fogging from operation of cooling towers would have only a minimal impact on terrestrial species and habitats. Long-term maintenance of transmission line ROWs as early successional habitat.	SMALL to MODERATE (potential for MODERATE limited to eastern fox snake)
Aquatic resources	Cooling system impacts on Lake Erie related to thermal discharges, impingement, and entrainment.	SMALL

Table 5-37 (contd)

Resource Area	Comments	Impact Level
Socioeconomics		
Physical impacts	Small increase in noise levels; cooling tower and associated condensate plume would be visible offsite.	SMALL
Demography	Minor increase in population resulting from in-migrating operations workforce.	SMALL beneficial
Economy and taxes	Economic and tax impacts would be beneficial but SMALL in all areas in the 50-mi region, except for Monroe County, where economic impacts would be SMALL and property tax impacts would be LARGE and beneficial.	SMALL beneficial in the region to LARGE beneficial in Monroe County
Infrastructure and community services	Minor impacts on traffic, recreation, housing, public services, and education associated with population increase offset by increase in tax revenue. Local traffic would increase during operations resulting in increased congestion especially during outages.	SMALL (during normal operations) to MODERATE (outages)
Environmental Justice	No environmental pathways or preconditions exist that could lead to disproportionately high and adverse impacts on minorities or low-income populations.	SMALL
Historic and Cultural Resources	Minor impacts on offsite historic properties associated with visible condensate plume from cooling towers. Impacts from operating the proposed transmission lines would be minor if there are no new significant alterations to the cultural environment.	SMALL
Air Quality and Meteorology	Slight increase in certain criteria pollutants and CO_2 from plant auxiliary combustion equipment (e.g., diesel generators); plumes and drift from cooling towers.	SMALL
Nonradiological Health	Operational activities would not have significant nonradiological health impacts on the public and workers.	SMALL
Radiological Impacts of Normal Operations		
Members of the public	Doses to members of the public would be below NRC and EPA standards, and there would be no observable health impacts (10 CFR Part 20, Appendix I to 10 CFR Part 50, 40 CFR Part 190).	SMALL

Table 5-37 (contd)

Resource Area	Comments	Impact Level
Plant workers	Occupational doses to plant workers would be below NRC standards, and program to maintain doses ALARA would be implemented.	SMALL
Biota other than humans	Dose to biota other than humans would be below NCRP and IAEA guidelines.	SMALL
Nonradioactive Wastes	Solid, liquid, gaseous, and mixed wastes generated during operations would be handled according to county, State, and Federal regulations.	SMALL
Impacts of Postulated Accidents		
Design-basis accidents	Impacts of design-basis accidents would be well below regulatory criteria.	SMALL
Severe accidents	Probability-weighted consequences of severe accidents would be lower than the Commission's safety goals and probability-weighted consequences for currently operating reactors.	SMALL

measure of their expected adverse impacts, if any. The bases for these determinations are provided in detail in Sections 5.1 through 5.11 of this EIS; a brief statement explaining the basis for the impact level for each major resource category is provided in the table. Some impacts, such as the addition of tax revenue from Detroit Edison for the local economies, are likely to be beneficial to the community.

5.14 References

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6.0 Fuel Cycle, Transportation, and Decommissioning

This chapter addresses the environmental impacts from (1) the uranium fuel cycle and solid waste management, (2) the transportation of radioactive material, and (3) the decommissioning of the proposed new nuclear unit Enrico Fermi Unit 3 (Fermi 3) at the Detroit Edison Enrico Fermi Atomic Power Plant (Fermi) site.

In its evaluation of uranium fuel cycle impacts from the new unit at the Fermi site, Detroit Edison used the Economic Simplified Boiling Water Reactor (ESBWR) advanced light-water reactor (LWR) design, assuming a capacity factor of 93 percent (Detroit Edison 2011a) for the ESBWR reactor design.

This chapter presents the U.S. Nuclear Regulatory Commission (NRC) staff's assessment of the environmental impacts from fuel cycle, transportation, and decommissioning activities in relation to the GE-Hitachi ESBWR design that Detroit Edison is proposing for Fermi 3.

6.1 Fuel Cycle Impacts and Solid Waste Management

This section discusses the environmental impacts from the uranium fuel cycle and solid waste management for the ESBWR reactor design. The environmental impacts of this design are evaluated against specific criteria for LWR designs in Title 10 of the Code of Federal Regulations (CFR) 51.51.

The regulations in 10 CFR 51.51(a) state the following:

> "Under §51.50, every environmental report prepared for the construction permit stage or early site permit stage or combined license stage of a light-water-cooled nuclear power reactor, and submitted on or after September 4, 1979, shall take Table S-3, Table of Uranium Fuel Cycle Environmental Data, as the basis for evaluating the contribution of the environmental effects of uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel, transportation of radioactive materials and management of low-level wastes and high-level wastes related to uranium fuel cycle activities to the environmental costs of licensing the nuclear power reactor. Table S-3 shall be included in the environmental report and may be supplemented by a discussion of the environmental significance of the data set forth in the table as weighed in the analysis for the proposed facility."

The ESBWR proposed for Unit 3 at the Fermi site is an LWR that would use uranium dioxide (UO_2) fuel; therefore, Table S-3 (10 CFR 51.51(b)) can be used to assess the environmental impacts of the uranium fuel cycle. Table S-3 values are normalized for a reference

1000-megawatt electrical (MW(e)) LWR at an 80 percent capacity factor. The 10 CFR 51.51(a) Table S-3 values are reproduced in Table 6-1. The power rating for the proposed Fermi 3 ESBWR is 4500 megawatts thermal (MW(t)) (Detroit Edison 2011a). With a capacity factor of 93 percent, Fermi 3 would produce an average of 1428 MW(e) (Detroit Edison 2011a).

Specific categories of environmental considerations are included in Table S-3 (see Table 6-1). These categories relate to land use, water consumption and thermal effluents, radioactive releases, burial of transuranic and high-level waste (HLW) and low-level waste (LLW), and radiation doses from transportation and occupational exposures. In developing Table S-3, the NRC staff considered two fuel cycle options that differed in the treatment of spent fuel removed from a reactor. The "no-recycle" option treats all spent fuel as waste to be stored at a Federal waste repository, whereas the "uranium-only recycle" option involves reprocessing spent fuel to recover unused uranium and return it to the system. Neither cycle involves the recovery of plutonium. The contributions in Table S-3 resulting from reprocessing, waste management, and transportation of wastes are maximized for both of the two fuel cycles (uranium-only and no-recycle); that is, the identified environmental impacts are based on the cycle that results in the greater impact. The uranium fuel cycle is defined as the total of those operations and processes associated with provision, utilization, and ultimate disposition of fuel for nuclear power reactors.

The Nuclear Nonproliferation Act of 1978 (22 USC 3201 *et seq.*) significantly affected the disposition of spent nuclear fuel by deferring indefinitely the commercial reprocessing and recycling of spent fuel produced in the U.S. commercial nuclear power program. While the ban on the reprocessing of spent fuel was lifted during the Reagan administration, economic circumstances changed, reserves of uranium ore increased, and the stagnation of the nuclear power industry in the United States provided little incentive for industry to resume reprocessing. During the 109th Congress, the Energy Policy Act of 2005 (119 Statute 594) was enacted. It authorized the U.S. Department of Energy (DOE) to conduct an advanced fuel recycling technology research and development program to evaluate proliferation-resistant fuel recycling and transmutation technologies that minimize environmental or public health and safety impacts. Consequently, while Federal policy does not prohibit reprocessing, additional governmental and commercial efforts would be needed before commercial reprocessing and recycling of spent fuel produced in the U.S. commercial nuclear power plants would commence.

The no-recycle option is presented schematically in Figure 6-1. Natural uranium is mined in either open-pit or underground mines or by an in situ leach solution mining process. In situ leach mining, currently the primary form of mining in the United States, involves injecting a lixiviant solution into the uranium ore body to dissolve uranium and then pumping the solution to the surface for further processing. The ore or in situ leach solution is transferred to mills where it is processed to produce "yellowcake" uranium oxide (U_3O_8). A conversion facility prepares the U_3O_8 by converting it to uranium hexafluoride (UF_6), which is then processed by an enrichment

Table 6-1. Uranium Fuel Cycle Environmental Data[(a)]

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MW(e) LWR
Natural Resource Use		
Land (acres)		
Temporarily committed[(b)]	100	
Undisturbed area	79	
Disturbed area	22	Equivalent to a 100-MW(e) coal-fired power plant.
Permanently committed	13	
Overburden moved (millions of MT)	2.8	Equivalent to a 95-MW(e) coal-fired power plant.
Water (millions of gallons)		
Discharged to air	160	Equal to 2 percent of model 1000-MW(e) LWR with cooling tower.
Discharged to water bodies	11,090	
Discharged to ground	127	
Total	11,377	Less than 4 percent of model 1000 MW(e) with once-through cooling.
Fossil fuel		
Electrical energy (thousands of MW-hr)	323	Less than 5 percent of model 1000-MW(e) LWR output.
Equivalent coal (thousands of MT)	118	Equivalent to the consumption of a 45-MW(e) coal-fired power plant.
Natural gas (millions of standard cubic feet)	135	Less than 0.4 percent of model 1000 MW(e) energy output.
Effluents – Chemical (MT)		
Gases (including entrainment)[(c)]		
SO_x	4400	
NO_x[(d)]	1190	Equivalent to emissions from a 45-MW(e) coal-fired plant for a year.
Hydrocarbons	14	
CO	29.6	
Particulates	1154	
Other gases:		
F	0.67	Principally from uranium hexafluoride (UF_6) production, enrichment, and reprocessing. The concentration is within the range of State standards – below level that has effects on human health.
HCl	0.014	

Table 6-1. (contd)

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MW(e) LWR
Liquids		
SO_4^-	9.9	From enrichment, fuel fabrication, and reprocessing steps. Components that constitute a potential for adverse environmental effect are present in dilute concentrations and receive additional dilution by receiving bodies of water to levels below permissible standards. The constituents that require dilution and the flow of dilution water are: NH_3 – 600 cfs, NO_3 – 20 cfs, Fluoride – 70 cfs.
NO_3^-	25.8	
Fluoride	12.9	
Ca^{++}	5.4	
Cl^-	8.5	
Na^+	12.1	
NH_3	10	
Fe	0.4	
Tailings solutions (thousands of MT)	240	From mills only – no significant effluents to environment.
Solids	91,000	Principally from mills – no significant effluents to environment.
Effluents – Radiological (curies)		
Gases (including entrainment)		
Rn-222		Presently under reconsideration by the Commission.
Ra-226	0.02	
Th-230	0.02	
Uranium	0.034	
Tritium (thousands)	18.1	
C-14	24	
Kr-85 (thousands)	400	
Ru-106	0.14	Principally from fuel reprocessing plants.
I-129	1.3	
I-131	0.83	
Tc-99		Presently under consideration by the Commission.
Fission products and transuranics	0.203	
Liquids		
Uranium and daughters	2.1	Principally from milling – included tailings liquor and returned to ground – no effluents; therefore, no effect on environment.
Ra-226	0.0034	From UF_6 production.
Th-230	0.0015	
Th-234	0.01	From fuel fabrication plants – concentration 10 percent of 10 CFR Part 20 for total processing 26 annual fuel requirements for model LWR.
Fission and activation products	5.9×10^{-6}	

Table 6-1. (contd)

Environmental Considerations	Total	Maximum Effect per Annual Fuel Requirement or Reference Reactor Year of Model 1000-MW(e) LWR
Solids (buried onsite)		
Other than high-level (shallow)	11,300	9100 Ci comes from low-level reactor wastes and 1500 Ci comes from reactor decontamination and decommissioning – buried at land burial facilities. 600 Ci comes from mills – included in tailings returned to ground. Approximately 60 Ci comes from conversion and spent fuel storage. No significant effluent to the environment.
TRU and HLW (deep)	1.1×10^7	Buried at Federal Repository.
Effluents – thermal (billions of Btus)	4063	Less than 5 percent of model1000-MW(e) LWR.
Transportation (person-rem):		
Exposure of workers and general public	2.5	
Occupational exposure (person-rem)	22.6	From reprocessing and waste management.

(a) In some cases where no entry appears, it is clear from the background documents that the matter was addressed and that, in effect, the table should be read as if a specific zero entry had been made. However, there are other areas that are not addressed at all in the table. Table S-3 does not include health effects from the effluents described in the table, or estimates of releases of radon-222 from the uranium fuel cycle or estimates of technetium-99 released from waste management or reprocessing activities. These issues may be the subject of litigation in the individual licensing proceedings.

Data supporting this table are given in the "Environmental Survey of the Uranium Fuel Cycle," WASH-1248 (AEC 1974); the "Environmental Survey of the Reprocessing and Waste Management Portion of the LWR Fuel Cycle," NUREG-0116 (Supp. 1 to WASH-1248) (NRC 1976); the "Public Comments and Task Force Responses Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle," NUREG-0216 (Supp. 2 to WASH-1248) (NRC 1977b); and in the record of the final rulemaking pertaining to Uranium Fuel Cycle Impacts from Spent Fuel Reprocessing and Radioactive Waste Management, Docket RM-50-3. The contributions from reprocessing, waste management, and transportation of wastes are maximized for either of the two fuel cycles (uranium only and no recycle). The contribution from transportation excludes transportation of cold fuel to a reactor and of irradiated fuel and radioactive wastes from a reactor, which are considered in Table S-4 of Sec. 51.20(g). The contributions from the other steps of the fuel cycle are given in columns A–E of Table S-3A of WASH-1248.

(b) The contributions to temporarily committed land from reprocessing are not prorated over 30 years, because the complete temporary impact accrues regardless of whether the plant services 1 reactor for 1 year or 57 reactors for 30 years.

(c) Estimated effluents based upon combustion of equivalent coal for power generation.

(d) 1.2 percent from natural gas use and process.

facility to increase the percentage of the more fissile isotope uranium-235 and decrease the percentage of the non-fissile isotope uranium-238. At a fuel fabrication facility, the enriched uranium, which is approximately 5 percent uranium-235, is then converted to UO_2. The UO_2 is pelletized, sintered, and inserted into tubes to form fuel assemblies, which are placed in a reactor to produce power. When the content of the uranium-235 reaches a point at which the nuclear reactor has become inefficient with respect to neutron economy, the fuel assemblies are withdrawn from the reactor. After onsite storage for sufficient time to allow for short-lived fission product decay and to reduce the heat generation rate, the fuel assemblies would be transferred to a waste repository for internment. Disposal of spent fuel elements in a repository constitutes the final step in the no-recycle option.

The following assessment of the environmental impacts of the fuel cycle as related to the operation of the proposed project is based on the values given in Table S-3 (Table 6-1) and the NRC staff's analysis of the radiological impact from radon-222 and technetium-99. In NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*

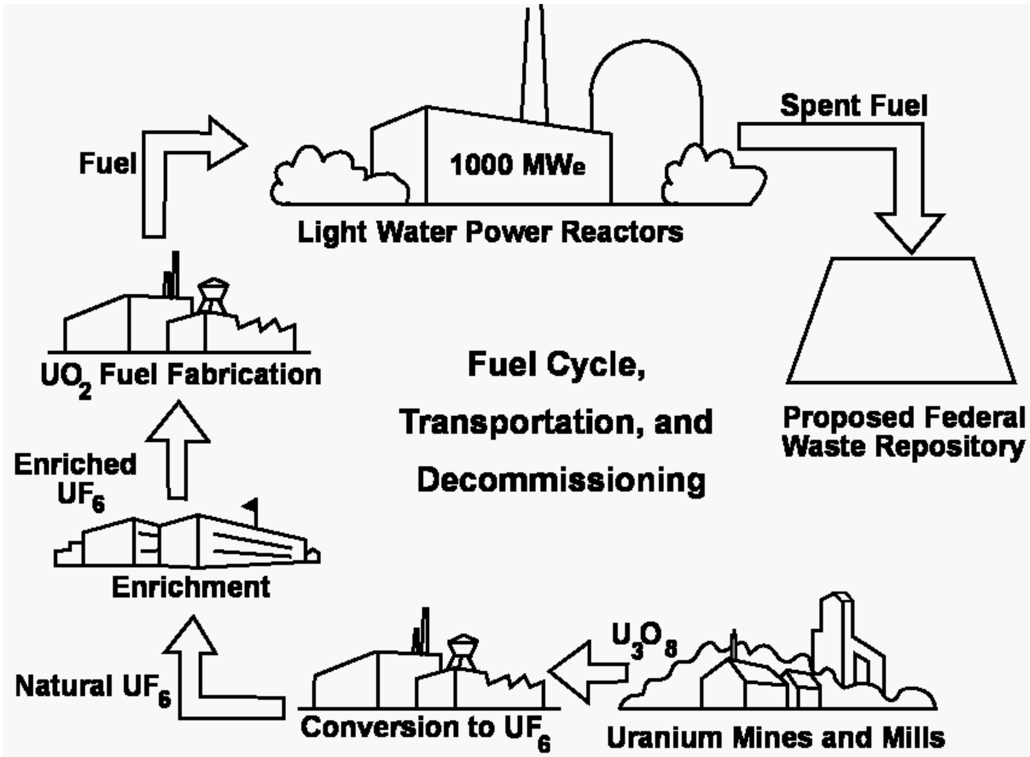

Figure 6-1. The Uranium Fuel Cycle: No-Recycle Option (derived from NRC 1996)

(GEIS) (NRC 1996, 1999),[(a)] the NRC staff provides a detailed analysis of the environmental impacts from the uranium fuel cycle. Although NUREG-1437 is specific to the impacts related to license renewal, the information is relevant to this review, because the advanced LWR design considered here uses the same type of fuel; the NRC staff's analyses in Section 6.2.3 of NUREG-1437 are summarized and set forth here.

The fuel cycle impacts in Table S-3 are based on a reference 1000-MW(e) LWR operating at an annual capacity factor of 80 percent for a net electric output of 800 MW(e). As explained above, the total net electric output from Fermi 3 is 1428 MW(e), which is about 1.79 times (i.e., 1428 MW(e) divided by 800 MW(e) yields 1.79) the impact values in Table S-3 (see Table 6-1). For simplicity and added conservatism in its review and evaluation of the environmental impacts of the fuel cycle, the NRC staff multiplied the impact values in Table S-3 by a factor of 2, rather than 1.79, thus scaling the impacts upward to account for the increased electric generation of the proposed unit. Throughout this chapter, scaling by a factor of 2 will be referred to as the 1000-MW(e) LWR-scaled model.

(a) NUREG-1437 was originally issued in 1996. Addendum 1 to NUREG-1437 was issued in 1999. Hereafter, all references to NUREG-1437 include NUREG-1437 and its Addendum 1.

Recent changes in the fuel cycle may have some bearing on environmental impacts; however, as discussed below, the NRC staff is confident that the contemporary fuel cycle impacts are below those identified in Table S-3. This is especially true in light of the following recent fuel cycle trends in the United States:

- Increasing use of in situ leach uranium mining, which does not produce mine tailings.
- Transitioning of U.S. uranium enrichment technology from gaseous diffusion (GD) to gas centrifuge (GC). The latter centrifuge process uses only a small fraction of the electrical energy per separation unit compared to GD. (U.S. GD plants relied on electricity derived mainly from the burning of coal.)
- Current LWRs use nuclear fuel more efficiently due to higher fuel burnup. Therefore, less uranium fuel per year of reactor operation is required than in the past to generate the same amount of electricity.
- Fewer spent fuel assemblies per reactor-year are discharged; hence, the waste storage/repository impact is lessened.

The values in Table S-3 were calculated from industry averages for the performance of each type of facility or operation within the fuel cycle. Recognizing that this approach meant that there would be a range of reasonable values for each estimate, the NRC staff followed the policy of choosing the assumptions or factors to be applied so that the calculated values would not be underestimated. This approach was intended to ensure that the actual environmental impacts would be smaller than the quantities shown in Table S-3 for all LWR nuclear power plants within the widest range of operating conditions. The NRC staff recognizes that many of the fuel cycle parameters and interactions vary in small ways from the estimates in Table S-3; the staff concludes that these variations would have no impacts on the Table S-3 calculations.

For example, to determine the quantity of fuel required for a year's operation of a nuclear power plant in Table S-3, the NRC staff defined the model reactor as a 1000-MW(e) LWR operating at 80 percent capacity with a 12-month fuel reloading cycle and an average fuel burnup of 33,000 megawatt-days per metric ton of uranium (MWd/MTU). This is a "reactor reference year" or "reference reactor-year" depending on the source (either Table S-3 or NUREG-1437), but it has the same meaning.

If approved, the combined license (COL) for Fermi 3 would allow 40 years of operation. In NUREG-1437, the sum of the initial fuel loading plus all of the reloads for the lifetime of the reactor can be divided by the 60-year lifetime (40-year initial license term and 20-year license renewal term) to obtain an average annual fuel requirement. This approach was followed in NUREG-1437 for both boiling water reactors and pressurized water reactors; the higher annual requirement, 35 metric tons (MT) of uranium made into fuel for a boiling water reactor, was chosen in NUREG-1437 as the basis for the reference reactor-year (NRC 1996). The average annual fuel requirement presented in NUREG-1437 would be increased by only 2 percent if a 40-year lifetime was evaluated. However, a number of fuel management improvements have been adopted by nuclear power plants to achieve higher performance and to reduce fuel and separative-work (enrichment) requirements. Since Table S-3 was promulgated, these improvements have reduced the annual fuel requirement; this means the Table S-3 assumptions remain bounding as applied to the proposed unit.

Another change supporting the bounding nature of the Table S-3 assumptions is the elimination of U.S. restrictions on the importation of foreign uranium. Until recently, the economic conditions in the uranium market favored utilization of foreign uranium at the expense of the domestic uranium industry. From the mid-1980s to 2004, the price of U_3O_8 remained below $20 per pound. These market conditions forced the closing of most U.S. uranium mines and mills, substantially reducing the environmental impacts in the United States from uranium-mining activities. However, the spot price of uranium increased dramatically, from $24 per pound in April 2005 to $135 per pound in July 2007, and has decreased to near $52 per pound as of July 2011 (UxC 2011). As a result, there is a renewed interest in uranium mining and milling in the United States, and the NRC anticipates receiving multiple license applications for uranium mining and milling in the next several years. The majority of these applications are expected to be for in situ leach solution mining that does not produce tailings. Factoring in changes to the fuel cycle suggests that the environmental impacts of mining and tail millings could drop to levels below those given in Table S-3; however, Table S-3 estimates remain bounding for the proposed unit.

In summation, these reasons highlight why Table S-3 is likely to overestimate impacts from Fermi 3 and, therefore, remains a bounding approach for this analysis.

Section 6.2 of NUREG-1437 discusses, in greater detail, the sensitivity to changes in the fuel cycle since issuance of Table S-3 on the environmental impacts.

6.1.1 Land Use

The total annual land requirement for the fuel cycle supporting the 1000-MW(e) LWR-scaled model is about 230 ac. Approximately 26 ac are permanently committed land, and 200 ac are temporarily committed. A “temporary” land commitment is a commitment for the life of the specific fuel cycle plant (e.g., a mill, enrichment plant, or succeeding plants). Following completion of decommissioning, such land can be released for unrestricted use. “Permanent” commitments represent land that may not be released for use after plant shutdown and decommissioning, because decommissioning activities do not result in removal of sufficient radioactive material to meet the limits in 10 CFR Part 20, Subpart E, for release of that area for unrestricted use. Of the 200 ac of temporarily committed land, 160 ac are undisturbed and 44 ac are disturbed. In comparison, a coal-fired power plant using the same MW(e) output as the LWR-scaled model and using strip-mined coal requires the disturbance of about 360 ac/yr for fuel alone. The NRC staff concludes that the impacts on land use to support the 1000-MW(e) LWR-scaled model would be SMALL.

6.1.2 Water Use

The principal water use for the fuel cycle supporting a 1000-MW(e) LWR-scaled model is that required to remove waste heat from the power stations supplying electrical energy for the enrichment step of this cycle. Scaling from Table S-3, of the total annual water use of 2.3×10^{10} gal, about 2.2×10^{10} gal are required for the removal of waste heat, assuming that a new unit uses once-through cooling. Also, scaling from Table S-3, other water uses involve the discharge to air (e.g., evaporation losses in process cooling) of about 3.2×10^{8} gal/yr and water discharged to the ground (e.g., mine drainage) of about 3.0×10^{8} gal/yr.

On a thermal-effluent basis, annual discharges from the nuclear fuel cycle are about 4 percent of the 1000-MW(e) LWR-scaled model using once-through cooling. The consumptive water use is about 2 percent of the 1000-MW(e) LWR-scaled model using cooling towers. The maximum consumptive water use (assuming that all plants supplying electrical energy to the nuclear fuel cycle use cooling towers) would be about 4 percent of the 1000-MW(e) LWR-scaled model using cooling towers. Under this condition, thermal effluents would be negligible. The NRC staff concludes that the impacts on water use for these combinations of thermal loadings and water consumption would be SMALL.

6.1.3 Fossil Fuel Impacts

Electric energy and process heat are required during various phases of the fuel cycle process. The electric energy is usually produced by the combustion of fossil fuel at conventional power plants. Electric energy associated with the fuel cycle represents about 5 percent of the annual electric power production of the reference 1000-MW(e) LWR. Process heat is generated primarily by the combustion of natural gas. This gas consumption, if used to generate electricity, would be less than 0.4 percent of the electrical output from the model plant. The NRC staff concludes that the fossil fuel impacts from the direct and indirect consumption of electric energy for fuel cycle operations would be SMALL relative to the net power production of the proposed project.

The largest use of electricity in the fuel cycle comes from the enrichment process. It appears that GC technology is likely to eventually replace GD technology for uranium enrichment in the United States. The same amount of enrichment from a GC facility uses less electricity and therefore results in lower amounts of air emissions such as carbon dioxide (CO_2) than a GD facility. Therefore, the NRC staff concludes that the values for electricity use and air emissions in Table S-3 continue to be appropriately bounding values.

As indicated in Appendix L, the largest source of carbon dioxide (CO_2) emissions associated with nuclear power is from the fuel cycle, not operation of the plant. The largest source of CO_2 in the fuel cycle is production of electric energy from the combustion of fossil fuel in conventional power plants. This energy is used to power components of the fuel cycle such as the enrichment process. The CO_2 emissions from the fuel cycle are about 5 percent of the CO_2 emissions from an equivalent fossil-fuel-fired plant.

In Appendix L, the NRC staff estimates that the carbon footprint of the fuel cycle to support a reference 1000-MW(e) LWR operating at an 80 percent capacity factor for a 40-year plant life is on the order of 17,000,000 MT of CO_2, including a very small contribution from other greenhouse gases (GHGs). Scaling this footprint to the power level of Fermi 3 with the scaling factor of 2 discussed earlier, the NRC staff estimates the carbon footprint for 40 years of fuel cycle emissions to be 34,000,000 MT of CO_2 (average annual emissions rate of 850,000 MT, averaged over the period of operation) as compared to a total U.S. annual emission rate of 5.5 billion MT of CO_2 (EPA 2011).

On this basis, the NRC staff concludes that the fossil fuel impacts, including GHG emissions, from the direct and indirect consumption of electric energy for fuel cycle operations, would be SMALL.

6.1.4 Chemical Effluents

The quantities of gaseous and particulate effluents from fuel cycle processes are given in Table S-3 (Table 6-1) for the reference 1000-MW(e) LWR and, according to WASH-1248 (AEC 1974), result from the generation of electricity for fuel cycle operations. The principal effluents are sulfur oxides, nitrogen oxides, and particulates. Table S-3 states that the fuel cycle for the reference 1000-MW(e) LWR requires 323,000 MW-hr of electricity. The fuel cycle for the 1000-MW(e) LWR-scaled model would therefore require 6.5×10^5 MW-hr of electricity, or 0.016 percent of the 4.1 billion MW-hr of electricity generated in the United States in 2008 (DOE/EIA 2009). Therefore, the gaseous and particulate emissions would add about 0.016 percent to the national gaseous and particulate chemical effluents for electricity generation.

Liquid chemical effluents produced in fuel cycle processes are related to fuel enrichment and fabrication and may be released to receiving waters. These effluents are usually present in dilute concentrations, such that only small amounts of dilution water are required to reach levels of concentration within established standards. Table S-3 (Table 6-1) specifies the amount of dilution water required for specific constituents. In addition, all liquid discharges into the navigable waters of the United States from plants associated with the fuel cycle operations would be subject to requirements and limitations set by the appropriate Federal, State, Tribal, and local agencies.

Tailings solutions and solids are generated during the milling process, but as Table S-3 indicates, effluents are not released in quantities sufficient to have a significant impact on the environment.

On the basis of the discussions above, the NRC staff concludes that the impacts of these chemical effluents would be SMALL.

6.1.5 Radiological Effluents

Radioactive effluents estimated to be released to the environment from waste management activities and certain other phases of the fuel cycle process are set forth in Table S-3 (Table 6-1). NUREG-1437 (NRC 1996) provides the 100-year environmental dose commitment to the U.S. population from fuel cycle activities for 1 year of operation of the model 1000-MW(e) LWR using the radioactive effluents in Table S-3. Excluding reactor releases and dose commitments because of exposure to radon-222 and technetium-99, the total overall whole body gaseous dose commitment and whole body liquid dose commitment from the fuel cycle were calculated to be approximately 400 person-rem and 200 person-rem, respectively. Scaling these dose commitments by a factor of 2 for the 1000-MW(e) LWR-scaled model results in whole body dose commitment estimates of 800 person-rem for gaseous releases and 400 person-rem for liquid releases. For both pathways, the estimated 100-year environmental dose commitment to the U.S. population would be approximately 1,200 person-rem for the 1000-MW(e) LWR-scaled model.

Currently, the radiological impacts associated with radon-222 and technetium-99 releases are not addressed in Table S-3. Principal radon releases occur during mining and milling operations and as emissions from mill tailings, whereas principal technetium-99 releases occur from GD facilities. Detroit Edison provided an assessment of radon-222 and technetium-99 in its Environmental Review (ER) (Detroit Edison 2011a). This evaluation relied on the information discussed in NUREG-1437 (NRC 1996).

In Section 6.2 of NUREG-1437 (NRC 1996), the NRC staff estimated the radon-222 releases from mining and milling operations and from mill tailings for each year of operation of the reference 1000-MW(e) LWR. The estimated releases of radon-222 for the reference reactor year for the 1000-MW(e) LWR-scaled model are approximately 10,400 curies (Ci). Of this total, about 78 percent would be from mining, 15 percent from milling operations, and 7 percent from inactive tails before stabilization. For radon releases from stabilized tailings, the NRC staff assumed that the LWR-scaled model would result in emissions of 2 Ci per site year (i.e., 2 times the NUREG-1437 [NRC 1996] estimate for the reference reactor year). The major risks from radon-222 are from exposure to the bone and the lungs, although there is a small risk from exposure to the whole body. The organ-specific dose-weighting factors from 10 CFR Part 20 were applied to the bone and lung doses to estimate the 100-year dose commitment from radon-222 to the whole body. The estimated 100-year environmental dose commitment from mining, milling, and tailings before stabilization for each reactor-year (assuming the 1000-MW(e) LWR-scaled model) would be approximately 1,840 person-rem to the whole body. From stabilized tailings piles, the estimated 100-year environmental dose commitment would be approximately 36 person-rem to the whole body. Additional insights regarding Federal policy/resource perspectives concerning institutional controls comparisons with routine radon-222 exposure and risk and long-term releases from stabilized tailing piles are discussed in NUREG-1437 (NRC 1996).

Also as discussed in NUREG-1437, the NRC staff considered the potential doses associated with the releases of technetium-99. The estimated releases of technetium-99 for the reference reactor year for the 1000-MW(e) LWR-scaled model are 14 millicuries (mCi) from chemical processing of recycled UF_6 before it enters the isotope enrichment cascade and 10 mCi into the groundwater from a HLW repository. The major risks from technetium-99 are from exposure to the gastrointestinal tract and kidney, although there is a small risk from exposure to the whole body. Applying the organ-specific dose-weighting factors from 10 CFR Part 20 to the gastrointestinal tract and kidney doses, the total-body 100-year dose commitment from technetium-99 to the whole body was estimated to be 200 person-rem for the 1000-MW(e) LWR-scaled model.

Radiation protection experts assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect, and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose-response relationship is used to describe the relationship between radiation dose and detriments such as cancer induction. A recent report by the National Research Council (2006), the Biological Effects of Ionizing Radiation (BEIR) VII report, uses the linear, no-threshold dose-response model as a basis for estimating the risks from low doses. This approach is accepted by the NRC as a conservative method for estimating health risks from radiation exposure, recognizing that the model may overestimate those risks. Based on this method, the NRC staff estimated the risk to the public from radiation exposure using the nominal probability coefficient for total detriment. This coefficient has the value of 570 fatal cancers, nonfatal cancers, and severe hereditary effects per 1,000,000 person-rem (10,000 person-sievert [Sv]), equal to 0.00057 effect per person-rem. The coefficient is taken from Publication 103 of the International Commission on Radiological Protection (ICRP) (ICRP 2007).

The nominal probability coefficient was multiplied by the sum of the estimated whole body population doses from gaseous effluents, liquid effluents, radon-222, and technetium-99 discussed above (approximately 3300 person-rem/yr) to calculate that the U.S. population would incur a total of approximately 1.9 fatal cancers, nonfatal cancers, and severe hereditary effects annually.

Radon-222 releases from tailings are indistinguishable from background radiation levels at a few miles distance from the tailings pile (at less than 0.6 mi in some cases) (NRC 1996). The public dose limit issued by the U.S. Environmental Protection Agency (EPA) (40 CFR Part 190) is 25 millirem per year (mrem/yr) to the whole body from the entire fuel cycle, but most NRC licensees have airborne effluents resulting in doses of less than 1 mrem/yr (61 FR 65120).

In addition, at the request of the U.S. Congress, the National Cancer Institute (NCI) conducted a study and published *Cancer in Populations Living Near Nuclear Facilities* in 1990 (Jablon et al. 1990). This report included an evaluation of health statistics around all nuclear power plants, as well as several other nuclear fuel cycle facilities, in operation in the United States in 1981, and found "no evidence that an excess occurrence of cancer has resulted from living near nuclear facilities." The contribution to the annual average dose received by an individual from fuel-cycle-related radiation and other sources as reported in a report published by the National Council on Radiation Protection and Measurements (NCRP) (NCRP 2009) is listed in Table 6-2. The contribution from the nuclear fuel cycle to an individual's annual average radiation dose is extremely small (less than 0.1 mrem/yr) compared to the annual average background radiation dose (311 mrem/yr).

Based on the analyses presented above, the NRC staff concludes that the environmental impacts of radioactive effluents from the fuel cycle are SMALL.

Table 6-2. Comparison of Annual Average Dose Received by an Individual from All Sources

Source		Dose (mrem/yr)[a]	Percentage of Total
Ubiquitous background	Radon and thoron	228	37
	Space	33	5
	Terrestrial	21	3
	Internal (body)	29	5
	Total background sources	**311**	**50**
Medical	Computed tomography	147	24
	Medical x-ray	76	12
	Nuclear medicine	77	12
	Total medical sources	**300**	**48**
Consumer	Construction materials, smoking, air travel, mining, agriculture, fossil fuel combustion	13	2
Other	Occupational	0.5[b]	0.1
	Nuclear fuel cycle	0.05[c]	0.01
Total		**624**	**100**

Source: NCRP 2009
(a) NCRP Report 160 expresses doses in mSv/yr (1 mSv/yr equals 100 mrem/yr).
(b) Occupational dose is regulated separately from public dose and is provided here for informational purposes.
(c) Calculated using 153 person-Sv/yr from Table 6.1 of NCRP 160 and a 2006 U.S. population of 300 million.

6.1.6 Radiological Wastes

The quantities of buried radioactive waste material (low-level, high-level, and transuranic wastes) generated by the reference 1000-MW(e) LWR are specified in Table S-3 (Table 6-1). For LLW disposal at land burial facilities, the Commission notes in Table S-3 that there would be no significant radioactive releases to the environment.

Detroit Edison can currently ship Class A LLW to the Energy Solutions site in Clive, Utah and has done so (Detroit Edison 2011b); however, it cannot dispose of Class B and C LLW at the Energy Solutions site in Barnwell, South Carolina. The Waste Control Specialists, LLC, site in Andrews County, Texas, is licensed to accept Class A, B, and C LLW from the Texas Compact (Texas and Vermont). As of May 2011, Waste Control Specialists, LLC, may accept Class A, B, and C LLW from outside the Texas Compact for disposal, subject to established criteria, conditions, and approval processes. Michigan is not currently affiliated with any compact. Other disposal sites may also be available by the time Fermi 3 could become operational.

Detroit Edison has committed to implementing a waste minimization program for Fermi 3 (Detroit Edison 2011a); however, additional waste minimization measures could be implemented by the licensee to specifically reduce or eliminate the generation of Class B and C waste. These measures could include reducing the service run length for resin beds, short-loading media volumes in ion-exchange vessels, and other techniques discussed in the Electric Power Research Institute (EPRI) *Class B/C Waste Reduction Guide* (EPRI 2007a) and *EPRI Operational Strategies to Reduce Class B/C Wastes* (EPRI 2007b). These measures would provide time for offsite disposal capability to be developed or onsite interim storage capacity to be added. Measures to reduce the generation of Class B and C wastes, such as reducing the service run length of resin beds, could increase the volume of LLW, but would not increase the total activity (in curies) of radioactive material in the waste. The volume of waste would still be bounded by or very similar to the estimates in Table S-3, and the environmental impacts would not be significantly different.

Detroit Edison has proposed a Solid Waste Management System for Fermi 3 that provides enough storage space to hold the total combined volume of 3 months of packaged Class A and 10 years of packaged Class B and Class C LLW generated during plant operations. If additional storage capacity for Class B and C LLW is required, Detroit Edison could elect to construct additional temporary storage facilities. Detroit Edison could also enter into an agreement with a third-party contractor to process, store, own, and ultimately dispose of LLW from Fermi 3.

The NRC staff anticipates that licensees would temporarily store Class B and C LLW onsite until offsite storage locations are available. Several operating nuclear power plants have successfully increased onsite storage capacity in the past in accordance with existing NRC regulations. This extended waste storage onsite resulted in no significant increase in dose to the public. In addition, the NRC issued Regulatory Issue Summary 2008-12 (NRC 2008), which included guidance for the extended onsite interim storage of LLW. This guidance addressed the storage of waste in a manner that minimizes potential exposure to workers, which may require adding shielding and storing waste in packaging compatible with the waste composition (e.g., chemical and thermal properties).

In most circumstances, the NRC's regulations (10 CFR 50.59) allow licensees operating nuclear power plants to construct and operate additional onsite LLW storage facilities without seeking approval from the NRC. Licensees are required to evaluate the safety and environmental impacts before constructing the facility and make those evaluations available to NRC inspectors. A number of nuclear power plant licensees have constructed and currently operate such facilities in the United States. Typically, these additional facilities are constructed near the power block inside the security fence, on land that has already been disturbed during initial plant construction. Therefore, the impacts on environmental resources (e.g., land use and aquatic and terrestrial biota) would be very small. All of the NRC (10 CFR Part 20) and EPA (40 CFR Part 190) dose limits would apply both for public and occupational radiation exposure.

In addition, NUREG-1437 assessed the impacts of LLW storage onsite at currently operating nuclear power plants and concluded that the radiation doses to offsite individuals from interim LLW storage are insignificant (NRC 1996). The radiological environmental monitoring programs around nuclear power plants that operate such facilities show that the increase in radiation dose at the site boundary is not significant; the doses continue to be below 25 mrem/yr, the dose limit of 40 CFR Part 190. The types and amounts of LLW generated during operations of the proposed Fermi 3 reactor would be very similar to those generated by currently operating nuclear power plants, and the construction and operation of these interim LLW storage facilities would be very similar to the construction and operation of the currently operating facilities. In addition, in NUREG-1437 (Section 6.4.4.2), the NRC staff concluded that there should be no significant issues or environmental impacts associated with interim storage of LLW generated by nuclear power plants. Interim storage facilities would be used until these wastes could be shipped safely to licensed disposal facilities. Detroit Edison's resolution of LLW disposal issues for the existing Fermi 2 facility could also be implemented for the proposed Fermi 3 facility.

Current national policy, as found in the Nuclear Waste Policy Act (42 USC 10101 *et seq.*), mandates that high-level and transuranic wastes be buried at a deep geologic repository, such as the proposed repository at Yucca Mountain, Nevada. No release to the environment is expected to be associated with deep geologic disposal, because it has been assumed that all of the gaseous and volatile radionuclides contained in the spent fuel are released to the atmosphere before the disposal of the waste. In NUREG-0116 (NRC 1976), which provides background and context for the Table S-3 values established by the Commission, the NRC staff indicates that these high-level and transuranic wastes will be buried and will not be released to the environment.

As part of the Table S-3 rulemaking, the NRC staff evaluated, along with more conservative assumptions, this zero-release assumption associated with waste burial in a repository, and the NRC reached an overall generic determination that fuel cycle impacts would not be significant. In 1983, the Supreme Court affirmed the NRC's position that the zero-release assumption was reasonable in the context of the Table S-3 rulemaking to address generically the impacts of the uranium fuel cycle in individual reactor licensing proceedings (*Baltimore Gas & Electric v. National Resources Defense Council* 1983). In January 2012, the Blue Ribbon Commission on America's Nuclear Future (a Federal advisory committee to the U.S. Department of Energy) provided recommendations on nuclear energy policy issues, including the storage and disposal of spent nuclear fuel (BRC 2012). Although focused primarily on addressing national policy issues, the conclusions of this report are consistent with the assessment in Table S-3 regarding the environmental impact of high-level radioactive waste disposal.

Since 1984, NRC has considered the environmental impacts of spent nuclear fuel storage following the licensed lifetime of reactor operations to be a generic issue that is best addressed through rulemaking. Thus, the Commission's Waste Confidence Decision and Rule, 10 CFR Part 51.23, undergirds many agency licensing decisions involving the management of spent nuclear fuel after the licensed life of a reactor. In 2010, the Commission completed its most recent update of the Waste Confidence Decision and Rule, to reflect information gained from experience in the storage of spent nuclear fuel and high-level waste (75 FR 81032). On June 8, 2012, the U.S. Court of Appeals for the District of Columbia Circuit (the Court) vacated the 2010 Waste Confidence Decision and Rule, finding that it did not comply with the National Environmental Policy Act (NEPA). The Court decision held that (1) the Waste Confidence rulemaking is a major Federal action necessitating either an environmental impact statement (EIS) or a finding of no significant environmental impact, and (2) the Commission's evaluation has several deficiencies in considering the environmental impacts of spent nuclear fuel storage after the licensed life of reactor operation (*New York v. NRC* 2012).

In response to petitions subsequently filed under multiple NRC hearing dockets that requested suspension of final licensing decisions for applications relying on the vacated rule, on August 7, 2012, the Commission stated that "…in recognition of our duties under the law, we will not issue licenses dependent upon the Waste Confidence Decision or the Temporary Storage Rule until the court's remand is appropriately addressed. This determination extends just to final license issuance; all current licensing reviews and proceedings should continue to move forward" (NRC 2012a). On September 6, 2012, the Commission directed the NRC staff to proceed with the development of an EIS to support publication of an updated Waste Confidence Decision and Rule by September 7, 2014 (NRC 2012b). The updated Rule and supporting EIS must address the deficiencies identified in the Court's remand and provide the necessary NEPA assessment of the environmental impacts from long-term storage of spent nuclear fuel following the licensed lifetime of reactor operations.

As directed by the Commission in CLI-12-16 (NRC 2012a), NRC will not issue licenses dependent on the Waste Confidence Decision or Temporary Storage Rule prior to resolution of waste confidence-related issues. This action will ensure that there would be no irretrievable or irreversible resource commitments or potential harm to the environment before waste confidence impacts have been addressed. In the meantime, however, the NRC staff will follow the Commission's instructions to move forward with current licensing reviews and proceedings. To do so, the NRC staff will rely on long-standing Commission conclusions in the Waste Confidence rulemaking regarding storage of spent fuel for the period following the licensed life of the proposed Fermi Unit 3 reactor, while recognizing that further information may be obtained in the development of the updated Rule and supporting EIS.

In Commission Memorandum and Order CLI-12-16 (NRC 2012a), the Commission reflects on the extensive information NRC has used to develop previous Waste Confidence determinations and recognized that current rulemaking efforts should build on this information. Previously, this information indicated there would be no significant environmental impacts from the long-term storage of spent nuclear fuel following cessation of reactor operations. In the context of operating license renewal, Sections 6.2 and 6.4 of NUREG-1437 (NRC 1996) also provide additional descriptions of the generation, storage, and ultimate disposal of LLW, mixed waste, and HLW, including spent fuel from power reactors, concluding that environmental impacts from these activities are either small or acceptable. This information supported the conclusion that the environmental impacts from radioactive waste storage associated with an individual reactor would be small.

The NRC staff recognizes, however, that the Court's remand of the Waste Confidence Decision and Rule introduces additional uncertainties that might impact the results of these previous environmental analyses. The Court did not indicate that it disagreed with the overall conclusion of the Commission that a repository was the most likely disposal alternative. However, the confirmation of expected impacts from storage, plus the discussion of alternative impacts as required by the court, must await the completion of the EIS for Waste Confidence currently under development.

Based on these considerations, the NRC staff has reached a conclusion that the impacts of storage of spent fuel after the operational lifetime of proposed Fermi Unit 3 are small. The staff also concludes, based on Table S-3 and the above conclusions regarding storage of low level waste and spent fuel, that the environmental impacts from radioactive waste storage and disposal associated with Fermi Unit 3 would be SMALL. This conclusion is conditional in the sense that the NRC recognizes that information— with respect to storage of spent fuel— is subject to the results of the ongoing rulemaking to update the Waste Confidence Decision and Rule, which could develop information that might require a supplemental EIS. The NRC staff will continue to evaluate information developed in the Waste Confidence rulemaking, including the results of the EIS being developed to support this rulemaking. That EIS will also be informed by public participation in the NEPA process. If the results of the Waste Confidence

EIS identify information that requires a supplement to the Fermi Unit 3 EIS, the NRC staff will perform any necessary additional NEPA reviews for those issues before the NRC makes a final licensing decision.

6.1.7 Occupational Dose

The annual occupational dose attributable to all phases of the fuel cycle for the 1000-MW(e) LWR-scaled model is about 1200 person-rem. This is based on a 600 person-rem occupational dose estimate attributable to all phases of the fuel cycle for the model 1000-MW(e) LWR (NRC 1996). The NRC staff concludes that the environmental impact from this occupational dose is SMALL because the dose to any individual worker is maintained within the limits of 10 CFR Part 20, which is 5 rem/yr.

6.1.8 Transportation

The transportation dose to workers and the public related to the uranium fuel cycle is about 2.5 person-rem annually for the reference 1000-MW(e) LWR per Table S-3 (Table 6-1). This corresponds to a dose of 5.0 person-rem for the 1000-MW(e) LWR-scaled model. For purposes of comparison, the population within 50 mi of the Fermi 3 site is estimated to be 7,713,709 people (Detroit Edison 2011a). By using 0.311 rem/yr as the average dose to a U.S. resident from natural background radiation (NCRP 2009), the collective dose to that population is estimated to be 2.4×10^6 person-rem/yr. On the basis of this comparison, the NRC staff concludes that environmental impacts of transportation would be SMALL.

6.1.9 Conclusions

The NRC staff evaluated the environmental impacts of the uranium fuel cycle, as given in Table S-3 (Table 6-1), considered the effects of radon-222 and technetium-99, and appropriately scaled the impacts for the 1000-MW(e) LWR-scaled model. The NRC staff also evaluated the environmental impacts of GHG emissions from the uranium fuel cycle and appropriately scaled the impacts for the 1000-MW(e) LWR-scaled model. Based on this evaluation, the NRC staff concludes that the impacts would be SMALL.

6.2 Transportation Impacts

This section addresses both the radiological and nonradiological environmental impacts during normal operating and accident conditions resulting from (1) shipment of unirradiated fuel to the Fermi 3 site and alternative sites, (2) shipment of irradiated (spent) fuel to a monitored retrievable storage facility or a permanent repository, and (3) shipment of low-level radioactive waste and mixed waste to offsite disposal facilities. Alternative sites evaluated in this EIS include the existing Fermi site (proposed site), Petersburg, South Britton, Greenwood Energy Center, and Belle River (see Section 9.3). There is no meaningful differentiation among the proposed and the alternative sites regarding the radiological and nonradiological environmental impacts from normal operations and accident conditions, and thus such impacts are not discussed further in Chapter 9.

The NRC performed a generic analysis of the environmental effects of transportation of fuel and waste to and from LWRs in the *Environmental Survey of the Transportation of Radioactive Materials to and from Nuclear Power Plants*, WASH-1238 (AEC 1972) and in a supplement to WASH-1238, NUREG-75/038 (NRC 1975), and found the impact to be SMALL. These documents provided the basis for Table S-4 in 10 CFR 51.52 that summarizes the environmental impacts of transportation of fuel and waste to and from one LWR of 3000 to 5000 MW(t) (1000 to 1500 MW(e)). Impacts are provided for normal conditions of transport and accidents in transport for a reference 1100-MW(e) LWR. The transportation impacts associated with the Fermi 3 site were normalized for a reference 1100-MW(e) LWR at an 80 percent capacity factor for comparisons to Table S-4.[(a)] Dose to transportation workers during normal transportation operations was estimated to result in a collective dose of 4 person-rem per reference reactor-year. The combined dose to the public along the route and dose to onlookers were estimated to result in a collective dose of 3 person-rem per reference reactor-year.

Environmental risks of radiological effects during accident conditions, as stated in Table S-4, are small. Nonradiological impacts from postulated accidents were estimated as 1 fatal injury in 100 reactor-years and 1 nonfatal injury in 10 reference reactor-years. Subsequent reviews of transportation impacts in NUREG-0170 (NRC 1977a) and NUREG/CR-6672 (Sprung et al. 2000) concluded that impacts were bounded by Table S-4 in 10 CFR 51.52.

In accordance with 10 CFR 51.52(a), a full description and detailed analysis of transportation impacts are not required when an LWR is licensed (i.e., impacts are assumed bounded by Table S-4) if the reactor meets the following criteria:

- The reactor has a core thermal power level not exceeding 3800 MW(t).
- Fuel is in the form of sintered uranium dioxide pellets having a uranium-235 enrichment not exceeding 4 percent by weight; and pellets are encapsulated in zircalloy-clad fuel rods.
- Average level of irradiation of the fuel from the reactor does not exceed 33,000 MWd/MTU, and no irradiated fuel assembly is shipped until at least 90 days after it is discharged from the reactor.
- With the exception of irradiated fuel, all radioactive waste shipped from the reactor is packaged and in solid form.

(a) Note that the basis for Table S-4 is an 1100-MW(e) LWR at an 80 percent capacity factor (AEC 1972; NRC 1975). The basis for Table S-3 in 10 CFR 51.51(b), which was discussed in Section 6.1 of this EIS, is a 1000-MW(e) LWR with an 80 percent capacity factor (NRC 1976). However, because fuel cycle and transportation impacts are evaluated separately, this difference does not affect the results and conclusions in this EIS.

- Unirradiated fuel is shipped to the reactor by truck; irradiated (spent) fuel is shipped from the reactor by truck, rail, or barge; and radioactive waste other than irradiated fuel is shipped from the reactor by truck or rail.

The environmental impacts of the transportation of fuel and radioactive wastes to and from nuclear power facilities were resolved generically in 10 CFR 51.52, provided that the specific conditions in the rule (see above) are met; if not, then a full description and detailed analysis are required for initial licensing. The NRC may consider requests for licensed plants to operate at conditions above those in the facility's licensing basis; for example, higher burnups (above 33,000 MWd/MTU), enrichments (above 4 percent uranium-235), or thermal power levels (above 3800 MW(t)). Departures from the conditions itemized in 10 CFR 51.52(a) must be supported by a full description and detailed analysis of the environmental effects, as specified in 10 CFR 51.52(b). Departures found to be acceptable for licensed facilities cannot serve as the basis for initial licensing for new reactors.

In its application, Detroit Edison requested a COL for an additional reactor at its Fermi site in Monroe County, Michigan. The proposed new reactor would be a GE-Hitachi ESBWR. The ESBWR has a thermal power rating of 4500 MW(t), with a gross electrical rating of 1605 MW(e). This thermal power rating exceeds the 3800-MW(t) limit considered in 10 CFR 51.52. The net electrical output is expected to be approximately 1535 MW(e) as the Fermi 3 power consumption is expected to be 70 MW(e) (Detroit Edison 2011a). Fuel for the plant would be enriched up to about 4.6 weight percent uranium-235, which exceeds the 10 CFR 51.52(a) condition. In addition, the expected irradiation level of about 46,000 MWd/MTU exceeds the 10 CFR 51.52(a) condition. Therefore, a full description and detailed analysis of transportation impacts is required.

In its ER (Detroit Edison 2011a), Detroit Edison provided a full description and detailed analyses of transportation impacts. In these analyses, radiological impacts of transporting fuel and waste to and from the Fermi site and alternative sites were calculated by Detroit Edison using the RADTRAN 5.6 computer code (Weiner et al. 2008). For this EIS, the NRC staff estimated the radiological impacts of transporting fuel and waste to and from the Fermi site and alternative sites using the RADTRAN 5.6 computer code. RADTRAN 5.6 is the most commonly used transportation impact analysis computer code in the nuclear industry, and the NRC staff concludes that the code is an acceptable analysis method.

Based on comments on previous nuclear power plant EISs, an explicit analysis of the nonradiological impacts of transporting workers and construction materials to/from the Fermi site and alternative sites is now included. Nonradiological impacts of transporting construction workers and materials and operations workers are addressed in Sections 4.8.3 and 5.8.6, respectively. Publicly available information about traffic accidents, injury, and fatality rates was used to estimate nonradiological impacts. In addition, the radiological impacts on maximally exposed individuals (MEIs) are evaluated.

6.2.1 Transportation of Unirradiated Fuel

The NRC staff performed an independent analysis of the environmental impacts of transporting unirradiated (i.e., fresh) fuel to the Fermi site and alternative sites. Radiological impacts of normal operating conditions and transportation accidents as well as nonradiological impacts are discussed in this section. Radiological impacts on populations and MEIs are presented. Because the specific fuel fabrication plant for Fermi 3 unirradiated fuel is not known at this time, the staff's analysis assumes a "representative" route between the fuel fabrication facility and the Fermi site or alternative sites. This means that one analysis was done using a "representative" route with one set of route characteristics (distances and population distributions), and that analysis was used to conclude that the impact from radiation dose would be small for the Fermi site and each of the alternative sites. Once the location of the fuel fabrication site is known, there will likely be small differences in the route and dose estimates for the Fermi site and the alternative sites. However, the radiation doses from transporting unirradiated fuel to the Fermi site and alternative sites will still likely be small.

6.2.1.1 Normal Conditions

Normal transportation conditions, sometimes referred to as "incident-free" transportation, are transportation activities in which shipments reach their destination without releasing any radioactive material to the environment. Impacts from these shipments would be from the low levels of radiation that penetrate the unirradiated fuel shipping containers. Radiation exposures at some level would occur to the following individuals: (1) persons residing along the transportation corridors between the fuel fabrication facility and the Fermi site; (2) persons in vehicles traveling on the same route as an unirradiated fuel shipment; (3) persons at vehicle stops for refueling, rest, and vehicle inspections; and (4) transportation crew workers.

Truck Shipments

Table 6-3 provides the NRC staff's estimate of the number of truck shipments of unirradiated fuel for the ESBWR compared to those of the reference 1100-MW(e) reactor specified in WASH-1238 (AEC 1972) operating at 80 percent capacity (880 MW(e)). After normalization, the number of truck shipments of unirradiated fuel to the proposed Fermi site is slightly smaller (about 15 percent) than the number of truck shipments of unirradiated fuel estimated for the reference LWR in WASH-1238.

Shipping Mode and Weight Limits

In 10 CFR 51.52(a)(5), a condition is identified that states all unirradiated fuel is shipped to the reactor by truck. Detroit Edison specifies that unirradiated fuel would be shipped to the proposed reactor site by truck (Detroit Edison 2011a). Section 10 CFR 51.52 includes a condition that the truck shipments not exceed 73,000 lb as governed by Federal or State gross

Table 6-3. Numbers of Truck Shipments of Unirradiated Fuel for the Reference LWR and the ESBWR

Reactor Type	Number of Shipments per Reactor Unit			Unit Electric Generation, MW(e)[c]	Capacity Factor[c]	Normalized, Shipments per 1100 MW(e)[d]
	Initial Core[a]	Annual Reload[a]	Total[a, b]			
Reference LWR (WASH-1238)	18	6	252	1100	0.8	252
Fermi 3 ESBWR	38	8.5	361	1605	0.93	213

(a) Shipments of the initial core and for every 2-year refueling period have been rounded up to the next highest whole number.
(b) Total shipments of unirradiated fuel over a 40-year plant lifetime (i.e., initial core load plus 38 years of average annual reload quantities). Refueling occurs every 24 months. No unirradiated fuel shipments anticipated during the last 2 years of operation.
(c) Unit capacities and capacity factors were taken from WASH-1238 for the reference LWR and the ER (Detroit Edison 2011a) for the ESBWR.
(d) Normalized to net electric output for WASH-1238 reference LWR (i.e., 1100-MW(e) plant at 80 percent or net electrical output of 880 MW(e)).

vehicle weight restrictions. Detroit Edison states in its ER that the unirradiated fuel shipments to the proposed Fermi site would comply with applicable weight restrictions (Detroit Edison 2011a).

Radiological Doses to Transport Workers and the Public

Table S-4 includes conditions related to radiological dose to transport workers and members of the public along transport routes. These doses are a function of many variables, including the radiation dose rate emitted from the unirradiated fuel shipments, the number of exposed individuals and their locations relative to the shipment, the time in transit (including travel and stop times), and number of shipments to which the individuals are exposed. For this EIS, the NRC staff independently calculated the radiological dose impacts to transport workers and the public from the transportation of unirradiated fuel using the RADTRAN 5.6 computer code (Weiner et al. 2008).

One of the key assumptions in WASH-1238 (AEC 1972) for the reference LWR unirradiated fuel shipments is that the radiation dose rate at 3.3 ft from the transport vehicle is about 0.1 mrem/hr, which is 1 percent of the regulatory limit. This assumption was also used in the NRC staff's analysis of the ESBWR unirradiated fuel shipments. This assumption is reasonable because the ESBWR fuel materials would be low-dose-rate uranium radionuclides and would be

packaged similarly to that described in WASH-1238 (i.e., inside a metal container that provides little radiation shielding). The numbers of shipments per year were obtained by dividing the normalized shipments in Table 6-3 by 40 years of reactor operation. Other key input parameters used in the radiation dose analysis for unirradiated fuel are shown in Table 6-4.

Table 6-4. RADTRAN 5.6 Input Parameters for Unirradiated Fuel Shipments

Parameter	RADTRAN 5.6 Input Value	Source
Shipping distance (km)	3600	AEC (1972).[(a)]
Travel fraction – rural	0.90	NRC (1977a).
Travel fraction – suburban	0.05	
Travel fraction – urban	0.05	
Population density – rural (persons/km^2)	10	DOE (2002a).
Population density – suburban (persons/km^2)	349	
Population density – urban (persons/km^2)	2260	
Vehicle speed (km/hr)	88.49	Conservative in transit speed of 55 mph assumed; predominantly interstate highways used.
Traffic count – rural (vehicles/hr)	530	DOE (2002a).
Traffic count – suburban (vehicles/hr)	760	
Traffic count – urban (vehicles/hr)	2400	
Dose rate at 1 m from vehicle (mrem/hr)	0.1	AEC (1972).
Shipment length (m)	7.3	Approximate length of two LWR fuel assemblies placed end to end.
Number of truck crew	2	AEC (1972), NRC (1977a), and DOE (2002a).
Stop time (hr/trip)	4.5	Based on one 30-minute stop per 4 hr of driving time (Johnson and Michelhaugh 2003).
Population density at stops (persons/km^2)	See Table 6-8 for truck stop parameters.	

(a) AEC (1972) provides a range of shipping distances between 25 and 3000 mi for unirradiated fuel shipments. A 2240-mi "representative" shipping distance was assumed in this EIS. While Detroit Edison intends to obtain its fresh fuel from the GE-Hitachi fuel fabrication facility in Wilmington, NC (Detroit Edison 2011a), a distance of approximately 771 mi, the analysis in this EIS bounds the potential shipping distance from other fuel fabrication facilities in the United States.

The RADTRAN 5.6 results for this "generic" unirradiated fuel shipment are as follows:

- Worker dose: 1.92×10^{-3} person-rem/shipment
- General public dose (onlookers/persons at stops and sharing the highway): 3.29×10^{-3} person-rem/shipment
- General public dose (along route/persons living near a highway or truck stop): 3.36×10^{-5} person-rem/shipment.

These values were combined with the number of average annual shipments of unirradiated fuel for the ESBWR to calculate annual doses to the public and workers. Table 6-5 presents the annual radiological impacts calculated by the NRC staff to workers, public onlookers (persons at stops and sharing the road), and members of the public along the route (i.e., residents within 0.5 mi of the highway) for transporting unirradiated fuel to the Fermi site and alternative sites. The cumulative annual dose estimates in Table 6-5 were normalized to 1100 MW(e) (880 MW(e) net electrical output). The NRC staff performed an independent review and determined that all dose estimates are bounded by the Table S-4 conditions of 4 person-rem/yr to transportation workers, 3 person–rem/yr to onlookers, and 3 person-rem/yr to members of the public along the route.

Table 6-5. Radiological Impacts under Normal Conditions of Transporting Unirradiated Fuel to the Fermi Site and Alternative Sites

Plant Type	Normalized Average Annual Shipments	Cumulative Annual Dose; person-rem/yr per 1100 MW(e)[a] (880 MW(e) net)		
		Workers	Public – Onlookers	Public – along Route
Reference LWR (WASH-1238)	6.3	1.2×10^{-2}	2.1×10^{-2}	2.1×10^{-4}
Fermi 3 ESBWR	5.3	1.0×10^{-2}	1.8×10^{-2}	1.8×10^{-4}
10 CFR 51.52, Table S-4 condition	<1 per day	4	3	3

(a) Multiply person-rem/yr times 0.01 to obtain doses in person-Sv/yr.

Radiation protection experts assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose-response relationship is used to describe the relationship between radiation dose and detriments such as cancer induction. A recent report by the National Research Council (2006), the BEIR VII report, uses the linear, no-threshold dose-response model as a basis for estimating the risks from low doses. This approach is accepted by the NRC as a conservative method for estimating health risks from radiation exposure, recognizing that the model may overestimate those risks. Based on this method, the NRC staff estimated the risk to the public from radiation exposure using the nominal probability coefficient for total detriment. This coefficient has the value of 570 fatal cancers, nonfatal cancers, and severe hereditary effects per 1,000,000 person-rem (10,000 person-Sv), equal to 0.00057 effects per person-rem. The coefficient is taken from ICRP Publication 103 (ICRP 2007).

Both the NCRP and ICRP suggest that when the collective effective dose is smaller than the reciprocal of the relevant risk detriment (i.e., less than 1/0.00057, which is less than 1754 person-rem), the risk assessment should note that the most likely number of excess health effects is zero (NCRP 1995; ICRP 2007). The largest annual collective dose estimate for transporting unirradiated fuel to the Fermi site and alternative sites was 1.8×10^{-2} person-rem, which is less than the 1754 person-rem value that the ICRP and NCRP suggest would most likely result in zero excess health effects.

To place these impacts in perspective, the average U.S. resident receives about 311 mrem/yr effective dose equivalent from natural background radiation (i.e., exposures from cosmic radiation, naturally occurring radioactive materials such as radon, and global fallout from testing of nuclear explosive devices) (NCRP 2009). By using this average effective dose, the collective population dose from natural background radiation to the population along this representative route would be about 2.5×10^5 person-rem. Therefore, the radiation doses from transporting unirradiated fuel to the proposed Fermi site and alternative sites are minimal compared to the collective population dose to the same population from exposure to natural sources of radiation.

Maximally Exposed Individuals under Normal Transport Conditions

The NRC staff conducted a scenario-based analysis to develop estimates of incident-free radiation doses to MEIs for fuel and waste shipments to and from the Fermi site. An MEI is a person who may receive the highest radiation dose from a shipment to and/or from the Fermi site. The following discussion also applies to shipments of unirradiated fuel, spent fuel, and radioactive waste to and from any of the alternative sites. The analysis is based on DOE data (2002b) and incorporates data about exposure times, dose rates, and the number of times an individual may be exposed to an offsite shipment. Adjustments were made where necessary to reflect the normalized fuel and waste shipments addressed in this EIS. In all cases, the NRC staff assumed that the dose rate emitted from the shipping containers is 10 mrem/hr at 6.6 ft from the side of the transport vehicle. This assumption is conservative, in that the assumed dose rate is the maximum dose rate allowed by U.S. Department of Transportation (DOT) regulations (49 CFR 173.441). Most unirradiated fuel and radioactive waste shipments would have much lower dose rates than the regulations allow (AEC 1972; DOE 2002a). The analysis is described below.

<u>Truck Crew Member</u>

Truck crew members would receive the highest radiation doses during incident-free transport because of their proximity to the loaded shipping container for an extended period. The NRC staff's analysis assumed that crew member doses are limited to 2 rem/yr, which is the DOE administrative control level presented in DOE-STD-1098-2008, *DOE Standard, Radiological Control*, Chapter 2, Article 211 (DOE 2008). This limit is anticipated to apply to spent nuclear fuel shipments to a disposal facility, because DOE would take title to the spent fuel at the reactor site. There will be more shipments of spent nuclear fuel from the Fermi site and alternative sites than there will be shipments of unirradiated fuel and radioactive waste other than spent fuel from these sites. This is because the capacities of spent fuel shipping casks are limited due to their substantial radiation shielding and accident-resistance requirements. Spent fuel shipments also have significantly higher radiation dose rates than unirradiated fuel and radioactive waste (DOE 2002b). As a result, crew doses from unirradiated fuel and radioactive waste shipments would be lower than the doses from spent nuclear fuel shipments. The DOE administrative limit of 2 rem/yr (DOE 2009) is less than the NRC limit for occupational exposures of 5 rem/yr (10 CFR Part 20).

The DOT does not regulate annual occupational exposures. It does recognize that air crews are exposed to elevated cosmic radiation levels and recommends dose limits to air crew members from cosmic radiation (DOT 2003). Air passengers are less of a concern because they do not fly as frequently as air crew members. The recommended limits are a 5-year effective dose of 2 rem/yr, with no more than 5 rem in a single year (DOT 2003). As a result, a 2-rem/yr MEI dose to truck crews is a reasonable estimate to apply to shipments of fuel and waste from the Fermi site and alternative sites.

Inspectors

Radioactive shipments are inspected by Federal or State vehicle inspectors, for example, at State ports of entry. The Yucca Mountain Final EIS (DOE 2002b) assumed that inspectors would be exposed for 1 hr at a distance of 3.3 ft from the shipping containers. The dose rate at 3.3 ft is conservatively assumed to be at the regulatory limit and equivalent to about 14 mrem/hr; therefore, the dose per shipment is about 14 mrem. This is independent of the location of the reactor site. Based on this conservative value and the assumption that the same person inspects all shipments of fuel and waste to and from the proposed Fermi site and alternative sites, the annual doses to vehicle inspectors were calculated to be about 2.2 rem/yr, based on a combined total of 160 shipments of unirradiated fuel, spent fuel, and radioactive waste per year. This value is greater than the DOE administrative control level (DOE 2009) on individual doses and is less than the 5-rem/yr NRC occupational dose limit.

Resident

The analysis assumed that a resident lives adjacent to a highway where a shipment would pass and would be exposed to all shipments along a particular route. Exposures to residents on a per-shipment basis were obtained from the NRC staff's RADTRAN 5.6 output files. These dose estimates are based on an individual located 100 ft from the shipments that are traveling 15 mph. The potential radiation dose to the maximally exposed resident is about 0.095 mrem/yr for shipments of fuel and waste to and from the proposed Fermi site and alternative sites.

Individual Stuck in Traffic

This scenario addresses potential traffic interruptions that could lead to a person being exposed to a loaded shipment for 1 hr at a distance of 4 ft. The NRC staff's analysis assumed this exposure scenario would occur only one time to any individual, and the dose rate was at the regulatory limit of 10 mrem/hr at 6.6 ft from the shipment. The dose to the MEI was calculated to be 16 mrem in DOE's Yucca Mountain Final EIS (DOE 2002b).

Person at a Truck Service Station

This scenario estimates doses to an employee at a service station where all truck shipments to and from the proposed Fermi site and alternative sites are assumed to stop. The NRC staff's analysis assumed this person would be exposed for 49 minutes at a distance of 52 ft from the loaded shipping container (DOE 2002b). The exposure time and distance were based on the observations discussed by Griego et al. (1996). This results in a dose of about 0.34 mrem/shipment and an annual dose of about 54 mrem/yr for the Fermi site and alternative sites, assuming that a single individual services all unirradiated fuel, spent fuel, and radioactive waste shipments to and from the Fermi site and alternative sites.

6.2.1.2 Radiological Impacts of Transportation Accidents

Accident risks are a combination of accident frequency and consequence. Accident frequencies for transportation of unirradiated fuel to the proposed Fermi site and alternative sites are expected to be lower than those used in the analysis in WASH-1238 (AEC 1972), which forms the basis for Table S-4 of 10 CFR 51.52, because of improvements in highway safety and security and an overall reduction in traffic accident, injury, and fatality rates since WASH-1238 was published. There is no significant difference between the ESBWR and current-generation LWRs in the consequences of transportation accidents severe enough to result in a release of unirradiated fuel particles to the environment, because fuel form, cladding, and packaging are similar to those analyzed in WASH-1238. Consequently, consistent with the conclusions of WASH-1238 (AEC 1972), the impacts of accidents during transport of unirradiated fuel for the ESBWR on the Fermi site and alternative sites are expected to be smaller than those listed in Table S–4 for current-generation LWRs.

6.2.1.3 Nonradiological Impacts of Transportation Accidents

Nonradiological impacts are the human health impacts projected to result from traffic accidents involving shipments of unirradiated fuel to the Fermi site and alternative sites; the analysis does not consider radiological or hazardous characteristics of the cargo. Nonradiological impacts include the projected number of traffic accidents, injuries, and fatalities that could result from shipments of unirradiated fuel to the site and return shipments of empty containers from the site.

Nonradiological impacts are calculated by using accident, injury, and fatality rates from published sources. The rates (i.e., impacts per vehicle-kilometer traveled) are then multiplied by estimated travel distances for workers and materials. The general formula for calculating nonradiological impacts is:

Impacts = (unit rate) × (roundtrip shipping distance) × (annual number of shipments)

In this formula, impacts are presented in units of the number of accidents, number of injuries, and number of fatalities per year. Corresponding unit rates (i.e., impacts per vehicle-km traveled) are used in the calculations.

Accident, injury, and fatality rates were taken from Table 4 in ANL/ESD/TM-150, *State-Level Accident Rates for Surface Freight Transportation: A Reexamination* (Saricks and Tompkins 1999). Nationwide median rates were used for shipments of unirradiated fuel to the site. The data are representative of traffic accident, injury, and fatality rates for heavy truck shipments similar to shipments of unirradiated fuel to the Fermi site and alternative sites. In addition, the DOT Federal Motor Carrier Safety Administration evaluated the data underlying the Saricks and Tompkins (1999) rates, which were taken from the Motor Carrier Management Information System, and determined that the rates were underreported. Therefore, the accident, injury, and fatality rates in Saricks and Tompkins (1999) were adjusted using factors derived from data provided by the University of Michigan Transportation Research Institute (UMTRI) (UMTRI 2003). The UMTRI data indicate that accident rates for 1994 to 1996, the same data used by Saricks and Tompkins (1999), were underreported by about 39 percent. Injury and fatality rates were underreported by 16 and 36 percent, respectively. As a result, the accident, injury, and fatality rates were increased by factors of 1.64, 1.20, and 1.57, respectively, to account for the underreporting.

The nonradiological accident impacts calculated by the NRC staff for transporting unirradiated fuel to (and empty shipping containers from) the Fermi site and alternative sites are shown in Table 6-6. The nonradiological impacts associated with the WASH-1238 reference LWR are also shown for comparison. Note that there are only small differences between the impacts calculated for an ESBWR at the Fermi site and alternative sites and the reference LWR in WASH-1238, due entirely to the estimated annual number of shipments.

Table 6-6. Nonradiological Impacts of Transporting Unirradiated Fuel to the Proposed Fermi Site and Alternative Sites, Normalized to Reference LWR

Plant Type	Annual Shipments Normalized to Reference LWR	One-Way Shipping Distance, km	Roundtrip Distance, km per year	Annual Impacts		
				Accidents per Year	Injuries per Year	Fatalities per Year
Reference LWR (WASH-1238)	6.3	3600	4.5×10^{4}	2.1×10^{-2}	1.1×10^{-2}	6.5×10^{-4}
Fermi and alternative sites ESBWR	5.3	3600	3.8×10^{4}	1.8×10^{-2}	8.9×10^{-3}	5.5×10^{-4}

6.2.2 Transportation of Spent Fuel

The NRC staff performed an independent analysis of the environmental impacts of transporting spent fuel from the proposed Fermi site and alternative sites to a spent fuel disposal repository. For the purposes of these analyses, the staff considered the proposed geologic HLW repository at the Yucca Mountain site in Nevada as a surrogate destination. Currently, the NRC Yucca Mountain adjudicatory proceeding is suspended, and there are Yucca Mountain-related matters pending in federal court. However, the NRC staff considers an estimate of the impacts of the transportation of spent fuel to a possible repository in Nevada to be a reasonable bounding estimate of the transportation impacts on a storage or disposal facility because of the distances involved and the representativeness of the distribution of members of the public in urban, suburban, and rural areas (i.e., population distributions) along the shipping routes. Radiological and nonradiological environmental impacts of normal operating conditions and transportation accidents, as well as nonradiological impacts, are discussed in this section. As noted above, the NRC Yucca Mountain adjudicatory proceeding is suspended, and there are Yucca Mountain-related matters pending in federal court. Regardless of the outcome of these proceedings, the NRC staff concludes that transportation impacts are roughly proportional to the distance from the reactor site to the repository site, in this case Michigan to Nevada.

This NRC staff analysis is based on shipment of spent fuel by legal-weight trucks in shipping casks with characteristics similar to casks currently available (i.e., massive, heavily shielded, cylindrical metal pressure vessels). Because of the large size and weight of spent fuel shipping casks, each shipment is assumed to consist of a single shipping cask loaded on a modified trailer. These assumptions are consistent with those made in the evaluation of the environmental impacts of transportation of spent fuel in Addendum 1 to NUREG-1437 (NRC 1999). Because the alternative transportation methods involve rail transportation or heavy-haul trucks, which would reduce the overall number of spent fuel shipments (NRC 1999), thereby reducing impacts, these assumptions are conservative. In addition, the use of current shipping cask designs for this analysis results in conservative impact estimates, because the current designs are based on transporting short-cooled spent fuel (approximately 120 days out of reactor). Future shipping casks would be designed to transport longer-cooled fuel (more than 5 years out of reactor) and would require much less shielding to meet external dose limitations. Therefore, future shipping casks are expected to have higher cargo capacities, thus reducing the numbers of shipments and associated impacts.

The NRC staff calculated the radiological impacts of transportation of spent fuel using the RADTRAN 5.6 computer code (Weiner et al. 2008). Routing and population data used in RADTRAN 5.6 for truck shipments were obtained from the Transportation Routing Analysis Geographic Information System (TRAGIS) routing code (Johnson and Michelhaugh 2003). The population data in the TRAGIS code are based on the 2000 Census. Nonradiological impacts were calculated using published traffic accident, injury, and fatality data (Saricks and

Tompkins 1999), in addition to route information from TRAGIS. Traffic accident rates input to RADTRAN 5.6 and nonradiological impact calculations were adjusted to account for underreporting, as discussed in Section 6.2.1.3.

6.2.2.1 Normal Conditions

Normal conditions, sometimes referred to as "incident-free" conditions, are transportation activities in which shipments reach their destination without an accident occurring en route. Impacts from these shipments would be from the low levels of radiation that penetrate the heavily shielded spent fuel-shipping cask. Radiation exposures would occur to the following populations: (1) persons residing along the transportation corridors between the Fermi site and alternative sites and the proposed repository location; (2) persons in vehicles traveling on the same route as a spent fuel shipment; (3) persons at vehicle stops for refueling, rest, and vehicle inspections; and (4) transportation crew workers (drivers). For this analysis, the NRC staff assumed that the destination for the spent fuel shipments is the proposed geologic HLW repository at Yucca Mountain in Nevada. This assumption is conservative because it tends to maximize the shipping distance from the Fermi site and alternative sites.

Shipping casks have not been designed for the spent fuel from advanced reactor designs such as the ESBWR. Information in *Early Site Permit Environmental Report Sections and Supporting Documentation* (INEEL 2003) indicated that advanced LWR fuel designs would not be significantly different from existing LWR designs; therefore, current shipping cask designs were used for the analysis of ESBWR spent fuel shipments. The NRC staff assumed that the capacity of a truck shipment of ESBWR spent fuel was 0.5 MTU per shipment, the same capacity as that used in WASH-1238 (AEC 1972). In its ER (Detroit Edison 2011a), Detroit Edison assumed a shipping cask capacity of 0.5 MTU per shipment.

Input to RADTRAN 5.6 includes the total shipping distance between the origin and destination sites and the population distributions along the routes. This information was obtained by running the TRAGIS computer code (Johnson and Michelhaugh 2003) for highway routes from the Fermi site and alternative sites to the proposed geologic HLW repository at Yucca Mountain. The resulting route characteristics information, generated by the NRC staff, is shown in Table 6-7. Note that for truck shipments, all the spent fuel is assumed to be shipped to the proposed geologic HLW repository at Yucca Mountain over designated highway-route controlled quantity routes. In addition, TRAGIS data were loaded into RADTRAN 5.6 on a State-by-State basis, which increases precision and allows results to be presented for each State along the route between the Fermi site or alternative sites and the proposed geologic HLW repository at Yucca Mountain, if desired.

Table 6-7. Transportation Route Information for Shipments from the Fermi Site and Alternative Sites to the Proposed Geologic HLW Repository at Yucca Mountain, Nevada[(a)]

Alternative Site	One-Way Shipping Distance, km				Population Density, persons/km^2			Stop Time per Trip, hr
	Total	Rural	Suburban	Urban	Rural	Suburban	Urban	
Fermi 3 Site	3480	2843	558	79	10.2	311.6	2384	4.5
Petersburg	3457	2829	549	79	10.1	314.5	2368	4.5
South Britton	3510	2864	564	82	10.2	312.7	2382	4.5
Greenwood Energy Center	3564	2860	630	74	10.3	309.0	2362	4.5
Belle River	3585	2827	652	106	10.2	328.0	2393	4.5

Source: Johnson and Michelhaugh 2003

(a) This table presents aggregated route characteristics provided by TRAGIS (Johnson and Michelhaugh 2003), including estimated distances from the alternative sites to the nearest TRAGIS highway node. Input to the RADTRAN 5.6 computer code was disaggregated to a State-by-State level.

Radiation doses are a function of many parameters, including vehicle speed, traffic count, dose rate, packaging dimensions, number in the truck crew, stop time, and population density at stops. The values for these parameters and others used in the NRC staff's analysis and the sources of the information are provided in Table 6-8.

For this analysis, the transportation crew for spent fuel shipments delivered by truck is assumed to consist of two drivers. Escort vehicles and drivers were considered, but they were not included in the analysis, because their distance from the shipping cask would reduce the dose rates to levels well below the dose rates experienced by the drivers and would be negligible. Stop times for refueling and rest were assumed to accrue at the rate of 30 minutes per 4 hr of driving time. TRAGIS outputs were used to estimate the number of stops. Doses to the public at truck stops have been significant contributors to the doses calculated in previous RADTRAN 5.6 analyses. For this analysis, doses to the public at refueling and rest stops ("stop doses") are the sum of the doses to individuals located in two annular rings centered at the stopped vehicle, as illustrated in Figure 6-2. The inner ring represents persons who may be at the truck stop at the same time as a spent fuel shipment and extends 1 to 10 m from the edge of the vehicle. The outer ring represents persons who reside near a truck stop and extends from 10 to 800 m from the vehicle. This scheme is similar to that used by Sprung et al. (2000). Population densities and shielding factors were also taken from those of Sprung et al. (2000), which were based on the observations of Griego et al. (1996).

Table 6-8. RADTRAN 5.6 Normal (Incident-free) Exposure Parameters

Parameter	RADTRAN 5.6 Input Value	Source
Vehicle speed (km/hr)	88.49	Based on average speed in rural areas given in DOE (2002a). Conservative in-transit speed of 55 mph assumed; predominantly interstate highways used.
Traffic count – rural (vehicles/hr)	530	DOE (2002a).
Traffic count – suburban (vehicles/hr)	760	
Traffic count – urban (vehicles/hr)	2400	
Vehicle occupancy (persons/vehicle)	1.5	DOE (2002a).
Dose rate at 1 m from vehicle (mrem/hr)	14	DOE (2002a, b) – approximate dose rate at 1 m that is equivalent to maximum dose rate allowed by Federal regulations (i.e., 10 mrem/hr at 2 m from the side of a transport vehicle).
Packaging dimensions (m)	Length – 5.2 Diameter – 1.0	DOE (2002b).
Number of truck crew	2	AEC (1972), NRC (1977a), and DOE (2002a, b).
Stop time (hr/trip)	Route-specific	See Table 6-7.
Population density at stops (persons/km^2)	30,000	Sprung et al. (2000). Equivalent to nine persons within 10 m of vehicle. See Figure 6-1.
Min/max radii of annular area around vehicle at stops (m)	1 to 10	Sprung et al. (2000).
Shielding factor applied to annular area surrounding vehicle at stops (dimensionless)	1 (no shielding)	Sprung et al. (2000).
Population density surrounding truck stops, persons/km^2	340	Sprung et al. (2000).
Min/max radius of annular area surrounding truck stop (m)	10 to 800	Sprung et al. (2000).
Shielding factor applied to annular area surrounding truck stop (dimensionless)	0.2	Sprung et al. (2000).

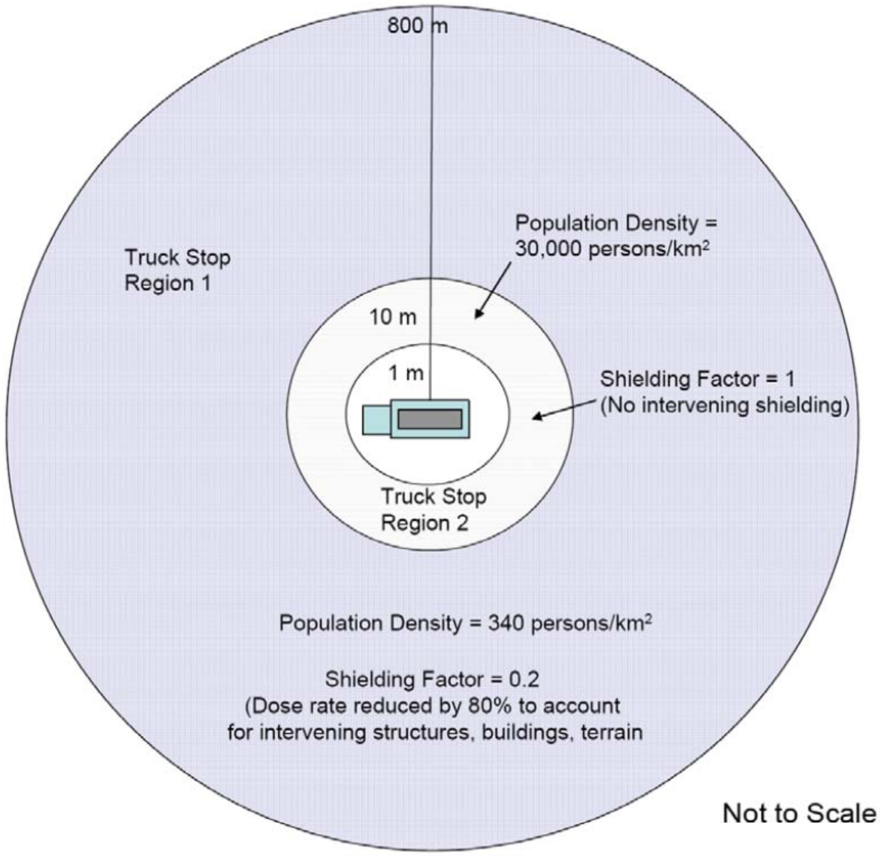

Figure 6-2. Illustration of Truck Stop Model

The results calculated by the NRC staff for these normal (incident-free) exposure calculations are shown in Table 6-9 for the proposed Fermi site and alternative sites. Population dose estimates are given for workers (i.e., truck crew members), onlookers (doses to persons at stops and persons on highways exposed to the spent fuel shipment), and persons along the route (persons living near the highway). Shipping schedules for spent fuel generated by Fermi 3 have not been determined. The NRC staff concluded it was reasonable to calculate annual doses assuming the annual number of spent fuel shipments is equivalent to the annual refueling requirements. Each refuel cycle is anticipated to reload 68.2 MTU of fresh fuel (Detroit Edison 2011a) every 2 years. It was assumed that the same corresponding amount of spent fuel was to be removed from the reactor and sent to a spent fuel storage facility or repository. With a truck capacity of 0.5 MTU/shipment, a minimum of 137 shipments would be required for transport of spent fuel after each refuel cycle. This level of activity would lead to an annual average of 68.5 spent fuel shipments.

Table 6-9. Normal (Incident-Free) Radiation Doses to Transport Workers and the Public from Shipping Spent Fuel from the Fermi Site and Alternative Sites to the Proposed Geologic HLW Repository at Yucca Mountain

Location	Worker (Crew)	Along Route	Onlookers
Reference LWR (WASH-1238) (person-rem/yr)[(a)]	9.5	0.37	19
ESBWR at Fermi site (person-rem/yr)	6.4	0.25	13
Petersburg (person-rem/yr)	6.3	0.25	13
South Britton (person-rem/yr)	6.5	0.26	13
Greenwood Energy Center (person-rem/yr)	6.5	0.28	13
Belle River	6.6	0.30	13
Table S-4 condition (person-rem/yr)	4	3	3

(a) To convert person-rem to person-Sv, divide by 100.

Population doses were normalized to the reference LWR in WASH-1238 (880 net MW(e)). This corresponds to an 1100-MW(e) LWR operating at 80 percent capacity. The normalized number of annual spent fuel shipments is 40.3, compared to 60 for the reference LWR. This difference in annual shipment numbers is solely responsible for the differences in the radiation doses for the reference LWR and the ESBWR at the proposed Fermi site as reported in Table 6-9.

There are only small differences in transportation impacts among the Fermi site and the four alternative sites. In general, the proposed Fermi site has the same impacts as the alternative sites, primarily because all routes have approximately the same shipping distance to the proposed geologic HLW repository at Yucca Mountain. However, the differences among sites are minor and are less than the uncertainty in the analytical results.

The bounding cumulative doses to the exposed population given in Table S-4 are:

- 4 person-rem/reactor-year to transport workers
- 3 person-rem/reactor-year to general public (onlookers) and members of the public along the route.

The calculated population doses to the crew and onlookers for the reference LWR and the Fermi and alternative site shipments exceed Table S-4 values. A key reason for the higher population doses relative to Table S-4 is the longer shipping distances assumed for this analysis (i.e., to a repository in Nevada) than the distances used in WASH-1238. WASH-1238 assumed that each spent fuel shipment would travel a distance of 1000 mi, whereas the shipping distances used in this assessment were about 2150 to 2230 mi. If the shorter distance was used to calculate the impacts for the Fermi spent fuel shipments, the doses could be reduced by more than 50 percent. Other important differences are the model related to vehicle stops described above and the additional precision that results from incorporating State-specific route characteristics.

Where necessary, the NRC staff made conservative assumptions to calculate impacts associated with the transportation of spent fuel. Some of the key conservative assumptions are as follows.

- ***Use of the regulatory maximum dose rate (10 mrem/hr at 2 m) in the RADTRAN 5.6 calculations***. The shipping casks assumed in the EIS prepared by DOE in support of the application for the proposed geologic HLW repository at Yucca Mountain (DOE 2002b) were designed to transport spent fuel that has cooled for a minimum of 5 years (see 10 CFR 961, Subpart B). Most spent fuel would have cooled for much longer than 5 years before being shipped to a possible geologic repository. Shipments from the Fermi site and alternative sites are also expected to be cooled for longer than 5 years. Consequently, the estimated population doses in Table 6-9 could be further reduced if more realistic dose rate projections and shipping cask capacities are used.
- ***Use of 30 minutes as the average time at a truck stop in the calculations***. Many stops made for actual spent fuel shipments are of short duration (i.e., 10 minutes) for brief visual inspections of the cargo (e.g., checking the cask tie-downs). These stops typically occur in minimally populated areas, such as an overpass or freeway ramp in an unpopulated area. Furthermore, empirical data provided in Griego et al. (1996) indicate that a 30-minute duration is toward the high end of the stop-time distribution. Average stop times observed by Griego et al. (1996) are on the order of 18 minutes.

A sensitivity study was performed to demonstrate the effects of using more realistic dose rates and stop times for the incident-free population dose calculations. For this sensitivity study, the dose rate was reduced to 5 mrem/hr, the approximate 50-percent confidence interval of the dose rate distribution estimated by Sprung et al. (2000) for future spent fuel shipments. The stop time was reduced to 18 minutes per stop. All other RADTRAN 5.6 input values were unchanged. The result is that the annual crew doses were reduced to 3.7 person-rem/yr, or about 58 percent of the annual dose shown in Table 6-9. The annual onlooker doses were reduced to 3.1 person-rem/yr (24 percent), and the annual doses to persons along the route were reduced to 0.097 person-rem/yr (39 percent). The NRC staff concludes that using more realistic parameters for shipment capacities, stop times, and dose rates would reduce the annual doses in Table 6-9 to below the Table S-4 values.

In its ER (Detroit Edison 2011a), Detroit Edison described the results of a RADTRAN 5.6 analysis of the impacts of incident-free transport of spent fuel to the proposed geologic HLW repository at Yucca Mountain. Although the overall approaches are the same (e.g., use of TRAGIS and RADTRAN 5.6), there are some differences in the modeling details. For example, the NRC staff's analysis used State-by-State route characteristics, whereas Detroit Edison elected to use aggregated route information). The NRC staff concludes that the results produced by Detroit Edison are similar to those calculated by the NRC staff in this EIS.

Using the linear no-threshold dose-response relationship discussed in Section 6.2.1.1, the annual public dose impact for transporting spent fuel from the proposed Fermi site and alternative sites to the proposed geologic HLW repository at Yucca Mountain is about 20 person-rem, which is less than the 1754 person-rem value the ICRP (ICRP 2007) and NCRP (NCRP 1995) suggest would most likely result in zero excess health effects. This dose is very small compared to the estimated 1.6×10^5 person-rem that the same population along the route from the proposed Fermi site to Yucca Mountain would incur annually from exposure to natural sources of radiation. Note that the estimated population doses along the route from the Fermi site-to-Yucca-Mountain route from natural background radiation are different than the natural background dose calculated by the NRC staff for unirradiated fuel shipments in Section 6.2.1.1 of this EIS, because the route characteristics are different. A generic route was used in Section 6.2.1.1 for unirradiated fuel shipments, and an actual highway route was used in this section for spent fuel shipments.

Dose estimates to the MEI from transport of unirradiated fuel, spent fuel, and wastes under normal conditions are presented in Section 6.2.1.1.

6.2.2.2 Radiological Impacts of Accidents

As discussed previously, the NRC staff used the RADTRAN 5.6 computer code to estimate impacts of transportation accidents involving spent fuel shipments. RADTRAN 5.6 considers a spectrum of postulated transportation accidents, ranging from those with high frequencies and low consequences (e.g., “fender benders”) to those with low frequencies and high consequences (i.e., accidents in which the shipping container is exposed to severe mechanical and thermal conditions).

Radionuclide inventories are important parameters in the calculation of accident risks. The radionuclide inventories used in this analysis were from the applicant’s ER (Detroit Edison 2011a). Spent fuel inventories used in the NRC staff analysis are presented in Table 6-10. The list of radionuclides set forth in the table includes all of the radionuclides that were included in the analysis conducted by Sprung et al. (2000). The NRC staff’s analysis also included the inventory of crud, or radioactive material deposited on the external surfaces of LWR spent fuel rods. Because crud is deposited from corrosion products generated elsewhere in the reactor cooling system and the complete reactor design and operating parameters are uncertain, the quantities and characteristics of crud deposited on ESBWR spent fuel are not available at this time. The Fermi 3 ESBWR spent fuel transportation accident impacts were calculated by assuming the cobalt-60 inventory in the form of crud is 169 Ci/MTU, based on information in Sprung et al. (2000).

Robust shipping casks are used to transport spent fuel because of the radiation shielding and accident resistance required by 10 CFR Part 71. Spent fuel shipping casks must be certified Type B packaging systems, meaning they must withstand a series of severe postulated accident

Table 6-10. Radionuclide Inventories Used in Transportation Accident Risk Calculations for an ESBWR[(a)(b)]

Radionuclide	Ci/MTU	Bq/MTU	Physical-Chemical Group
Am-241	1.30×10^{3}	4.81×10^{13}	Particulate
Am-242m	2.79×10^{1}	1.03×10^{12}	Particulate
Am-243	3.26×10^{1}	1.21×10^{12}	Particulate
Ce-144	1.35×10^{4}	5.00×10^{14}	Particulate
Cm-242	4.86×10^{1}	1.80×10^{12}	Particulate
Cm-243	3.47×10^{1}	1.28×10^{12}	Particulate
Cm-244	4.96×10^{3}	1.84×10^{14}	Particulate
Cm-245	6.75×10^{-1}	2.50×10^{10}	Particulate
Co-60 (crud)[(c)]	3.38×10^{2}	1.25×10^{12}	Crud
Co-60 (activation)[(c)]	2.86×10^{3}	1.06×10^{14}	Particulate
Cs-134	5.19×10^{4}	1.92×10^{15}	Cesium
Cs-137	1.27×10^{5}	4.70×10^{15}	Cesium
Eu-154	1.04×10^{4}	3.85×10^{14}	Particulate
Eu-155	5.40×10^{3}	2.00×10^{14}	Particulate
I-129	4.24×10^{-2}	1.57×10^{9}	Cesium
Kr-85	9.27×10^{3}	3.43×10^{14}	Gas
Pm-147	3.53×10^{4}	1.31×10^{15}	Particulate
Pu-238	6.15×10^{3}	2.28×10^{14}	Particulate
Pu-239	3.86×10^{2}	1.43×10^{13}	Particulate
Pu-240	6.22×10^{2}	2.30×10^{13}	Particulate
Pu-241	1.22×10^{5}	4.51×10^{15}	Particulate
Pu-242	2.24×10^{0}	8.29×10^{10}	Particulate
Ru-106	1.86×10^{4}	6.88×10^{14}	Ruthenium
Sb-125	4.81×10^{3}	1.78×10^{14}	Particulate
Sr-90	9.08×10^{4}	3.36×10^{15}	Particulate
Y-90	9.09×10^{4}	3.36×10^{15}	Particulate

(a) Divide Becquerel (Bq) per Metric Ton Uranium (Bq/MTU) by 3.7×10^{10} to obtain curies per MTU (Ci/MTU).

(b) The source of the spent fuel inventories is Detroit Edison (2011a), Table 3.8-12, except as noted in footnote (c).

(c) Co-60 exists both as an activation product in spent fuel and is the primary radioactive constituent in fuel assembly crud, or radioactive material deposited on the external surfaces of fuel assemblies. The Co-60 inventory in crud was calculated using information in NUREG/CR-6672 (Sprung et al. 2000).

conditions with essentially no loss of containment or shielding capability. These casks are also designed with fissile material controls to ensure the spent fuel remains subcritical under normal and accident conditions. According to Sprung et al. (2000), the probability of encountering accident conditions that would lead to shipping cask failure is less than 0.01 percent (i.e., more than 99.99 percent of all accidents would result in no release of radioactive material from the shipping cask). The NRC staff assumed that shipping casks approved for transportation of spent fuel from an ESBWR would provide equivalent mechanical and thermal protection of the spent fuel cargo.

Accident frequencies were calculated in RADTRAN 5.6 by using user-specified accident rates and conditional shipping cask failure probabilities. State-specific accident rates were taken from Saricks and Tompkins (1999) and used in the RADTRAN 5.6 calculations. The State-specific accident rates were adjusted to account for underreporting, as described in Section 6.2.1.3. Conditional shipping cask failure probabilities (i.e., the probability of cask failure as a function of the mechanical and thermal conditions applied in an accident) were taken from Sprung et al. (2000).

The RADTRAN 5.6 accident risk calculations were performed by using the radionuclide inventories given in Table 6-10. The resulting risk estimates were then multiplied by assumed annual spent fuel shipments to derive estimates of the annual accident risks associated with spent fuel shipments from the proposed Fermi site or alternative sites to the proposed geologic HLW repository at Yucca Mountain in Nevada. As was done for routine exposures, the NRC staff assumed that the numbers of shipments of spent fuel per year are equivalent to the annual discharge quantities.

For this assessment, release fractions for current-generation LWR fuel designs (Sprung et al. 2000) were used to approximate the impacts from the ESBWR spent fuel shipments. This assumes that the fuel materials and containment systems (i.e., cladding, fuel coatings) behave similarly to current LWR fuel under applied mechanical and thermal conditions.

The NRC staff used RADTRAN 5.6 to calculate the population dose from the released radioactive material from four of five possible exposure pathways.[(a)] These pathways are as follows:

- External dose from exposure to the passing cloud of radioactive material (cloudshine).
- External dose from the radionuclides deposited on the ground by the passing plume (groundshine). The NRC staff's analysis included the radiation exposure from this pathway,

(a) Internal dose from ingestion of contaminated food was not considered, because the staff assumed evacuation and subsequent interdiction of foodstuffs following a postulated transportation accident.

even though the area surrounding a potential accidental release would be evacuated and decontaminated, thus preventing long-term exposures from this pathway.

- Internal dose from inhalation of airborne radioactive contaminants (inhalation).
- Internal dose from resuspension of radioactive materials that were deposited on the ground (resuspension). The NRC staff's analysis included the radiation exposures from this pathway, even though evacuation and decontamination of the area surrounding a potential accidental release would prevent long-term exposures.

Table 6-11 presents the environmental consequences calculated by the NRC staff for transportation accidents when spent fuel from the Fermi site and alternative sites is shipped to the proposed geologic HLW repository at Yucca Mountain. The shipping distances and population distribution information for the routes were the same as those used for the normal "incident-free" conditions (see Section 6.2.2.1). The results are normalized to the WASH-1238 reference reactor (880-MW(e) net electrical generation, 1100-MW(e) reactor operating at 80 percent capacity) to provide a common basis for comparison to the impacts listed in Table S-4. Note that the impacts for all site alternatives are less than the reference LWR impacts. Also, although there are slight differences in impacts among the alternative sites, none of the alternative sites would be clearly favored over the proposed Fermi site.

Table 6-11. Annual Spent Fuel Transportation Accident Impacts for an ESBWR at the Proposed Fermi Site and Alternative Sites, Normalized to Reference 1100-MW(e) LWR Net Electrical Generation

Location	Normalized Population Impacts, person-rem/yr[(a)]
Reference LWR (WASH-1238)	4.6×10^{-6}
Fermi site	3.1×10^{-6}
Petersburg site	3.1×10^{-6}
South Britton site	3.2×10^{-6}
Greenwood site	3.2×10^{-6}
Belle River-St. Clair site	4.3×10^{-6}

(a) Multiply person-Sv/yr times 100 to obtain person-rem/yr.

By using the linear no-threshold dose-response relationship discussed in Section 6.2.1.1, the annual collective public dose estimates for transporting spent fuel from the Fermi and alternative sites to the proposed geologic HLW repository at Yucca Mountain are on the order of 3×10^{-6} person-rem, which is less than the 1754 person-rem value that the ICRP (ICRP 2007) and NCRP (NCRP 1995) suggest would most likely result in zero excess health effects. This risk is very minute compared to the estimated 1.6×10^{5} person-rem that the same population along the route from the proposed Fermi site to the proposed geologic HLW repository at Yucca Mountain would incur annually from exposure to natural sources of radiation. Note that the estimated population dose to persons along the Fermi-to-Yucca-Mountain route is different than the population dose calculated by the NRC staff for unirradiated fuel shipments in Section 6.2.1.1, because the route characteristics are different.

The NRC staff performed a confirmatory evaluation of Detroit Edison's spent fuel transportation accident risk analysis. It noted that Detroit Edison used a different, though valid, methodology for the ER calculations. The primary difference was that Detroit Edison assumed aggregated route parameters, whereas in this EIS, the NRC staff used State-by-State shipping distances and population densities. The staff concluded that Detroit Edison's analysis was reasonable and comprehensive and meets the intent of 10 CFR 51.52(b).

6.2.2.3 Nonradiological Impacts of Spent Fuel Shipments

The general approach used to calculate nonradiological impacts of spent fuel shipments is the same as that used for unirradiated fuel shipments. The main difference is that the spent fuel shipping route characteristics are better defined, so the State-level accident statistics in Saricks and Tompkins (1999) may be used. State-by-State shipping distances were obtained from the TRAGIS output file and combined with the annual number of shipments and accident, injury, and fatality rates by State from Saricks and Tompkins (1999) to calculate nonradiological impacts. In addition, the accident, injury, and fatality rates from Saricks and Tompkins (1999) were adjusted to account for underreporting (see Section 6.2.1.3). The results calculated by the NRC staff are shown in Table 6-12.

Table 6-12. Nonradiological Impacts of Transporting Spent Fuel from the Proposed Fermi Site and Alternative Sites to the Proposed Geologic HLW Repository at Yucca Mountain, Normalized to Reference LWR

Site	One-Way Shipping Distance (km)	Nonradiological Impacts per Year		
		Accidents/yr	Injuries/yr	Fatalities/yr
Fermi (proposed site)	3481	1.5×10^{-1}	6.8×10^{-2}	4.6×10^{-3}
Petersburg	3457	1.5×10^{-1}	6.7×10^{-2}	4.5×10^{-3}
South Britton	3510	1.5×10^{-1}	6.8×10^{-2}	4.6×10^{-3}
Greenwood Energy Center	3564	1.5×10^{-1}	7.3×10^{-2}	4.9×10^{-3}
Belle River	3585	1.6×10^{-1}	7.4×10^{-2}	4.9×10^{-3}

Note: The number of shipments of spent fuel assumed in the calculations is 40.3 shipments/yr after normalizing to the reference LWR. Estimates are for roundtrip travel.

6.2.3 Transportation of Radioactive Waste

This section discusses the environmental effects of transporting radioactive waste other than spent fuel from the proposed Fermi site and alternative sites. The environmental conditions listed in 10 CFR 51.52 that apply to shipments of radioactive waste are as follows.

- Radioactive waste (except spent fuel) would be packaged and in solid form.

- Radioactive waste (except spent fuel) would be shipped from the reactor by truck or rail.
- The weight limitation of 73,000 lb per truck and 100 tons per cask per railcar would be met.
- Traffic density condition would be less than the one truck shipment per day or three railcars per month.

Radioactive waste (other than spent fuel from the Fermi 3 ESBWR) is expected to be capable of being shipped in compliance with Federal or State weight restrictions. Table 6-13 presents the NRC staff's estimates of annual waste volumes and annual waste shipment numbers for an ESBWR, normalized to the reference 1100-MW(e) LWR defined in WASH-1238 (AEC 1972). The expected annual waste volumes for the ESBWR are estimated at 15,900 ft^3/yr. By using the same packaging assumptions as WASH-1238 (2.34 m^3/shipment), the annual number of waste shipments was estimated at 114 shipments per year after normalization to the reference LWR in WASH-1238.

Table 6-13. Summary of Radioactive Waste Shipments from the Proposed Fermi Site and Alternative Sites

Reactor Type	Waste Generation Information	Annual Waste Volume, m^3/yr per Unit	Electrical Output, MW(e) per Unit	Normalized Rate, m^3/1100 MW(e) Unit (880 MW(e) Net)[(a)]	Shipments/ 1100 MW(e) (880 MW(e) Net) Electrical Output[(b)]
Reference LWR (WASH-1238)	3800 ft^3/yr per unit	108	1100	108	46
Fermi 3 and alternative sites ESBWR	15,859 ft^3/yr per unit[(c)]	449[(c)]	1605	265	114

Conversions: 1 m^3 = 35.31 ft^3. Drum volume = 210 liters (0.21 m^3).

(a) Capacity factors used to normalize the waste generation rates to an equivalent electrical generation output are 80 percent for the reference LWR (AEC 1972) and 93 percent for the Fermi 3 ESBWR (Detroit Edison 2011a). Waste generation for the ESBWR is normalized to 880 MW(e) net electrical output (1100-MW(e) unit with an 80-percent capacity factor).

(b) The number of shipments per 1100 MW(e) was calculated by dividing the normalized rate by the assumed shipment capacity used in WASH-1238 (2.34 m^3/shipment).

(c) This value was taken from DCD Revision 9 (GEH 2010).

The annual waste volume and annual number of shipments are greater than those for the 1100-MW(e) reference reactor that was the basis for Table S-4. However, by using currently available shipping packages and practices, the annual shipment estimates could be reduced below those for the reference LWR if higher shipment capacities were considered for certain types of radioactive waste from the Fermi 3 site. For example, if all of the dry active waste, approximately 12,827 ft^3 of the 15,859 ft^3/yr LLRW projected (GEH 2010), were to be shipped in standard 20-ft Sealand containers (1,000 ft^3, 1 container per truck), approximately 50 shipments per year to a disposal site would be required, assuming a shipment capacity of 2.34 m^3 of waste per shipment for the remaining waste as was assumed in WASH-1238. For comparison to the 46 annual shipments of radioactive waste for the reference reactor, the normalized number of shipments required for Fermi 3 radioactive waste would then be 30 shipments, rather than the 114 shipments identified in Table 6-13.

The sum of the daily shipments of unirradiated fuel, spent fuel, and radioactive waste for an ESBWR located at the Fermi site and alternative sites is less than the one-truck-shipment-per-day condition given in 10 CFR 51.52, Table S-4.

Dose estimates to the MEI from transport of unirradiated fuel, spent fuel, and waste under normal conditions are presented in Section 6.2.1.1.

Nonradiological impacts of radioactive waste shipments were calculated by using the same general approach as unirradiated and spent fuel shipments. For this EIS, the shipping distance was assumed to be 500 mi one way (AEC 1972). Because the actual destination is uncertain, national median accident, injury, and fatality rates were used in the calculations (Saricks and Tompkins 1999). These rates were adjusted to account for underreporting, as described in Section 6.2.1.3. The results are presented in Table 6-14. As shown, the calculated nonradiological impacts for transportation of radioactive waste other than spent fuel from the Fermi site and alternative sites to waste disposal facilities are greater than the impacts calculated for the reference LWR in WASH-1238. As noted above, the calculated impacts would be less than those calculated for the reference reactor, if currently available shipping packages and practices were used.

Table 6-14. Nonradiological Impacts of Radioactive Waste Shipments from an ESBWR at the Proposed Fermi Site

Location	Normalized Shipments per Year	One-Way Distance (km)	Accidents per Year	Injuries per Year	Fatalities per Year
Reference LWR (WASH-1238)	46	800	3.4×10^{-2}	1.7×10^{-2}	1.1×10^{-3}
Fermi 3 ESBWR	114	800	8.5×10^{-2}	4.2×10^{-2}	2.6×10^{-3}

Note: The shipments and impacts have been normalized to the reference LWR.

6.2.4 Conclusions

The NRC staff conducted a confirmatory analysis and performed independent calculations of the potential impacts under normal operating and accident conditions of transporting fuel and wastes to and from an ESBWR to be located at the Fermi site and alternative sites. For comparison with Table S-4, the environmental impacts were adjusted (i.e., normalized) to the environmental impacts associated with the reference LWR in WASH-1238 (AEC 1972), by multiplying the ESBWR impact estimates by the ratio of the total electric output for the reference reactor to the electric output of the proposed reactor.

Because of the conservative approaches and data used to calculate impacts, the actual environmental effects are not likely to exceed those calculated in this EIS. Thus, the NRC staff concludes that the environmental impacts of transportation of fuel and radioactive wastes to and from the Fermi site and alternative sites would be SMALL and would be consistent with the environmental impacts associated with transportation of fuel and radioactive wastes to and from current-generation reactors presented in Table S-4 of 10 CFR 51.52.

On March 3, 2010, DOE submitted a motion to the Atomic Safety and Licensing Board to withdraw with prejudice its application for a permanent geologic repository at Yucca Mountain, Nevada (DOE 2010). Currently the NRC Yucca Mountain adjudicatory proceeding is suspended, and there are Yucca Mountain-related matters pending in federal court. Regardless of the outcome of these proceedings, the NRC staff concludes that transportation impacts are roughly proportional to the distance from the reactor site to the repository site, in this case Michigan to Nevada. The distance from the Fermi site or any of the alternative sites to any new planned repository in the contiguous United States would be no more than double the distance from the Michigan site to Yucca Mountain. Doubling the environmental impact estimates from the transportation of spent reactor fuel, as presented in this section, would provide a reasonable bounding estimate of the impacts for NEPA purposes. The NRC staff concludes that the environmental impacts of these doubled estimates would still be SMALL.

6.3 Decommissioning Impacts

At the end of the operating life of a power reactor, NRC regulations require that the facility be decommissioned. The NRC defines decommissioning as the safe removal of a facility from service and the reduction of residual radioactivity to a level that permits termination of the NRC license. The regulations governing decommissioning of power reactors are found in 10 CFR 50.75 and 10 CFR 50.82. The radiological criteria for termination of the NRC license are in 10 CFR Part 20, Subpart E. Minimization of contamination and generation of radioactive waste requirements for facility design and procedures for operation are addressed in 10 CFR 20.1406.

An applicant for a COL is required to certify that sufficient funds will be available to provide for radiological decommissioning at the end of power operations. As part of its COL application for the Fermi 3 on the Fermi site, Detroit Edison included a Decommissioning Funding Assurance Report in its COL Application Part 1 (Detroit Edison 2010), which stated that Detroit Edison would establish an external sinking funds account to accumulate funds for decommissioning.

Environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license are evaluated in the *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*, NUREG-0586, Supplement 1 (NRC 2002) (referred to as the GEIS-DECOM). Environmental impacts of the DECOM, SAFSTOR, and ENTOMB decommissioning methods are evaluated in the GEIS-DECOM. A COL applicant is not required to identify a decommissioning method at the time of the COL application. The NRC staff's evaluation of the environmental impacts of decommissioning presented in the GEIS-DECOM identifies a range of impacts for each environmental issue for a range of different reactor designs. Based on a DOE study (DOE 2004), it is expected that the ESBWR design would have lower physical plant inventories, less accumulated radioactivity, and fewer disposal and transportation costs than current operating reactors. Therefore, the NRC staff concludes that the impacts discussed in GEIS-DECOM remain bounding for reactors deployed after 2002, including the ESBWR.

The GEIS-DECOM does not specifically address the carbon footprint of decommissioning activities. However, it does list the decommissioning activities and states that the decommissioning workforce would be smaller than the operational workforce and that the decontamination and demolition activities could take up to 10 years to complete. Finally, it discusses SAFSTOR, in which decontamination and dismantlement are delayed for a number of years. Given this information, the NRC staff estimated the CO_2 footprint of decommissioning to be approximately 70,000 MT without SAFSTOR. This footprint is about equally split between decommissioning workforce transportation and equipment usage. The details of the estimate are presented in Appendix L. A 40-year SAFSTOR period would increase the footprint of decommissioning by about 40 percent. These CO_2 footprints are roughly three orders of magnitude lower than the CO_2 footprint presented in Section 6.1.3 for the uranium fuel cycle.

Therefore, the NRC staff relies upon the bases established in GEIS-DECOM and concludes the following with respect to the decommissioning of proposed Fermi 3:

1. Doses to the public would be well below applicable regulatory standards, regardless of which decommissioning method considered in the GEIS-DECOM is used.
2. Occupational doses would be well below applicable regulatory standards during the license term.
3. The quantities of Class C or greater than Class C wastes generated would be comparable or less than the amounts of solid waste generated by reactors licensed before 2002.
4. Air quality impacts of decommissioning are expected to be negligible at the end of the operating term.
5. Measures are readily available to avoid potential significant water quality impacts from erosion or spills. The liquid radioactive waste system design includes features to limit the release of radioactive material to the environment, such as pipe chases and tank collection basins. These features will minimize the amount of radioactive material in spills and leakage that would have to be addressed at decommissioning.
6. Ecological impacts of decommissioning are expected to be negligible.

7. Socioeconomic impacts would be short term and could be offset by decreases in population and economic diversification.

On the basis of the GEIS-DECOM and the evaluation of air quality impacts from GHG emissions above, the NRC staff concludes that, as long as the regulatory requirements on decommissioning activities to limit the impacts of decommissioning are met, the decommissioning activities would result in a SMALL impact.

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NUREG-2105, Vol. 2

Environmental Impact Statement for the Combined License (COL) for Enrico Fermi Unit 3

Final Report

Chapters 7 to Appendix D

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NUREG-2105, Vol. 2

Environmental Impact Statement for the Combined License (COL) for Enrico Fermi Unit 3

Final Report

Chapters 7 to Appendix D

Manuscript Completed: December 2012
Date Published: January 2013

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Final Environmental Impact Statement
for Combined License (COL) for Enrico Fermi Unit 3

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Abstract:

This environmental impact statement (EIS) has been prepared in response to an application submitted to the U.S. Nuclear Regulatory Commission (NRC) by Detroit Edison for a construction permit and operating license (combined license or COL). The proposed actions related to the Detroit Edison application are (1) NRC issuance of a COL for a new power reactor unit at the Detroit Edison Enrico Fermi Atomic Power Plant (Fermi) site in Monroe County, Michigan; and (2) U.S. Army Corps of Engineers (USACE) permit action to perform certain regulated activities on the site. The USACE is participating with the NRC in preparing this EIS as a cooperating agency and participates collaboratively on the review team.

This EIS includes the NRC staff's analysis, which considers and weighs the environmental impacts of constructing and operating a new nuclear unit at the Fermi site and at alternative sites, and mitigation measures available for reducing or avoiding adverse impacts. Based on its analysis, the staff determined that there are no environmentally preferable or obviously superior sites.

The EIS includes the evaluation, in part, of the proposed action's impacts on the public interest, including impacts on waters of the United States pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Appropriations Act of 1899. The USACE will decide whether to issue a permit on the basis of the EIS evaluation of the probable impacts on the public interest, including cumulative impacts, of Detroit Edison's proposed activities that are within the USACE scope of analysis; USACE verification of compliance with the requirements of USACE regulations and the Clean Water Act Section 404(b)(1) Guidelines; and any supplemental information, evaluations, or verifications that may be outside the NRC's scope of analysis and not included in this EIS, but are required by the USACE to support its permit decision.

After considering the environmental aspects of the proposed action, the staff's recommendation to the Commission is that the COL be issued as proposed.[a] This recommendation is based on (1) the application, including the Environmental Report (ER) submitted by Detroit Edison; (2) consultation with Federal, State, Tribal, and local agencies; (3) the staff's independent review; (4) the staff's consideration of comments related to the environmental review that were received during the public scoping process

(a) As directed by the Commission in CLI-12-16, the NRC will not issue the COL prior to completion of the ongoing rulemaking to update the Waste Confidence Decision and Rule (see Section 6.1.6 of this EIS).

and on the draft EIS; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and this EIS. The USACE permit decision would be made following issuance of this final EIS and completion of its permit application review process and permit decision documentation.

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Executive Summary

By letter dated September 18, 2008, the U.S. Nuclear Regulatory Commission (NRC or the Commission) received an application from Detroit Edison Company (Detroit Edison) for a combined license (COL) for a new power reactor unit, the Enrico Fermi Unit 3 (Fermi 3), at the Detroit Edison Enrico Fermi Atomic Power Plant (Fermi) site in Monroe County, Michigan.

The proposed actions related to the Fermi 3 application are (1) NRC issuance of COLs for construction and operation of a new nuclear unit at the Fermi site and (2) U.S. Army Corps of Engineers (USACE) permit action pursuant to Section 404 of the Federal Water Pollution Control Act, as amended (33 USC 1251, *et seq*.) (Clean Water Act), and Section 10 of the Rivers and Harbors Appropriation Act of 1899 (33 USC 403 *et seq.*) (Rivers and Harbors Act of 1899) to perform certain regulated activities associated with the Fermi 3 project, within the USACE jurisdiction and scope of analysis. The USACE is participating with the NRC in preparing this environmental impact statement (EIS) as a cooperating agency and participates collaboratively on the review team. The reactor specified in the application is an Economic Simplified Boiling Water Reactor (ESBWR) designed by GE-Hitachi Nuclear Energy Americas, LLC (GEH). The GEH design was approved by the NRC in March 2011. The final design approval was published in the *Federal Register* on March 16, 2011 (76 FR 14437).

The NRC staff completed its safety review of the ESBWR design on March 9, 2011 and issued a final safety evaluation report (FSER, Agencywide Documents Access and Management System [ADAMS] accession number ML103470210). The NRC staff also issued a standard design approval (SDA) via letter to GE Hitachi Nuclear Energy on March 9, 2011 (ADAMS accession number ML110540310). This SDA signified that the NRC staff reviewed the design and found the design met all applicable regulations.

In parallel with the SDA, the NRC staff began preparing a rulemaking to certify the design approved in the SDA. Based on the completion of its safety review, the NRC published a proposed rule on March 24, 2011 (77 FR 16549) that would certify the ESBWR design in Appendix E to 10 CFR Part 52.

In late 2011, while the NRC staff was preparing the final rule, issues were identified with the ESBWR steam dryer, which is a non-safety component. These issues called into question certain conclusions in the staff's safety review under the SDA. Resolution of these issues requires additional analyses by the applicant and review by the NRC staff in order for the NRC staff to conclude the design is acceptable for certification. The design certification rulemaking process is delayed pending resolution of these issues. If the additional analyses resolve the issues, certification, via publication of a final rule, is expected to be completed in 2013.

Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321 *et seq*.), directs that an EIS be prepared for major Federal actions that significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in Title 10 of the Code of Federal Regulations (CFR), Part 51. Further, in 10 CFR 51.20, the NRC has determined that the issuance of a COL under 10 CFR Part 52 is an action that requires an EIS.

The purpose of Detroit Edison's requested NRC action – issuance of the COL – is to obtain a license to construct and operate a new nuclear unit. This license is necessary but not sufficient for construction and operation of the unit. A COL applicant must obtain and maintain the necessary permits from other Federal, State, Tribal, and local agencies and permitting authorities. Therefore, the purpose of the NRC's environmental review of the Detroit Edison application is to determine if a new nuclear power plant of the proposed design can be constructed and operated at the Fermi site without unacceptable adverse impacts on the human environment. The objective of Detroit Edison's anticipated request for USACE action would be to obtain a decision on a permit application proposing structures and/or work in, over, or under navigable waters and/or the discharge of dredged or fill material into waters of the United States, including jurisdictional wetlands. Upon acceptance of the Detroit Edison application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing in the *Federal Register* (FR) a Notice of Intent (73 FR 75142) to prepare an EIS and conduct scoping. On January 14, 2009, the NRC held two scoping meetings in Monroe, Michigan, to obtain public input on the scope of the environmental review. To gather information and to become familiar with the sites and their environs, the NRC and its contractors, Argonne National Laboratory, Energy Research, Inc., and Ecology and Environment, Inc., visited the Fermi site in February 2009 and the four alternative sites, Belle River/St. Clair, Greenwood Energy Center, and two greenfield sites (Petersburg and South Britton sites) in January 2009.

During the Fermi site visit, the NRC staff, its contractors, and the USACE staff met with Detroit Edison staff, public officials, and the public. The NRC staff reviewed the comments received during the scoping process and contacted Federal, State, Tribal, regional, and local agencies to solicit comments. Included in this EIS are (1) the results of the review team's analyses, which consider and weigh the environmental effects of the proposed action (i.e., issuance of the COL) and of building and operating a new nuclear unit at the Fermi site; (2) mitigation measures for reducing or avoiding adverse effects; (3) the environmental impacts of alternatives to the proposed action; and (4) the staff's recommendation regarding the proposed action.

To guide its assessment of the environmental impacts of a proposed action or alternative actions, the NRC has established a standard of significance for impacts based on Council on Environmental Quality guidance (40 CFR 1508.27). Table B-1 of 10 CFR Part 51, Subpart A,

Appendix B, provides the following definitions of the three significance levels – SMALL, MODERATE, and LARGE:

> SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Mitigation measures were considered for each resource category and are discussed in the appropriate sections of the EIS.

In preparing this EIS, the NRC staff and USACE staff reviewed the application, including the Environmental Report (ER) submitted by Detroit Edison; consulted with Federal, State, Tribal, and local agencies; and followed the guidance set forth in NUREG-1555, *Environmental Standard Review Plan*. In addition, the NRC staff considered the public comments related to the environmental review received during the scoping process. Comments within the scope of the environmental review are included in Appendix D of this EIS.

A 75-day comment period began on October 28, 2011, when the U.S. Environmental Protection Agency (EPA) issued a FR Notice of Availability (76 FR 66925) of the draft EIS to allow members of the public to comment on the results of the environmental review. Two public meetings were held on December 15, 2011, at Monroe County Community College, in Monroe, Michigan. During these public meetings, the review team described the results of the NRC environmental review, answered questions related to the review, and provided members of the public with information to assist them in formulating their comments. The comment period for the draft EIS ended January 11, 2012. Comments on the draft EIS and the staff's responses are provided in Appendix E of this EIS.

The USACE issued LRE-2008-00443-1-S11 public notice for a 30-day review on December 23, 2011, describing the proposed USACE-regulated activities associated with the Fermi 3 project; proposed water of the United States avoidance and minimization plan and conceptual mitigation strategy; and USACE preliminary assessment of certain impacts. The purpose of the public notice was to solicit comments from the public; Federal, State, and local agencies and officials; Indian Tribes; and other interested parties in order to consider and evaluate the impacts of regulated activities within the USACE scope of analysis that are associated with the Fermi 3 project. The comments received during the public comment period are under review by USACE.

The NRC staff's recommendation to the Commission related to the environmental aspects of the proposed action is that the COL be issued as requested.[a] This recommendation is based on (1) the application, including the ER submitted by Detroit Edison and the applicant's supplemental letters and responses to the staff's Requests for Additional Information; (2) consultation with other Federal, State, Tribal, and local agencies; (3) the staff's independent review; (4) the staff's consideration of public comments related to the environmental review that were received during the scoping process and on the draft EIS; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and this EIS. The USACE will base its evaluation of Detroit Edison's permit application on items (1), (2), (4), and (5) listed above; USACE consideration of public comments received in response to the USACE public notice; the requirements of USACE regulations and the Clean Water Act Section 404(b)(1) Guidelines; and the USACE public interest review. The USACE's permit decision will be based, in part, on this EIS and will be made after issuance of the final EIS and completion of its permit application review and decision-making process.

The NRC staff's evaluation of the site safety and emergency preparedness aspects of the proposed action will be addressed in the NRC's Safety Evaluation Report anticipated to be published in the future.

(a) As directed by the Commission in CLI-12-16, NRC will not issue the COL prior to completion of the ongoing rulemaking to update the Waste Confidence Decision and Rule (see Section 6.1.6 of this EIS).

Abbreviations/Acronyms

χ/Q	dispersion values
°F	degree(s) Fahrenheit
ABWR	advanced boiling water reactor
ac	acre(s)
AC	alternating current
ACHP	Advisory Council on Historic Preservation
ADAMS	Agencywide Documents Access and Management System
ADG	ancillary diesel generator
ADT	average daily traffic
AEC	Atomic Energy Commission
AHS	Auxiliary Heat Sink
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
APE	area of potential effects
AQCR	Air Quality Control Region
Argonne	Argonne National Laboratory
AST	aboveground storage tank
ASLB	Atomic Safety and Licensing Board
AWEA	American Wind Energy Association
BA	Biological Assessment
BACT	Best Available Control Technology
BEA	Bureau of Economic Analysis (U.S. Department of Commerce)
BEIR	Biological Effects of Ionizing Radiation
BGEPA	Bald and Golden Eagle Protection Act of 1940
BIA	Bureau of Indian Affairs
BiMAC	basemat internal melt arrest and coolability
BMP	best management practice
Bq	Becquerel
Bq/MTU	Becquerel per metric ton uranium
BRC	Blue Ribbon Commission
Btu	British thermal unit(s)
BWR	boiling water reactor
CAA	Clean Air Act
CAES	compressed air energy storage
CAIR	Clean Air Interstate Rule

CCR	coal combustion residuals
CCRG	Commonwealth Cultural Resources Group, Inc.
CCS	carbon capture and sequestering/sequestration
CDC	Centers for Disease Control and Prevention
CDF	core damage frequency
CEQ	Council on Environmental Quality
CER	Capital Expenditure and Recovery
CFR	Code of Federal Regulations
cfs	cubic feet per second
cfu	colony forming units
CH_4	methane
CHP	combined heat and power
Ci	curie(s)
CIRC	Circulating Water System
CIS	containment isolation system
CN	Canadian National
CNF	Capacity Need Forum (MPSC)
CO	carbon monoxide
CO_2	carbon dioxide
CO_2-e	carbon dioxide-equivalent
COL	combined construction permit and operating license
CSAPR	Cross-State Air Pollution Rate
CSP	concentrated solar power
CSX	CSX Transportation
CT	combustion turbine
CWA	Clean Water Act
CWIS	Cooling Water Intake Structure
CZMA	Coastal Zone Management Act
DA	Department of the Army
dB	decibel
dBA	A-weighted decibel
DBA	design-basis accident
dbh	diameter at breast height
DC	direct current
DCD	Design Control Document
DDT	dichlorodiphenyltrichloroethane
Detroit Edison	Detroit Edison Company
DHS	U.S. Department of Homeland Security
DNL	equivalent continuous sound level

DNR	Designated Network Resource
DOC	U.S. Department of Commerce
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOT	Department of Transportation
D/Q	deposition factor
DRIWR	Detroit River International Wildlife Refuge
DSM	demand-side management
DTW	Detroit Metropolitan Wayne County Airport
DWSD	Detroit Water and Sewerage Department
E&E	Ecology and Environment, Inc.
EAB	Exclusion Area Boundary
EERE	U.S. Department of Energy Office of Energy Efficiency and Renewable Energy
EGS	engineered geothermal system
EIA	Energy Information Administration
EIS	environmental impact statement
ELF	extremely low frequency
EMF	electromagnetic field
EOP	emergency operating procedure
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
EPT	Ephemeroptera, Plecoptera, Trichoptera (index)
EPZ	emergency planning zone
ER	Environmental Report
ERI	Energy Research, Inc.
ESA	Endangered Species Act of 1973, as amended
ESBWR	Economic Simplified Boiling Water Reactor
ESRP	Environmental Standard Review Plan
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
Fermi	Enrico Fermi Atomic Power Plant
Fermi 1	Enrico Fermi Unit 1
Fermi 2	Enrico Fermi Unit 2
Fermi 3	Enrico Fermi Unit 3
FES	Final Environmental Statement
FIRM	Flood Insurance Rate Map
FIS	Financial Reporting and Analysis

FP	fire pump
fps	feet per second
FPS	Fire Protection System
FR	*Federal Register*
FSAR	Final Safety Analysis Report
FSER	Final Safety Evaluation Report
ft	foot (feet)
ft/day	feet per day
ft^3	cubic feet
FTE	full-time equivalent
FWS	U.S. Fish and Wildlife Service
FY	fiscal year
GAF	Generation and Fuel
gal	gallon
GBq	gigabecquerel
GC	gas centrifuge
GD	gaseous diffusion
GEH	General Electric-Hitachi Nuclear Energy Americas, LLC
GEIS	*Generic Environmental Impact Statement for License Renewal of Nuclear Plants*
GEIS-DECOM	*Generic Environmental Impact Statement for Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*
GHG	greenhouse gas
GIS	geographical information system
GLC	Great Lakes Commission
GLENDA	Great Lakes Environmental Database
GLOFS	Great Lakes Operational Forecast System
GLWC	Great Lakes Wind Council
gpd	gallon(s) per day
gpm	gallon(s) per minute
GWh	gigawatt hour(s)
GWP	global warming potential
ha	hectare
HAP	hazardous air pollutant
HCMA	Huron-Clinton Metropolitan Authority
HDR	hot dry rock
HEPA	high-efficiency particulate air
HFC	hydrofluorocarbon

HFE	hydrofluorinated ether
HLW	high-level waste
HQUSACE	U.S. Army Corps of Engineers Headquarters
hr	hour(s)
HRSG	heat recovery steam generator
HUD	U.S. Department of Housing and Urban Development
HVAC	heating, ventilating, and air-conditioning
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
IEEE	Institute of Electrical and Electronics Engineers
IGCC	integrated gasification combined cycle
IGLD 85	International Great Lakes Datum of 1985
IJC	International Joint Commission
in.	inch(es)
INAC	Indian and Northern Affairs Canada
IOU	investor-owned utility
IPCC	Intergovernmantal Panel on Climate Change
IPCS	Integrated Plant Computer System
IPP	independent power producer
IRP	Integrated Resource Plan
ISD	Intermediate School District
ISFSI	Independent Spent Fuel Storage Installation
ITC	ITC Holdings Corporation
JPA	Joint Permit Application
kg	kilogram(s)
KiKK	Childhood Cancer in the Vicinity of Nuclear Power Plants (German acronym)
km	kilometer(s)
km^2	square kilometer(s)
kV	kilovolt(s)
kW	kilowatt(s)
kWh	kilowatt hour(s)
L	liter(s)
L_{90}	sound level exceeded 90 percent of the time
LaMP	Lakewide Management Plan
lb	pound(s)
L_{dn}	day-night average sound level
LEDPA	least environmentally damaging practicable alternative

LEOFS	Lake Erie Operational Forecast System
L_{eq}	equivalent continuous sound level
LET	Lake Erie Transit
LFA	Load Forecasting Adjustment
LLW	low-level waste
LOLE	Loss of Load Expectation
LOLP	Loss-of-Load Probability
LOS	level of service
LPZ	low population zone
LRF	large release frequency
LTRA	Long-Term Reliability Assessment (NERC)
LW	long wave
LWR	light water reactor
µg	microgram(s)
m	meter(s)
m^3	cubic meter(s)
MACCS2	MELCOR Accident Consequence Code System
MBTA	Migratory Bird Treaty Act of 1918
MCCC	Monroe County Community College
mCi	millicurie
MCL	maximum contaminant level; Michigan Compiled Laws
MCRC	Monroe County Road Commission
MDCH	Michigan Department of Community Health
MDCT	mechanical draft cooling tower
MDELEG	Michigan Department of Energy, Labor and Economic Growth
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MDOT	Michigan Department of Transportation
MDSP	Michigan Department of State Police
MEI	maximally exposed individual
METC	Michigan Electric Transmission Company
mGy	milliGray
MGD	million gallons per day
mi	mile(s)
mi^2	square mile(s)
MichCon	Michigan Consolidated Gas Company
MISO	Midwest Independent System Operator
MIT	Massachusetts Institute of Technology
mL	milliliter(s)
MMT	million metric tons

$MMTCO_2$-e	million metric tons of carbon dioxide equivalent
MNFI	Michigan Natural Features Inventory
mo	month(s)
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
mph	mile(s) per hour
MPSC	Michigan Public Service Commission
mrad	milliradian
mrem	millirem(s)
MSA	Metropolitan Statistical Area
MSW	municipal solid waste
MT	metric ton(s) (or tonne[s])
MTEP	MISO Transmission Expansion Plan
MTU	metric ton(s) of uranium
MW	megawatt(s)
MW(e)	megawatt(s) electrical
MW(t)	megawatt(s) thermal
MWd	megawatt-day(s)
MWd/MTU	megawatt-day(s) per metric ton of uranium
MWh	megawatt hour(s)
NAAQS	National Ambient Air Quality Standard
NACD	Native American Consultation Database
NaCl	sodium chloride
NAGPRA	Native American Graves Protection and Repatriation Act of 1990
NAS	National Academy of Sciences
NAVD 88	North American Vertical Datum of 1988
DCDC	National Climate Data Center
NCI	National Cancer Institute
NCRP	National Council on Radiation Protection and Measurements
NDCT	natural draft cooling tower
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act of 1969, as amended
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NESHAP	National Emission Standards for Hazardous Air Pollutants
NF_3	nitrogen trifluoride
NGCC	natural gas combined-cycle
NHPA	National Historic Preservation Act of 1966, as amended
NIEHS	National Institute of Environmental Health Sciences
NMFS	National Marine Fisheries Service

NML	noise monitoring location
NNW	north-northwest
N_2O	nitrous oxide
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxide
NPDES	National Pollutant Discharge Elimination System
NPHS	normal power heat sink
NPS	National Park Service
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
NREPA	Natural Resources and Environmental Protection Act
NRHP	*National Register of Historic Places*
NS	Norfolk Southern
NSPS	New Source Performance Standard
NSR	new source review
NTC	Nuclear Training Center
NTU	nephelometric turbidity unit
NWI	National Wetland Inventory
NWIS	National Water Information System
NWR	National Wildlife Refuge
O_3	ozone
ODCM	Offsite Dose Calculation Manual
ODNR	Ohio Department of Natural Resources
OGS	off-gas system
OSHA	Occupational Safety and Health Administration
PAM	primary amebic meningoencephalitis
PAP	personnel access portal
Pb	lead
PC	personal computer
PCB	polychlorinated biphenyl
pCi/L	picocurie(s) per liter
PCTMS	Plant Cooling Tower Makeup System
PEM	palustrine emergent marsh
PESP	Pesticide Environmental Stewardship Program
PFC	perfluorocarbon
PFO	palustrine forested wetland
P-IBI	Planktonic Index of Biotic Integrity

PIPP	Pollution Incident Prevention Plan
PJM	PJM Interconnection
PM	particulate matter
$PM_{2.5}$	particulate matter with a mean aerodynamic diameter of less than or equal to 2.5 µm
PM_{10}	particulate matter with a mean aerodynamic diameter of less than or equal to 10 µm
PRA	probabilistic risk assessment
PRB	Powder River Basin
PSD	Prevention of Significant Deterioration
psia	pounds per square inch absolute
PSR	Physicians for Social Responsibility
PSS	palustrine scrub-shrub wetland
PSWS	Plant Service Water System
PTE	potential to emit
Pu-239	plutonium-239
PV	photovoltaic
PWSS	pretreated water supply system
RAI	Request for Additional Information
RCRA	Resource Conservation and Recovery Act of 1976, as amended
RDF	refuse-derived fuel
REIRS	Radiation Exposure Information and Reporting System
rem	roentgen equivalent man
REMP	radiological environmental monitoring program
RESA	Regional Educational Service Agency
RFC	Reliability*First* Corporation
RHAA	Rivers and Harbors Appropriation Act of 1899
RHR	residual heat removal
RIMS II	Regional Input-Output Modeling System
ROI	region of interest
ROW	right-of-way
RPS	Renewable Portfolio Standard
RRD	Remediation and Redevelopment Division
RSICC	Radiation Safety Information Computational Center
RTO	Regional Transmission Organization
RTP	Regional Transportation Plan
RV	recreational vehicle
Ryr	reactor-year

SACTI	Seasonal/Annual Cooling Tower Impact
SAMA	severe accident mitigation alternative
SAMDA	severe accident mitigation design alternative
SAMG	severe accident management guidelines
SBO	station blackout
SCPC	supercritical pulverized coal
SCR	selective catalytic reduction
SDA	standard design approval
SDG	standby diesel generator
sec	second(s)
SEGS	Solar Energy Generating System
SEMCOG	Southeast Michigan Council of Governments
SER	Safety Evaluation Report
SESC	soil erosion and sedimentation control
SF_6	sulfur hexafluoride
SHPO	State Historic Preservation Office(r)
SO_2	sulfur dioxide
SO_x	sulfur oxides
SOARCA	State-of-the-Art Reactor Consequence Analyses
SRHP	*State Register of Historic Places*
SRREN	Special Report on Renewable Energy Sources and Climate Change Mitigation
SSC	system, structure, and component
SSE	safe shutdown earthquake ground motion
STG	steam turbine generator
STORET	Storage and Retrieval Database
SUV	sport-utility vehicle
Sv	sievert
SWMS	solid radioactive waste management system
SWPPP	Stormwater Pollution Prevention Plan
SWS	Station Water System
TDS	total dissolved solids
TEDE	total effective dose equivalent
THPO	Tribal Historic Preservation Office
TI	Temporary Instruction
TIP	Transportation Improvement program
TLD	thermoluminescent dosimeter
TMDL	total maximum daily load
TRAGIS	Transportation Routing Analysis Geographic Information System
TRU	transuranic

U.S.	United States
USC	United States Code
U_3O_8	triuranium octoxide (“yellowcake”)
UF_6	uranium hexafluoride
UMTRI	University of Michigan Transportation Research Institute
UO_2	uranium dioxide
USACE	U.S. Army Corps of Engineers
USBLS	U.S. Bureau of Labor Statistics
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
VIB	Vehicle Inspection Building
VOC	volatile organic compound
WHO	World Health Organization
WNW	west-northwest
WPSCI	Wolverine Power Supply Cooperative, Inc.
WRA	Wind Resource Area
WTE	waste-to-energy
WWSL	wastewater stabilization lagoon
WWTP	wastewater treatment plant
yd^3	cubic yard(s)
yr	year(s)

7.0 Cumulative Impacts

The National Environmental Policy Act of 1969, as amended (NEPA), requires Federal agencies to consider the cumulative impacts of proposals under its review. Cumulative impacts may result when the environmental effects associated with the proposed action are overlain on or added to temporary or permanent impacts associated with past, present, and reasonably foreseeable future projects.

Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. In its proposal for a new nuclear unit at the Enrico Fermi Atomic Power Plant (Fermi) site, Detroit Edison Company (Detroit Edison) submitted a combined license (COL) application, including an Environmental Report (ER), to the U.S. Nuclear Regulatory Commission (NRC). When evaluating the potential impacts of building and operating a new unit (Fermi 3), the NRC and the U.S. Army Corps of Engineers (USACE) review team considered potential cumulative impacts on resources that could be affected by the preconstruction, construction, and operation of one General Electric-Hitachi, LLC (GEH) Economic Simplified Boiling Water Reactor (ESBWR) at the Fermi site located on the western shore of Lake Erie approximately 30 mi southwest of Detroit, Michigan, and 7 mi from the United States-Canada border.

Cumulative impacts result when the effects of an action are added to or interact with other past, present, and reasonably foreseeable future effects on the same resources. For the purposes of this analysis, past actions are those that occurred prior to receipt of the COL application. Present actions are those related to resources and taken from the time of receipt of the COL application until the start of NRC-authorized construction of Fermi 3. Future actions are those that are reasonably foreseeable throughout the building and operating of Fermi 3, including its decommissioning. The geographical area over which the past, present, and future actions could contribute to cumulative impacts depends on the type of resource considered and is described individually for each resource. The review team considered, among other actions, the cumulative effects of Fermi 3 with current operations of Fermi Unit 2 (Fermi 2) on the Fermi site.

The approach for this environmental impact statement (EIS) is outlined in the following discussion. To guide its assessment of the environmental impacts of a proposed action or alternative actions, the NRC has established a standard of significance for impacts based on guidance developed by the Council on Environmental Quality (CEQ); see Title 40 of the Code of Federal Regulations (specifically, 40 CFR 1508.27). The three significance levels established by the NRC – SMALL, MODERATE, and LARGE – are defined as follows:

> SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The impacts of the proposed action, as described in Chapters 4 and 5, are combined in this chapter with those of other past, present, and reasonably foreseeable future actions in the general area surrounding the Fermi site that would affect the same resources as those affected by the proposed Fermi 3, regardless of what agency (Federal or non-Federal) or person undertakes such actions. These combined impacts are defined by the CEQ as "cumulative" in 40 CFR 1508.7 and include individually minor but collectively significant actions taking place over a period of time. It is possible that an impact that may be SMALL by itself could result in a MODERATE or LARGE impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the resource's overall decline.

The description of the affected environment in Chapter 2 serves as the baseline for the cumulative impacts analysis, including the effects of past actions. The incremental impacts related to construction activities that require NRC authorization (10 CFR 50.10(a)) are described and characterized in Chapter 4, and those related to operations are described and characterized in Chapter 5. These impacts are summarized for each resource area in the sections that follow. The level of detail is commensurate with the significance of the impact for each resource area.

This chapter includes an overall cumulative impact assessment for each resource area. NRC staff performed the cumulative impact analysis according to guidance provided in the staff memorandum "Addressing Construction and Preconstruction Activities, Greenhouse Gas Issues, General Conformity Determinations, Environmental Justice, Need for Power, Cumulative Impact Analysis, and Cultural/Historical Resources Analysis Issues In Environmental Impact Statements" (NRC 2011a). The specific resources and components that could be affected by the incremental effects of the proposed action and other actions in the same geographical area are assessed. This assessment includes the impacts of construction and operations for the proposed new unit as described in Chapters 4 and 5; impacts of preconstruction activities as described in Chapter 4; impacts of fuel cycle, transportation, and decommissioning as described in Chapter 6; and impacts from past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could affect the same resources as those affected by the proposed actions.

The team used information provided by Detroit Edison in the ER, Detroit Edison's responses to requests for additional information (RAIs) issued by the NRC and USACE staff, information from other Federal and State agencies, and information gathered during the scoping period and visits by the staff to the Fermi site to evaluate the cumulative impacts on resources affected by building and operating a new nuclear power plant at the site. To inform the cumulative analysis, the review team researched U.S. Environmental Protection Agency (EPA) databases for recent EISs within the region, used an EPA database of permits for water discharges (NEPAssist) in the geographic area, and used the www.recovery.gov Web site to identify projects in the area funded by the American Recovery and Reinvestment Act of 2009 (Public Law 111-5). Other actions and projects that were identified during this review and considered in the review team's independent analysis of the potential cumulative effects are described in Table 7-1.

7.1 Land Use

The description of the affected environment in Section 2.2 serves as a baseline for the cumulative impacts assessment in this resource area. As described in Section 4.1, the impacts of NRC-authorized construction on land use would be SMALL, and no further mitigation would be warranted. As described in Section 5.1, the review team concludes that the effects of operations on land use would be SMALL, and no further mitigation would be warranted.

The combined impacts from preconstruction and construction activities on land use are described in Section 4.1 and were determined to be SMALL. In addition to the impacts from preconstruction, construction, and operations, the cumulative analysis also considers other past, present, and reasonably foreseeable future projects in the geographical area of interest that could affect land use (Table 7-1). For this cumulative analysis, the geographic area of interest is the area within 15 mi of the Fermi site. This geographic area of interest includes the primary communities, such as Frenchtown Township, that would be affected by the proposed Fermi 3 and its transmission lines.

Although mostly agricultural land surrounds the Fermi site, there are areas of residential development in the City of Monroe to the southwest of the plant, in the Stony Point area directly southeast of the Fermi site, along the Lake Erie shoreline, and to the north of the Fermi site near Swan Creek (Monroe County Planning Department and Commission 2010). The majority of the land west of the Fermi site is zoned for agricultural use. There are a number of industrial areas to the southwest of the site along the Lake Erie shoreline and in the City of Monroe, including the Detroit Edison Monroe Power Plant, the Automotive Components Holdings plant, and the Port of Monroe (Monroe County Planning Department and Commission 2010). Although land to the south of the site is anticipated to remain a low- and medium-density residential area, it is expected that the site will continue to be surrounded primarily by agricultural lands, open areas, and woodlands to the west and north for the foreseeable future (James D. Anulewicz Associates, Inc., and McKenna Associates, Inc. 2003). A farmland preservation and conservation program in Monroe County may prevent additional residential

Table 7-1. Past, Present, and Reasonably Foreseeable Future Projects and Other Actions Considered in the Cumulative Analysis (closest to furthest from the Fermi site)

Project Name	Summary of Project	Location	Status
Energy Projects			
Fermi Nuclear Power Plant Unit 2	1098-MW nuclear power plant	On Fermi site	Operational; current license expires March 20, 2025. On July 18, 2011, NRC received a notice of intent to submit a license renewal application for Fermi Unit 2 in 2014.[a]
Fermi Nuclear Power Plant Unit 1	Decommissioning and demolition of shutdown nuclear power plant	On Fermi site	In progress[b]
Independent Spent Fuel Storage Installation for Fermi 2	Dry spent-fuel storage	On Fermi site	Recently completed, but preoperational
Detroit Edison Monroe Power Plant	3280-MW coal-fired plant	6 mi southwest of Fermi site on Lake Erie	Operational, includes recent and planned refurbishment[c]
J.R. Whiting Power Plant, Luna Pier, Michigan	328-MW coal-fired plant	14 mi south-southwest of Fermi site on Lake Erie	Operational[d]
Bayshore Power Plant	499-MW coal-fired plant	20 mi south-southwest of Fermi site on Lake Erie in Maumee Bay	Operational[e]
Davis-Besse Nuclear Power Station Unit 1	925-MW nuclear power plant	27 mi southeast of Fermi site on Lake Erie	Operational[f]
Davis-Besse Independent Spent Fuel Storage Installation	Dry spent fuel storage	On Davis-Besse site	Operational[g]
Mining Projects			
Rockwood Quarry	Crushed and broken limestone quarry	2.5 mi north-northeast of Fermi site	Operational[h]
Stoneco Newport	Crushed and broken limestone quarry	2.5 mi north-northeast of Fermi site	Operational[i]
Sylvania Minerals	Crushed and broken limestone and crushed silica quarry	6 mi north-northwest of Fermi site	Operational[j]
Sora Limestone	Crushed and broken limestone quarry	6 mi north-northeast of Fermi site	Operational[k]

Table 7-1. (contd)

Project Name	Summary of Project	Location	Status
Mining Projects (contd)			
Stoneco Denniston	Crushed and broken limestone quarry	9 mi southwest of Fermi site	Operational[l]
Stoneco Maybee	Crushed and broken limestone quarry	13 mi west-northwest of Fermi site	Operational[m]
Sibley Quarry	Crushed and broken limestone quarry	14 mi north-northeast of Fermi site	Operational[n]
Transportation Projects			
Cleveland-Toledo-Detroit Passenger Rail Line	Addition to regional transportation hub with rail lines connecting Cleveland, Buffalo, Toronto, Pittsburgh, Cincinnati, and Detroit	Rail line would pass through Monroe County on its way to Detroit	Proposed; schedule undetermined[o]
Other Actions/Projects			
Berlin Township Wastewater Treatment Plant	Wastewater treatment plant that discharges to Swan Creek near its confluence with Lake Erie	1.1 mi northwest of Fermi site	Operational[p]
Frenchtown Township Water Plant	Water treatment plant that withdraws water from Lake Erie	2 mi southwest of Fermi site	Operational[q]
Monroe Metropolitan Wastewater Treatment Facility	Wastewater treatment plant that discharges to Lake Erie–Plum Creek–Levee Channel	6 mi southwest of Fermi site	Operational[r]
Ventower Industries	Wind turbine tower manufacturing facility	6 mi southwest of Fermi site in Monroe, Michigan	Operational[s]
Monroe Water Filtration Plant	Water treatment plant that withdraws water from Lake Erie	7 mi southwest of Fermi site	Operational
Carleton Wastewater Treatment	Wastewater treatment plant that discharges to Swan Creek	9 mi northwest of Fermi site	Operational[t]
Lazy Oak Sub Wastewater Treatment	Wastewater treatment plant that discharges to Swan Creek	9 mi northwest of Fermi site	Operational[u]
Guardian Industries Glass Plant	Manufacturing facility that discharges into Swan Creek	10 mi north-northwest of Fermi site	Operational[v]
Luna Pier Wastewater Treatment	Wastewater treatment plant that discharges to La Pointe Drain	14 mi south-southwest of Fermi site	Operational[w]
Rawsonville Woods Mobile Estates	Mobile home community with National Pollutant Discharge Elimination System (NPDES) permit	18 mi northwest of Fermi site	Operational[x]
Oil Refineries	Plants that refine crude oil for other applications	Various throughout region	Operational

Table 7-1. (contd)

Project Name	Summary of Project	Location	Status
Other Actions/Projects (contd)			
Future Urbanization	Construction of housing units and associated commercial buildings, roads, bridges, and rail; construction of water and/or wastewater treatment and distribution facilities and associated pipelines, as described in local land use planning documents (no specific data found on development and expansion of towns within 20 mi of site)	Throughout region	Construction would occur in the future, as described in State and local land use planning documents
Great Lakes Restoration Initiative	Restoration activities to address toxic substances, invasive species, nearshore health and nonpoint source pollution, and habitat and wildlife protection	Great Lakes watershed	Began in FY 2011[y]
Global Climate Change/ Natural Environmental Stressors	Short- or long-term changes in precipitation or temperature	Throughout region	Impacts would occur in the future

(a) Detroit Edison (2011d).
(b) NRC (2010a).
(c) EPA (2011c).
(d) Consumers Energy (2011).
(e) EPA (2011d).
(f) NRC (2011b).
(g) NRC (2010b).
(h) EPA (2011e).
(i) EPA (2011f).
(j) Our Good Neighbors (2011).
(k) EPA (2011g).
(l) EPA (2011h).
(m) EPA (2011i).
(n) EPA (2011j).
(o) MHR (2011).
(p) EPA (2011k).
(q) Frenchtown Charter Township (2010).
(r) EPA (2011l).
(s) Ventower (2011).
(t) EPA (2011m).
(u) EPA (2011n).
(v) EPA (2011o).
(w) EPA (2011p).
(x) EPA (2011q).
(y) EPA (2011a).

and other development from occurring on undeveloped land used for agriculture that is close to the Fermi site (Monroe County Planning Department and Commission 2010).

Most undeveloped lands on the site are managed as part of the Detroit River International Wildlife Refuge (DRIWR), which extends along the shore of Lake Erie from the River Raisin in the south to the Detroit River in the north and contains habitat for wildlife, including some wetland and water-dependent species (FWS 2010). There are proposals to add to the land included in the DRIWR; these additions to recreational and conservation land uses in the vicinity of the Fermi site would be small and would not be constrained by development and operation of Fermi 3. There are currently no plans to remove land elsewhere from the DRIWR.

As described in Sections 4.1 and 4.3, building Fermi 3 would affect more than 301 ac of land, including conversion of approximately 197 ac of naturally vegetated land to industrial/utility land, at the site and could also indirectly result in some conversions of offsite land to residential areas, roads, and businesses in order to accommodate growth, new workers, and services related to the proposed nuclear facility. Other reasonably foreseeable future projects in the geographic area of interest (see Table 7-1) – such as anticipated commercial waterfront development – would also contribute to reductions in the amount of open, forested, and wetland areas and to increases in residential areas, roads, and business; however, these projects are expected to be consistent with Monroe County's land use plans. Cumulative land use impacts within the 15-mi geographic area of interest are generally expected to be consistent with existing land use plans and zoning.

Detroit Edison anticipates that three new 345-kV transmission lines would be needed to serve Fermi 3. These lines would connect Fermi 3 to the Milan Substation and would likely follow a single 29.4-mi route in Monroe County, southwest Wayne County, and southeast Washtenaw County (Detroit Edison 2011a). Approximately 18.6 mi of the route would follow an established transmission line corridor, and approximately 10.8 mi of the route would cross undeveloped rural land. The applicant also expects to have to expand the Milan Substation. Assuming that a 300-ft-wide right-of-way (ROW) would be required, approximately 1069 ac would be used for the proposed lines, approximately 19 ac would be needed to expand the Milan Substation, and additional acreage would be needed for laydown and other activities (Detroit Edison 2011a). Land use impacts resulting from these activities are expected to be minimal. Although the precise areas of impact are not yet known, these activities would result in the loss of small areas of forests, agricultural lands, wetlands, and streams. Once the lines were installed, only the land around the transmission tower bases would be unavailable for future agricultural use, and any forested areas that are cleared to establish the corridor would have to remain cleared over the operation life of the transmission lines. At this time, it is not known whether other utility transmission lines might be developed in the area that could contribute to cumulative impacts.

Climate change could increase precipitation and lake storm surges in the geographic area of interest (USGCRP 2009), thus changing land use as a result of the inundation of low-lying areas along the lakeshore. The rate of forest growth and growth of other vegetation may increase as a result of more carbon dioxide in the atmosphere (USGCRP 2009). In addition, climate change could change crop yields and livestock productivity (USGCRP 2009), which might alter the characteristics of land used for agriculture in the geographic area of interest. Changes resulting from climate change could cause minor shifts in land use in the geographic area of interest, which might be exacerbated by the operation of Fermi 3.

Over the expected operational life of Fermi 3, few reasonably foreseeable future land use changes, other than gradually continuing urbanization and minor changes resulting from climate change, are anticipated, including the impacts from building and operating Fermi 3. Therefore, the review team concludes that the cumulative land use impacts would be SMALL, and no mitigation would be warranted.

7.2 Water Use and Quality

This section analyzes the potential cumulative impacts of the proposed Fermi 3 in addition to other past, present, and reasonably foreseeable future projects on water use and water quality.

7.2.1 Surface Water Use

The description of the affected environment in Section 2.3 of this document serves as the baseline for the cumulative impact assessments in this resource area. As described in Section 4.2, the NRC staff concludes that the impacts of NRC-authorized construction activities on surface water use would be SMALL, and no further mitigation would be warranted. The combined surface water use impacts from preconstruction and construction activities are described in Section 4.2.2.1 and were determined by the review team to be SMALL. As described in Section 5.2, the review team concludes that the impacts of operations on surface water use would also be SMALL, and no further mitigation would be warranted.

In addition to the impacts from preconstruction, construction, and operations, the cumulative analysis for surface water use also considers other past, present, and reasonably foreseeable future actions that could potentially affect this resource (Table 7-1). For the cumulative analysis of impacts on surface water, the geographic area of interest is considered to be within a 15-mi radius surrounding the intake and discharge structures, as it is a bounding estimate of the geographical extent of potential impacts of Fermi 3 on surface water due to the significant water supply available in Lake Erie.

As described in Section 5.2.2.1, the review team determined that the annual consumptive use of surface water from the operation of Fermi 3 would not be significant compared to the relative volume of water in Lake Erie (0.006 percent), and it would also remain a small portion of the average annual consumptive water use of all users in the Lake Erie basin (4.1 percent). The impacts would be minor within the geographic area of interest's 15-mi radius. The predominant surface water user within a 15-mi radius of the Fermi site is Fermi 2, and its withdrawals would not noticeably alter surface water availability. There are also two water intakes on Lake Erie and in the vicinity of the Fermi site for public water supply: the Frenchtown Water Plant, which uses 8 million gallons per day (MGD), and the Monroe County Water Plant, which uses 7.5 MGD (Frenchtown Charter Township 2010; AWWA 2009). The impacts of these two water plants and the other projects listed in Table 7-1 are considered in the analysis in Sections 4.2 and 5.2 and would not be detectable or would be so minor that they would not affect surface water use.

The review team also evaluated the impact of potential climate changes on water availability, as well as the cumulative impact that climate change and reactor operations could have on the availability of water resources for other uses. A recent compilation of the state of the knowledge on climate change (USGCRP 2009) was considered during the preparation of this EIS. The USGCRP report and a related study for the Great Lakes (Hayhoe et al. 2010) discuss projected changes in the climate for the region during the operating license period for Fermi 3 (estimated to be from 2020 to 2060) based on a range of CO_2 emissions scenarios simulated using the NOAA Great Lakes model. The lowest of these potential emission scenarios (B1) predicts a maximum CO_2 air concentration of 550 ppm by 2100 (roughly double pre-industrial levels), resulting in a slight increase in average air temperature but little to no significant change in Lake Erie water levels due to a corresponding increase in precipitation. The highest-emissions scenario (A1Fi) predicts a maximum CO_2 air concentration of 940 ppm by 2100 (about four times pre-industrial levels), resulting in noticeable impacts on both average air temperature and lake volume.

The predicted impacts of the highest emissions scenario include an increase in average temperature of at least 3–4°F by the end of the operating license period of Fermi 3 (about 2060) and a slight increase in precipitation in the winter and spring. Rainstorms are anticipated to be more intense throughout the year. Average water levels in Lake Erie could decrease as much as 1.5 ft because of increased evaporation of the lake, which would cause a decrease of up to 2 percent of the volume of Lake Erie. If the water volume in Lake Erie were to be reduced by 2 percent, its volume could noticeably decline from 128 trillion gallons to 125 trillion gallons. In addition, the increase in the average air temperature when combined with lower lake levels could result in an increase in the average monthly water temperature of Lake Erie.

The review team used projected population estimates presented in Section 2.5.1 of the ER and the reported water use in Monroe County as presented in the ER to estimate future water use in Monroe County by 2060. Assuming that per capita water use remains in the range of current amounts and population increases by 76 percent by 2060 (Detroit Edison 2011a) the quantity of Lake Erie water used for the public water supply in Monroe County would increase from approximately 12 MGD in 2000 to 21 MGD by 2060. The review team was not aware of studies estimating potential future water use from the Lake Erie basin between 2020 and 2060. Detroit

Cumulative Impacts

Edison (2011a) estimates of population growth indicate an increase of approximately 40 percent by 2060 within a 50-mi radius of Fermi 3. The review team used the projected population growth estimates and assumed that per capita water use (for all uses) remains in the range of present amounts to estimate total future use of Lake Erie water by 2060. If Lake Erie water use were to increase by 40 percent above the average water use observed from 2000 through 2006, then the total water use would be approximately 75,600 MGD, with a consumptive use of approximately 702 MGD. On an annual basis, a consumptive use of 702 MGD would be approximately 0.2 percent of the Lake Erie volume, if reduced by the effects of climate change to 125 trillion gallons.

Potential increases in Lake Erie water temperature resulting from climate change could increase the amount of cooling water needed for operation of the proposed Fermi 3 and other major users. Therefore, the operations of Fermi and other thermoelectric plants on Lake Erie could be altered as a result of climate change. If the volume of Lake Erie water decreased by 2 percent as a result of climate change, then the annual consumptive water use by Fermi 3 would still be negligible (approximately 0.006 percent of the total lake volume) even if the monthly average use increased significantly. The review team considered the cumulative consumptive use of surface water from the operation of the existing Fermi 2, proposed Fermi 3, and other (existing or reasonably foreseeable) consumptive uses and the potential effects of climate change. The greatest potential future impact on Lake Erie water availability is predicted to be from climate change. The impact predicted for the lowest-emissions scenario would not be detectable or would be so minor that it would not noticeably alter the availability of water from Lake Erie. However, if CO_2 emissions follow the trend evaluated in the highest-emissions scenario, the cumulative effects on the quantity of surface water in Lake Erie may be detectable and may noticeably alter the availability of water in the lake, resulting in the potential for water-use restrictions and less water availability. On the basis of its evaluation, the review team concludes that the potential impacts of both increased future use (assuming constant per capita use and projected population increase) and climate change on surface water quantity in Lake Erie would be SMALL to MODERATE. A SMALL impact would be expected under the condition of minimal climate change associated with the lowest-emissions scenario. A MODERATE impact would be expected under the highest-emissions scenario, which is expected to produce the highest increases in air and water temperatures. These increases in air and water temperature could noticeably alter water levels but would not do so to the point that the resource and surrounding environment become destabilized. However, the cumulative impacts of building and operating Fermi 3 would not contribute significantly to the overall cumulative impacts in the geographical area of interest. The incremental increases in water use by Fermi 3 and other present and foreseeable future uses (other than the effects of climate change) should not noticeably reduce the quantity of water within Lake Erie. The potentially increased water temperature in Lake Erie that may result from climate change could also increase the amount of cooling water needed for operation of the proposed Fermi 3 and other major users, although these effects are not expected to be significant. Therefore, the incremental impacts from NRC-authorized activities would be SMALL, and no further mitigation would be warranted.

7.2.2 Groundwater Use

The description of the affected environment in Section 2.3 of this document serves as the baseline for the cumulative impact assessments in this resource area. As described in Section 4.2, the NRC staff concludes that the impacts of NRC-authorized construction activities on groundwater use would be SMALL, and no further mitigation would be warranted. As described in Section 5.2, the review team concludes that the impacts of operations on groundwater use would also be SMALL, and no further mitigation would be warranted.

The combined groundwater use impacts from preconstruction and construction were described in Section 4.2.2 and were determined to be SMALL. In addition to the impacts from preconstruction, construction, and operation, the cumulative analysis also considers past, present, and reasonably foreseeable future actions that could affect groundwater use. For this analysis, the geographic area of interest affected by dewatering for preconstruction and construction activities is considered to be the local aquifer in the overburden unit and the Bass Islands Group aquifer in the vicinity of the Fermi site (within 15 mi). From a local standpoint, changes within the overburden unit would not affect any other groundwater users.

From a regional standpoint, the Bass Islands Group aquifer is tapped for public water supply, industrial use, thermoelectric power facilities, agricultural irrigation, golf course irrigation, and dewatering for quarry mining operations. Approximately 75 percent of groundwater withdrawn in Monroe County is for quarry dewatering operations (Reeves et al. 2004). In the past, groundwater flow within the Bass Islands Group aquifer flowed to the east toward Lake Erie; however, in the vicinity of the Fermi site, groundwater flow within the Bass Islands Group aquifer has reversed to flow toward mining quarry dewatering operations (toward Sylvania Minerals and Stoneco Denniston Quarry listed in Table 7-1). Groundwater elevations in the vicinity of the Fermi site have declined between 10 and 15 ft since the early 1990s as a result of dewatering for offsite quarry operations elsewhere in Monroe County (Reeves et al. 2004). Detroit Edison (2011a) used U.S. Geological Survey values (from Reeves et al. 2004) for groundwater withdrawals within Monroe County and in adjacent Wayne County that will affect groundwater levels within Monroe County to estimate total freshwater groundwater withdrawals in Monroe County. It estimated that withdrawals would increase from about 28 MGD in 2000 to 49 MGD in 2060. In Monroe County, 0.8 percent of the total water use in 2000 was from groundwater.

During preconstruction and construction activities, dewatering operations would temporarily lower groundwater levels in the vicinity of the Fermi site. The overburden unit is not used at the Fermi site or the area immediately surrounding the site, because of its low yield and spatial discontinuity. The unit is assumed to be in direct contact with Lake Erie in many places; consequently, it is unlikely that there would be a noticeable drawdown in the unit outside of the construction area. In addition, slurry walls will be in place around the dewatering operation, and dewatering wells will only pump from the Bass Islands Group aquifer. Groundwater wells that could be affected by drawdown from dewatering during the building of Fermi 3 are nearby household wells, irrigation wells, and other wells (Detroit Edison 2011a). According to modeling scenarios, it is estimated that at a distance of 1.5 mi from the Fermi site, the largest drawdown would occur 1 ft below current water levels (Detroit Edison 2011a). The offsite well with the highest amount of drawdown is a domestic water supply well located about 3800 ft from the center of the power block area where drawdown would be up to 2 ft, according to modeling scenarios. In addition, groundwater dewatering activities are not expected to affect onsite wetlands, since they are hydraulically connected to Lake Erie.

Given that (1) the proposed Fermi 3 would not use groundwater for operations, (2) there would be no discharges to groundwater from Fermi 3, and (3) temporary dewatering operations during preconstruction and construction activities would have limited spatial effect and would not affect the overall productivity of the Bass Islands Group aquifer, the review team determined that the potential impacts on groundwater use from building and operating Fermi 3 would be minimal. In addition, the review team concluded that the cumulative groundwater use impacts would be SMALL. The incremental impacts from NRC-authorized activities would be SMALL, and no further mitigation would be warranted.

7.2.3 Surface Water Quality

The description of the affected environment in Section 2.3 serves as the baseline for the cumulative impact assessments in this resource area. As described in Section 4.2.3.1, the NRC staff concludes that the impacts of NRC-authorized construction activities on surface water quality would SMALL, and no further mitigation would be warranted. As described in Section 5.2.3.1, the review team concludes that the impacts of operations on surface water quality would also be SMALL, and no further mitigation would be warranted.

The combined surface water quality impacts from preconstruction and construction are described in Section 4.2.3.1 and were determined to be SMALL. In addition to the impacts from preconstruction, construction, and operations, the cumulative analysis for surface water quality also considers other past, present, and reasonably foreseeable future actions that could potentially affect this resource. Because water within the western basin of Lake Erie is well mixed, water quality within the entire western basin could be affected by construction and operation of the proposed Fermi 3. Consequently, the geographic area of interest for surface water quality is the entire western basin of Lake Erie.

The western basin of Lake Erie near the proposed Fermi 3 receives input from two major streams: the Detroit River to the north and the River Raisin to the south. The Detroit River contributes approximately 80 percent of the inflows to Lake Erie. The Maumee River further south, however, is a major sediment source for Lake Erie and contributes the highest amount of suspended solids per year of any other tributary to the Great Lakes (Bridgeman 2006). Sediment carried by the Maumee River is deposited in the Toledo Harbor. This sediment is currently dredged at an average rate of 850,000 tons per year by the USACE to maintain an important shipping channel (USACE 2009). The majority of dredge spoils from this procedure are disposed of in an existing two-square-mile placement area at the western basin north of the location of the shipping channel (USACE 2009). A recently completed study found that there was no significant environmental impact of this open water disposal (USACE 2009).

The current water quality in the western basin of Lake Erie is primarily influenced by these streams but also includes the impacts from operations of industrial facilities, wastewater treatment plants, and thermoelectric energy generating facilities (including Fermi 2) in the region, which are listed in Table 7-1.

Point and non-point sources of pollution have affected the water quality of the western basin of Lake Erie. The two main water quality concerns in Lake Erie are (1) increased phosphorus loading from regional agricultural activities causing toxic algal blooms, and (2) elevated concentrations of the bioaccumulative contaminants – such as dioxin, polychlorinated biphenyls (PCBs), and mercury – occurring mostly as a result of historical industrial activities (Hartig et al. 2007; Brannan 2009).

The EPA's Great Lakes National Program Office has initiated the Great Lakes Restoration Initiative program, a consortium of 11 Federal agencies that developed an action plan to address environmental issues. These issues fall into five areas: cleaning up toxics and areas of concern, combating invasive species, promoting nearshore health by protecting watersheds from polluted run-off, restoring wetlands and other habitats, and tracking progress and working with strategic partners. The results of this long-term initiative would presumably address water quality concerns in Lake Erie.

The review team also evaluated the impact of potential climate changes on water quality as well as the cumulative impact climate change and reactor operations could have on the quality of water resources for other uses. As mentioned in Section 7.2.1, potential climate change scenarios discussed in a recent compilation of the state of the knowledge in this area (USGCRP 2009) and a related study for the Great Lakes (Hayhoe et al. 2010) were considered during the preparation of this EIS. As these studies indicate, both the lowest (B1) and highest (A1Fi) CO_2 emissions scenarios are predicted to increase air and lake temperatures, with the greatest increase predicted if CO_2 emissions rate follow the highest-emissions scenario.

By the end of the operating license period of Fermi 3 (about 2060) annual average air temperatures are projected to have increased by at least 2–3°F under the lower-emissions scenario and 3–4°F under the higher-emissions scenario. This increase could result in a slight increase in precipitation in the winter and spring. Rainstorms are anticipated to be more intense throughout the year. Higher-intensity precipitation events could lead to increased erosion and sediment loading in Lake Erie tributaries and thus increase sediment loading in Lake Erie itself. Sediment loading, phosphorus loading, and the concentrations of bioaccumulative contaminants within Lake Erie could also be exacerbated by the lowered lake levels resulting from the highest temperature increase, given that less dilution would take place with lower lake levels. Climate change scenarios indicate that while the changes in the surface water quality of Lake Erie that result from climate change may be noticeable, they would not be destabilizing.

The size of the thermal plume created by Fermi 3 discharge would increase slightly if lake levels were to decrease as a result of climate change (where reductions are projected to be as much as 1.5 ft). This decrease in lake levels would result in a larger mixing zone, which would be regulated by the Michigan Department of Environmental Quality (MDEQ). The thermal plume modeling using the CORMIX model was discussed in Section 5.2. Input data for the CORMIX simulations included discharge rate, discharge temperature, water depth, ambient lake temperature, and ambient lake current velocity and direction. Both the ambient lake temperature and the ambient lake current inputs were derived from Lake Erie Operational Forecast System (LEOFS) model estimates. LEOFS is a National Oceanic and Atmospheric Administration (NOAA) project and is a part of the Great Lakes Operational Forecast System (GLOFS). The thermal plume analysis included a scenario with a Lake Erie water depth of 7.0 ft, which is 1.5 ft below the average depth for the month associated with the largest thermal plume (May). This scenario estimated that the plume would be about 55,300 square feet, a small fraction of the western basin of Lake Erie. The thermal plume of the existing Fermi 2 would also increase with lower lake levels. The increase in the average air temperature combined with lower lake levels could lead to an increase in the average monthly temperature of Lake Erie, further leading to an increase in the average monthly use of cooling water by the proposed Fermi 3 and existing Fermi 2. Increases in cooling water use would result in a slightly larger volume of heated water discharged back into Lake Erie and would therefore further increase the size of thermal plumes. However, the thermal impacts attributable to Fermi 3 would remain minor within the western basin of Lake Erie.

Surface water quality impacts include sediment loading, and thermal and chemical discharges from the proposed Fermi 3. Thermal and chemical (i.e., biocides, metal and organic compounds) discharges from Fermi 3 would be required to meet applicable NPDES permit requirements, health standards, regulations, and total maximum daily loads (TMDLs) mandated by MDEQ and EPA (Detroit Edison 2011a). On the basis of its evaluation, the review team concluded that the cumulative impacts on surface water quality would be MODERATE; however, the cumulative impacts of building and operating Fermi 3 would not contribute significantly to the overall cumulative impacts in the geographical area of interest. Therefore, the incremental impacts from NRC-authorized activities would be SMALL, and no further mitigation would be warranted.

7.2.4 Groundwater Quality

The description of the affected environment in Section 2.3 serves as the baseline for the cumulative impact assessments in this resource area. As described in Section 4.2, the NRC staff concludes that the impacts of NRC-authorized construction activities on groundwater quality would be SMALL, and no further mitigation would be warranted. As described in Section 5.2, the review team concludes that the impacts of operations on groundwater quality would also be SMALL, and no further mitigation would be warranted.

The combined impacts on groundwater quality from preconstruction and construction activities were described in Section 4.2.3 and determined to be SMALL. In addition to the impacts from preconstruction, construction, and operations, the cumulative analysis also considers past, present, and reasonably foreseeable future actions that could affect groundwater quality. For this analysis, the geographic area of interest is considered to be the local aquifer in the overburden unit and the Bass Islands Group aquifer in the 15-mi region surrounding the proposed Fermi 3. As mentioned in Section 7.2.2, groundwater would not be used for operation of Fermi 3.

The overburden unit is not used at the Fermi site or the area immediately surrounding the site because of its low yield and spatial discontinuity. Any impacts on the quality of this aquifer at the Fermi site from activities associated with the preconstruction and construction of Fermi 3 would not affect this resource regionally. During site preparation, construction activities, and operation of the proposed Fermi 3, it is possible that spills could transport pollutants (e.g., gasoline) to groundwater in the overburden unit. Adherence to good housekeeping rules and best management practices described in the Pollution Incident Prevention Plan (PIPP) would reduce impacts to groundwater quality. These practices include conducting an inventory of potential sources, performing preventative maintenance and inspections, posting signs and labels, and planning for secondary containment.

It is anticipated that during construction and operations, the impacts on groundwater quality would be localized and temporary, because there are no plans to use groundwater or to discharge waste to groundwater during construction or operations. No other projects listed in Table 7-1 would affect groundwater quality in the vicinity of the Fermi site; therefore, the review team concludes that cumulative impacts on groundwater quality would be SMALL, and no further mitigation would be warranted.

7.3 Ecology

This section addresses the cumulative impacts on terrestrial, wetland, and aquatic ecological resources from proposed Fermi 3 and past, present, and reasonably foreseeable future activities.

7.3.1 Terrestrial and Wetland Resources

The description of the affected environment in Section 2.4.1 provides the baseline for the cumulative impact analysis for terrestrial ecological resources (including wetlands). As described in Section 4.3.1, the NRC staff concludes that the impacts of NRC-authorized construction on terrestrial ecological resources would be SMALL to MODERATE, and no further mitigation other than that proposed by the applicant and discussed in Section 4.3.1.5 would be warranted. As described in Section 5.3.1, the review team concluded that the impacts of operations of Fermi 3 on terrestrial ecological resources would be SMALL to MODERATE and no further mitigation other than that proposed by the applicant and discussed in Section 5.3.1.5 would be warranted.

The combined impacts from preconstruction and construction of Fermi 3 on terrestrial ecological resources were described in Section 4.3.1 and determined to be SMALL to MODERATE. The potential for MODERATE cumulative impacts is limited to possible adverse effects of Fermi 3 on the eastern fox snake. The staff's evaluation of the potential impacts on the eastern fox snake recognizes the potential for mitigation measures proposed by Detroit Edison (Detroit Edison 2012a, b) and approved by the MDNR to significantly reduce impacts from Fermi 3 on that species, thereby leading to SMALL impacts, but acknowledges the possibility of MODERATE impacts if proposed mitigation is not implemented as described in their plan. Although the extent of wetland impacts (involving approximately 34.5 ac of temporary and permanent impacts) is noticeable, these unavoidable wetland impacts would be compensated for by reestablishing wetlands offsite and rehabilitating temporarily disturbed wetlands onsite. In addition to the impacts from Fermi 3 preconstruction, construction, and operation, the following cumulative analysis also considers other past, present, and reasonably foreseeable future actions that could affect the same terrestrial ecological resources. The geographic area of interest is considered to be a 50-mi radius around the Fermi 3 site (as defined in Section 2.4.1). This area is expected to encompass the ecologically relevant landscape features and species potentially affected by the proposed Fermi 3.

Current projects within the geographic area of interest that are potentially capable of affecting the same terrestrial ecological resources as Fermi 3 include the ongoing operation of Fermi 2, the ongoing decommissioning of Fermi 1, the Detroit Edison Monroe Power Plant, the Bayshore Power Plant, the J.R. Whiting Power Plant, three limestone quarries, and several wastewater treatment plants (see Table 7-1). Reasonably foreseeable future projects within the geographic area of interest that could affect the same terrestrial ecological resources include expanded regional commercial and residential development, operation of the recently constructed Ventower Industries manufacturing facility, and construction and operation of a proposed Cleveland-Toledo-Detroit passenger rail line. The Ventower facility was constructed recently on a former industrial site in the City of Monroe. Although ongoing commercial and residential development in the region would be expected to result in the loss of various habitats and wildlife, the review team is not aware of particular development proposals that may be planned.

The geographic area of interest is located primarily in the Lower Peninsula ecoregion and on the western Lake Erie shoreline. This ecoregion has been altered considerably since European settlement, primarily by agriculture and urbanization. Before settlement, most of the region was forested with a mix of oak and oak-hickory on loamy soils and a mix of black ash (*Fraxinus nigra*), white oak (*Quercus alba*), bur oak (*Q. macrocarpa*), and American basswood (*Tilia americana*) on wetter, clayey soils (Alpert 1995). The recent devastation of the ash tree population in the region because of the emerald ash borer (*Agrilus planipennis*) has also substantially altered the composition of the remaining forested habitats (Detroit Edison 2011a). Currently, the main uses for land in the area of interest are for row crops and other agricultural uses; industrial, commercial, and residential development; deciduous upland forest; and forested and emergent wetlands (Detroit Edison 2011a). Residential and commercial urbanization is ongoing within the geographic area of interest.

The geographic area of interest includes agricultural land, including row crops; open water, including part of Lake Erie and shallow lagoons within the Fermi site; developed land, especially in the Detroit metropolitan area; upland forests; and forested and emergent wetlands. As discussed in Section 2.4.1.3, none of the habitats that would be affected by Fermi 3 has been designated as “critical habitat” by the U.S. Fish and Wildlife Service.

7.3.1.1 Wildlife and Habitat

The impacts on terrestrial wildlife and habitats, including important species and wetlands, from preconstruction, construction, and operation of Fermi 3 are described in Section 4.3.1.

Operation of the recently constructed Ventower manufacturing facility on abandoned industrial land in the City of Monroe is not expected to have adverse terrestrial ecological impacts that would substantially add to impacts from building and operating Fermi 3. The proposed Cleveland-Toledo-Detroit passenger rail line would be built primarily within existing ROWs. New rail sidings and improvements to the existing ROW could potentially result in the clearing of vegetation adjoining existing trackbeds. The review team is not aware of specific design information about the project; nevertheless, impacts on ecological resources are expected to be mostly limited to areas within or adjacent to the existing ROW. Impacts from operation of the rail line are expected to be negligible. Consequently, the review team believes that cumulative impacts on terrestrial ecological resources from building and operating the rail line would be minimal and would not substantially add to terrestrial ecological impacts from Fermi 3.

Among the reasonably foreseeable future actions in the geographic area of interest that could adversely affect terrestrial ecological resources, continuing regional urbanization has the greatest potential to contribute to the adverse effects from Fermi 3 on those resources. Absent specific information about the location, extent, and design of future urban development, the review team draws general conclusions about the cumulative impacts on terrestrial ecological resources within the geographic area of interest. Urbanization could result in the conversion of some agricultural land, forest land, wetlands, and other wildlife habitat to urban uses. Urbanization-related activities, which usually involve the filling and/or draining of wetlands, operation of heavy equipment, and generation of noise from construction equipment, could result in many of the same terrestrial ecological impacts – including habitat loss from the clearing and grading of land (temporary and permanent), increased human activity in natural areas, increased traffic (resulting in increased wildlife mortality), and the spread of fugitive dust – as would the proposed action of building Fermi 3. Some of the effects of these activities, such as noise and dust, would be short term and localized in nature. The impacts caused by noise and dust would be temporary if routine best management practices are followed. Other effects, such as replacing wildlife habitat with urban features, would be permanent. The impacts from land clearing and grading, filling wetlands, increased human presence, and increased traffic would likely be permanent.

As temperatures increase under anticipated climate change, a long-term northward shift of plant species now associated with the southeastern United States could occur (USGCRP 2009). This shift could result in changes in the species composition of plant communities in the geographic area of interest. Higher temperatures could cause increased evaporation rates, which, along with the greater likelihood of drought, could reduce the extent of wetlands in the area. As discussed in Section 7.2.3, average annual air temperatures in the project area are projected to increase by between 2–3°F and 3–4°F by the year 2060 (USGCRP 2009). The review team concluded that the thermal impacts attributable to Fermi 3 would remain minor within the western basin of Lake Erie. Any effects on wetlands hydrologically connected to the western basin of Lake Erie would therefore similarly be minor. Impacts on forests could be mixed and represent a balance in which the benefits of higher levels of carbon dioxide might be offset by more frequent droughts and increases in destructive pests (USGCRP 2009). According to USGCRP (2009), “All major groups of [terrestrial] animals […] will be affected by impacts on local populations, and by competition from other species moving into the Midwest region.”

Building Fermi 3 could contribute to the impacts discussed above. However, much of the area affected by building Fermi 3 has already experienced disturbance by past site activities or would be restored after development. Disturbances to terrestrial habitats and wetlands in the proposed transmission corridor would be mostly limited to the loss of forest cover and some limited areas used for grading tower pads and access roads. Forested areas within the corridor would be converted to herbaceous or shrubby vegetation. Building Fermi 3 would permanently fill approximately 8.3 ac of wetland and temporarily affect 23.7 ac of wetland (Detroit Edison 2011b). The temporarily impacted wetlands would be rehabilitated. See Section 4.3.1 for additional discussion of wetlands impacts and mitigation.

As discussed in Section 4.3, preconstruction and construction activities would likely displace or destroy wildlife that inhabits affected areas. Other activities included in this cumulative analysis could affect wildlife in similar ways. In the case of some wildlife, including some individual State-listed eastern fox snakes and other Federally and State-listed species, displacement or mortality could occur during land clearing for any of the above projects. Local populations of wildlife would experience habitat loss, fragmentation, and competition for remaining resources. There would be a greater risk of mortality of less mobile animals, such as reptiles, amphibians, and small mammals, as a result of construction activities than there would be for more mobile animals, such as birds, many of which would be displaced to adjacent communities.

Wildlife would also be subjected to impacts from noise and traffic. Noise and traffic would result from other future development activities in the geographic area of interest, as well as from Fermi 3. The impact on wildlife from each noise-generating activity is expected to be temporary and minimal. Although the creation of new utility corridors, including but not limited to the proposed Fermi 3 transmission line corridors, could have negative effects on forest-dwelling birds, amphibians, reptiles, and other wildlife, some species might benefit, including those that inhabit early successional habitat or use forest-edge environments. Birds of prey that are more effective in hunting in open areas would likely exploit newly created hunting grounds.

The effects of the preconstruction and construction activities of Fermi 3 on wildlife would be limited to the Fermi site, transmission line corridors, and nearby areas. Because other reasonably foreseeable future projects would be widely dispersed in the geographic area of interest, the review team concludes that the cumulative impacts would be minimal, with the exception of wetland impacts discussed in Section 7.3.1.2.

As described in Section 5.3.1, potential operational impacts of Fermi 3 would include cooling-tower noise, salt drift from vapor plumes, bird collisions with tall structures, and transmission line operation and corridor maintenance. Even when combined with similar impacts from other past, present, and reasonably foreseeable future projects in the geographic area of interest, most would have only minimal impacts on wildlife and habitat, with the exception of the eastern fox snake impacts, as discussed in Section 7.3.1.2.

Among the past, present, and reasonably foreseeable future actions known to the review team, only future urbanization has the potential to substantially affect terrestrial ecological resources in a way similar to the operation of Fermi 3. Urbanization could lead to increases in noise, traffic, and human presence that could negatively affect some species, including the eastern fox snake, either indirectly by causing the species to avoid activities or directly through roadway mortality. Future urbanization in the region, however, is expected to be minimal. However, these impacts would be minor and dispersed and are not expected to be proximate enough to the Fermi site and transmission line to cumulatively affect terrestrial ecological resources on a substantial basis. The impacts of building or operating Fermi 3 are not expected to affect climate change on either an individual or cumulative basis with past, present, and reasonably foreseeable future projects in the geographic area of interest. However, the impacts on terrestrial habitats and wildlife from climate change could be detectable.

7.3.1.2 Important Species and Habitats

Important Species

Although the eastern fox snake, a State-listed species, may be adversely affected by preconstruction, construction, and/or operation of the Fermi 3 project, the project would not destabilize the regional population. Detroit Edison has prepared and submitted to the Michigan Department of Natural Resources (MDNR) the Fermi 3 Construction Habitat and Species Conservation Plan and the Fermi 3 Operational Conservation and Monitoring Plan for the eastern fox snake (Detroit Edison 2012a, b). The plans identify mitigation measures to protect the species and its habitat during preconstruction, construction, and operation of Fermi 3. The plans involve awareness training, education, signage, and other measures to reduce the likelihood of vehicular collisions with eastern fox snakes when using new and existing roadways on the Fermi site. Combined impacts from preconstruction, construction, and operation activities on the eastern fox snake could be regionally noticeable, but not destabilizing in the absence of mitigation; however, mitigation performed in accordance with the Construction Habitat and Species Conservation Plan prior to conducting site preparation, preconstruction, and construction activities and the Operational Conservation and Monitoring Plan during operations could reduce these impacts to minimal levels. The review team is not aware of other particular development proposals that may be planned and, consequently, cannot speculate on the locations, regulatory controls, and further effects on the eastern fox snake and its habitats beyond the areas covered by the Plans.

Small patches of the State-listed American lotus (State-listed as threatened) may be disturbed by preconstruction activities in emergent wetlands on the site. Detroit Edison has stated its intention to develop mitigation measures addressing American lotus before site preparation activities are initiated (Detroit Edison 2011a). Any future permits issued by the MDEQ and/or USACE involving wetlands are not likely to be granted without consideration of measures to prevent and mitigate adverse effects on Federal and State-listed species; consequently, future urbanization and other future projects are unlikely to contribute substantially to cumulative impacts on American lotus populations in southeast Michigan.

Important Habitats

Although much of the coastal wetland areas once present on the western shore of Lake Erie, where the Fermi site is located, have already been drained or filled by agricultural, industrial, or urban development, the Fermi project would impact only a small portion of the remaining wetlands, and State and Federal wetland protection regulations are expected to avoid, minimize, and compensate for future unavoidable losses of coastal (and other) wetlands as a result of future urbanization. All but 1.9 acres of the permanent wetland impacts described in Section 4.3.1 would be compensated for by the restoration of wetlands at an off-site location in the coastal zone of Lake Erie (Appendix K) (Detroit Edison 2012c), and the temporarily impacted wetlands on-site would be rehabilitated (Detroit Edison 2012d).

The transmission corridor, once exiting the Fermi site, would not traverse coastal wetlands but would cross several areas of noncoastal (inland lake and/or stream) wetlands. The review team assumes that the 93.4 ac of “woody wetlands” identified in Table 2-6 for the proposed corridor would be cleared of trees and converted to an herbaceous or shrub condition. State and/or Federal wetland regulations protect inland as well as coastal wetlands, although future urban development in the area can be expected to result in some limited losses of inland wetlands from permitted and exempted activities.

The EPA’s recent Great Lakes Restoration Initiative (GLRI) program funds a variety of restoration projects. The program’s action plan covers fiscal years 2010 through 2014 and addresses five urgent focus areas, including combating invasive species and restoring wetlands and other habitats. Several projects are currently funded and under way in the geographic area of concern (EPA 2011a), including one located in the Pointe Aux Peaux State Wildlife Area, which is south of and adjacent to the Fermi site. Detroit Edison’s proposed compensatory mitigation would complement and expand upon the benefits to the region from the GLRI wetland restoration projects.

Overall, the cumulative impacts of Fermi 3 and other past, present, and reasonably foreseeable future activities in the geographic area of interest on wetlands are not expected to be extensive.

7.3.1.3 Summary of Terrestrial and Wetland Impacts

The analysis of the cumulative impacts on terrestrial ecology is based on information provided by Detroit Edison and the review team’s independent evaluation. The review team concludes that the cumulative impacts of other past, present, and reasonably foreseeable future projects and the preconstruction, construction, and operation of Fermi 3 on terrestrial ecological resources would be SMALL to MODERATE. The potential for MODERATE cumulative impacts reflects possible adverse effects of Fermi 3 on the eastern fox snake. If also reflects the possible effects of climate change. The staff’s evaluation of the potential impacts on the eastern fox snake recognizes the potential for mitigation measures proposed by Detroit Edison (Detroit Edison 2012a, b) and approved by the MDNR to significantly reduce impacts from Fermi 3 on that species, thereby leading to SMALL impacts, but acknowledges the possibility of MODERATE impacts if proposed mitigation is not implemented as described in their plan. The incremental contribution of building and operating the Fermi 3 project could be noticeable (MODERATE) with respect to the eastern fox snake but would be minor (SMALL) for other terrestrial resources. The incremental contribution of NRC-authorized elements of the Fermi 3 project, which exclude preconstruction activities such as site preparation and building transmission lines, but which include operations, could likewise be noticeable (MODERATE) with respect to the eastern fox snake but would be minor (SMALL) with respect to other terrestrial resources.

7.3.2 Aquatic Resources

The description of the affected environment in Section 2.4.2 of this EIS provides the baseline for the cumulative impacts assessment for aquatic ecological resources. As described in Section 4.3.2, the impacts from NRC-authorized construction on aquatic ecological resources would be SMALL, provided that Detroit Edison implements the mitigation measures described in Section 4.3.2.5. The combined impacts from preconstruction and construction activities on aquatic resources of the Fermi site and transmission line corridor were described in Section 4.3.2 and were also determined to be SMALL for all aquatic species and habitats, provided that the potential mitigation measures identified in Section 4.3.2.5 are implemented.

As described in Section 5.3.2, the review team concluded that the impacts of operation of Fermi 3 and the transmission line on aquatic ecological resources would also be SMALL, provided that the mitigation measures described in Section 5.3.2.5 are implemented.

In addition to the impacts from preconstruction, construction, and operation of Fermi 3, the cumulative analysis considers other past, present, and reasonably foreseeable future actions that could affect aquatic resources within the watersheds that could be affected by construction and development of Fermi 3. The geographic area of interest for the cumulative impact analysis for aquatic resources includes primarily the lower Swan Creek watershed and the western basin of Lake Erie. This geographic area encompasses ecologically relevant aquatic habitat features and the associated populations of aquatic species that could be affected by construction and operation of the proposed Fermi 3.

Impacts on aquatic resources can result from changes in habitat availability or quality, degradation of water quality, and increased mortality of organisms. Impacts can include changes in populations or composition of communities. Activities and environmental changes that may contribute to cumulative impacts on aquatic resources within the geographic area of interest include building and operating the proposed Fermi 3, operation of other power plants (including the existing Fermi 2), discharge of treated wastewater, surface water runoff, increased urban development, agricultural activities, commercial and recreational fisheries, introduced invasive species, and global climate change. Human activities have resulted in considerable changes in the Lake Erie aquatic ecosystem during the past century (see Section 2.4.2.1 of the EIS). These changes have resulted from many causes, including overfishing, introduction and expansion of invasive exotic species, nutrient enrichment, dredging, degradation of tributary conditions and other habitat features, and introduction of contaminants.

Impacts related to building the proposed Fermi 3, associated facilities, and transmission lines on aquatic habitat and biota could result from altered hydrology, erosion, stormwater runoff of soil and contaminants, and direct disturbance or loss of aquatic habitats. In addition to having a minor potential impact on recreationally or commercially important fish species that could occur in the vicinity of the Fermi site, building Fermi 3 could also affect some Federally or State-listed aquatic species in the western basin of Lake Erie or in the lower Swan Creek watershed, including northern riffleshell (*Epioblasma torulosa rangiana*), pugnose minnow (*Opsopoeodus emeiliae*), rayed bean (*Villosa fabalis*), salamander mussel (*Simpsonaias ambigua*), sauger (*Sander canadensis*), silver chub (*Macrhybopsis storeriana*), and snuffbox (*Epioblasma triquetra*) (Section 4.3.2.3). However, the likelihood that building activities could affect these species is low and, if mitigation identified in Section 4.3.2.5 is implemented, the impacts of Fermi 3 preconstruction and construction activities, including development of associated transmission lines, would be SMALL. These effects should not measurably increase cumulative impacts on those species within the geographic area of interest. Other construction projects that occur along the shores of Lake Erie's western basin or within watersheds that drain into the western basin would contribute in similar ways to the impacts on aquatic habitats and biota within the geographic area of interest, although the overall cumulative level of impact is difficult to quantify.

The Lake Erie aquatic ecosystem is also affected by urbanization, industrialization, and agriculture. The Lake Erie basin has a greater population than do the other Great Lakes and surpasses them in the amounts of effluent received from sewage treatment plants and of sediment loading (LaMP Work Group 2008). Development of Fermi 3 and other projects in the region, such as the proposed projects identified in Table 7-1, could result in increased population and additional urbanization, with subsequent impacts on aquatic resources within the western basin of Lake Erie or in the lower Swan Creek watershed. Increased urbanization within the region could affect aquatic resources by increasing the amount of impervious surface, non-point source pollution, and water use and by altering riparian and in-stream habitat and existing hydrology patterns. Agricultural development within the basin introduces large amounts of sediment to Lake Erie (LaMP Work Group 2008).

As identified in Table 7-1, there are currently five operational power plants within the geographic area of interest, including Fermi 2 (located on the Fermi site), the Detroit Edison Monroe Power Plant (6 mi southwest of the Fermi site), the J.R. Whiting Power Plant (14 mi south-southwest of the Fermi site), the Bayshore Power Plant (20 mi south-southwest of the Fermi site), and the Davis-Besse Nuclear Power Station Unit 1 (Davis-Besse) (27 mi southeast of the Fermi site). All of these power plants withdraw cooling water from and discharge heated effluent into the western basin of Lake Erie. Fermi 2 and Davis-Besse use closed cycle cooling; the Whiting, Bayshore, and Monroe power plants employ once-through cooling.

Cumulative Impacts

As described for Fermi 3 in Section 5.3.2, withdrawing cooling water has a potential to affect aquatic organisms through impingement and entrainment. If the organisms being entrained or impinged at different power plants are members of the same populations, the impacts on those populations would be cumulative. Because the water intakes for Fermi 2 and Fermi 3 would be located in close proximity within the intake bay, it is estimated that the combined operation of the Fermi 2 and Fermi 3 facilities would effectively double the water intake and would likely increase entrainment and impingement rates of aquatic organisms in the immediate vicinity of the intake bay as compared to the operation of Fermi 2 alone (Detroit Edison 2011a). The mean daily entrainment of the larvae of four species of fish that are common in Lake Erie's western basin – gizzard shad (*Dorsoma cepedianum*), white bass (*Morone chrysops*), walleye (*Sander vitreus*), and freshwater drum (*Aplodinotus grunniens*) – at four power plants (i.e., the once-through Bayshore, Monroe, Acme [no longer operational], and Whiting) averaged over three seasons of production (1975–1977) ranged from nearly zero to approximately 8 percent of the larvae present within nearshore areas (Patterson 1987) and is considered to be detectable. The study suggested that the numbers of larvae surviving to reach older life stages for these species would increase substantially if the effects of power plant entrainment were removed (Patterson and Smith 1982; Patterson 1987). Cooling water intake rates for each of the four facilities (Patterson and Smith 1982; Patterson 1987) were estimated to be 4 to 15 times higher than the cooling water intake rates for the Fermi 2 facility and for the proposed Fermi 3 facility (Detroit Edison 2011a). The larval fish entrainment rates for these facilities are expected to be higher than for Fermi 3. Therefore, even though the estimated impingement and entrainment rates for Fermi 3 would be considerably lower than that reported for most of the other power stations within the western basin (Detroit Edison 2011a, Section 5.3.1.2.3.2) and individually would represent a minor incremental impact to aquatic resources (as described in Section 5.3.2 of this EIS), the cumulative impacts of impingement and entrainment from all power stations on fish populations within the western basin could have a significant impact on some aquatic species.

In addition to mortality of fish from impingement and entrainment at power plants, millions of pounds of fish are harvested annually from the western basin through recreational and commercial fishing activities (see Section 2.4.2.3), thereby contributing to cumulative mortality impacts on fish populations. The status of fish populations in the western basin are monitored by the MDNR, the Ohio Department of Natural Resources, and the Ontario Ministry of Natural Resources, and regulations and annual harvest limits for important target species are periodically adjusted by those agencies to prevent overfishing and to maintain suitable population levels. The Great Lakes Fisheries Commission, which coordinates fisheries research and facilitates cooperative fishery management among the State, Provincial, Tribal, and Federal agencies that manage fishery resources within the Great Lakes, has established a Lake Erie Committee that considers issues pertinent to Lake Erie. Therefore, the management and control of cumulative impacts on populations of harvested fish species are partially addressed through the actions of these agencies.

As described in Section 5.3.2, discharge of heated cooling water from other power plants also has the potential to affect survival and growth of organisms by altering ambient water temperatures. In most cases, thermal plumes from power plants discharging into Lake Erie would be expected to affect relatively small areas, and the plumes from Fermi 3 and the existing power plants in the western basin are not expected to overlap. Although many of the aquatic species that could be affected by the thermal plumes from different power plants are likely to belong to the same populations, the numbers of individuals that could be affected by cold shock or heat stress are expected to be small relative to the overall numbers of individuals within populations. As a consequence, the cumulative effect of thermal discharges from existing power plants and the proposed Fermi 3 on aquatic resources within the western basin of Lake Erie would be minor, and the incremental contribution of Fermi 3 would be insignificant.

Cumulative impacts on water quality associated with other projects and activities (e.g., agriculture, stormwater runoff, sewage and wastewater treatment facilities) in the western basin of Lake Erie and the lower Swan Creek watershed are significant, although the incremental contribution of Fermi 3 operations to the cumulative impact would be minor (see Section 7.2.3).

Dredging occurs in many locations within the western basin of Lake Erie and has the potential to affect aquatic biota and habitats through disturbance of benthic habitats, increased turbidity, the suspension and deposition of sediment, introduction of contaminants, and other changes in water quality. The potential for dredging to affect aquatic habitats and biota depends upon the uniqueness and sensitivity of the habitat that would be disturbed by dredging or by disposal of dredged sediments, the types of organisms present in the areas that would be affected, and the size of the area. However, activities in such aquatic habitats in waters of the United States must comply with the requirements of the CWA Section 404(b)(1) Guidelines, the substantive criteria used by the USACE to determine a project activity's environmental impact on aquatic resources attributable to the discharge of dredged or fill material, and any additional State procedural and substantive criteria. Such compliance ensures that the discharges of dredged or fill material into waters of the United States, including wetlands, should not occur unless it can be demonstrated that such discharges, either individually or cumulatively, would not result in unacceptable adverse effects on the aquatic ecosystem. In some cases, open-water disposal of dredged sediments occurs within the western basin. For example, portions of the sediment dredged periodically from the Toledo Harbor Federal navigation channels are disposed of within an authorized open-lake placement area of two square miles located in the western basin. Although some small areas of the Fermi site would be affected by dredging in order to build and operate Fermi 3, the dredged materials would be disposed of in the existing onsite spoil disposal area, not in the open waters of Lake Erie. Although dredging and disposal activities within the western basin of Lake Erie may have some degree of impact on aquatic resources, the cumulative effects of dredging for Fermi 3 on aquatic habitats and biota would be minor (see Sections 4.3.2 and 5.3.2).

Cumulative Impacts

The presence of invasive non-native species is one of the major stressors affecting the Lake Erie ecosystem (LaMP Work Group 2008). These species may prey on native species or compete with them for limited resources, thereby altering the structure of aquatic ecosystems. For example, invasions by quagga (*Dreissena rostriformis bugensis*) and zebra mussels (*Dreissena polymorpha*) have affected ecosystem conditions in Lake Erie by altering nutrient conditions and competing with other species that feed on phytoplankton and zooplankton. Increases in these species have been implicated in the declines of native freshwater mussels (see Section 2.4.2).

The presence of non-native invasive species is the result of intentional or unintentional introductions or range expansion and colonization. Invasive nuisance organisms that have been found or are presumed to occur in Lake Erie in the vicinity of the Fermi site include lyngbya (*Lyngbya wollei*), the fishhook water flea (*Cercopagis pengoi*), the spiny water flea (*Bythotrephes longimanus*), quagga and zebra mussels, the sea lamprey (*Petromyzon marinus*), and the round goby (*Neogobius melanostomus*) (see Section 2.4.2.3 of this EIS). Some of the above species have the potential to adversely affect the aquatic environment. For example, lyngbya can form dense algal mats on the lake bottom that could significantly affect native or introduced benthic organisms. These species are not considered abundant in the vicinity of the Fermi site. Although the cumulative impacts of invasive non-native species on the Lake Erie ecosystem are considered significant, building and operating Fermi 3 are not expected to measurably promote expansion of populations of invasive species (see Sections 4.3.2 and 5.3.2), and the incremental contribution of Fermi 3 to cumulative impacts from invasive species would be minor.

The EPA's Great Lakes National Program Office has initiated the Great Lakes Restoration Initiative to address environmental issues in five topical areas: cleaning up toxic materials and areas of concern, combating invasive species, promoting nearshore health by protecting watersheds from polluted runoff, restoring wetlands and other habitats, and tracking progress and working with strategic partners. It is expected that this long-term initiative would address some water quality and non-native species concerns that contribute to cumulative impacts of aquatic resources in the area of interest.

The review team is also aware that potential climate changes together with reactor operations could affect water quality and aquatic ecosystems. As identified in Section 7.2.3 of this EIS, a study by U.S. Global Change Research Program (USGCRP) projected that during the operating license period for Fermi 3 (estimated to be 2020 to 2060), changes in the region's climate would include a 3–4°F increase in the average temperature, slightly increased precipitation in the winter and spring, more intense rainstorms throughout the year, and a drop of 1–1.5 ft in the average water levels in Lake Erie (USGCRP 2009). These changes could lead to increased erosion and sediment loading in tributaries and in Lake Erie.

It is expected that as temperatures increase and water quality changes as a result of climate change, a long-term shift could occur in the aquatic species assemblages present within the region (USGCRP 2009). With increases in evaporation rates and longer periods between rainfalls, the likelihood of drought will increase, and water levels in rivers, streams, and wetlands are likely to decline (USGCRP 2009), thereby reducing the availability of some aquatic habitats. It is also predicted that reduced summer water levels are likely to reduce the recharge of groundwater, causing small streams to dry up and potentially reducing the habitat needed by native aquatic biota, such as freshwater mussels and fish. The size of coastal wetland areas that are important for specific life stages of many aquatic organisms within the region could also be affected. With increased water temperatures, populations of coldwater fish such as trout would be expected to decline, while populations of coolwater fish such as muskellunge (*Esox masquinongy*) and warmwater species such as smallmouth bass (*Micropterus dolomieu*) and bluegill (*Lepomis macrochirus*) would become more dominant (USGCRP 2009). Such changes in aquatic species assemblages are likely to be further affected by invasions of non-native species that could thrive under warmer conditions. USGCRP (2009) also predicts that in some lakes, increased water temperatures could lead to an earlier and longer period in summer during which mixing of the relatively warm surface lake water with the colder water below is reduced, potentially increasing the risk of developing oxygen-poor zones that could result in increased mortality of fish and other aquatic organisms. In lakes with contaminated sediment, mercury and other persistent pollutants could become more mobilized with increased temperatures, potentially increasing the quantities of contaminants entering the aquatic food chain (USGCRP 2009).

The assessment of cumulative impacts on aquatic resources is based on information provided by Detroit Edison and the review team's independent review. The building and operation of Fermi 3 would affect a small amount of aquatic habitat within the western basin of Lake Erie, including habitat used by species or taxa described in Section 2.4.2. With projected climate change, the cumulative effects of past, present, and reasonably foreseeable future actions on aquatic resources may be detectable and noticeably altered. However, it is anticipated that the incremental contributions from building and operating Fermi 3 to effects on aquatic resources – including recreational and commercially important species and Federally and State-listed species – would be minor. Therefore, the review team concludes that, with projected climate change and past, present, and reasonably foreseeable future actions in the lower Swan Creek watershed and the western basin of Lake Erie, cumulative impacts on aquatic resources would be MODERATE. The incremental contribution of impacts on aquatic resources from building and operating Fermi 3 would not contribute significantly to the overall cumulative impact to the geographical area of interest. Therefore, the incremental impacts from NRC-authorized activities would be SMALL, and no further mitigation would be warranted.

7.4 Socioeconomics and Environmental Justice

The evaluation of cumulative impacts on socioeconomics and environmental justice is presented in this section.

7.4.1 Socioeconomics

The description of the affected environment in Section 2.5 serves as the baseline for the cumulative impact assessment in this resource area. As described in Section 4.4, adverse impacts of the NRC-authorized construction activities on socioeconomics would be SMALL, with the following exceptions. The combined impacts of preconstruction and construction activities on demographics would be SMALL but beneficial. NRC-authorized construction would result in MODERATE adverse impacts on traffic, primarily during the peak construction period. NRC-authorized construction activities also would result in LARGE beneficial tax revenue impacts in Monroe County and the local jurisdictions within Monroe County. They would result in SMALL beneficial economic and tax revenue impacts elsewhere in the region.

As described in Section 5.4, the adverse impacts of operations on socioeconomics would be SMALL, with the following exceptions. The impact on demographics would be SMALL but beneficial. Impacts on traffic would be SMALL during normal operations and MODERATE during outages. SMALL beneficial impacts on the economy would occur as a result of increases in employment and wages. Tax impacts would be LARGE in the local jurisdictions within Monroe County and SMALL elsewhere in the region.

The combined impacts of construction and preconstruction activities were described in Section 4.4 and were determined to be the same as those described above for NRC-authorized construction. In addition to the impacts from construction, preconstruction, and operations, the cumulative analysis also considers other past, present, and reasonably foreseeable future projects that could impact socioeconomics. For this analysis, the geographic area of interest is considered to be Monroe and Wayne counties in Michigan and Lucas County in Ohio because these counties are the primary areas (1) where Fermi 3 workers would live; (2) where the economy, tax base, and infrastructure would most likely be affected; and, therefore, (3) where the socioeconomic impacts would occur.

The Fermi plant site, which is located in Monroe County, is approximately 8 mi northeast of the City of Monroe, Michigan. Wayne County is located to the north of Monroe County, and Lucas County is to the south. The region around the Fermi plant site is strongly influenced by the cities of Detroit (Wayne County) and Toledo (Lucas County) and their historic manufacturing base. Through most of the twentieth century, Detroit has been the automotive capital of the country. Manufacturers in Monroe and Lucas County have included various suppliers for three large automobile manufacturers: Ford, General Motors, and Chrysler. People migrated to southeast Michigan for the manufacturing jobs, and by 1950, Detroit was the fourth-largest city in the country. Much of the infrastructure around southeast Michigan was built to support the large population and industrial base of the area, including the transportation routes, housing, schools, and other public services. Since its population peak in the 1970 census, Wayne County has declined in population by nearly 1 million people, and Lucas County has declined in population by nearly 40,000 people. Much of this population loss occurred in urban areas, as the population either migrated to suburban communities or left the region as the manufacturing base declined.

However, although the rate of growth has declined, the population of Monroe County has continued to grow, with only a slight decline in population (of less than 1 percent) occurring between 1980 and 1990. In addition to manufacturing, the economy of Monroe County has had a strong agricultural base, and population growth has resulted in the loss of much of the county's agricultural land. Detroit Edison is the largest employer in Monroe County, with a workforce of approximately 1500 workers at the Fermi plant site and the coal-fired Monroe County Power Plant. During outages, an additional 1200–1500 outage workers are also employed at the Fermi plant site for a period of 30 days every 18 months. Between 2009 and 2010, Detroit Edison had a construction workforce at the Monroe County Power Plant to conduct capital improvements of the air emission control equipment (Detroit Edison 2011a). Future projects involving installation of air pollution control equipment will require a workforce ranging between 100 and 550 workers. Detroit Edison expects that the work at the Monroe County Power Plant will be completed by 2014, and therefore it will be a part of the historic cumulative impacts associated with Fermi 3 but will not be a concurrent activity (Detroit Edison 2011c). The impact analyses in Chapters 4 and 5 are cumulative by nature. Past and current economic impacts associated with activities listed in Table 7-1, such as the ongoing refurbishment (e.g., installation of air pollution control equipment) at the Monroe Power Plant, have already been considered as part of the socioeconomic baseline presented in Section 2.5 or in the analyses for Sections 4.4 and 5.4. In addition, the economic impacts of existing enterprises, such as the loss of manufacturing and construction jobs and growth of health care jobs in the region, are part of the baseline used for establishing the Regional Input-Output Multiplier System (RIMS) II multipliers. Regional planning efforts and associated demographic projections formed the basis for the review team's assessment of reasonably foreseeable future impacts. State and county plans, along with modeled demographic projections such as those used in Sections 2.5, 4.4, and 5.4, include forecasts of future development (such as the proposed Cleveland-Toledo-Detroit Passenger Rail Line) and population increases. The cumulative impacts associated with the preconstruction, construction, and operation of Fermi 3 are thus evaluated in Chapters 4 and 5. The review team did not identify any other cumulative impacts associated with building and operating Fermi 3 beyond those already evaluated in Chapters 4 and 5.

On the basis of the above considerations, Detroit Edison's ER, and the review team's independent evaluation, the review team concludes that under some circumstances, the building of Fermi 3 could make a short-term, MODERATE and adverse contribution to the cumulative effects associated with traffic. However, an increase in population in Wayne County would be considered a SMALL cumulative and beneficial impact, since the income and expenditures from in-migrating workers would contribute to the tax base that supports a large infrastructure. The cumulative effects on regional economies would be SMALL and beneficial throughout the 50-mi region, with the exception of Monroe County. In Monroe County, the cumulative effects on the economy would be LARGE and beneficial. There would also be a SMALL and beneficial impact on taxes throughout the 50-mi region, with the exception of Monroe County, where there would be a LARGE beneficial cumulative effect on taxes.

The incremental economic impact of operations from NRC-authorized activities would be SMALL and beneficial in the 50-mi region, including Monroe County. Incremental tax impacts in the 50-mi region would also be SMALL and beneficial, with the exception of Monroe County, where the impact of taxes would be LARGE and beneficial. There would also be a SMALL incremental impact on traffic during normal operations, and an incremental MODERATE and adverse impact during outages on traffic along local roadways near the Fermi site. The review team concludes that the incremental cumulative impacts from NRC-authorized activities on all other socioeconomic impact categories would be SMALL.

7.4.2 Environmental Justice

The description of the affected environment in Section 2.6 serves as a baseline for the cumulative impacts assessment in this resource area. As described in Section 4.5, the NRC staff concludes that NRC-authorized construction activities would not result in disproportionately high and adverse impacts on minority or low-income populations; therefore, the environmental justice impacts would be SMALL. As described in Section 5.5, the review team concludes that operations activities would not cause disproportionately high and adverse impacts on minorities and low-income populations. Therefore, those impacts would be SMALL, and no further mitigation would be warranted.

The combined impacts from preconstruction and construction were described in Section 4.5 and determined to be SMALL.

In addition to the impacts from preconstruction, construction, and operation, the cumulative impacts analysis also considers other past, present, and reasonably foreseeable future projects that could cause disproportionately high and adverse impacts on minority and low-income populations. For this cumulative impacts analysis, the geographic area of interest is considered to be the 50-mi region described in Section 2.5.1.

There is a potential for minority and low-income populations to experience disproportionately high and adverse impacts from the activities of other past, present, and reasonably foreseeable future projects. However, the impact analyses in Chapters 4 and 5 are cumulative by nature. Environmental justice impacts associated with past and current activities listed in Table 7-1 have already been considered as part of the environmental justice baseline presented in Sections 2.6. Census block groups classified as minority or low-income lie to the north and south of the Fermi site, in Wayne and Lucas counties within and near Detroit and Toledo. The closest census block group with a population of interest is in Monroe County. It qualifies as both minority and low-income; it is located approximately 5 mi from the Fermi site. The review team did not identify environmental pathways that could result in disproportionately high and adverse human health, environmental, physical, or socioeconomic effects beyond those identified in Sections 4.5 and 5.5 on minority or low-income populations in the 50-mi region.

On the basis of the above considerations, information provided by Detroit Edison, and the review team's independent evaluation, the review team concludes that there would be no disproportionately high and adverse cumulative impacts on minority and low-income populations beyond those described in Chapters 4 and 5; therefore, the environmental justice impacts would be SMALL. The environmental justice impacts from NRC-authorized activities would be SMALL, and no further mitigation would be warranted.

7.5 Historic and Cultural Resources

The description of the affected environment in Section 2.7 serves as a baseline for this cumulative impacts assessment in this resource area. As described in Section 4.6, the staff concluded that the impacts on cultural resources from NRC-authorized construction would be MODERATE. As described in Section 5.6, the review team concluded that the impacts on cultural resources from operations would be SMALL. See Section 4.6 for a discussion of Detroit Edison's plan to develop the procedures or guidance necessary to address the steps that Detroit Edison and its contractors will follow for unanticipated discoveries. The review team does not expect that there would be unanticipated discoveries during operation of the plant because it is unlikely that activities would involve previously undisturbed areas.

The combined impacts from preconstruction and construction activities were described in Section 4.6 and determined to be MODERATE. If preconstruction activities associated with the offsite transmission lines resulted in significant alterations to the cultural environment, then the additional impacts could be realized. In addition to the impacts from preconstruction, construction, and operations, the cumulative analysis also considers past, present, and reasonably foreseeable future projects that could affect historic and cultural resources. For this cumulative analysis, the geographic area of interest is considered to be the areas of potential effects (APEs) defined in Section 2.7. The APEs were developed in consultation with the Michigan State Historic Preservation Office (SHPO).

Cumulative Impacts

Projects identified in Table 7-1 that may impact historic and cultural resources include the decommissioning and demolition of Fermi 1, operation of the recently completed Fermi 2 Independent Spent Fuel Storage Installation (ISFSI) at the Fermi site, operation of the Ventower wind turbine tower manufacturing facility, construction of the Cleveland-Toledo-Detroit Passenger Rail Line (including a proposed Monroe station), operation of Fermi 2, operation of the Detroit Edison Monroe Power Plant, and future urbanization. Four of these projects – decommissioning and demolition of Fermi 1, operation of the Fermi 2 ISFSI at the Fermi site, continued operation of Fermi 2, and future urbanization – are or might be within the geographic area of interest as defined above. As part of its independent evaluation, the review team reviewed the cultural and historic information available at the SHPO. The activities at Fermi 1 are the only ones in the geographic area of interest to have undergone National Historic Preservation Act Section 106 review. As a result of this review, Fermi 1 was determined eligible for listing in the *National Register of Historic Places* (NRHP) and is considered a historic property. The review team concurs with the finding that the decommissioning of Fermi 1 has no adverse effect on historic properties (Conway 2011b). The review team also concurs with the finding that demolishing Fermi 1 in order to construct Fermi 3 would have an adverse effect on historic properties (Conway 2011a).

The NRC review team consulted with the Michigan SHPO, Detroit Edison, and Monroe County Community College and executed a Memorandum of Agreement (MOA) (ADAMS Accession No. ML12089A007) that stipulated measures to mitigate the adverse effects of demolishing Fermi 1 prior to building Fermi 3 (see Appendix F), pursuant to 36 CFR 800.6(c). See Sections 2.7.4 and 4.6 for discussions of the measures developed to resolve the adverse effect on the Fermi 1 historic property attributable to the proposed demolition of Fermi 1. Building and operating one additional unit at the Fermi site, in addition to the other projects identified above that could affect historic and cultural resources, would likely contribute to cumulative cultural resource impacts within the geographic area of interest for historic and cultural resources.

As described in Sections 4.6 and 5.6, the review team concludes that the incremental impacts from installation of offsite transmission lines would be minimal provided that there are no significant alterations (either physical alterations or visual intrusions) to the cultural environment. If these activities were to result in significant alterations to the cultural environment, then the additional impacts could be realized. Construction and operation of the offsite transmission lines would be the responsibility of ITC*Transmission* in consultation with the appropriate Federal and State regulatory authorities. Section 2.7.3 contains a description of known cultural resources in the transmission line corridors. Cultural resources impacts related to construction of the proposed transmission lines are discussed in Sections 10.2.1 and 10.4.1.5. Operation impacts of the proposed transmission lines on cultural resources are discussed in Sections 5.6 and 10.2.2.

Historic and cultural resources are nonrenewable; therefore, the impacts on historic and cultural resources within the APEs are cumulative. Section 4.6 described how building activities for Fermi 3 would result in the demolition of one onsite property (Fermi 1) that is eligible for listing in the NRHP and located within the associated APEs. On the basis of its evaluation, the review team concludes that the cumulative impacts on historic and cultural resources from preconstruction, construction, and operation of Fermi 3 and from other projects listed in Table 7-1 that are in the geographic area of interest would be MODERATE. If activities related to offsite transmission lines and/or urbanization within the APEs would result in alterations to the cultural environment, then additional impacts could be realized. The review team further concludes that the incremental impacts associated with the onsite NRC-authorized activities would be MODERATE, because of the demolition of Fermi 1, and no mitigation measures would be warranted beyond those discussed in Sections 4.6 and 5.6.

7.6 Air Quality

The description of the affected environment in Section 2.9 serves as the baseline for the cumulative impact assessments for air quality. As described in Section 4.7, the NRC staff concludes that the impacts of NRC-authorized construction activities on air quality, including contribution to greenhouse gas (GHG) emissions, would be SMALL, although some mitigation may be warranted, depending on the outcome of conformity applicability analyses being performed by the NRC and USACE pursuant to the Clean Air Act Section 176 (42 USC section 7506) and 40 CFR Part 93, Subpart B (NRC 2011a). As described in Section 5.7, the review team concludes that the impacts of operations on air quality, including contribution to GHG emissions, would be SMALL, and no further mitigation would be warranted.

7.6.1 Criteria Pollutants

As was discussed in Section 2.9, the Fermi 3 site is located in an area that has been designated as being in nonattainment for the $PM_{2.5}$ (particulate matter with an aerodynamic diameter of less than or equal to 2.5 μm) National Ambient Air Quality Standards (NAAQS) and in maintenance for the 8-hour ozone NAAQS (EPA 2010a). In July 2011, the MDEQ submitted a request asking the EPA to redesignate southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011a). In July 2012, the EPA issued a proposed rule designating southeastern Michigan as having attained both the 1997 annual $PM_{2.5}$ NAAQS and the 2006 24-hour $PM_{2.5}$ NAAQS, based on 2009–2011 ambient air monitoring data (77 FR 39659, dated July 5, 2012), but the final determination has yet to be made. The area around the Fermi 3 site is designated as in attainment for all other criteria pollutants.

Section 4.7 of this EIS examined air quality impacts associated with preconstruction and construction. Emissions associated with these activities would be predominately the fugitive dust from ground-disturbing activities and engine exhaust from heavy equipment and vehicles.

Cumulative Impacts

Emissions from preconstruction and construction are expected to be temporary and limited in magnitude. Consequently, potential impacts on ambient air quality would be SMALL. Notwithstanding these minor impacts to air quality, the NRC and USACE will perform Clean Air Act Section 176 air conformity applicability analyses pursuant to 40 CFR Part 93, Subpart B, to determine whether additional mitigation may be warranted. Section 5.7 addressed air quality impacts from operations. Air emissions from operations would be primarily particulate emissions from cooling towers and criteria pollutants from worker vehicles and stationary combustion sources such as diesel generators and an auxiliary boiler. These stationary sources would be permitted and operated in accordance with State and Federal regulatory requirements, and their operation would be infrequent and mostly for maintenance testing. Therefore, potential impacts from operations would be SMALL.

In addition to the impacts from building and operations, the cumulative impact analysis considers past, present, and reasonably foreseeable future actions that could impact air quality (Table 7-1). For this cumulative impact analysis of air quality, Detroit Edison considered Monroe County as the geographic area of interest. This geographic area of interest includes the primary communities that would be affected by the proposed Fermi 3.

No major nonresidential development projects are in progress or anticipated near the Fermi site, although industrial development may increase in the near future. However, the Monroe County Comprehensive Plan update will have a focus on farmland preservation and conservation. This focus should keep development projects from being built close to the Fermi site, as a large portion of the undeveloped land near the Fermi site is used for agriculture (Detroit Edison 2011a).

In 2002, total annual emissions from stationary sources in Monroe County were 6850 tons/yr of particulate matter with an aerodynamic diameter of less than or equal to 10 µm (PM_{10}), 4749 tons/yr of $PM_{2.5}$, 2761 tons/yr of volatile organic compounds (VOCs), 112,333 tons/yr of sulfur dioxide (SO_2), and 47,879 tons/yr of nitrogen oxides (NO_x) (EPA 2010b). Two coal-fired power plants (Detroit Edison's Monroe Power Plant and J.R. Whiting Power Plant) and Holcim Cement together accounted for most emissions of criteria pollutants and VOCs in Monroe County. In 2002, emissions from Fermi 2 operations were an insignificant portion (less than 0.1 percent on a pollutant-by-pollutant basis) of stationary source emissions in Monroe County.

On the basis of the estimates in Sections 4.7 and 5.7, emissions from construction and operation of Fermi 3 will be about 1.9 percent and 0.3 percent on a pollutant-by-pollutant basis, respectively, of the total 2002 stationary source emissions in Monroe County. These emissions will be insignificant compared to total emissions from the six neighboring counties within the $PM_{2.5}$ nonattainment area and the 8-hour ozone maintenance area. Apart from Fermi 3, the only known major construction project planned in Monroe County is the installation of pollution control equipment at the Monroe Power Plant. The Monroe Power Plant project is expected to be complete prior to initiation of major construction activities for Fermi 3 and could improve air quality in the region (Detroit Edison 2011c). Most projects listed in Table 7-1 would not increase air emissions above their current levels. Any new industrial projects would either have *de minimis* impacts or would be subject to regulation by the MDEQ. Fermi 3 is located in an area designated as being in nonattainment for $PM_{2.5}$, although the MDEQ believes it is in compliance with the current $PM_{2.5}$ standards. Given the anticipated lack of growth and new sources of air emissions in the vicinity of Fermi 3 and the minimal contribution of emissions from preconstruction, construction, and operation, the cumulative air impacts from construction and operation of the proposed Fermi 3 would be SMALL; thus, it is unlikely that ambient air quality in the region would be degraded significantly.

7.6.2 Greenhouse Gas Emissions

As discussed in the state of the science report issued by the USGCRP (2009), it is the

> "production and use of energy that is the primary cause of global warming, and in turn, climate change will eventually affect our production and use of energy. The vast majority of U.S. greenhouse gas emissions, about 87 percent, come from energy production and use."

Approximately one-third of GHG emissions are the result of generating electricity and heat (USGCRP 2009). GHG emissions associated with building, operating, and decommissioning a nuclear power plant are addressed in Sections 4.7, 5.7, 6.1.3, and 6.3. The review team concluded that the atmospheric impacts of the emissions associated with each aspect of building, operating, and decommissioning a single nuclear power plant would be minimal. The review team also concluded that the impacts of the combined emissions for the full plant life cycle would be minimal.

It is difficult to evaluate cumulative impacts of a single source or combination of GHG emission sources because:

1. The impact is global rather than local or regional.
2. The impact is not particularly sensitive to the location of the release point.
3. The magnitude of individual GHG sources related to human activity, no matter how large compared to other sources, are small when compared to the total mass of GHGs in the atmosphere.
4. The total number and variety of GHG emission sources are extremely large and are ubiquitous.

These points are illustrated by the comparison of annual carbon dioxide emission rates in Table 7-2.

Table 7-2. Comparison of Annual Carbon Dioxide Emission Rates

Source	Metric Tons per Year
Global emissions	30,000,000,000[(a)]
United States	5,500,000,000[(a)]
1000-MW nuclear power plant (including fuel cycle, 90 percent capacity factor)	500,000[(b)]
1000-MW nuclear power plant (operations only)	5000[(b)]
Average U.S. passenger vehicle	5[(c)]

(a) Source: EPA 2011b.
(b) Source: Appendix L of this EIS.
(c) Source: EPA 2005.

Evaluation of cumulative impacts of GHG emissions requires the use of a global climate model. The USGCRP report referenced above provides a synthesis of the results of numerous climate modeling studies. The review team concludes that the cumulative impacts of GHG emissions around the world as presented in the report are an appropriate basis for its evaluation of cumulative impacts. On the basis of the impacts set forth in the USGCRP report and on the CO_2 emissions criteria in the final EPA CO_2 Tailoring Rule (75 FR 31514), the review team concludes that the national and worldwide cumulative impacts of GHG emissions are noticeable but not destabilizing. The review team further concludes that the cumulative impacts would be noticeable but not destabilizing, with or without the GHG emissions of the proposed project.

Consequently, the review team recognizes that GHG emissions, including carbon dioxide, from individual stationary sources and, cumulatively, from multiple sources can contribute to climate change and that the carbon footprint is a relevant factor in evaluating energy alternatives. Section 9.2.5 contains a comparison of the carbon footprints of the viable energy alternatives.

7.6.3 Summary of Cumulative Air Quality Impacts

Cumulative impacts to air quality are estimated based on the information provided by Detroit Edison and the review team's independent evaluation. Other past, present, and reasonably foreseeable future activities exist in the geographic areas of interest (local and regional for criteria pollutants and global for GHG emissions) that could affect air quality resources. The cumulative impacts on the emissions of criteria pollutants from Fermi 3 and other projects would be minimal. The national and worldwide cumulative impacts of GHG emissions are noticeable but not destabilizing. The review team concludes that the cumulative impacts would be noticeable but not destabilizing with or without the GHG emissions from Fermi 3. The review team concludes that cumulative impacts from other past, present, and reasonably foreseeable future actions on air quality resources in the geographic areas of interest would be SMALL for criteria pollutants and MODERATE for GHGs. The incremental contribution of impacts on air quality resources from building and operating activities for the proposed Fermi 3 would be

SMALL. The incremental contribution of impacts on air quality resources from the NRC-authorized activities would also be SMALL.

7.7 Nonradiological Health

The description of the affected environment in Section 2.10 serves as a baseline for the cumulative analysis for nonradiological health. As described in Section 4.8, the impacts from NRC-authorized construction on nonradiological health would be SMALL, and no further mitigation would be warranted. As described in Section 5.8, the review team concludes that the impacts of operations on nonradiological health would also be SMALL, and no further mitigation would be warranted.

As described in Section 4.8, the combined nonradiological health impacts from construction and preconstruction activities would be SMALL, and no further mitigation would be warranted beyond what is described in Detroit Edison's ER. In addition to the impacts from preconstruction, construction, and operations, the cumulative analysis also considers other past, present, and reasonably foreseeable future actions that could contribute to cumulative impacts on nonradiological health (see Table 7-1).

Most of the nonradiological impacts of building and operation (e.g., noise, etiological agents, occupational injuries) would be localized and would not have a significant impact at offsite locations. However, impacts such as vehicle emissions arising from the activity of transporting personnel to and from the site would encompass a larger area. Therefore, for nonradiological health impacts, the geographic area of interest for cumulative impacts analysis includes projects within a 50-mi radius of Fermi 3 based on the influence of vehicle and other air emissions sources because Fermi 3 is in a nonattainment area (Section 7.6). For cumulative impacts associated with transmission lines, the geographical area of interest is the transmission line corridor (as described in Section 2.2.2). These geographical areas of interest are expected to encompass areas where public and worker health could be influenced by the proposed project and associated transmission lines, in combination with any past, present, or reasonably foreseeable future actions.

Current projects within the geographic area of interest that could contribute to cumulative nonradiological health impacts include the energy and mining projects in Table 7-1, as well as vehicle emissions and existing urbanization-related activities. Reasonably foreseeable future projects in the geographic area of interest that could contribute to cumulative nonradiological health impacts include the construction of the proposed Cleveland-Toledo-Detroit Passenger Rail Line, future transmission line development, and future urbanization.

There are no existing or future projects that could contribute to cumulative occupational injuries to workers at Fermi 3. Existing and potential development of new transmission lines could increase nonradiological health impacts from exposure to acute electromagnetic fields (EMFs). However, as stated in Section 5.8.3, adherence to Federal criteria and State utility codes would help keep any cumulative nonradiological health impacts at the minimal level. With regard to the chronic effects of EMFs, the scientific evidence on human health does not conclusively link extremely-low-frequency EMFs to adverse health impacts. Cumulative impacts from noise and vehicle emissions associated with current urbanization, current operations of Fermi 2, and decommissioning of Fermi 1 could occur. However, as discussed in Sections 4.8 and 5.8, the Fermi 3 contribution to these impacts would be temporary and minimal, and it is expected that existing facilities would comply with local, State, and Federal regulations governing noise and emissions. Section 7.11.2 discusses cumulative nonradiological health impacts related to additional traffic on the regional and local highway networks leading to and from the Fermi site, and the review team has determined that these impacts would be minimal.

The health impacts of operating the existing Fermi 2 and the proposed Fermi 3 at the Fermi site were evaluated relative to Lake Erie and the potential propagation of etiological microorganisms. As discussed in Section 5.8, the thermal discharges from the operation of Fermi 3 would not have detrimental impacts on the concentration levels of deleterious etiological microorganisms. No recreational activity occurs in the immediate vicinity of the proposed discharge structure for Fermi 3 that would have any bearing on potential nonradiological health impacts.

The review team is also aware of the potential climate changes that could affect human health; a recent compilation of the state of knowledge in this area (USGCRP 2009) has been considered in the preparation of this EIS. Projected changes in the climate for the region during the life of proposed Fermi 3 include the following:

- Reduced cooling system efficiency at Fermi 3 (and other power generation facilities), which would result in increased temperature of the cooling-tower discharge water and possible increased growth of etiological agents;
- Increased incidence of diseases transmitted by food, water, and insects following heavy downpours and severe storms; and
- Increased severity of water pollution associated with sediments, fertilizers, herbicides, pesticides, and thermal pollution caused by projected heavier rainfall intensity and longer periods of drought.

Although the changes that are attributed to climate change in these studies are not inconsequential, their relationship to Fermi 3 operations is not clear, and the review team did not identify anything that would alter its conclusion regarding the presence of etiological agents or the incidence of waterborne diseases.

Cumulative nonradiological health impacts were determined on the basis of information from Detroit Edison and the review team's independent evaluation of impacts resulting from the proposed Fermi 3, along with a review of potential impacts from other past, present, and reasonably foreseeable future projects and from urbanization in the geographic areas of interest. The review team concludes that cumulative impacts on the nonradiological health of the public and workers would be SMALL, and that mitigation beyond what is discussed in Sections 4.8 and 5.8 would not be warranted. The review team acknowledges, however, that there is still uncertainty associated with the chronic effects of EMFs.

7.8 Radiological Health Impacts of Normal Operation

The description of the affected environment in Section 2.11 serves as the baseline for the cumulative impacts assessment in this resource area. As described in Section 4.9, the NRC staff concludes that the radiological impacts from NRC-authorized construction would be SMALL, and no further mitigation would be warranted. As described in Section 5.9, the NRC staff concludes that the radiological impacts from operations would be SMALL, and no further mitigation would be warranted.

The combined impacts from preconstruction and construction activities were described in Section 4.9 and determined to be SMALL. In addition to impacts from preconstruction, construction, and operations, this cumulative analysis also considers past, present, and reasonably foreseeable future actions that could contribute to cumulative radiological impacts. For the purpose of this analysis, the geographic area of interest is considered to be the area within a 50-mi radius of the proposed Fermi 3. Historically, the NRC has used the 50-mi radius as a standard bounding geographical area to evaluate population doses from routine releases from nuclear power plants. Within the 50-mi radius, there are the operating Fermi 2, Fermi 1 (going through decommissioning), and Davis-Besse. Detroit Edison also plans to operate the Fermi 2 ISFSI on the Fermi site. In addition, within the 50-mi radius of the site, there are likely to be medical, industrial, and research facilities that use radioactive materials.

As stated in Section 2.11, Detroit Edison has conducted a radiological environmental monitoring program (REMP) around Fermi 1 and 2 since 1978. The REMP measures radiation and radioactive materials from all sources, including existing Fermi 1 and 2, Davis-Besse, area hospitals, and industrial facilities. The results of the REMP indicate that the levels of radiation and radioactive material in the environment around the Fermi site are generally not above or only a little above natural background levels. As described in Section 2.11, sporadic and variable trace quantities of tritium were detected in a few shallow groundwater wells downwind from the Fermi 2 stack as a result of the recapturing of tritium in precipitation from the plant's gaseous effluent.

As described in Section 4.9, it is estimated that the doses to construction workers during the building of the proposed Fermi 3 would be within NRC annual exposure limits (i.e., 100 mrem), which are designed to protect public health. This estimate includes exposure to doses from the operation of Fermi 2, the decommissioned Fermi 1, and the recently completed Fermi 2 ISFSI. As described in Section 5.9, the public and occupational doses predicted from the proposed operation of Fermi 3 would be below regulatory limits and standards. In addition, the site-boundary dose to the maximally exposed individual (MEI) from existing Fermi 2 and proposed Fermi 3 at the Fermi site would be well within the regulatory standard of 40 CFR Part 190.

On the basis of the results of the REMP and the estimates of doses to biota given in Section 5.9, the NRC staff concludes that the cumulative radiological impact on biota would not be significant. The results of the REMP indicate that effluents and direct radiation from area medical, industrial, and research facilities that use radioactive materials do not contribute measurably to the cumulative dose for biota in the vicinity of the Fermi site.

Currently, there are no other nuclear facilities planned within 50 mi of the Fermi site. The NRC, U.S. Department of Energy, and State of Michigan would regulate or control any reasonably foreseeable future actions in the region that could contribute to cumulative radiological impacts. Therefore, the NRC staff concludes that the cumulative radiological impacts of operation of the proposed Fermi 3 and existing Fermi 1 (undergoing decommissioning) and Fermi 2 (operational) and the influence of other manmade sources of radiation nearby would be SMALL, and no further mitigation would be warranted.

7.9 Nonradioactive Waste

Cumulative impacts on water and air from nonradiological waste are discussed in Sections 7.2 and 7.6, respectively. The cumulative impacts of nonradioactive waste destined for land-based treatment and disposal are related to (1) the available capacity of the area treatment and disposal facilities; and (2) the amount of solid waste generated by the proposed project and the current and reasonably foreseeable future projects in Table 7-1. The geographic area of interest for this cumulative analysis is the area within 15 mi of the Fermi site. This area includes four landfills that could potentially be used by Detroit Edison (MDEQ 2011b).

Nonradioactive wastes generated at the Fermi site, including those from Fermi 3, would be managed in accordance with applicable Federal, State, and local laws and regulations and with permit requirements. As described in the ER (Detroit Edison 2011a), nonradiological waste management practices at Fermi 3 would be similar to those implemented at Fermi 2 and would include the following:

1. Nonradioactive solid waste would be collected and stored temporarily on the Fermi site and disposed of offsite only at authorized and licensed commercial waste disposal sites or recovered at an offsite permitted recycling or recovery facility, as appropriate.

2. Sanitary waste would be delivered to the Monroe Metropolitan Wastewater Treatment Facility for treatment.
3. Debris (e.g., vegetation) collected on trash screens at the water intake structure would be disposed of offsite as solid waste, in accordance with State regulations.
4. Dredge spoils resulting from construction and periodic maintenance of the discharge and intake areas would be disposed of in the existing onsite Spoils Disposal Pond.
5. Scrap metal, lead acid batteries, and paper on the Fermi site would be recycled.
6. Water discharges from cooling and auxiliary systems would be discharged directly and indirectly to Lake Erie through permitted outfalls.
7. Air emissions from Fermi 2 and Fermi 3 operations would be compliant with air quality standards as permitted by MDEQ.

During preconstruction and construction, offsite land-based waste treatment and disposal would be minimized by production and delivery of modular plant units; by segregation of recyclable materials; and by management of vegetative waste, excavated materials, and dredged materials onsite. As described in Section 4.10.1, the solid waste impacts from building Fermi 3 would be expected to be minimal with no additional mitigation warranted. The few reasonably foreseeable proposed projects listed in Table 7-1 generally either would not coincide with the building of Fermi 3 (e.g., demolition of Fermi 1) or would produce waste streams of a different nature (e.g., mining projects).

The types of nonradioactive solid waste that would be generated, handled, and disposed of during Fermi 3 operations include municipal waste, dredge spoils, sewage treatment sludge, and industrial wastes. In addition, small quantities of hazardous waste and mixed waste (waste that has both hazardous and radioactive characteristics), would be generated during Fermi 3 operations. As described in Section 5.10.1 and mentioned above, because the effective practices already in place at Fermi 2 for recycling, minimizing, and managing waste will be used, the expected impacts on land from nonradioactive wastes generated during the operation of Fermi 3 would be SMALL, and no further mitigation would be warranted. Many projects listed in Table 7-1 would generate municipal and industrial waste. However, no known capacity constraints exist for the treatment or disposal of such types of waste either within Michigan, Ohio, or the nation as a whole (EPA 2010c; MDEQ 2011b). Each reactor at the Fermi site is expected to produce about 0.5 m^3 per year of mixed waste. Detroit Edison anticipates that the Fermi 3 would claim a low-level mixed waste exemption from the State of Michigan (Fermi 2 currently operates under this exemption). Of the projects listed in Table 7-1, Fermi 2, demolition of Fermi 1, and the hospitals and industrial facilities that use radioactive materials have the potential to generate mixed waste. None of the considered projects are expected to generate mixed waste in significant quantities above the current rates, and therefore cumulative impacts would be minimal.

On the basis of the projected small quantity of nonradioactive and mixed waste that would be produced during Fermi 3 building activities and operation and the available treatment and disposal capacity, the review team concludes that cumulative impacts of nonradioactive and mixed waste would be SMALL, and additional mitigation would not be warranted.

7.10 Postulated Accidents

The following impact analysis covers radiological impacts from postulated accidents from operations of Fermi 3. The analysis also considers other past, present, and reasonably foreseeable future actions at which postulated accidents that could affect radiological health could occur, including other Federal and non-Federal projects and those projects listed in Table 7-1 within the geographic area of interest. The geographic area of interest is considered to be the area within a 50-mi radius of the proposed Fermi 3. The cumulative analysis considers the risk from potential severe accidents at all other existing and proposed nuclear power plants that have the potential to increase risks at any location within 50 mi of the proposed Fermi 3.

As described in Section 5.11.4, the NRC staff concludes that the potential environmental impacts (risk) from a postulated accident from the operation of the proposed Fermi 3 would be SMALL. Section 5.11 considers both design-basis accidents (DBAs) and severe accidents.

As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of DBAs at the Fermi site would be SMALL for an ESBWR. DBAs are addressed specifically to demonstrate that a reactor design is sufficiently robust to meet NRC safety criteria. The consequences of DBAs are bounded by the consequences of severe accidents.

As described in Section 5.11.2, the NRC staff concludes that the severe-accident probability-weighted consequences (i.e., risks) of an ESBWR at the Fermi site are SMALL when compared with the risks to which the population is generally exposed, and no further mitigation would be warranted. Existing reactors within the geographic area of interest are Fermi 2 and Davis-Besse because the 50-mi radii for Fermi 2 and Davis-Besse overlap part of the 50-mi radius for the proposed Fermi 3. No other new reactors have been proposed, within the geographic area of interest.

Tables 5-34 and 5-35 in Section 5.11.2 provide comparisons of estimated risk for the proposed Fermi 3 ESBWR and for current-generation reactors. The estimated population dose risk for the proposed ESBWR at the Fermi site is well below the mean and median values for current-generation reactors. In addition, as discussed in Section 5.11.2, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028). For existing plants within the geographic area of interest (i.e., Fermi 2 and Davis-Besse), the Commission has determined that the probability-weighted consequences of severe accidents are small (10 CFR Part 51, Appendix B, Table B-1). It is expected that risks for any new reactors at any other locations within the geographic area of interest of the Fermi site would be well below risks for current-generation reactors and meet the Commission's safety goals. The risk of severe accident attributable to any particular nuclear power plant becomes smaller as the distance from that plant increases. However, the combined risk at any location within 50 mi of the Fermi site would be bounded by the sum of risks for all these operating nuclear power plants. Even though two or more nuclear power plants could be included in the combined risk, it would still be low.

On the basis of these findings, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Fermi site would likely be SMALL, and no further mitigation would be warranted.

7.11 Fuel Cycle, Transportation, and Decommissioning

The cumulative impacts related to the fuel cycle, transportation of radioactive materials (fuel and waste), and facility decommissioning for the proposed site are described below.

7.11.1 Fuel Cycle (Including Radioactive Waste)

As described in Section 6.1, the NRC staff concludes that the environmental impacts of the fuel cycle from the operation of Fermi 3 would be SMALL. Fuel-cycle impacts would not only occur at the Fermi site but would also be scattered throughout other locations in the United States or, in the case of foreign-purchased uranium, in other countries, as described in Section 6.1.

In addition to fuel-cycle impacts from Fermi 3, this cumulative analysis also considers fuel-cycle impacts from existing Fermi 2 and Davis-Besse, located southeast of Toledo, Ohio. There are no other nuclear power plants, existing or proposed, within 50 mi of the Fermi site. The fuel-cycle impacts of Fermi 2 and Davis-Besse would be similar to those of the proposed Fermi 3. In accordance with 10 CFR 51.51(a), the NRC staff considers the impacts to be acceptable for a 1000-MW(e) reference reactor. The impacts of producing and disposing of nuclear fuel include those from mining the uranium ore, milling the ore, converting the uranium oxide to uranium hexafluoride, enriching the uranium hexafluoride, fabricating the fuel (in which the uranium hexafluoride is converted into uranium oxide fuel pellets), and disposing of the spent fuel in a proposed Federal waste repository. As discussed in Section 6.1, advances in reactors since the development of Table S-3 in 10 CFR 51.51 have reduced the environmental impacts relative to those of the operating reference reactor. For example, a number of fuel management improvements have been adopted by nuclear power plants to improve performance and reduce fuel and separative work (enrichment) requirements. In Section 6.1, the NRC staff multiplied the values in Table S-3 by a factor of two to scale the impacts up from the 1000-MW(e) light water reactor model to address the fuel-cycle impacts of Fermi 3. Adding the fuel-cycle impacts from

Fermi 2 and Davis-Besse would increase the scaling further – but by a factor of no more than four. Therefore, the NRC staff considers the cumulative fuel-cycle impacts of operating Fermi 3 to be SMALL, and no further mitigation would be warranted.

7.11.2 Transportation

The description of the affected environment in Section 2.5.2 serves as a baseline for the cumulative impacts assessment in this resource area. As described in Sections 4.8.3 and 5.8.6, the review team concludes that impacts of transporting personnel and nonradiological materials to and from the Fermi site would be SMALL. In addition to impacts from preconstruction, construction, and operations, the cumulative analysis also considers other past, present, and reasonably foreseeable future actions that could contribute to cumulative transportation impacts. For this analysis, the geographic area of interest is the 50-mi region surrounding the Fermi site.

Nonradiological impacts from transportation would be related to the additional traffic on the regional and local highway networks leading to and from the Fermi site. Additional traffic would result from the shipments of construction materials and the movements of construction personnel to and from the site. This additional traffic would increase the risk of traffic accidents, injuries, and fatalities. The most significant cumulative nonradiological impacts in the vicinity of the Fermi site would result from major construction projects. However, as shown in Table 7-1, no major construction projects are planned in the region surrounding the Fermi site. The operation of existing facilities could also result in cumulative nonradiological impacts if traffic to and from the Fermi site interacted with traffic traveling to and from operating facilities in the region. Nearby operating facilities that could contribute to traffic hazards include the existing Fermi 2 and Stoneco Newport and Rockwood Quarry mining projects. However, the Fermi site is located on the edge of the Detroit metropolitan area, where a more constant level of traffic flow across the region over extended periods of time is expected, regardless of individual projects, thus limiting any impacts from interactions with nearby facilities. Mitigation measures designed to improve traffic flow at the Fermi site have been proposed by Detroit Edison (2011a).

In Sections 4.8.3 and 5.8.6, the review team concluded that the impacts of transporting construction material and construction and operations personnel to and from the Fermi site would be a small fraction of the existing nonradiological impacts. Because of the extent of nonradiological transportation impacts of new nuclear power plant construction and operation relative to impacts from existing traffic patterns and levels, the review team considers the cumulative nonradiological transportation impacts associated with constructing and operating the proposed new reactor at the Fermi site to be minimal, and no further mitigation would be warranted.

As described in Section 6.2, the NRC staff concludes that impacts of transporting unirradiated fuel to the Fermi site and irradiated fuel and radioactive waste from the Fermi site would be SMALL. In addition to impacts from preconstruction, construction, and operations, the cumulative analysis also considers other past, present, and reasonably foreseeable future actions that could contribute to cumulative transportation impacts. For this analysis, the geographic area of interest is the 50-mi region surrounding the Fermi site.

Historically, the radiological impacts on the public and the environment that are associated with the transportation of radioactive materials in the region surrounding the Fermi site have been dominated by shipments of fuel and waste to and from the existing Fermi 2. Davis-Besse, which is located in Oak Harbor, Ohio (21 mi east-southeast of Toledo, Ohio), is also within 50 mi of the Fermi site, and shipments of fuel to and shipments of waste from the Davis-Besse site may also contribute to the cumulative radiological impacts of transportation as a result of sharing some highway links with Fermi 2 shipments. Additional cumulative impacts on the Fermi site would result from the additional fuel and waste shipments associated with the operation of the new unit. Radiological impacts from transporting radioactive materials would occur along the routes leading to and from the Fermi site and would also be scattered throughout the United States. For all of these historical, current, and potential future projects, the radiological transportation impacts are a small fraction of the impacts from natural background radiation. The impacts from transporting this fuel and radioactive waste to and from the Fermi site would be consistent with the environmental impacts associated with transporting fuel and radioactive waste from current-generation reactors presented in Table S-4 of 10 CFR 51.52. On the basis of 10 CFR 51.52, the NRC staff concludes that the impacts from the 1000-MW(e) reference reactor are acceptable. Advances in reactors since the development of Table S-4 of 10 CFR 51.52 would reduce the environmental impacts relative to those of the operating reference reactor. For example, fuel management improvements have been adopted by nuclear power plants to improve performance and reduce fuel requirements. The improvements have led to fewer unirradiated and spent fuel shipments than those estimated for the 1000-MW(e) reference reactor in 10 CFR 51.52. In addition, advances in shipping cask designs to increase their capacities would result in fewer shipments of spent fuel to offsite storage or disposal facilities.

Therefore, the NRC staff concludes that the cumulative nonradiological and radiological transportation impacts from operating the proposed new reactor at the Fermi site would be SMALL, and no further mitigation would be warranted.

7.11.3 Decommissioning

As discussed in Section 6.3 of this EIS, the NRC staff concludes that the environmental impacts from decommissioning the proposed Fermi 3 would be SMALL because the licensee would have to comply with decommissioning regulatory requirements.

In this cumulative analysis, the geographic area of interest is the area within a 50-mi radius of the Fermi site. In addition to Fermi 3, the other nuclear power plants within this area are the existing Davis-Besse, Fermi 2, and Fermi 1 (which is going through decommissioning). The impacts of decommissioning nuclear power plants are bounded by the discussion in the assessment in Supplement 1 to NUREG-0586, *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities* (NRC 2002). In that document, the NRC found that the impacts from decommissioning a nuclear plant on the radiation dose to workers and the public, waste management, water quality, air quality, ecological resources, and socioeconomics would be small. In addition, the review team concluded in Section 6.3 of this EIS that the incremental contribution of the impact of greenhouse gas emissions on air quality during decommissioning would be small. Therefore, the cumulative impacts from decommissioning would be SMALL, and further mitigation would not be warranted.

7.12 Conclusions

The review team considered the potential cumulative impacts resulting from preconstruction, construction, and operation of one additional nuclear unit at the Fermi site together with past, present, and reasonably foreseeable future actions. The specific resources that could be affected by the proposed action and other past, present, and reasonably foreseeable future actions in the same geographical area were assessed. This assessment included the impacts of preconstruction activities as described in Chapter 4; impacts of construction and operations for the proposed new unit as described in Chapters 4 and 5; impacts of fuel cycle, transportation, radiological waste, and decommissioning as described in Chapter 6; and impacts of past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could affect the same resources affected by the proposed action, as described in Table 7-1.

Table 7-3 summarizes the cumulative impacts by resource area. The cumulative impacts for the majority of resource areas would be SMALL, although there could be MODERATE and LARGE impacts for some resources, as presented below.

Cumulative land use impacts, including impacts associated with transmission line development, are anticipated to be SMALL primarily because few land use changes are anticipated from reasonably foreseeable projects, including building and operating Fermi 3, over the period of interest (i.e., approximately 2010–2060).

With projected climate change, the cumulative effects of past, present, and reasonably foreseeable future actions on the surface water quantity of Lake Erie would be SMALL to MODERATE, with MODERATE impacts possible under the highest predicted increases in air and water temperature. The cumulative effects of past, present, and reasonably foreseeable future actions combined with the predicted impacts of climate change on the quality of surface water in Lake Erie would be MODERATE. However, the incremental increases in water use and changes in water quality resulting from operation of Fermi 3 under projected climate change conditions should not be noticeable, and the incremental contribution of Fermi 3 would be SMALL. Cumulative impacts on groundwater use and quality would be SMALL.

Together with the impacts of past, present, and reasonably foreseeable future actions, the impacts on terrestrial resources of building and operating Fermi 3 are expected to result in SMALL to MODERATE cumulative impacts on the eastern fox snake (but only minimal impacts on other terrestrial resources). This conclusion relies in part on mitigation measures proposed by Detroit Edison, and discussed in Section 7.3.1.2, regarding impacts on wetlands, eastern fox snakes, and American lotus.

With projected climate change, the cumulative effects on aquatic resources are expected to be MODERATE. However, the incremental contributions of Fermi 3 operations to effects on aquatic resources including recreational and commercially important species and Federally and State-listed species would be SMALL.

For socioeconomics, cumulative impacts in most categories would be SMALL and adverse. However, there would be a MODERATE to LARGE and beneficial cumulative impact to the economy of Monroe County and LARGE impact to tax revenues in Monroe County, as well as a SMALL beneficial impact to the economy and tax revenues on the rest of the 50-mi region. The entire 50-mi region would also experience a SMALL beneficial impact to demographics. The incremental impact from NRC-authorized activities would be SMALL and beneficial for the economies and taxes throughout the 50-mi region, with the exception of Monroe County, where the incremental tax revenue impact and impact on the economy from the NRC-authorized activities would be MODERATE to LARGE and beneficial. The review team also identified a

Table 7-3. Cumulative Impacts on Environmental Resources Including the Impacts of the Proposed Fermi 3

Resource Category	Impact Level
Land Use	SMALL
Water Resources	
Surface water use	SMALL to MODERATE
Groundwater use	SMALL
Surface water quality	MODERATE
Groundwater quality	SMALL
Ecological Resources	
Terrestrial and wetland resources	SMALL to MODERATE (potential for MODERATE limited to eastern fox snake)
Aquatic resources	MODERATE
Socioeconomics	
Physical impacts	SMALL
Demography	SMALL beneficial
Economic Impacts on the Community	
Economy	SMALL to LARGE beneficial
Taxes	SMALL to LARGE beneficial
Infrastructure and Community Services Impacts	SMALL to MODERATE
Traffic	SMALL
Recreation	SMALL
Housing	
Public services	SMALL
Education	SMALL
Environmental Justice	SMALL
Historic and Cultural Resources	MODERATE
Air Quality	SMALL to MODERATE
Nonradiological Health	SMALL
Radiological Health	SMALL
Nonradioactive Waste	SMALL
Postulated Accidents	SMALL
Fuel Cycle (including radioactive waste), Transportation, and Decommissioning	SMALL

short-term MODERATE and adverse impact associated with increased traffic on local roads near the Fermi site during construction and during periods of outages; during normal operations, the adverse impact on local roads would be SMALL. The incremental contribution from NRC-authorized activities on traffic would be MODERATE during construction and during periods of outages. Cumulative impacts to other socioeconomic impact categories and environmental justice would be SMALL.

The cumulative impacts on historic and cultural resources are expected to be MODERATE because NRC actions would result in the demolition, which would be mitigated, of one onsite property (Fermi 1) that has been recommended for the NRHP. The incremental impacts associated with onsite NRC-authorized construction activities are the principal contributors to the MODERATE rating of cumulative impacts.

For air quality, the cumulative impacts would be MODERATE, primarily due to national and worldwide impacts of greenhouse gas emissions, but SMALL for criteria pollutants. The incremental impacts from NRC-authorized activities would be SMALL because such impacts would be minimal.

For radiological health, nonradiological health, nonradioactive waste, postulated accidents, fuel cycle (including radioactive waste), transportation, and decommissioning, cumulative impacts are expected to be SMALL.

7.13 References

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36 CFR Part 800. Code of Federal Regulations, Title 36, *Parks, Forests, and Public Property*, Part 800, “Protection of Historic Properties.”

40 CFR Part 93. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 93, “Determining Conformity of Federal Actions to State or Federal Implementation Plans.”

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8.0 Need for Power

Chapter 8 of the U.S. Nuclear Regulatory Commission's (NRC) *Environmental Standard Review Plan* (ESRP) (NRC 2000), with additional clarification provided in NRC Staff Memorandum (NRC 2011), guides the NRC staff's review and analysis of the need for power from a proposed nuclear power plant. In addition to the ESRP guidance, the NRC addressed the need for power in a 2003 response to a petition for rulemaking (68 FR 55910). In the 2003 response, the NRC reviewed whether or not need for power should be considered in NRC environmental impact statements (EISs) prepared in conjunction with applications that could result in construction of a new nuclear power plant. The NRC (68 FR 55910) concluded that:

> The need for power must be addressed in connection with new power plant construction so that the NRC may weigh the likely benefits (e.g., electrical power) against the environmental impacts of constructing and operating a nuclear power reactor. The Commission emphasizes, however, that such an assessment should not involve burdensome attempts to precisely identify future conditions. Rather, it should be sufficient to reasonably characterize the costs and benefits associated with proposed licensing actions.

While the NRC will perform a need for power analysis for a new nuclear power plant in its EIS, the NRC also stated in its response to the petition that (1) the NRC does not supplant the States, which have traditionally been responsible for assessing the need for power-generating facilities, for determining their economic feasibility and for regulating rates and services; and (2) the NRC has acknowledged the primacy of State regulatory decisions regarding future energy options (68 FR 55910).

Detroit Edison Company (Detroit Edison), a wholly owned subsidiary of DTE Energy, has submitted a combined license (COL) application to the NRC for a new nuclear reactor, Enrico Fermi Unit 3 (Fermi 3), to be located at the existing Detroit Edison Enrico Fermi Atomic Power Plant (Fermi) site in Monroe County, Michigan. The proposed nuclear reactor would use the GE-Hitachi Nuclear Energy Economic Simplified Boiling Water Reactor (ESBWR) design that has a rated core thermal power of 4500 megawatts thermal (MW(t)) and a gross electrical output of approximately 1605 ± 50 megawatts electric (MW(e)). For analytical purposes, DTE determined 2021 was the appropriate year for the commencement of operations at Fermi 3. (Detroit Edison 2012). Fermi 3 would operate as a regulated investor-owned electric utility connected to the electrical grid operated by ITC*Transmission*.

In its Environmental Report (ER) (Detroit Edison 2011), Detroit Edison identified the following purposes of the proposed reactor:

- Generate at least 1535 ± 50 MW(e) of reliable electricity to address the forecasted energy and capacity needs of Detroit Edison customers.
- Provide new baseload generation capacity in 2021 to accommodate new growth in electrical demand, replace the expected retirement of aging baseload generating units, and compensate for the diminishing availability of baseload generation capacity in the Midwest Independent System Operator (MISO) service area.
- Provide price stability by minimizing the importation of power into the Detroit Edison service area.
- Establish baseload generation technology that is less subject to price fluctuations resulting from either fuel or regulatory drivers, provides fuel diversity, and reduces reliance on fossil fuels and their resulting environmental impacts.

Section 8.1 describes the Detroit Edison service area as well as the broader power generation and transmission system in which Detroit Edison participates. Section 8.1 also introduces and describes the Michigan Public Service Commission's (MPSC) 21st Century Energy Plan (hereafter, the MPSC Plan) (MPSC 2007), the first comprehensive statewide electricity planning initiative completed in Michigan and the basis for the review team's independent need for power analysis. Section 8.2 describes the factors that could influence changes in the demand for power over the licensing period for Fermi 3 that were addressed in the MPSC Plan. Section 8.3 discusses existing and potential sources of electricity supply in the Detroit Edison service area. Section 8.4 presents the review team's projected supply and demand estimates for the Detroit Edison service area, along with the review team's conclusions regarding the need for power.

8.1 Power Systems and Power Planning in Michigan

Deregulation of the electricity markets has had a significant impact on how projected power needs are met. Because of the deregulation of bulk sales markets for electricity, the advent of independent power producers, and the increased use of purchases and exchanges of electricity among utilities, the demand for electricity by ultimate consumers and wholesale customers within a utility's service area is increasingly not being met by the utility's own generating resources. Greater degrees of collaboration among transmission balancing authorities to more efficiently accommodate renewable energy sources and plans for long-distance transfers of renewable energy-generated power to distant load centers have served to further expand the geographic area from which generation resources might be routinely drawn to meet demand. Trading of electricity is further facilitated by the Federal Energy Regulatory Commission's final rule requiring all public utilities that own, control, or operate facilities used for transmitting electricity in interstate commerce to file open access nondiscriminatory transmission tariffs that contain minimum terms and conditions on nondiscriminatory service. It is therefore incumbent on the review team to ensure that impacts from all of these issues are properly incorporated into its need for power analysis.

8.1.1 National and Michigan Electricity Generation and Consumption

Electricity generation in the United Stated in 2008 was 4119 million megawatt hours (MWh), a 0.9 percent decrease from the 2007 total of 4157 million MWh, using a variety of generating technologies: coal (48.2 percent), natural gas (21.4 percent), nuclear (19.6 percent), hydroelectric (6.0 percent), non-hydro renewables (3.1 percent), petroleum (1.1 percent), other gases (0.3 percent), and other sources (0.3 percent) (DOE/EIA 2010a). Electric utility plants accounted for 2475.5 million MWh (60.1 percent of the MWh produced), with combined heat and power (CHP) plants accounting for the remaining 1643.5 million MWh (39.9 percent).

Michigan’s 2008 net summer electricity generating capacity stood at 30,419 MW, 21,885 MW of which were represented by electric utilities and 8534 MW provided by independent power producers and CHP facilities. In 2008, Michigan’s electric utilities generated 94,503,953 MWh of electricity (down 2.4 percent from 96,785,842 MWh in 2007) of the statewide total production of 114,989,806 MWh (down 3.6 percent from the 2007 statewide total of 119,309,936 MWh) (EERE 2009; DOE/EIA 2010b).

8.1.2 The Detroit Edison Power System

The Detroit Edison power system is managed and/or overseen by four separate entities, each responsible for a different but integrated aspect of the generation, transmission, and distribution of electricity. The four entities, described below in greater detail are Detroit Edison (DTE Energy), ITC*Transmission*, MISO and PJM Interconnection (MISO/PJM), and North American Electric Reliability Council’s (NERC’s) Reliability*First* Corporation (RFC).

Detroit Edison

Detroit Edison was founded in 1903. It is a wholly owned subsidiary of DTE Energy, a diversified energy company incorporated in 1995 and involved in the development and management of energy-related businesses and services nationwide. Detroit Edison and the Michigan Consolidated Gas Company (MichCon), a natural gas utility serving 2.1 million customers in lower Michigan, are DTE Energy’s two largest operating subsidiaries. Beside electricity production, other energy-related activities of DTE Energy include the ownership and management of natural gas storage facilities and pipelines, coal marketing and transporting, conventional and unconventional natural gas resource recovery, and energy trading.[(a)] The MichCon and Detroit Edison service areas are shown in Figure 8-1.

Detroit Edison generates, transmits, and distributes electricity to 2.2 million customers throughout an 11-county area [(b)] in southeastern Michigan, an area of approximately 7600 mi^2 (DTE Energy 2008a; Detroit Edison 2010).

Detroit Edison is the largest electric utility in Michigan and the tenth largest in the country (DTE Energy 2008b). The electricity generating stations owned and operated by Detroit Edison

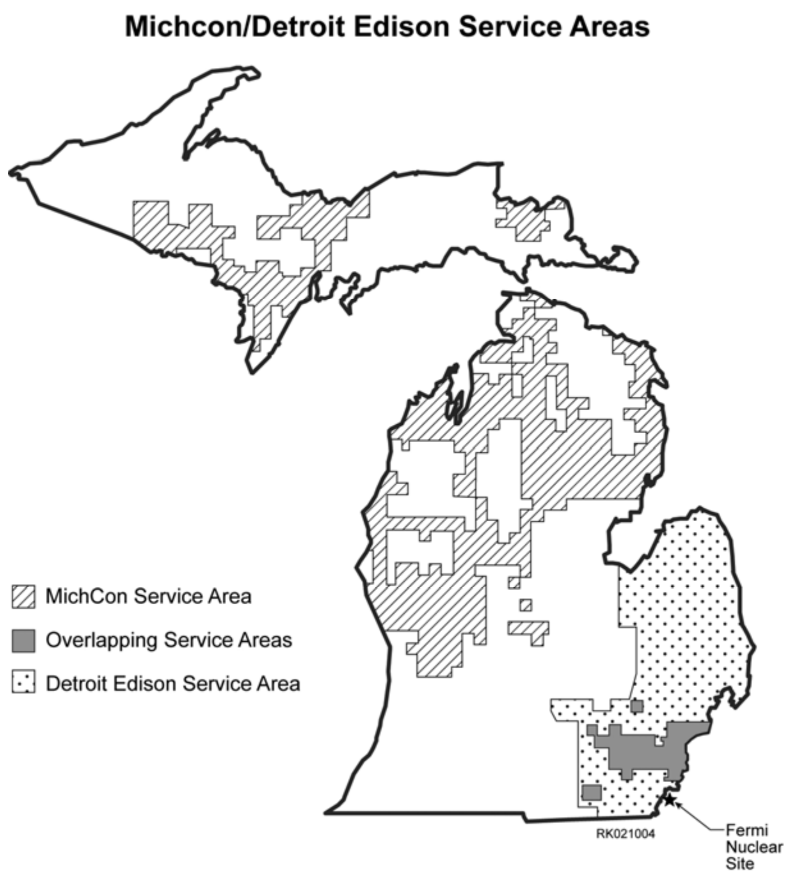

Figure 8-1. DTE Energy's MichCon and Detroit Edison Service Areas (DTE Energy 2008a)

(a) Additional details regarding the activities of DTE Energy subsidiaries are available from its corporate Web site: http://www.dteenergy.com/residentialCustomers/productsPrograms.
(b) Counties comprising Detroit Edison's service area include: Huron, Lenawee, Macomb, Monroe, Oakland, Sanilac, Tuscola, Lapeer, St. Clair, Washtenaw, and Wayne.

have an overall generating capacity of 11,518 MW (DTE Energy 2008a). Detroit Edison operates nine baseload generating plants, including Fermi 2, and is co-owner of a pumped-storage hydroelectric facility in Ludington, Michigan. In 2008, Detroit Edison operated four of the State's top ten electric generating facilities (based on net summer capacity): three coal-fired plants – Monroe (3129 MW), Belle River (1509 MW), St. Clair (1393 MW) – and Fermi 2 (1173 MW) (DOE/EIA 2010b).

Reliability of power is ensured, in part, by the mix of fuels in the Detroit Edison generating portfolio: coal, natural gas, nuclear, pumped-storage hydroelectricity, and renewable energy sources. Historically, coal has accounted for 80 to 85 percent of Detroit Edison's electricity generation with Fermi 2 accounting for the majority of the remainder of Detroit Edison's generating capacity. Of the total 11,518 MW of Detroit Edison's electricity generating capacity, 78.8 percent is provided by coal, 16.9 percent by nuclear, 2.3 percent by natural gas, 0.8 percent by oil, 0.1 percent by hydroelectric, and 1 percent by renewable sources (biomass 0.6 percent and solid waste incineration 0.4 percent) (DTE Energy 2008a). The promulgation of a State Renewable Portfolio Standard (RPS), as well as increasingly rigorous environmental regulations on fossil fuel-fired power generation[(a)] (including possible future regulations requiring the capture and sequestration of greenhouse gases, especially carbon dioxide) are likely to cause major changes in DTE's power portfolio going forward.

Detroit Edison testimony in Rate Case No. U-15244 provided highlights of Detroit Edison's Integrated Resource Plan (IRP) process, pointing out its similarities to the MPSC Plan, including use of the same planning model (MPSC 2008). The testimony also noted that the process by which MPSC would grant a Certificate of Need would require submission of an IRP at the time the regulated utility applied to the MPSC for certification and that Detroit Edison intended to follow that process.[(b)] However, Detroit Edison has not yet submitted an application to the MPSC for a Certificate of Need for Fermi 3. Fermi 3 would add approximately 1535 MW(e) of generating capacity to the Detroit Edison portfolio, should it become operational on schedule in 2021.

(a) See Sections 9.2.2.2 and 9.2.2.3 for a detailed discussion of environmental regulations applicable to coal-fired and natural gas-fired power plants, respectively.

(b) The process for obtaining a Certificate of Need that was described in the MPSC Plan has since become law. (See Michigan Compiled Laws Section 460.6s at http://www.legislature.mi.gov/doc.aspx?mcl-460-6s). A Certificate of Need must now be obtained for energy-related capital projects costing $500 million or more, including construction of new electricity generating facilities, upgrades, or acquisition of existing facilities, investments in new generating assets, or execution of long-term power purchasing agreements. The Certificate would provide authority for cost recoveries.

ITC*Transmission*

Power generated by Fermi 3 would be delivered to the high-voltage transmission system operated by ITC*Transmission* through three redundant 345-kV lines (Fermi-Milan 1, Fermi-Milan 2, and Fermi-Milan 3). The point of connection would be ITC*Transmission*'s Milan substation, approximately 29.3 mi west-northwest of the Fermi site (Detroit Edison 2010). Power would be distributed to customers by the interconnected transmission networks operated by ITC*Transmission* and the Michigan Electric Transmission Company (METC), both of which are owned by ITC Holdings Corporation and which together are responsible for the majority of electric power distribution throughout southeastern Michigan, including the entirety of the traditional Detroit Edison service area. The ITC*Transmission* service area coincides with the Detroit Edison service area, covering 7600 mi^2 and including the metropolitan areas of Detroit and Ann Arbor (ITC 2010a). METC's service area covers 18,800 mi^2 and consists of more than 5400 mi of high-voltage transmission lines (ITC 2010b). The ITC*Transmission* and METC service areas are displayed in Figures 8-2 and 8-3, respectively.

MISO/PJM

In December 2000, ITC*Transmission* joined MISO. MISO is responsible for the reliability of the nearly 94,000 mi of interconnected high-voltage electric transmission grids in 15 States and the Canadian Province of Manitoba. MISO has partnered with PJM to develop and operate a wholesale market of high-voltage electric transmission that extends to 23 States, the District of Columbia, and Manitoba. The MISO and PJM service areas are displayed in Figure 8-4. Finally, the MISO and PJM service areas are part of the RFC,[a] one of eight Regional Reliability Entities that comprise NERC (NERC 2008). The geographic area of RFC is displayed in Figure 8-5. The eight NERC regional entities are shown in Figure 8-6.

NERC/RFC

NERC is required by the Federal Power Act of 2005 (16 USC 791a *et seq.*) to conduct annual reliability assessments. One such Long-Term Reliability Assessment (LTRA) report (including the RFC self-assessment report contained within the system-wide NERC assessment) was published by NERC in October 2008 (NERC 2008) and covered the period 2008–2017.[b] NERC relies upon reports created by its component regional entities for its annual reliability assessments.

(a) Additional details on RFC are available on the RFC Web site at http://www.rfirst.org.

(b) Although more recent LTRAs have since been published, the review team has elected to refer to this 2008 version as the most appropriate analysis for use as independent corroboration of other need for power reports addressed in this analysis.

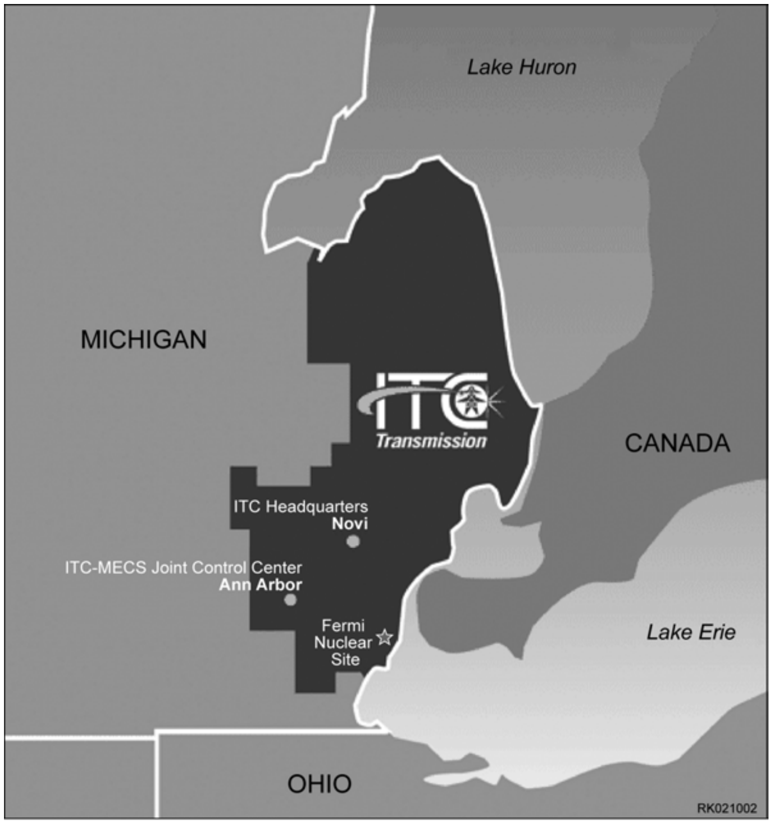

Figure 8-2. ITC*Transmission* Service Area (Detroit Edison 2011)

8.1.3 Electricity Planning in Michigan

This section discusses the electricity planning initiatives that have been completed for Michigan and the manner in which the review team relied on those initiatives for its need for power analysis.

8.1.3.1 The MPSC Plan

The need for power analysis provided by Detroit Edison in the ER was derived from the MPSC Plan (MPSC 2007). The MPSC Plan, the first comprehensive statewide electricity planning initiative completed in the State of Michigan, was developed in response to Executive Directive No. 2006-02 (Granholm 2006). The MPSC Plan has a geographic scope of the entire State and a planning horizon through 2025, well beyond the planned startup of Fermi 3.

To produce the MPSC Plan, various workgroups were assembled, each with an assignment to address different aspects of energy planning. Among the various workgroups, the Capacity Need Forum (CNF) Update Workgroup was most directly responsible for a determination of the

Figure 8-3. METC Service Area (Detroit Edison 2011)

need for power; consequently, its methodologies and results became the focus of the review team's assessment of the Plan. MPSC Plan projections were compiled for three regions of the State of Michigan – Southeast Michigan (the area served by ITC), the balance of the Lower Peninsula (primarily served by the Michigan Joint Zone), and the Upper Peninsula (served by American Transmission Company) – and then aggregated into the MPSC Plan. Because Detroit Edison represents approximately 99 percent of generation capacity in the Plan's Southeast Michigan Planning Area,[(a)] the review team determined the MPSC Plan's "Southeast Michigan" was sufficiently close in service area and customer base to the Detroit Edison service area that it could serve as representative of the Detroit Edison service area for this need for power assessment. Therefore, the review team uses the MPSC Plan's analysis and results for

(a) The City of Wyandotte, the City of Detroit, and the Lansing Board of Water and Light comprise the remainder of generating capacity in the Southeast Michigan Planning Area. See Section 5.5, MPSC Plan, Appendix Volume II, Workgroup Reports (MPSC 2007).

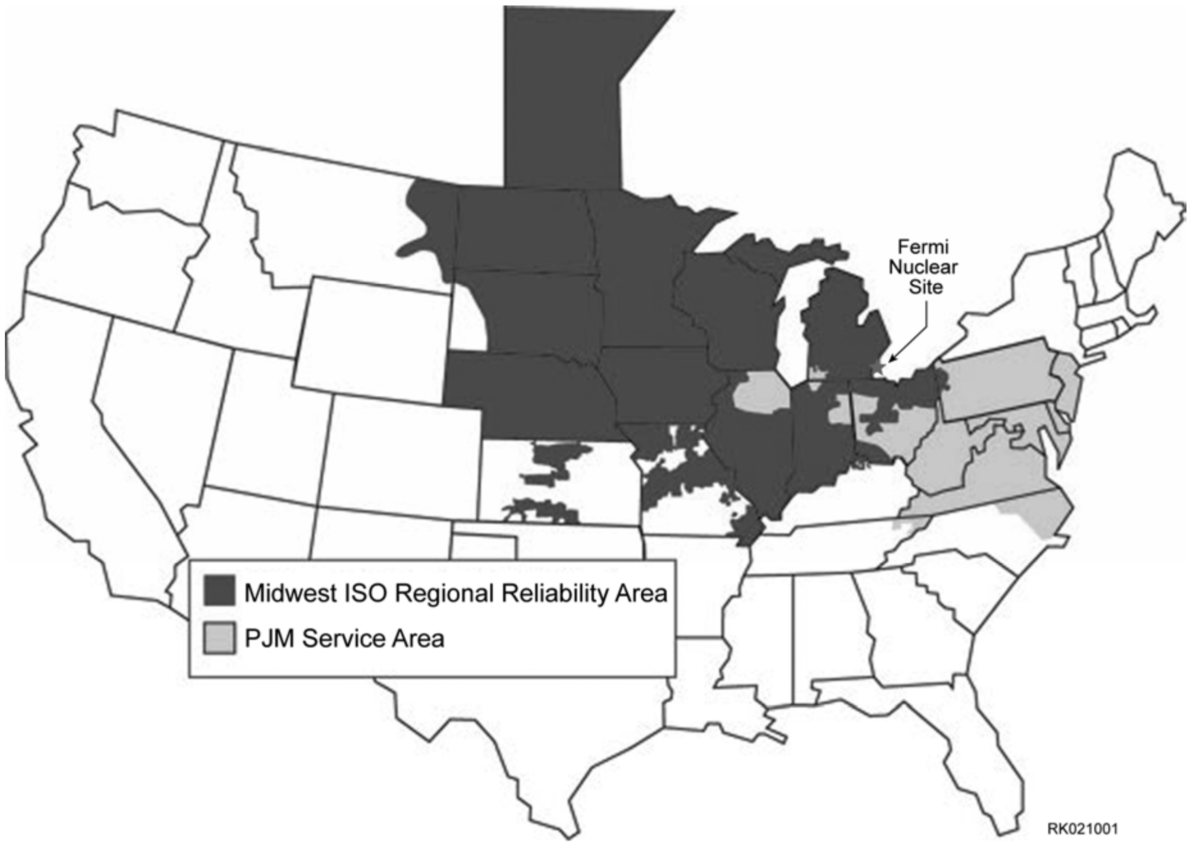

Figure 8-4. MISO (dark gray) and PJM (light gray) Service Territories (Detroit Edison 2011)

the Southeast Michigan Planning Area as the basis for its independent need for power assessment.

Because the MPSC Plan was intended to serve as the primary and official long-term electricity planning document for Michigan, and because of its appropriate geographic reach and planning horizon, the review team concluded that the results of that planning initiative could be accepted as a sufficient determination of the need for power in the Detroit Edison service area, provided the methodologies used in its development satisfied the ESRP acceptance criteria – that the MPSC Plan was systematic, comprehensive, subject to confirmation, and responsive to forecasting uncertainties. To confirm the adequacy of the MPSC Plan against these criteria, the review team reviewed the plan's data processing procedures and the methodologies employed by the CNF Update Working Group. These details had been provided in appendices contained in Volume II of the MPSC Plan (MPSC 2007). A summary of the salient points of the review team's assessment of the relevant appendices is provided below.

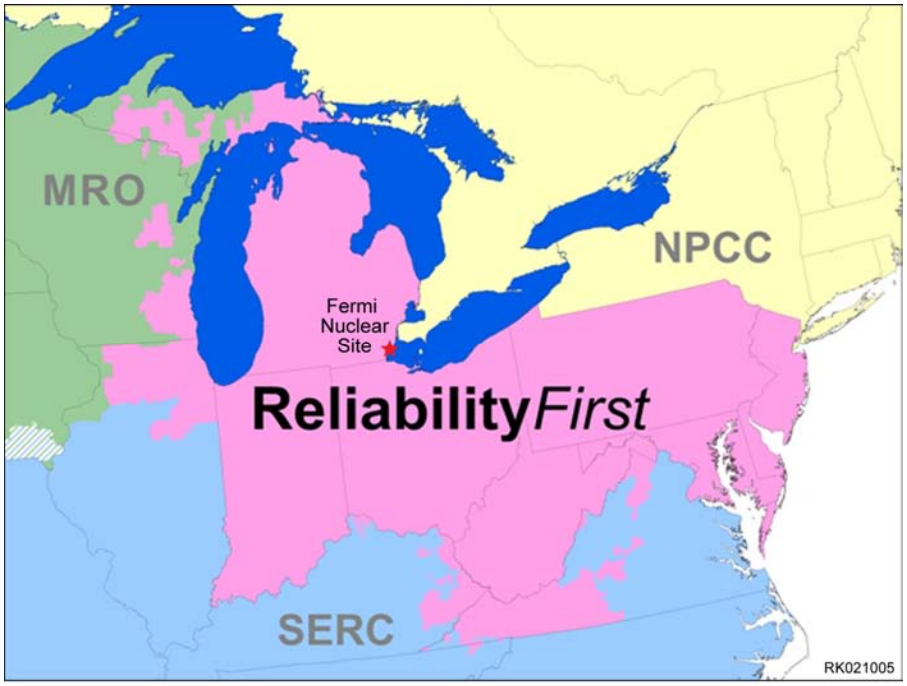

Figure 8-5. Reliability*First* Corporation Boundaries (Detroit Edison 2011)

Data used as inputs to the planning process were provided by the Michigan utilities whose representatives also comprised the members of the Plan's various working groups. *Strategist*, a proprietary computer software program developed by NewEnergy Associates, LLC, was used in data processing. The program consists of five application modules: Load Forecasting Adjustment (LFA), Generation and Fuel (GAF), PROVIEW, Capital Expenditure and Recovery, and Financial Reporting and Analysis. The CNF Update Working Group was responsible for updating the results of the 2005 CNF study, which had been independently produced in five planning areas, in the following respects:

- Confirm the inventory of generating plants currently operational in Michigan, including a review of investment and operating costs, performance, and emission profiles of central station generation technologies, and assess planning review requirements and siting issues, especially those relating to necessary air permits.
- Review the transmission analysis provided in the 2005 study to confirm the simultaneous, on-peak transmission capability and determine the capability availability for reliability support for the Lower Peninsula.
- Assess electric reliability for all regions of Michigan.

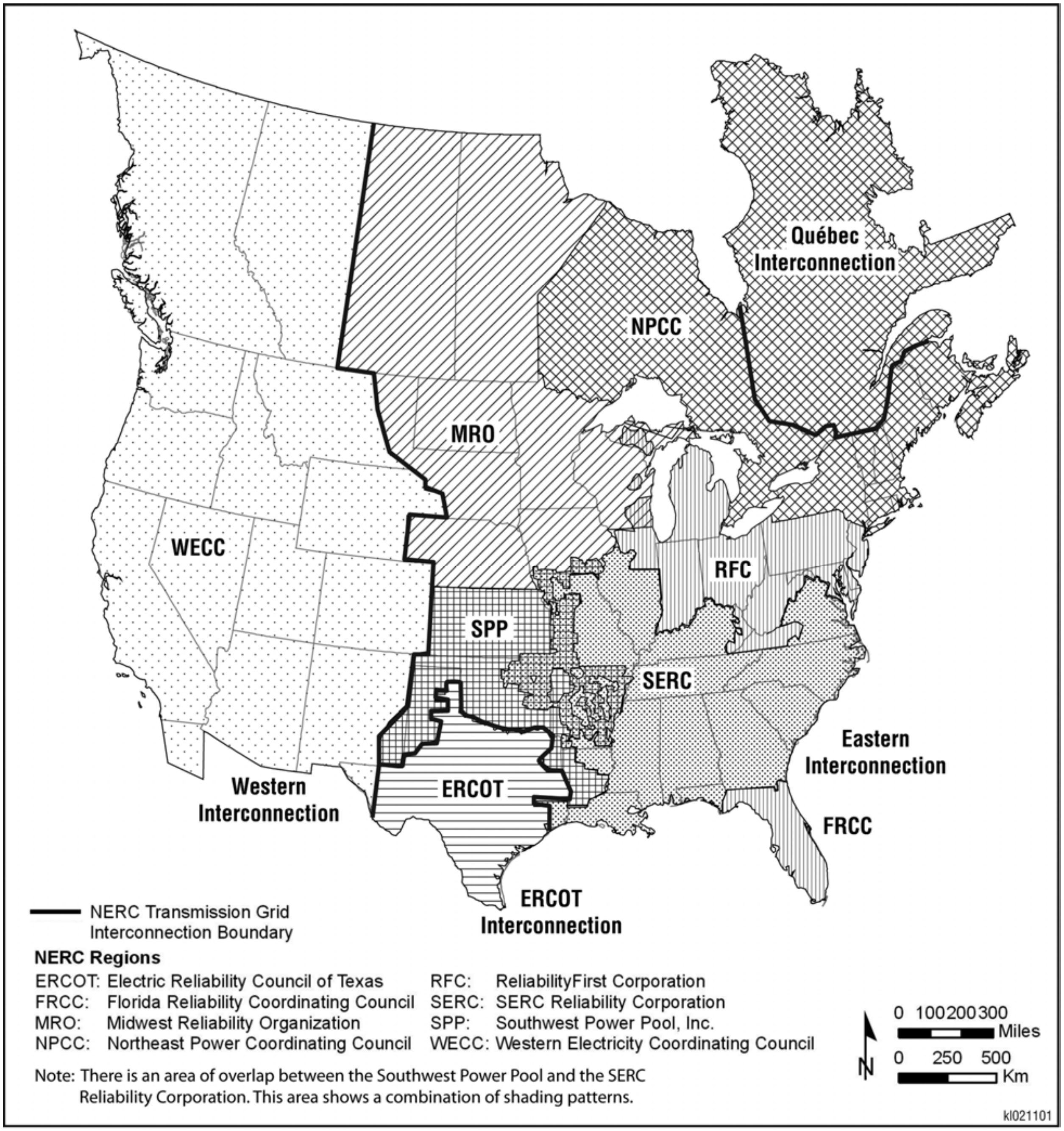

Figure 8-6. NERC Regions and Electricity Transmission Grid Interconnections (modified from NERC 2011)

- Develop an updated 20-year electric sales and peak demand forecast for each of the three planning regions (Southeast Michigan, Upper Peninsula, and Balance of Lower Peninsula) for Michigan.
- Expand the model system, providing fuel and emission cost forecasts for various scenarios and sensitivities.

The ESRP establishes four acceptance criteria for a need for power analysis. The analysis must be (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainties. The review team's evaluation of the MPSC Plan's satisfaction of these criteria is as follows:

Systematic: The architecture and operation of the *Strategist* computer program used to support development of the MPSC Plan ensure a systematic approach to data analysis. The GAF module uses probabilistic methods to simulate power system operation on an hourly basis, providing production costs and reliability estimates that are essential elements to utility supply and demand planning while providing the user with the flexibility to establish dispatch queue priorities on either a seasonal or annual basis. System load data developed by the GAF module is provided as input to the LFA module, which provides the user with additional flexibility in dispatching power, allowing non-thermal resources such as pumped storage to be dispatched before thermal resources, with imported power dispatched only after in-State resources and then only through a marginal cost-based algorithm to minimize costs. Further, the LFA module algorithm dispatches stored energy from the highest cost hour down for generation and pumps water to storage from the lowest cost hour up, thus reducing demands on other technologies at high-cost hours and increasing the load met by those other technologies at low cost hours. The LFA module also provides the user with an option of using the capacity of storage to ensure system reliability as well as for more typical economic reasons. The probabilistic methods employed by the *Strategist* software duplicate widely used production costing procedures, mimicking the typical decision-making procedures of a transmission system operator, ensuring not only the most economical dispatch of power but also that system reliability indices such as loss-of-load hours, expected emergency power, and spinning reserve margins are also satisfied. The user is also provided the flexibility to hold reliability indices constant, allowing capacity benefits that would accrue from Demand Side Management (DSM) programs to be separately calculated. Additional, more detailed evaluations of the impacts of DSM strategies are introduced through the operation of the PROVIEW module, which develops a least-cost balanced demand and supply plan for a utility system under user-prescribed sets of constraints and assumptions. The review team concludes that the data analysis methodologies contained in the *Strategist* software program are systematic, incorporating all aspects of utility planning and thus duplicating real-world decision-making procedures while providing the user with the flexibility to alter default settings to evaluate the impacts of various strategies on the Michigan power system.

Comprehensive: The CNF Update Working Group addressed all aspects of electric utility planning and strategy development, considering the existing central station generation portfolio, existing technologies, and likely future technologies such as conversion of existing coal-fired power plants to integrated gasification combined cycle or pulverized coal plants producing ultra-supercritical steam. The analysis extended into evaluations of the potential for increased efficiencies with incorporation of newer technologies as well as the costs and logistical issues associated with adoption of those new technologies. The Working Group also considered whether existing support infrastructures could support significant changes to the complexion of the State's central station generators, evaluating, for example, whether the existing natural gas pipeline infrastructure would support major shifts to natural gas combined cycle generation or whether the existing transmission system would respond to dramatic changes in central station generation or power imports without sacrificing reliability. Existing agreements and constraints that could change the effective on-peak transfer capacity of the Michigan transmission system were also considered. The review team concludes that the CNF Update Working Group's approach to meeting its responsibilities was comprehensive, addressing all major aspects of utility planning and strategy development.

Subject to Confirmation: Data used to develop the initial 2005 CNF report as well as the more recent data used by the CNF Update Working Group are subject to independent confirmation by MISO in development of statutorily prescribed annual electric system reliability assessments. Importantly, MISO's independent confirmation is for reliability purposes alone and provides no insight into the manner in which generation sources can be used to meet system reliability demands, which is the primary focus of the MPSC Plan. Nevertheless, the MISO reliability assessment still serves as an independent confirmation of the production data that are the basis for the analyses that support MPSC Plan conclusions and recommendations. Reliability modeling is performed to determine whether existing generation, together with electric transmission transfer capability and available external support, can reliably meet projected hourly peak load. The MISO staff used the MARELLI computer model to independently evaluate production data and estimate future generating reliability throughout the RFC region, which includes all of Michigan. The results of the most recent MISO analysis were incorporated into the NERC 2008 Long-Term Reliability Assessment (NERC 2008) that was discussed in Section 8.1.2 above. The MISO procedures were also determined by the review team to satisfy ESRP acceptance criteria. The review team concludes, therefore, that the annual, independent analysis of reliability performed by MISO and using the same production data as were used in the MPSC Plan constitutes an independent confirmation of the conclusions of the CNF Update Working Group and thus satisfies the ESRP criterion.

Responsive to Forecasting Uncertainties: The *Strategist* computer program used by the CNF Update Working Group has sufficient sophistication and flexibility to accommodate a variety of electric system planning scenarios. The CNF Update Working Group was responsible for updating the 20-year electric sales and peak demand forecast for Michigan provided in the initial CNF report, which at the time of the Workgroup's deliberations was less than 3 years old. With adoption of the MARELLI default value of one day's Loss-of-Load Probability (LOLP) every 10 years as an acceptable risk target to system reliability, the CNF Update Working Group acknowledged that Michigan's reliability forecasting was significantly affected by forecasting uncertainties, including changing conditions in external markets that are interconnected with the Michigan electricity system and economic conditions in local markets served by Detroit Edison. Approximately 99 percent of the Southeast Michigan forecast that was used by the CNF Update Working Group relied on Detroit Edison's electricity projections, which are based on econometric and end-use modeling techniques and which reflected a then-current weaker economic outlook, increased conservation, and efficiency improvements over what was provided as the forecasting basis in the earlier CNF report. Because the CNF Update Working Group was directed to update the relatively recent CNF forecasts and because the Detroit Edison forecast reflected existing as well as projected local economic conditions, the review team concludes that the methodologies employed by the CNF Update Working Group were sensitive to forecasting uncertainties and that its conclusions and recommendations were based on appropriate incorporation of existing economic and market conditions. Sensitivity analyses for the LOLP risk target performed against the assumptions defining Base Case, High Load, Low Load, Expanded Transmission, and Low Imports were viewed by the review team as demonstration of the MPSC Plan's sensitivity to forecasting uncertainties.

8.2 Power Demand

This section discusses the historic and projected demand for electricity as described by the MPSC Plan. Detroit Edison identified the projected start of operations for Fermi 3 as 2021. Because the MPSC Plan projects supply and demand data to 2025, the review team determined that use of the 2025 projections was consistent with ESRP guidance to extend its need for power analysis "through the 3rd year of commercial operation of all proposed units" (NRC 2000). Section 8.2.1 discusses key factors that influence projected demand for electricity. Section 8.2.2 provides an overview of the projected peak summer demand for electricity in the Detroit Edison service area.

8.2.1 Factors Considered in Projecting Growth in Demand

The MPSC Plan included projections for demographics of the industrial, residential, and commercial electricity customer sectors and projected industrial activity levels (especially in auto and truck manufacturing, steel production, and other related industries) and major factors that resulted in forecasting uncertainties (e.g., weather and business cycles of major industrial users). Finally, energy efficiency and energy conservation can have significant impact on the growth in electricity demand. Additional details of how energy efficiency and energy conservation were considered in demand projects are provided below.

Four categories of energy efficiency were examined in detail in the MPSC Plan: (1) statewide energy efficiency programs, (2) electric utility load response programs, (3) commercial building energy efficiency code programs, and (4) State-specific energy efficiency standards for appliances. The MPSC Plan predicted that a reduction in the growth of power demand by as much as 50 percent over a 10-year period would result from the implementation of a comprehensive energy efficiency program and aggressive enforcement, resulting in statewide electric energy savings of between 6664 and 10,603 GWh (gigawatt hour) and reductions in peak electricity demand of between 876 and 1889 MW. Independently developed estimates by Detroit Edison and Consumer's Energy suggest that a 10-year load management programming effort could reduce peak electric demand by 569 MW and annual energy use by 35 GWh (Detroit Edison 2011). The MPSC Plan estimates promulgation and enforcement of energy efficient commercial building codes could result in statewide electric energy savings over that same period of 477 GWh. The adoption of energy efficiency standards for certain electric appliances could result in additional significant savings. Assuming that all appropriate policies and standards will be adopted and enforced, comparing the projected energy savings against even the more conservative estimate for growth of energy demand contained in the MPSC Plan shows the collective impacts of all such programs would slow, but not completely reverse, the long-term trend of increasing electric power demand.

Table 8-1 displays the MPSC Plan's projected energy efficiency demand savings from 2007 to 2025 for the entire State of Michigan. Of the total 96,785,842 MWh of power generated by electric utilities in Michigan in 2008, Detroit Edison was responsible for 48,816,410 MWh, or approximately 50 percent of the total (DOE/EIA 2010b). To translate MPSC's projected energy efficiency savings in Table 8-1 to an appropriate level for the Detroit Edison service area, the review team made the simplifying assumption that Detroit Edison customers would contribute to the statewide DSM reductions in the same proportion as their contribution to the total power generated in the State of Michigan. Therefore, the review team assumed Detroit Edison would be able to reduce its system-wide generating capacity by at least half of the amount shown in Table 8-1, or about 1400 MW by 2025.

If pursued and successfully executed, energy efficiency and energy conservation programs would result in meaningful energy savings and reductions in electricity demand. However, even if comprehensively structured and aggressively implemented and enforced, energy efficiency programs would have only a limited influence on the rate of growth of Michigan's need for power. Identification of potential savings does not necessarily guarantee demand response programs will be successfully implemented or that all eligible customers will participate fully; consequently, there is no guarantee that the identified potential amounts of demand reduction will actually materialize.

The review team determined that the factors described above that were considered in developing forecasting uncertainties presented in the MPSC Plan and cited in Detroit Edison's

Table 8-1. Modeled Energy Efficiency Program Demand Savings

Year	Demand Savings (MW)
2007	385
2008	513
2009	640
2010	764
2011	886
2012	1069
2013	1250
2014	1429
2015	1609
2016	1787
2017	1902
2018	2016
2019	2130
2020	2243
2021	2356
2022	2468
2023	2579
2024	2690
2025	2801

Source: MPSC Plan Appendix – Volume II (MSPC 2007)

ER were consistent with NRC guidance, were systematically developed, gave adequate consideration to historic trends in energy consumption, and were sufficiently sensitive to an appropriate array of forecasting uncertainties.

8.2.2 Independent Projections on Growth in Demand

A comprehensive transmission planning exercise, MISO Transmission Expansion Plan (MTEP), was completed in November 2008 (MISO 2008). Analyses performed in the context of that study were independent of the MPSC Plan, but nevertheless consistent with the MPSC Plan in their results. MISO assessed power resource adequacy from both resource availability (based on minimum reserve margin requirements of 14.5 percent established by State authorities) and a confidence (or risk) level over the period 2008 through 2017 over various scenarios to determine the onset of reliability problems (a level of risk defined as a Loss of Load Expectation [LOLE] of greater than 1 day in 10 years), assuming a reserve margin of 14.5 percent. Models were run for a Base Case (which assumes as much as 80 percent of capacities represented in the requested generator interconnection requests will come on-line) and for other factors deemed to have critical impacts on reserve margins. The results as shown in Table 8-2 indicate that without new generating capacity, current resource levels would put the MISO area at risk for a load disruption by 2014, and that under scenarios that approximate reasonably expected changes in the MISO system, exposure to such disruption could begin even sooner. The 2008 MISO planning exercise predicts immediate exposure to loss of load if no power were to be imported, as displayed in Table 8-2.

Table 8-2. MISO Predicted Year of LOLE of Greater Than One Day in 10 Years

Scenario	Onset of LOLE of 1 day in 10 years
Base Case[(a)]	2014
2-year delay for all projects in the queue	2014
Increased retirements of baseload units	2013
Increase in forced outage rates	2011
Elimination of production tax credit for wind energy	2014
No firm imports of power	2009
Reduction in demand-side management	2012

Source: MISO 2008

(a) The MISO Base Case assumes that 80 percent of interconnection requests currently on the queue for which an Interconnection Agreement has been signed will come on-line and that 20 percent of all other projects on the queue will ultimately come on-line.

8.2.3 Power Demand and Energy Requirements

Statewide, the customer base for retail electricity sales in 2008 included 32.4 percent residential, 36.8 percent commercial, and 30.7 percent industrial (DOE/EIA 2010b). The distribution of electricity sales between those three rate categories in the Detroit Edison service area over that same period was 32.6 percent residential, 39.8 percent commercial, and 27.6 percent industrial (DOE/EIA 2010b).

The review team notes that despite incorporation of the downward projections of demand provided by the State's utilities, the MPCS Plan projected a modest growth in electricity demand in Southeast Michigan of 1.2 percent annually over the planning horizon represented in the Plan (2006 to 2025). Table 8-3 shows the MPSC Plan's forecasted growth in peak demand in the Southeast Michigan Planning Area over the period 2005–2025 for each of the planning scenarios addressed in the MPSC Plan: Base Case, High Growth, and Low Growth.

Table 8-3. Forecasted Annual Summer Non-Coincident Peak Electricity Demand (in MW) for the MPSC Southeast Michigan Planning Area

Year	Base Case	High Growth	Low Growth
2005	12,209	12,331	12,087
2006	12,427	12,676	12,178
2007	12,579	12,957	12,202
2008	12,682	13,190	12,175
2009	12,666	13,300	12,033
2010	12,806	13,574	12,038
2011	12,955	13,861	12,048
2012	13,144	14,196	12,092
2013	13,287	14,483	12,091
2014	13,442	14,786	12,098
2015	13,598	14,958	12,238
2016	13,728	15,101	12,355
2017	13,865	15,252	12,479
2018	14,031	15,434	12,628
2019	14,190	15,609	12,771
2020	14,414	15,856	12,973
2021	14,643	16,107	13,178
2022	14,875	16,362	13,387
2023	15,111	16,622	13,600
2024	15,351	16,886	13,816
2025	15,595	17,154	14,035

Source: MPSC Plan, Appendix – Volume II, Workgroup Reports, Tables 10, 11, and 12 (MPSC 2007)

The MPSC Plan projects a statewide growth rate for electricity consumption of 1.3 percent over the period 2006 to 2025, from 112,183 GWh to 143,094 GWh, and a growth rate in electricity consumption in Southeast Michigan of 1.2 percent. The MPSC Plan estimated a statewide summer peak demand of 23,756 MW in 2006 and 29,856 MW in 2025 (Base Case). Of this amount, 12,427 MW and 15,595 MW of peak summer demand were projected for Southeast Michigan in 2006 and 2025, respectively (MPSC 2007, Table 10, Appendix, Volume II, Workgroup Reports). In confirmation of the reliability of the MPSC Plan for this need for power assessment, the review team determined the MSPC Plan's projected growth rates are generally consistent with forecasts independently developed by MISO and incorporated into NERC's LTRA report (NERC 2008).

Table 8-4 displays the MPSC Plan's projected 2025 demand for electricity at summer peak in the Southeast Michigan Planning Area, adjusted to account for energy efficiency measures that

Table 8-4. 2025 Projected Summer Peak Demand in Southeast Michigan Planning Area (in MW)

	Demand Component	2025
A	Peak Summer Demand[(a)]	15,595
B	(Less) Energy Efficiency Measures[(b)]	1400
C	Net Peak Summer Demand (A – B)	14,195
D	Reserve Margin (C × 0.145)	2058
E	Total Peak Summer Demand (C + D)	16,253

(a) Source: MPSC 2007 (Base Case Scenario)
(b) Value calculated as 50 percent of 2025 demand savings (MPSC 2007, Plan Appendix – Volume II).

reduce overall demand and to include the reserve margin additional capacity necessary to maintain grid stability. Based upon the MPSC Plan's Base Case estimate and the assumptions discussed above, the review team identified a net peak summer demand in 2025 of 14,195 MW.

8.2.4 Reassessment of the MPSC Plan Based on Current Data

Because the MPSC 21st Century Electric Energy Plan was completed in 2007, it did not include any potential shifts in the demand for electricity due to the economic downturn that began in late 2008. The impacts of the recession were particularly severe in Michigan, due in large part to downturns in automobile manufacturing and supporting industries. Because the industrial sector represented a significant portion of electricity demand, especially in communities hosting automobile manufacturing and assembly facilities, the projections for growth in electricity demand contained in the MPSC Plan were never realized. Concurrent reductions in populations in those same communities eroded the residential electrical customer sector, further reducing the need for electricity. Consequently, the review team concluded it was prudent to determine, based on currently available electricity demand data, whether or not the projections discussed in the MPSC Plan were still relevant.

The review team's reassessment is based on Reliability*First*'s 2010 Long Term Resource Assessment, hereafter the LTRA (RFC 2010). However, unlike the MPSC Plan, the LTRA does not disaggregate its analysis into a subregion that is analogous to the DTE service area. To determine whether or not the MPSC Plan's projections were still valid, the review team had to make a limiting assumption regarding the relationship between Midwest ISO aggregated projection values and those developed for the MPSC Plan, which is a subregion of Midwest ISO:

- The summertime peak demand for electricity in the Detroit Edison Service Area is a relatively constant proportion of the total summertime peak demand for electricity in the Midwest ISO.

To determine the reasonableness of the assumption, the review team compared the 2010 through 2019 estimated summer peak demand from the MPSC Plan's Southeast Michigan region and those from the LTRA. In all cases, the summer peak demand estimates represented between 7.60 and 7.78 percent of Reliability*First*'s analogous demand, with an average over the 10 years of 7.69 percent. Because the difference between the two estimates in any given year was less than 1 percent, the review team determined it was not unreasonable to assume that the Detroit Edison portion of Reliability*First*'s electricity demand was sufficiently constant for the purposes of this EIS. The review team then compared the change in demand predicted by the MPSC Plan to that from the more contemporary estimates in the LTRA. To do this, the review team extracted the DTE portion of the LTRA's estimated demand between 2010 and 2019 by multiplying each year's peak summer demand value by the average percentage found during the confirmation stage: 7.69 percent.

As can be seen in Figure 8-7, one outstanding characteristic of the comparison needs to be addressed: the relative closeness of the two sets of estimates. At no point does the value from one estimate vary by more than about 200 MW from that of the other, with the final year of the figure carrying the largest variation, when extrapolation is least reliable, and the average difference between the two estimates is slightly more than 100 MW. The review team does not consider the relative closeness of the two trend lines to be evidence that the MPSC Plan is still valid, because the proximity of the two estimates in any given year is an artificial construct of the table created by the review team for comparative purposes only. What is more important is the similarity in the slopes of the two trend lines, which indicates that even if the gap between the two estimates were larger, the overall trend for growth in the MPSC Plan is corroborated by that of the LTRA. Therefore, the review team determined a reasonable interpretation of the data found in Figure 8-7 is that the MPSC Plan was relatively accurate until one of the factors affecting the demand for electricity – the economic downturn – changed the energy industry. However, since the slopes are still similar following that decline, the demand for electricity in the DTE Service Area has continued growing at about the same pace that had been originally projected, but from a slightly lower starting point. This scenario is supported by the PJM Regional Transmission Organization (RTO) analysis and Figure PJM-1 in the LTRA 2010–2019 report, which shows the same sort of pattern elsewhere in the Midwest ISO (RFC 2010).

Based on the confirmatory analysis performed on the Michigan 21st Century Plan using an additional independent assessment (the NERC subregion LTRA), the review team determined the original assessment made by the MPSC Plan is still representative of the potential for future growth in electricity demand in the DTE Service Area. Therefore, the review team determined the original need for power assessment performed for the DEIS is still valid, and no revisions have been made to the analysis or the conclusions of this chapter for purposes of the FEIS.

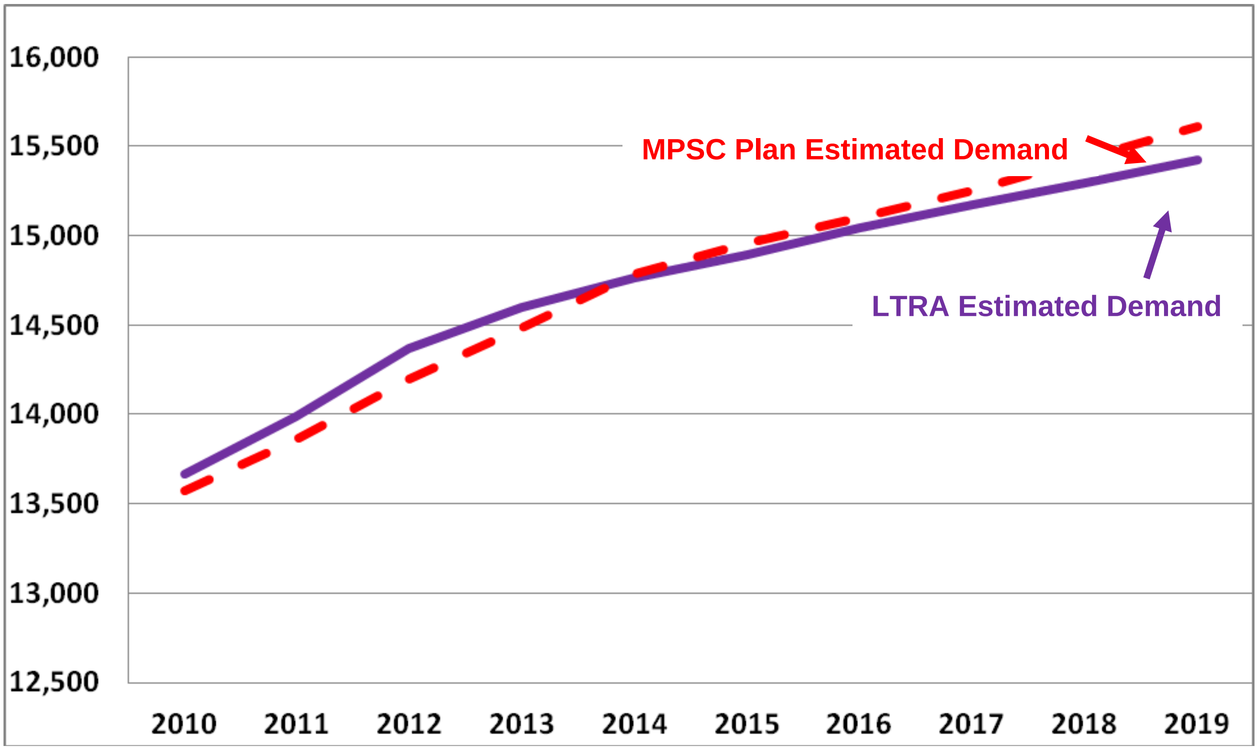

Figure 8-7. Comparison of Summer Peak Electricity Demand Estimates (MW)

8.3 Power Supply

This section assesses the evaluation by Detroit Edison of the adequacy of its existing power generating capability against current and expected future power demands. The fuel mix used in Michigan for electricity generation was outlined in Section 8.1. Within Southeast Michigan, the technology mix used by investor-owned utilities (primarily Detroit Edison) includes steam turbines supported by nuclear, coal, natural gas, and oil combined cycle plants consisting of natural gas-fired combustion turbines and combustion turbines and run-of-the-river and pumped-storage hydroelectric turbines. With a rated capacity of 1111 MW, the Fermi 2 nuclear reactor operated by Detroit Edison is the largest single generator among the 119 central station generating units operating within the region. Table 8-5 displays the electricity generating capacity within the Detroit Edison service area and the rest of the Southeast Michigan Planning Area.

Detroit Edison was the source for some of the data contained in the MPSC Plan regarding an inventory of existing generating capacity within the State (reported separately for each of the three major planning regions established in the MPSC Plan: Southeast Michigan, Balance of Lower Peninsula, and Upper Peninsula). The MPSC Plan lists central station power generating

Table 8-5. Electricity Generation Capacity in Southeast Michigan (2005 Data)

Plant Type	Summer Capacity (MW)	Winter Capacity (MW)	Number of Units
Ownership: Investor Owned Utility			
Nuclear	1110	1125	1
Steam generator	8248	8275	26
Combined cycle/gas turbine	969	1188	31
Internal combustion	152	152	61
Subtotal	10,479	10,740	119
Ownership: Municipality/Cooperative/Public Authority			
Steam generator	470	472	8
Combined cycle/gas turbine	25	30	1
Internal combustion	39	40	36
Subtotal	534	542	45
Ownership: Non-Utility			
Steam generator	326	338	7
Combined cycle/gas turbine	1502	1515	23
Hydroelectric	5	6	5
Internal combustion	76	77	76
Subtotal	1909	1936	111
Southeast Total	12,922	13,218	275

Source: MPSC Plan, Appendix Volume II, Workgroup Reports, Chapter 2, Capacity Need Forum Update Workgroup Resource Assessment, Table 1 (MPSC 2007).

facilities in Southeast Michigan as consisting of: 32 natural gas-fired combustion turbines; 26 oil-fired combustion turbines; 3 run-of-river hydroelectric plants; 34 steam turbines (supported by 8 landfill gas-fired, 21 coal-fired, 5 oil-fired, and 1 refuse-fired boilers); and 1 nuclear plant (MPSC 2007). Although some minor changes may have occurred to the operating conditions or capacities of the listed units since these tabulations were developed, the review team has determined that these data represent a sufficiently reliable inventory of existing power generating capacity as suggested by NRC's ESRP guidance.

As outlined in Section 8.1, Detroit Edison power enters the transmission grid operated by ITC*Transmission*, a member of MISO. Detroit Edison continues to rely on the Generation Interconnection Request Queue maintained by MISO for a reliable and authoritative listing of proposed new generating capacity. As of January 29, 2010, there were 47 active generator interconnection requests in the MISO interconnection queue for new generation sources in

Michigan, representing a potential infusion of 8776 MW of new generating capacity (maximum summer capacity)[(a)] (including Fermi 3). A facility's presence on the interconnection queue does not guarantee that it will ultimately begin operation.[(b)] Consequently, only 4180 MW of new capacity has actually become available to date. Future generation capacity must also account for power generated outside of Michigan and imported into the State. Although as much as 3000 MW of on-peak power transfer capability existed in 2009, firm reserves of 800 MW are in place for those likely sources of exported power from locations outside of Michigan. Consequently, reliable power import estimates used in forecasting performed in the MPSC Plan were limited to 2200 MW.

A number of other factors related to wholesale electricity markets contribute to uncertainties with respect to available future retail power in the Detroit Edison service area. Upgrades to the configurations and interconnections of ITC*Transmission* and METC transmission systems as well as various expansion projects under consideration can all dramatically change power import/export characteristics for the Detroit Edison service area. Finally, future estimates of available power must consider announced and expected retirement schedules of baseload units within the Detroit Edison service area. To anticipate retirements, the MPSC Plan assigned expected lifetimes to each type of baseload unit currently in operation: 65 years for coal, 60 years for nuclear, 40 years for combined cycle plants, and 30 years for combustion turbines. The review team concurs in the reasonableness of these lifetime assumptions. Twenty-nine fossil fuel units throughout the State are scheduled for retirement through 2024, representing a total generating capacity of 3755 MW. Table 8-6 displays the MPSC Plan's projected retirements for the State of Michigan from 2013 through 2024.

In the MPSC Plan's Southeast Michigan Planning Area, generating unit retirements are projected to total 2039 MW through 2024 (1877 MW from Detroit Edison, 93 MW from Lansing Board of Water and Light, 47 MW from the City of Detroit, and 22 MW from the City of Wyandotte). All of the units projected to be retired in Table 8-7 are currently supplying power to customers in the same area that would be served by the 1535-MW(e) Fermi 3. Introduction of Fermi 3 into the Detroit Edison power portfolio will potentially offset approximately 75 percent of the generation capacity represented by the projected unit retirements in Southeast Michigan and 82 percent of the generating capacity represented by retiring Detroit Edison-owned units.

(a) Data reported in the ER reflected the generator interconnection queue as of June 11, 2008. At that time, there were 28 active interconnection requests totaling 7015 MW maximum summer capacity. The ER did not distinguish between in-service or proposed generating units on the queue. The current MISO Generation Interconnection Request Queue can be viewed on the MISO Web site http://www.midwestiso.org/page/Generator%20Interconnection.

(b) MISO reports that historically only 20 percent of the projects in the interconnection queue for which a signed Interconnection Agreement has been executed actually go into service (MISO 2008).

Table 8-6. Aggregate Unit Retirements in Michigan

Year	Modeled Capacity Retired (MW)
2013	129
2014	0
2015	301
2016	226
2017	204
2018	439
2019	375
2020	180
2021	402
2022	584
2023	400
2024	515
Total	**3755**

Source: MPSC Plan Appendix – Volume II (MPSC 2007)

Table 8-7. Aggregate Retirements in Southeast Michigan

Plant Name	Owner	Retire Year	Capacity (MW)
TRNTNCHN	Detroit Edison	2015	210
MSTERSKY 5	City of Detroit	2015	39
CNNRSCRK	Detroit Edison	2016	215
STCLAIR 1	Detroit Edison	2018	153
STCLAIR 2	Detroit Edison	2018	162
STCLAIR 3	Detroit Edison	2019	171
STCLAIR 4	Detroit Edison	2019	158
ECKERT 1	Lansing BWL	2019	46
RVRROUGE 1	Detroit Edison	2021	242
RVRROUGE 2	Detroit Edison	2022	247
WYNDTTWY 5	Wyandotte	2022	22
RVRROUGE 3	Detroit Edison	2023	280
ECKERT 2	Lansing BWL	2023	47
MSTERSKY 6	City of Detroit	2023	47
Total			**2039**

Source: MPSC Plan Appendix – Volume II (MPSC 2007)

8.4 Summary of Need for Power

The review team has examined the methodology employed in developing the short- and long-term electric power needs discussed in the MPSC Plan and has verified that it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty (NRC 2000). The evaluation also confirmed that the planning effort represented in the MPSC Plan extended beyond supply-side projections for construction of conventional generation, transmission, and distribution systems to consider a full complement of both supply-side and demand-side projections and extended beyond conventional energy resources to examine the feasibility and potential role of renewable energy resources. The review team also examined the scope of the MPSC Plan and has verified that it met the objectives of ensuring continued electricity reliability, controlling both short- and long-term costs, minimizing environmental impacts, and enhancing overall system security by decreasing reliance on imported energy resources and maximizing the use of locally available energy resources. Next, the review team assessed the MPSC Plan and its supporting data and determined that the MPSC Plan's conclusions were reproducible and gave consideration to the influence of forecasting uncertainties to an appropriate extent. Finally, the review team reconfirmed the relevance of the MPSC Plan following the economic downturn of the economy that the Plan was unable to consider.

In summary, power from Fermi 3 would largely offset the projected loss of 2039 MW of generating capacity in the Southeast Michigan Planning Area due to unit retirements. In addition to planned retirements, the MPSC Plan Base Case Scenario projected a growth in power demand throughout the State. According to data presented in the MPSC Plan, in the Southeast Michigan Planning Area, the 2005 baseload capacity of 12,922 MW would need to increase by 3331 MW to meet the projected 2025 peak demand of 16,253 MW while still preserving adequate spinning reserve and system reliability. Notwithstanding other changes to demand or supply, Fermi 3 would meet 46 percent of that required additional power capacity. Table 8-8 provides a summary of the need for power in Southeast Michigan in 2025.

The review team finds the MPSC Plan conclusion, that the State will continue to experience growth in power demand into the foreseeable future, is not unreasonable. The review team also finds the MPSC Plan conclusion not unreasonable that new baseload capacity will be needed no later than 2015 to preserve adequate reserve margins, and that such needs exist irrespective of reductions in demand resulting from successful implementation of energy conservation programs or changes to power import/export conditions affecting the Detroit Edison service area. The review team concludes, therefore, that by 2024 (3 years after the commencement of commercial operations at Fermi 3), there will be an electricity supply shortage sufficient to accommodate the capacity of Fermi 3, and therefore there is a demonstrated need for power.

Table 8-8. Summary of MPSC Plan 2025 Need for Power in the Southeast Michigan Area (in MW)

	Component	2025
A	Total Peak Summer Demand	16,253
B	Baseline Supply of Electricity (2005 Data)	12,922
C	Loss in Generating Capacity Due to Projected Retirements	(2039)
D	Net Supply of Electricity in 2025 (B + C)	10,883
E	Surplus (Deficit) in 2025 Generating Capacity Needs (D – A)	(5370)
F	Fermi 3 Net Generating Capacity	1535
G	Surplus (Deficit) in 2025 Generating Capacity with Fermi 3 (E + F)	(3835)

Source: MPSC Plan Appendix – Volume II (MPSC 2007)

8.5 References

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9.0 Environmental Impacts of Alternatives

This chapter describes alternatives to the proposed U.S. Nuclear Regulatory Commission (NRC) action for a combined license (COL) and the U.S. Army Corps of Engineers' (USACE's) action for a Department of Army (DA) permit and discusses the environmental impacts of those alternatives. Section 9.1 discusses the no-action alternative. Section 9.2 addresses alternative energy sources. Section 9.3 reviews Detroit Edison Company's (Detroit Edison's) region of interest (ROI) evaluated in the site selection process, its alternative site selection process, and issues common or generic to all the alternative sites; and summarizes the environmental impacts for the proposed and alternative sites. Section 9.4 examines plant design alternatives. Section 9.5 lists the references cited in this chapter.

The need to compare the proposed action with alternatives arises from the requirement in Section 102(2)(C)(iii) of the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321), that environmental impact statements (EISs) include an analysis of alternatives to the proposed action. NRC implements this requirement through regulations in Title 10 of the *Code of Federal Regulations* (CFR) Part 51 and its Environmental Standard Review Plan (ESRP) (NRC 2000). The environmental impacts of the alternatives are evaluated using the NRC's three-level standard of significance – SMALL, MODERATE, or LARGE – developed using Council on Environmental Quality (CEQ) guidelines (40 CFR 1508.27) and set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. The issues evaluated in this chapter are the same as those addressed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Volumes 1 and 2 (GEIS) (NRC 1996, 1999)[(a)] with the additional issue of environmental justice. Although NUREG-1437 was developed for license renewal, it provides useful information for this review and is referenced throughout this chapter. Additional guidance on conducting environmental reviews is provided in the NRC Staff Memorandum *Addressing Construction and Preconstruction, Greenhouse Gas Issues, General Conformity Determinations, Environmental Justice, Need for Power, Cumulative Impact Analysis, and Cultural/Historical Resources Analysis Issues in Environmental Impact Statements* (NRC 2011a).

As part of the evaluation of a permit application submitted to USACE that is subject to Section 404 of the Clean Water Act (CWA), USACE must define the overall project purpose in addition to the basic project purpose. The overall project purpose establishes the scope of the alternatives analysis and is used for evaluating practicable alternatives under the Environmental Protection Agency's (EPA's) CWA Section 404(b)(1) Guidelines (40 CFR Part 230). In accordance with the Guidelines and USACE Headquarters guidance (HQUSACE 1989), the

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(a) NUREG-1437 was originally issued in 1996. Addendum 1 to NUREG-1437 was issued in 1999. Hereafter, all references to the GEIS or NUREG-1437 include NUREG-1437 and its Addendum 1.

overall project purpose must be specific enough to define the applicant's needs, but not so narrow and restrictive that it precludes a proper evaluation of alternatives. USACE is responsible for controlling every aspect of the Guidelines analysis. In this regard, defining the overall project purpose is the sole responsibility of USACE. While generally focusing on the applicant's statement, USACE will, in all cases, exercise independent judgment in defining the purpose and need for the project from both the applicant's and the public's perspective (33 CFR Part 325 Appendix B(9)(c)(4); see also 53 FR 3120).

Section 230.10(a) of the Guidelines requires that "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge that would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences." Section 230.10(a)(2) of the Guidelines states that "an alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of the overall project purposes. If it is otherwise a practicable alternative, an area not presently owned by the applicant that could reasonably be obtained, utilized, expanded, or managed in order to fulfill the basic purpose of the proposed activity may be considered." Thus, this analysis is necessary to determine which alternative is the least environmentally damaging practicable alternative (LEDPA) that meets the project purpose and need. Detroit Edison's proposed Fermi 3 onsite alternative analysis and LEDPA are included in Appendix J.

Where the activity associated with a discharge is proposed for a special aquatic site (as defined in 40 CFR Part 230, Subpart E) and does not require access or proximity to or siting within these types of areas to fulfill its basic project purpose (i.e., the project is not "water dependent"), practicable alternatives that avoid special aquatic sites are presumed to be available, unless clearly demonstrated otherwise (40 CFR 230.10(a)(3)).

The NRC's determination as to whether an alternative site is environmentally preferable to the proposed site for Fermi 3 is independent of the USACE's determination of a LEDPA pursuant to the CWA Section 404(b)(1) Guidelines at 40 CFR Part 230. USACE will conclude its 404(b)(1) evaluation of alternatives in its regulatory permit decision document for Detroit Edison's permit application.

9.1 No-Action Alternative

For purposes of an application for a COL, the no-action alternative refers to a scenario in which the NRC would deny the COL requested by Detroit Edison. The no-action alternative for USACE would be embodied by denial of the request for a DA permit. Upon such a denial by NRC, the construction and operation of a new nuclear unit at the proposed location on the Fermi site in accordance with 10 CFR Part 52 would not occur and the predicted environmental impacts associated with the project would not occur. Preconstruction impacts associated with activities not within the definition of construction in 10 CFR 50.10(a) and 51.4 may occur. The no-action alternative would result in the proposed facility not being built, and the predicted environmental impacts from the project would not occur. If no other facility would be built or strategy implemented to take its place, the electrical capacity to be provided by the proposed project would not become available. If no additional conservation measures were enacted to decrease the amount of electrical capacity that would otherwise be required for power in the ROI, the need for power discussed in Chapter 8 would not be met. Therefore, the purpose of and need for this project would not be satisfied if the no-action alternative was chosen and the need for power was not met by other means.

If other generating sources were built, either at another site or using a different energy source, the environmental impacts associated with these other sources would eventually occur. As discussed in Chapter 8, Detroit Edison has regulatory responsibilities in Michigan to provide electrical service in its service area. This needed power may be provided and supported through a number of energy alternatives and alternative sites, which are discussed in Sections 9.2 and 9.3, respectively.

9.2 Energy Alternatives

The purpose and need for the proposed project identified in Section 1.3.1 of this EIS is to provide for additional large baseload electricity-generating capacity to address Michigan's expected future peak electric demand. This section examines the potential environmental impacts associated with alternatives to construction of a new baseload nuclear generating facility. Section 9.2.1 discusses energy alternatives not requiring new generating capacity. Section 9.2.2 discusses energy alternatives requiring new generating capacity. Other alternatives are discussed in Section 9.2.3. A combination of alternatives is discussed in Section 9.2.4. Section 9.2.5 compares the environmental impacts from new nuclear, coal-fired, and natural-gas-fired generating units and a combination of energy technologies at the Fermi site. For analysis of energy alternatives, Detroit Edison assumed a bounding target value of 1535 megawatt electrical (MW(e)) (net) output. The review team also used this level of output in its analysis of energy alternatives.

9.2.1 Alternatives Not Requiring New Generating Capacity

Four alternatives to the proposed action that do not require Detroit Edison to construct new generating capacity involve taking some or all of the following actions:

- Purchase the needed electric power from other suppliers
- Reactivate retired power plants
- Extend the operating life of existing power plants

- Implement conservation or demand-side management (DSM) programs.

Power to replace the capacity of a new nuclear unit would have to be purchased from sources within the United States and/or from sources within Canada, and involve a generating technology likely to be one of those previously described by the NRC staff in its GEIS for license renewal (NRC 1996) or those currently in use for electricity production (e.g., coal, natural gas, nuclear, or renewable energy sources). The description of the environmental impacts of other technologies in the GEIS is representative of the impacts associated with the construction and operation of new generating units at the Fermi site. Under the purchased-power alternative, the environmental impacts of power production would still occur but would be located elsewhere within the region or nation or in Canada. The environmental impacts of electricity-generating technologies that are feasible alternatives to nuclear power are discussed in Section 9.2.2. In addition, purchased power is generally economically adverse in that the cost of generated power is typically less than the cost of the same power provided by a third party.

If the purchased-power alternative is implemented, the most significant environmental unknown is whether new transmission line corridors would be required. The construction of new transmission lines could have environmental consequences, particularly if new transmission line corridors were needed. The review team concludes that the local environmental impacts from purchased power would be SMALL when existing transmission line corridors with sufficient uncommitted current carrying capacity are used, and could range from SMALL to LARGE, depending on the nature of the affected environment, if the existing transmission infrastructure needed to be significantly upgraded (i.e., by adding circuits on existing support towers; by upgrading voltage, including when support tower replacements are necessary; or by adding a second transmission line in the existing or expanded right-of-way [ROW]) or if acquisition of a new ROW is required to meet new power transfer levels. The environmental impacts of power generation would depend on the generation technology and location of the generation site and, therefore, are unknown at this time.

Nuclear power facilities are initially licensed by the NRC for a period of 40 years. The operating license can be renewed for up to 20 years, and NRC regulations permit additional license renewals. Detroit Edison currently operates the Fermi 2 nuclear reactor under an NRC operating license. Detroit Edison plans to submit an application to the NRC for license renewal for Fermi 2 (Detroit Edison 2011c). The environmental impacts of continued operation of a nuclear power plant are significantly smaller than those of constructing a new plant. However, continued operation of an existing nuclear plant does not provide additional generating capacity.

Older operating fossil-fueled plants, predominantly coal-fired and natural-gas-fired plants, tend to be old enough that refurbishment to extend plant life and meet current environmental requirements would be costly. The review team concludes that the environmental impacts of a refurbishment scenario would be bounded by the coal- and natural gas-fired alternatives (see Section 9.2.2) and that extending the life of existing generating plants would not be a reasonable alternative to the proposed action.

Similar to older operating plants, retired generating plants, predominantly coal-fired and natural-gas-fired plants that could be reactivated, would ordinarily require extensive refurbishment prior to reactivation. Such plants would typically be old enough that refurbishment would be very costly, and the refurbished plants would likely be viewed as new sources, subject to the current-day complement of regulatory controls on air emissions and waste management. The environmental impacts of any reactivation scenario would be bounded by the impacts associated with coal-fired and natural-gas-fired alternatives (see Section 9.2.2). The staff concludes that reactivating retired generating plants would not be a reasonable alternative to the proposed action.

Detroit Edison already offers several conservation and DSM programs to its customers to reduce peak electricity demands and daily power consumption. In its Renewable Energy and Energy Optimization filings to the Michigan Public Service Commission (MPSC) in March 2009 (MPSC Case U-15806-EO and Case U-15806-RPS, respectively), Detroit Edison summarized its energy optimization plan and renewable energy plan and demonstrated both plans' conformance with the relevant MPSC Temporary Order (MPSC Case 15800) implementing State law. MPSC approved both the renewable energy plan and the energy optimization plan in an order issued June 2, 2009, but required Detroit Edison to amend certain portions of its plan after consultation with MPSC staff (MPSC Order in Case U-15806). Orders subsequently issued on August 25 and September 29, 2009, approved amended portions of the initially filed plans.[a]

Based on the preceding discussion, as well as on information and discussions provided in the need for power analysis in Chapter 8, the review team concludes that the options of purchasing electric power from other suppliers, reactivating retired power plants, extending the operating life of existing power plants, and implementing conservation and DSM programs are not reasonable or sufficient alternatives in and of themselves to providing new baseload power generation in the amounts represented in the proposed project or amounts sufficient to satisfy projected future power needs.

9.2.2 Alternatives Requiring New Generating Capacity

This section discusses the environmental impacts of energy alternatives to the proposed action that would require Detroit Edison to build new generating capacity. Each year, the Energy Information Administration (EIA), a component of the U.S. Department of Energy (DOE), issues an annual energy outlook. In its *Annual Energy Outlook 2010, With Projections to 2035*

(a) All related electronic filings to the MPSC as well as MPSC orders can be accessed at http://efile.mpsc.state.mi.us/efile/viewcase.php?casenum=15806&submit.x=21&submit.y=16.

(DOE/EIA 2010c), the EIA reference case projects that electricity demand will increase by 30 percent from 3873 billion kWh in 2008 to 5021 billion kWh in 2035. Based on the assumption that no greenhouse gas (GHG) emission regulations are in place, while coal still represents the largest percentage among generating technologies, its share would drop from 48 percent in 2008 to 44 percent in 2035. The natural gas share is expected to fall in the near term but then steadily rise, so that over the period 2008 to 2035, it remains essentially constant at 21 percent. Although generation from nuclear actually increases, its share falls from 20 percent in 2008 to 17 percent in 2035. Finally, renewable generation technologies are projected to enjoy the largest growth, from 9 percent in 2008 to 17 percent in 2035. However, the capacity factors of key renewable energy sources (e.g., wind and solar) are too low to satisfy a need for baseload power when acting separately as discrete alternative technologies.

In keeping with the NRC's evaluation of alternatives to operating license renewal for nuclear power plants, a reasonable set of energy alternatives to the construction and operation of a new nuclear unit at the Fermi site should be limited to an analysis of discrete power generation sources and those power generation technologies that are technically reasonable and commercially viable (NRC 1996). In 2009, total net generation of electricity in Michigan (from industrial and commercial generation sources) was 101,202,605 MWh (DOE/EIA 2011b). Of the in-state generation amount, 82,787,341 MWh (81.8 percent) was produced in the Electric Power Sector (DOE/EIA 2011b). Coal is the predominant fuel for production of electricity in Michigan. The energy sources and their contributions to electricity produced in Michigan in 2009 include: coal (66,847,683 MWh, 66 percent), nuclear (21,851,009 MWh, 22 percent), natural gas (8,419,551 MWh, 8.3 percent), hydroelectric (1,371,926 MWh, 1.4 percent), and petroleum (399,249 MWh, 0.4 percent).[a] Other renewable sources (other than large hydroelectric), including biomass (municipal solid waste, wood wastes, and agricultural products), geothermal, solar thermal, or solar photovoltaic, accounted for only 2,623,184 MWh of power, 2.6 percent. The three primary energy sources for generating electric power in the United States in 2009 and their relative percentages were coal (44 percent), natural gas (23 percent), and nuclear energy (20 percent) (DOE/EIA 2011a).

For both the United States and Michigan, the three primary energy sources for generating electric power are coal, nuclear, and natural gas. It is reasonable to assume that these same energy sources would be the most viable discrete alternatives to the proposed introduction of baseload power that would be produced by Fermi 3. The discussion in Section 9.2.2 is therefore limited to coal and natural gas, which the review team considers to be viable discrete alternatives to the proposed Fermi 3 reactor.

The review team assumed that new coal-fired or natural-gas-fired alternative generation capacity would be located on the Fermi site and that Lake Erie would provide water for the steam cycle, for steam condensate heat rejection in a wet closed cycle cooling system using a

(a) Totals do not equal 100 percent due to independent rounding.

natural draft cooling tower (NCDT), and for ancillary industrial applications. The review team also assumed that the same transmission infrastructure planned to support Fermi 3 would also serve the coal-fired or natural-gas-fired alternatives with no substantive modifications to either technical parameters or route.

9.2.2.1 Coal-Fired Power Generation

For the coal-fired generation alternative, the review team assumed construction and operation of supercritical pulverized coal (SCPC) units with a net electricity generation equivalent to Fermi 3. The review team also assumed that new transmission lines would be needed to deliver power from the alternative coal-fired plant and that these lines would be identical in both capacity and location to the lines being proposed to support Fermi 3. The coal plant is assumed to have an operating life of 60 years.

The review team also investigated an integrated gasification combined cycle (IGCC) coal-fired plant. IGCC is an emerging technology for generating electricity with coal that combines modern coal gasification technology with both gas turbine and steam turbine power generation. However, IGCC plants are expensive to build and operate, and the technology continues to be plagued by reliability problems, relatively high parasitic loads (primarily associated with operation of the gasifiers), and low-capacity factors. Therefore the review team determined that, at this time, IGCC is unsuitable as a baseload power alternative.

Finally, the review team also considered fluidized bed designs for the coal-burning alternative. However, while fluidized beds are the technology of choice for fuels that are difficult to burn or that have great variability in critical parameters, wall-fired pulverized coal boilers are the preferred technological approach for combustion of bituminous and subbituminous coals. Because Detroit Edison already has the infrastructure in place to receive, handle, and distribute substantial quantities of subbituminous coals and lesser but still significant amounts of bituminous coals for burning in its existing coal-fired units, these are coals likely to be used for a coal-fired alternative built at the Fermi site, thus favoring pulverized coal boiler technology. Finally, fluidized bed boilers are available in much smaller sizes than pulverized coal boilers, making them less attractive for baseload units.

Various sizes of pulverized coal boilers and steam turbine generators (STGs) are available; however, the review team recognizes that no single boiler/STG combination could match the net electrical generation capacity of the proposed Fermi 3 reactor. Clearly, multiple units would be required. To complete this analysis, the review team has elected not to specify the number or discrete sizes of the coal-fired units that could collectively serve as an alternative, but instead presumes that all units, regardless of size, would have the same features, operate at generally the same conditions, affect the environment to an extent proportional to their power capacity, and be equipped with the same pollution control devices, such that once all parasitic loads are overcome, the net power collectively produced would be equivalent to the power expected from a nuclear reactor with a nameplate rating of 1535 MW(e) net (1605 MW(e) gross).

Current regulations require that these coal-fired generating units be fitted with pollution control equipment to control criteria pollutants (e.g., particulates, sulfur oxide, and nitrogen oxide emissions). Recently proposed EPA regulations (EPA 2011) would require such plants to be outfitted with equipment to control hazardous air pollutants (including mercury, acid gases, and other toxic pollution), and considerations have been given to promulgation of regulations that would require the capture and sequestration of CO_2 from the power plant's exhaust gas stream. All such pollution controls will impose parasitic loads such that the net electric power available will be reduced from gross nameplate values. The review team has accounted for the impact of those parasitic loads in estimating the gross nameplate capacity of fossil fuel alternatives necessary to allow for production of amounts of power equivalent to those of the proposed Fermi 3 reactor. Gross nameplate adjustments are reflected in calculations of environmental impacts from fossil fuel plant operation.

To compare a coal-fired alternative to the proposed Fermi 3 plant, the review team selected an SCPC plant. Supercritical steam technologies[(a)] are increasingly common in new coal-fired plants installed to deliver baseload power. Supercritical plants operate at higher temperatures and pressures than older subcritical coal-fired plants and therefore can attain higher thermal efficiencies. While supercritical facilities are more expensive to construct, they consume less fuel for a given output, reducing environmental impacts throughout the fuel life cycle. Based on technology forecasts from EIA, the review team expects that a new, supercritical coal-fired plant beginning operation in 2014 would operate at a heat rate of 9069 Btu/kWh,[(b)] or approximately 38 to 39 percent thermal efficiency.

The review team also assumed that a closed loop cooling system of the type proposed for Fermi 3 would be used to support the coal-fired alternative, with Lake Erie as the source of cooling water. Because nuclear plants require somewhat more cooling capacity per megawatt-hour generated than comparably sized SCPC plants (because of the difference in thermal

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(a) "Supercritical" refers to the thermodynamic properties of the steam being produced. Steam whose temperature and pressure is below water's "critical point" (3200 psia and 705°F) is subcritical. Subcritical steam forms as water boils and both liquid and gas phases are observable in the steam. The majority of coal boilers that currently operate in the United States produce subcritical steam with pressures of about 2400 psia and temperatures as high as 1050°F. Above the critical point pressure, water expands rather than boils, and the liquid and gaseous phases of water are indistinguishable in the supercritical steam that results. Newer model boilers are likely to use pulverized coal instead of the lump coal used in older boilers. More than 150 pulverized coal boilers currently operating in the United States produce supercritical steam with pressure between 3300 and 3500 psia and temperatures between 1000 and 1100°F.

(b) Heat inputs could be less, depending on the fuel source. A coal-fired alternative would likely burn subbituminous western coal, which generally has a slightly lower average heat content.

efficiency), a lesser amount of water would be required for the SCPC plant than projected for Fermi 3.

The boilers constituting the supercritical coal-fired alternative are presumed to have the following characteristics and be equipped with the following pollution control devices:

- Dual wall-fired, dry bottom boilers, configured to be New Source Performance Standard-(NSPS) compliant
- Overall thermal efficiency of 39 percent
- Capacity factor of 79 percent
- Collective nameplate rating of 1788 MW(e) (net)[(a)]
- Supercritical steam
- Powder River Basin (PRB) coal; caloric value 8820 Btu/lb, ash 6.44 percent, sulfur 0.48 percent, pulverized to greater than 70 percent passing a 200-mesh sieve[(b)]
- Fabric filter for particulate control operating at 99.9 percent efficiency
- Wet calcium carbonate sulfur dioxide (SO_2) scrubber operating at 95 percent efficiency
- Low-nitrogen oxide (NO_x) burners with overfire air and selective catalytic reduction for NO_x controls capable of attaining an NO_x removal of 86 percent (an emission rate less than or equal to 2.5 parts per million by volume [dry basis]).

Air Quality

The following sections provide a brief discussion of the status of ambient air quality in that portion of Michigan that includes the Fermi site and an overview of the Federal and State regulations in effect in Michigan that would be applicable to a coal-fired alternative built on the Fermi site. Nothing in these sections is meant to preempt the interpretation of their regulations by Federal or State authorities or to usurp the authorities to include specific provisions and emission limitations in construction or operating permits that would be required.

(a) A higher net nameplate rating is required to account for the differences in expected capacity factors between an SCPC boiler and the Fermi 3 reactor, 79 percent versus 92 percent, respectively.

(b) Detroit Edison already uses PRB coal in its existing coal-fired power plants. To meet environmental regulations and limitations, some eastern bituminous coals are also blended with PRB coal. Such blending may also be required for a new coal-fired alternative to Fermi 3, but the extent of any required blending would be difficult to precisely determine at this time. Nevertheless, coal transportation and handling infrastructures are already in place and would be able to meet the fuel demands of this coal-fired alternative with only minor modifications. Average coal characteristics of PRB coal were used in this analysis as per Stricker and Ellis (1999).

Air Pollution Control Regulations in Michigan Applicable to a Coal-Fired Alternative

The Fermi site is located in Monroe County, Michigan. Monroe County is in nonattainment of the $PM_{2.5}$ (particulate matter with an aerodynamic diameter of less than or equal to 2.5 μm) National Ambient Air Quality Standards (NAAQS) and a maintenance area for the 8-hr ozone NAAQS. In July 2011, the Michigan Department of Environmental Quality (MDEQ) submitted a request asking the EPA to redesignate Southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011). In July 2012, the EPA issued a proposed rule designating southeastern Michigan as having attained both the 1997 annual $PM_{2.5}$ NAAQS and the 2006 24-hour $PM_{2.5}$ NAAQS, based on 2009–2011 ambient air monitoring data (77 FR 39659, dated July 5, 2012), but the final determination has yet to be made. A new coal-fired generating plant would qualify as a new major source of criteria pollutants and would be subject to Prevention of Significant Deterioration of Air Quality Review under requirements of the Clean Air Act (CAA) and to Michigan State regulations. A new coal-fired generating plant would need to comply with the NSPS for coal-fired plants set forth in 40 CFR 60 Subpart Da: particulate matter and opacity (40 CFR 60.42(a)); SO_2 (40 CFR 60.43(a)), and NO_x (40 CFR 60.44(a)). The new coal-fired generating plant would qualify as a major source because of its potential to emit (PTE) greater than 100 tons/yr of criteria pollutants and would be required to secure a Title V operating permit from MDEQ.

Section 169A of the CAA (42 USC 7401) establishes a national goal of preventing future, and remedying existing, impairment of visibility in mandatory Class I Federal areas when impairment results from man-made air pollution. The Regional Haze Rule, promulgated by EPA in 1999 and last amended in October 2006 (71 FR 60612), requires States to demonstrate reasonable progress toward the national visibility goal for Class I areas established in 1977. The only Class I areas in Michigan are the Isle Royale National Park (about 500 mi from the site) and the Seney National Wildlife Refuge (about 340 mi from the site), both located in the Upper Peninsula of Michigan. Neither of these Class I areas could reasonably be expected to be adversely affected by the operation of a coal-fired plant at the Fermi site. There are no Class I areas in the neighboring State of Ohio.

Michigan is one of 28 States whose stationary sources of criteria pollutants would have been subject to revised emission limits for SO_2 and NO_x under the Clean Air Interstate Rule (CAIR). The Federal rule was vacated by the D.C. Circuit Court on February 8, 2008; however, in December 2008, the U.S. Court of Appeals for the D.C. Circuit reinstated the rule, but required EPA to revise both the rule and its implementation plan. However, on July 6, 2010, EPA instead proposed replacing CAIR with the Transport Rule for control of SO_2 and NO_x emissions that cross state lines.[a] Regulations implementing the Transport Rule would be promulgated starting in 2011 and finalized in 2012. Michigan stationary sources of SO_2 and NO_x would be subject to this rule, as well as complementary regulatory controls developed at the State level

(a) See this EPA Web site for additional details regarding the Transport Rule: http://www.epa.gov/airtransport/actions.html#jul10.

(EPA 2010a).[a] On July 6, 2011 EPA announced the finalization of the Cross-State Air Pollution Rule (CSAPR, previously referred to as the Transport Rule) as a response to previous court decisions and as a replacement to the CAIR.[b] Fossil fuel power plants in Michigan would be subject to the CSAPR and would be required to reduce emissions of SO_2 and NO_x to help reduce downwind ambient concentrations of fine particulates ($PM_{2.5}$) and ozone. Because drafts of the Michigan rules are not available, their impacts on a coal-fired alternative cannot be assessed at this time. However, the review team recognizes that the environmental impacts of air emissions from the coal-fired plant would be significantly greater than those from Fermi 3, even after application of the CSAPR.

Sulfur Oxides

A new coal-fired power plant at the Fermi site would likely use wet limestone-based scrubbers to remove SO_2. EPA indicates that this technology can remove more than 90 percent of SO_2 from flue gases (EPA 2002). SO_2 emissions from a new coal-fired power plant would be subject to the requirements of Title IV of the CAA. Title IV was enacted to reduce emissions of SO_2 and NO_x, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power plant SO_2 emissions and imposes controls on SO_2 emissions through a system of marketable allowances. EPA issues one allowance for each ton of SO_2 that a unit is allowed to emit. New units do not receive allowances but must secure allowances (or offsets) from existing sources to cover their SO_2 emissions. Owners of new units must therefore purchase allowances from owners of other power plants or reduce SO_2 emissions at other power plants they own. Allowances can be banked for use in future years. Thus, provided a new coal-fired power plant is able to purchase sufficient allowances to operate, Title IV ensures that the new source of pollution would not add to net regional SO_2 emissions, although it might do so locally.

Nitrogen Oxides

A coal-fired power plant at the Fermi site would most likely employ various available NO_x control technologies, which can include combustion modifications and postcombustion processes. Combustion modifications include low-NO_x burners, over-fire air, and operational modifications. Postcombustion processes include selective catalytic reduction and selective noncatalytic reduction. A combination of the combustion modifications and postcombustion processes may allow the reduction of NO_x emissions by up to 95 percent (EPA 1998). The most likely NO_x control would involve a combination of low-NO_x burners and selective catalytic reduction technologies in order to reduce NO_x emissions from this alternative. For the coal-fired alternative, the review team assumed a more likely reduction of 86 percent.

(a) Additional details regarding the CAIR program in Michigan can be found at the MDEQ Web site: http://www.michigan.gov/deq/0,1607,7-135-3310-122941--,00.html.
(b) Details of the CSAPR can be found on the EPA Web site, http://www.epa.gov/crossstaterule/.

Section 407 of the CAA establishes technology-based emission limitations for NO_x emissions. A new coal-fired power plant would be subject to the new source performance standards for such plants as indicated in 40 CFR 60.44a(d)(1). This regulation, issued on September 16, 1998 (63 FR 49453), limits the discharge of any gases that contain NO_x to 1.6 lb/MWh of gross energy output, based on a 30-day rolling average.

Particulates

A new coal-fired power plant would use fabric filters to remove particulates from flue gases with an expected 99 percent removal efficiency. When present, wet SO_2 scrubbers further reduce particulate matter emissions (EPA 2008a). Coal-handling equipment would introduce fugitive dust emissions when fuel is being transferred to onsite storage and then reclaimed from storage for use in the plant. Coal preparation activities (e.g., cleaning, pulverizing) would be additional sources of fugitive dust. The onsite management of coal combustion residuals (CCR) and scrubber sludge may be additional sources of fugitive dust during operation.

The review team also presumed that the coal-fired alternative would use a closed cycle cooling system with an NCDT. The cooling tower would also be a source of particulate matter through salt drift. In addition, smaller mechanical draft cooling towers (MCDTs) are used to support plant operations. Detroit Edison estimated the total drift from the cooling towers to be 8.47 tons/year (Detroit Edison 2011a, 2009b). Because heat rejection demands for a nuclear reactor can be expected to be greater than the demands of a coal-fired power plant of equivalent capacity, these estimates of drift are considered to be bounding conditions for any thermoelectric power generating technology relying on fossil fuels.

Carbon Monoxide

Based on firing conditions and the boiler's overall firing efficiency, SCPC boilers would emit CO in limited quantities. Emission limits for CO would be based on heat input and typically expressed as pounds per million Btu input.

Hazardous Air Pollutants

EPA determined that coal-fired and oil-fired electric utility steam-generating units are significant emitters of the following hazardous air pollutants (HAPs): arsenic, beryllium, cadmium, chromium, dioxins, hydrogen chloride, hydrogen fluoride, lead, manganese, and mercury (65 FR 79825). EPA concluded that mercury is the HAP of greatest concern and that (1) a link exists between coal combustion and mercury emissions, (2) electric utility steam-generating units are the largest domestic source of mercury emissions, and (3) certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects resulting from mercury exposures caused by the consumption of contaminated fish (65 FR 79825). EPA is developing mercury emission standards for power plants under the CAA Section 112 authority (EPA 2011). On March 16, 2011, EPA proposed a rule to control mercury and other toxic pollutants from power plants (see http://www.epa.gov/airquality/powerplanttoxics for additional details and the rule's implementation schedule). However, the review team recognizes that the environmental impacts of air emissions from the coal-fired plant would be significantly greater than those from Fermi 3, even after application of any new mercury emissions standards.

Carbon Dioxide

Historically, CO_2, an unavoidable byproduct of combustion of carbonaceous fuels, has not been regulated as a pollutant. However, regulations are now under development for CO_2 and other GHGs. In response to the Consolidated Appropriations Act of 2008 (Public Law 110-161), EPA promulgated final mandatory GHG reporting regulations[a] in October 2009, effective in December 2009 (74 FR 56260) (see also http://www.epa.gov/climatechange/emissions/ghgrulemaking.html). The rules are applicable to major sources of CO_2 (those emitting greater than 25,000 tons/yr). New utility-scale coal-fired power plants would be subject to those regulations.

The coal-fired alternative plant would qualify as a major generator of GHGs under the "Tailoring Rule" recently promulgated by EPA (see 75 FR 31514). Beginning January 2, 2011, operating permits issued to major sources of GHG under the Prevention of Significant Deterioration (PSD) or Title V Federal permit programs must contain provisions requiring the use of best available control technology (BACT) to limit the emissions of GHGs if those sources would be subject to PSD or Title V permitting requirements because of their non-GHG pollutant emission potentials and if their estimated GHG emissions are at least 75,000 tons/yr of CO_2 equivalent (CO_2-e).[b] The amount of CO_2 released per unit of power produced would depend on the quality of the fuel and the firing conditions and overall firing efficiency of the boiler. Subbituminous coal from the Powder River Basin has an average CO_2 emission factor of 212.7 lb/million Btu of coal input (Hong and Slatick 1994). Meeting permit limitations for GHG emissions may require installation of carbon capture and sequestering (CCS) devices on any new coal-fired power plant, which could add substantial power penalties. However, the review team recognizes that the environmental impacts of air emissions from the coal-fired plant would be significantly greater than those from Fermi 3, even after application of any new GHG emissions standards.

(a) The GHGs covered by the final rule are CO_2, CH_4, N_2O, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), SF_6, and other fluorinated gases including NF_3 and hydrofluorinated ethers (HFEs).
(b) Full text of the Tailoring Rule can be found at http://www.gpo.gov/fdsys/pkg/FR-2010-06-03/pdf/2010-11974.pdf.

Estimated Impacts on Air Quality from the Construction of a Coal-Fired Alternative

Construction of a coal-fired power plant would result in the release of various criteria pollutants from the operation of internal combustion engines in construction vehicles, equipment, delivery vehicles, and vehicles used by the commuting construction workforce. Volatile organic chemical releases will also result from the onsite storage and dispensing of vehicle and equipment fuels. Onsite activities would also generate fugitive dust. These impacts would be intermittent and short-lived, however, and adherence to well-developed and well-understood construction best management practices (BMPs, such as development and execution of an appropriate fugitive dust control plan) would mitigate such impacts. Construction-related impacts on air quality from a coal-fired alternative would be of relatively short duration and would be SMALL.

Estimated Impacts on Air Quality from the Operation of a Coal-Fired Alternative

NRC (1996) did not quantify emissions from coal-fired power plants but suggested that air impacts would be substantial. During operation, a coal-fired power plant would emit criteria pollutants, as well as hazardous pollutants such as mercury.[(a)] Detroit Edison (2011a) provided estimates of emissions from a coal-fired plant alternative with a capacity of 1600 MW(e) and a design that would minimize air emissions through a combination of boiler technology and postcombustion pollutant removal. Detroit Edison's estimates of emissions from a coal-fired alternative are as follows:

- SO_2, 2260 tons/yr
- NO_x, 1330 tons/yr
- PM_{10}, 48 tons/yr
- CO_2, 17,750,000 tons/yr
- Mercury, 0.1 tons/yr.

Although the review team has identified the primary features and operating parameters of the supercritical pulverized coal boiler represented in this coal-fired power plant alternative, many additional aspects of system design, boiler firing conditions, and operating procedures can influence the amount of criteria pollutants ultimately released to the environment. Further, because any new coal-fired power plant constructed in Monroe County would be subject to NSPS and PSD controls, any new operating permit will likely require the application of BACT. However, the performance metrics for BACT would change over time as real-world experience

(a) Depending on the coal source, precombustion coal cleaning, and boiler firing conditions, many other pollutants can be emitted, including acid gases such as hydrogen chloride, various heavy metals besides mercury, a wide array of organic compounds, and various GHGs, including (especially) CO_2. However, because neither the coal source nor the firing conditions can be precisely specified, except for CO_2, this assessment does not extend to quantifying those other pollutant emissions.

grew, and the ultimate performance requirements contained in any operating permit would be subject to negotiations among the EPA and/or State permit writers and the applicant. Consequently, the quantifications of pollutant emissions appearing below should be considered only as estimates. Algorithms and emission coefficients developed by EPA (EPA 1998) were used to estimate the amounts of pollutants that would result from operation of the coal-fired power plant alternative.

Operating at a capacity factor of 92 percent, the proposed 1535 MW(e) (net) Fermi 3 reactor can be expected to produce 12.4 million MWh of power annually. To produce a more or less equivalent amount of power, an SCPC boiler operating at a capacity factor of 79 percent would need to have a rated capacity of approximately 1788 MW(e) (net). The review team assumes that approximately 5.2 percent of the boiler's gross megawatt capacity is needed to supply typical parasitic loads (i.e., plant operation, including control devices for limiting emissions of criteria and hazardous air pollutants to meet NSPS). Introducing controls for GHG emissions (i.e., CCS) would cause the parasitic load to increase to 17.8 percent of the boiler's gross rated capacity (NETL 2010). However, given the significant uncertainty regarding the details of any CCS and when such controls might be required, the review team has elected to include parasitic losses from conventional pollution control devices and plant operation, but to not include parasitic losses from CCS in its calculations of environmental impacts. Based on a parasitic load of 5.2 percent, the coal plant would have a gross electrical generation capacity of 1886 MW(e).

To produce the required amount of power, the SCPC boilers described above, operating at a capacity factor of 79 percent, would burn 6.5 million tons of PRB coal annually (5.9 MMT/yr).

Applying EPA emission factors and reasonably expected pollution control equipment efficiencies results in the estimated annual pollutant releases shown in Table 9-1.

While the GEIS analysis mentions global warming from unregulated CO_2 emissions and acid rain from SO_2 and NO_x emissions as potential impacts, it does not quantify emissions from the operation of coal-fired power plants. However, the GEIS analysis does indicate that air impacts would be substantial (NRC 1996). The above analysis shows that emissions of air pollutants, including sulfur oxides (SO_x), NO_x, CO, particulates, HAPs, and CO_2, exceed those that would result from operation of the proposed Fermi 3 nuclear power plant by significant margins (see Section 5.7.2), as well as those of the other alternatives considered in this section.

The analysis for an SCPC power plant at the Fermi site indicates that air quality impacts from the operation of an SCPC power plant alternative would be clearly noticeable, but with the expected application of regulatory requirements, permit limitations, and emissions controls, would not destabilize air quality. Participation in emissions trading schemes may also be required. Therefore, because of these expected controls, the review team concludes that air impacts from an SCPC power plant alternative located at the Fermi site would be MODERATE.

Table 9-1. Estimated Emissions (in tons/yr) of Criteria Pollutants and Carbon Dioxide from the Coal-Fired Power Generation Alternative

Pollutant	Annual Uncontrolled Emissions	Annual Controlled Emissions	Notes
SO_2	54,381	2719	Assumes PRB coal at 0.48 percent sulfur and a 95 percent efficient limestone scrubber. Emission factor: 35× (percent sulfur) lb/ton of coal
NO_x	23,953	3353	Assumes 86 percent efficient pre- and postcombustion NO_x controls. Emission factor: 7.4 lb/ton of coal
CO	1618	1618	Assumes typical NSPS-compliant firing conditions. Emission factor: 0.5 lb/ton of coal
Particulates (filterable)	208,459	208	Assumes PRB coal at 6.44 percent ash and a 99.9 percent efficient fabric filter control device. Emission factor: 10× (percent ash) lb/ton of coal
Particulates (filterable PM_{10})[(a)]	47,829	48	Assumes 99.9 percent efficient fabric filter control device. Emission factor: 2.3× (percent ash) lb/ton of coal
CO_2	12.1 million	12.1 million	Assumes no CO_2 capture. Emission factor: 212.7 lb/million Btu

(a) PM_{10} = particulate matter with an aerodynamic diameter of less than or equal to 10 μm.

Waste Management

Construction Waste Management

Both sanitary wastes resulting from support of the construction crew and industrial wastes (some with hazardous character) would be generated during the construction of the coal-fired power plant alternative from activities such as clearing the construction site of vegetation, excavating and preparing the site surface before other crews begin actual construction of the plant, modifying existing infrastructure, and constructing any additionally required infrastructure. Minor amounts of industrial wastes will result from the onsite management of construction vehicles and equipment, the use of cleaning solvents, and the application of corrosion control coatings. Construction-related wastes are expected to be properly characterized and initially managed onsite and eventually removed to properly permitted offsite treatment or disposal facilities. New transmission lines identical to those proposed for the Fermi 3 reactor would be constructed to connect to the ITC*Transmission* Milan Substation. The existing rail spur would be sufficient to support both construction and operation of a coal-fired plant. Waste impacts from construction are expected to be SMALL.

Operational Waste Management

Coal combustion generates several waste streams, including ash (a dry solid recovered from both pollution control devices [fly ash] and from the bottom of the boiler [bottom ash]) and sludge (a semisolid byproduct of emission control system operation, in this case, primarily calcium sulfate from the operation of the wet calcium carbonate SO_2 scrubber). Combustion of 6.5 million tons/yr of PRB coal would result in substantial amounts of CCR recovered from the fabric filter and from the bottom of the boiler. Recycling options that may exist for some of the CCR generated include road sub-base fill material, an admixture in lightweight concrete products, and highway embankment stabilization. However, much of the CCR would require disposal. Although EPA has not declared CCR as hazardous (65 FR 32214), it does contain hazardous constituents that may leach from improperly designed or operated disposal cells and that may threaten surface or groundwater resources. Coal-fired power plant operation would also result in substantial quantities of calcium sulfate recovered from the SO_2 scrubber. Most such sludge may be recycled for use in production of gypsum wallboard for the construction industry. However, temporary holding facilities as well as drying facilities may need to be constructed. Spent catalysts from NO_x catalytic reduction would also be produced. Scrubber sludge and CCR may have beneficial uses, but, in the worst case, all solid wastes resulting from operation would require disposal. Wastes typical of the construction of large industrial facilities would also be generated.

The review team estimates that 416,918 tons/yr of ash would be either recovered from the boiler as bottom ash or captured as fly ash in the fabric filter,[(a)] and the remainder, 208 tons/yr, released to the atmosphere. Detroit Edison notes that approximately 40 percent of CCR is currently recycled and that the published EPA goal is to increase this amount to 50 percent (Detroit Edison 2011a). The review team assumes that the EPA goal of recycling 50 percent of CCR would be realized, leaving about 208,251 tons/yr requiring disposal. Disposal of this amount of ash annually by landfilling over the expected 40-year lifetime of the coal-fired plants could noticeably affect land use and groundwater quality. Landfill locations would require proper siting in accordance with State solid waste regulations,[(b)] and leachate from the disposal cells would need to be monitored and possibly captured for treatment, because of leaching of toxic components (including heavy metals) in the ash. The review team has not presumed the location of this ash disposal landfill, but presumes that insufficient area would be available on

(a) Some additional fly ash may also be captured in the SO_2 scrubber downstream of the fabric filter. However, that amount has not been quantified.
(b) In May 2000, the EPA issued a "Notice of Regulatory Determination on Wastes from the Combustion of Fossil Fuels" (EPA 2000a) stating that it would issue regulations for disposal of coal combustion waste under Subtitle D of the Resource Conservation and Recovery Act. EPA has not yet issued these regulations. Until such rules are issued at the Federal level, State regulations concerning solid waste disposal are the primary controls.

the Fermi site to accommodate any onsite disposal. After closure of the waste site and revegetation, the land could be available for other uses.

Combustion of 6.5 million tons/yr of PRB coal with 0.48 percent sulfur would result in the generation of 51,914 tons/yr of SO_2, 95 percent of which would be captured in the wet scrubber and converted to an equimolar amount of calcium sulfate, or 110,310 tons/yr (dry basis). Although Detroit Edison notes that 77 percent of scrubber sludge is currently put to beneficial use (Detroit Edison 2011a), the review team presumes that as much as 90 percent of the scrubber sludge could be recycled in the future for such applications as gypsum wallboards and that the remainder, 11,031 tons/yr, would be codisposed with the CCR that is not recycled.

The review team has not made an estimate of the amount of spent catalysts that would be produced, but presumes that the entire amount would have no recycling potential and thus would require disposal. Depending on the catalysts used, special handling might also be required to address the potential hazardous character of these spent catalysts.

The impacts from waste generated during operation of this coal-fired power plant alternative would be MODERATE; the impacts would be clearly noticeable but, with proper design and operation of waste management systems, would not destabilize any important resource.[a] The extent of the impacts of disposal would depend on the percentage of the CCR and scrubber sludge that could be recycled.

Therefore, the review team concludes that the overall impacts of wastes resulting from the construction and operation of the coal-fired alternative would be MODERATE.

Human Health

Coal-fired power plants introduce worker risks from coal and limestone mining, from coal and limestone transportation, and from disposal of CCR and scrubber wastes. In addition, there are public risks from inhalation of stack emissions and the secondary effects of eating foods grown in areas subject to deposition of pollutants emitted from plant stacks.

Human health risks of coal-fired power plants are described in general in Table 8-2 of the GEIS (NRC 1996). Cancer and emphysema resulting from the inhalation of toxins and particulates are identified as potential health risks to occupational workers and members of the public (NRC 1996). The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contribute to health risk. Air emissions from a coal-fired power generation plant

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(a) The NRC is aware of the significant environmental impacts that resulted from recent failures of coal waste ponds in Alabama and Tennessee (see *http://www.msnbc.msn.com/id/28579190/ns/us_news-environment/t/utility-waste-pond-ruptures-time-ala/).* However, NRC believes that such wholesale failures are rare and preventable with proper design and maintenance of CCR impoundments and other waste management facilities.

located at the Fermi site would be regulated by MDEQ. In addition, natural uranium and thorium contained in routine air emissions from coal-fired power plants could result in radiological doses that could be in excess of those from nuclear power plant operations (Gabbard 1993).

Regulations restricting emissions enforced by either EPA or delegated State agencies have reduced potential health effects but have not entirely eliminated them. These agencies also impose site-specific emissions limits as needed to protect human health. Even if the coal-fired power plant alternative were located in a nonattainment area, emission controls and trading or offset mechanisms could prevent further regional degradation; however, local effects could be visible. Many of the byproducts of coal combustion responsible for health effects are largely controlled, captured, or converted in modern power plants, although some level of health effects may remain.

Aside from emission impacts, the coal-fired alternative would introduce the risk of coal pile fires and, if lined impoundments were used to contain CCR and scrubber sludge, the risk of accidental release of the waste due to a failure of the impoundment[a] or leaching of hazardous constituents due the impoundment liner's failure.[b]

Overall, given health-based regulation and controls likely to be imposed as permit conditions by either EPA or delegated State agencies, the review team concludes that human health impacts of a coal-fired power plant alternative would be SMALL.

Climate Change-Related Impacts

Climate changes are under way in the United States and globally, and these are projected to continue to grow substantially over the next several decades unless intense, concerted measures are taken to reverse this trend. Many of the projected climate changes are believed to be the result of the release of GHGs. The primary GHG of concern for global climate change because of its global warming potential as well as the amounts being emitted worldwide is CO_2 and the major anthropogenic source of CO_2 is the combustion of fossil fuels. Climate-related changes include rising temperature and sea level; increased frequency and intensity of extreme weather conditions (e.g., heavy snows and downpours, floods, and droughts); earlier snowmelts and associated frequent wildfires; and reduced snow cover, glaciers, permafrost, and sea ice. After a thorough examination of the scientific evidence and careful consideration of public comments, the EPA officially announced on December 15, 2009, that GHGs threaten the public health and welfare of the American people and fit the CAA definition of air pollutants (74 FR 66496). The coal-fired power plant alternative would contribute GHG emissions to

(a) Although there have been incidents in recent years of waste impoundment failures, such incidents are nevertheless considered rare.
(b) Leachate capture and recycling or treatment would typically be required to reduce the probability of such occurrences.

climate change. This section presents an assessment of the potential impacts that construction and operation of the coal-fired power plant alternative would have on climate.

Impacts on climate change from the construction of a coal-fired power plant alternative would result primarily from the consumption of fossil fuels in reciprocating internal combustion engines (RICE) of construction vehicles and equipment, workforce vehicles used in commuting to and from the work site, and delivery vehicles. As noted elsewhere, construction-related releases of criteria pollutants and GHGs such as CO_2 would be temporary. Estimates of CO_2 emissions related to the building of Fermi 3 are provided in Section 4.7.1. Overall, impacts of constructing a new coal-fired power plant would be expected to have a lesser impact on climate change than the building of Fermi 3, because of both a smaller workforce and a shorter construction period. Overall, as with the impact on air quality from releases of criteria pollutants, the impact on climate change from the releases of GHGs during construction would be SMALL.

A comprehensive inventory of Michigan GHG emissions was published in 2008 with projections from the 2005 “business as usual” base case through the year 2025 (CCS 2008). In 2005 (the latest year for which data were available at the time of publication of the Michigan inventory), all anthropogenic sources of GHGs in Michigan accounted for the generation of approximately 248 million MMT of CO_2-e gross emissions (excluding Michigan forests that serve as GHG sinks and emissions associated with exported electricity). Energy-related emissions of GHG totaled 214.7 MMT of CO_2-e (CO_2, CH_4, and N_2O emissions combined).[(a)] Of that amount, 70.8 MMT was related to in-state electricity production using coal (67.7 MMT), natural gas (2.38 MMT), or oil (0.71 MMT). The U.S. total GHG emissions and total emissions of CO_2 from coal combustion for electricity production in 2005 were 7108.6 MMT and 2381 MMT, respectively (EPA 2009a). Thus, the Michigan total GHG emissions accounted for 0.99 percent of the nationwide total GHG emissions and 2.8 percent of the nationwide total GHG emissions related to coal-fired electricity production. Although Michigan’s GHG emissions are rising more slowly than the U.S. average, they nevertheless rose by 12 percent over the period 1990 to 2005 (versus a national GHG growth rate of 16 percent) (CCS 2008).

As discussed above, the review team estimates that the emission of 12.1 million tons/yr (11.0 MMT/yr) of CO_2 would result from the operation of a coal-fired power plant alternative to produce the amount of power equivalent to that expected annually from Fermi 3. Consequently, operation of Fermi 3 instead of a coal-fired power plant would represent an avoidance of these

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(a) The total CO_2-e emissions reported represent a total of the three primary GHG emissions related to fossil fuel combustion: CO_2, CH_4, and N_2O. However, of these three, CO_2 is by far the largest source. For simplicity, the percentages that follow disregard the contributions of CH_4 and N_2O to statewide energy-related GHG totals.

CO_2 emissions.[a] A coal-fired alternative would represent approximately 16 percent and 0.46 percent of the GHGs emitted in Michigan and in the United States, respectively, in 2005 from coal-fired power plant operations. While any single project would be inconsequential when compared to global GHG emissions, the review team doesn't believe that this is the correct way to measure the impacts. A 16 percent increase in emissions from coal plants within the State cannot be construed as undetectable. The review team concludes, therefore, that the impact of the operation of a coal-fired power plant at the Fermi site on global climate change would be MODERATE.

Groundwater Use and Quality

Impacts on groundwater from construction and operations of the coal-fired power plant alternative would be minimal. Except for potable uses, the immediate availability of lake water suggests that groundwater resources would not likely be utilized to support operation of the coal-fired plant. Total usage for potable purposes would likely be less for operations of a coal-fired power plant than for reactor operation because of a smaller operating workforce. No effect on groundwater quality would be apparent.

Construction of a coal-fired plant may have a limited and minor impact on groundwater due to changes to surface drainage patterns during construction and operation, and the onsite storage of coal and CCR. However, no onsite disposal of CCR would occur, and controls to capture and treat any hazardous leachate from coal and CCR piles would limit impacts. The review team concludes that the impact on groundwater from the coal-fired power plant alternative would be SMALL.

Surface Water Use and Quality

Minor impacts on surface water would occur during construction of a new coal-fired power plant because of ground disturbances, alteration of natural drainage patterns, and potential increases in sediment loadings in surface drainage. A site-wide stormwater pollution prevention plan (SWPPP) would be established for the construction period and would include controls and mitigations that would limit adverse impacts on surface water quality. The elements of that plan would be incorporated into a General Stormwater Permit, enforceable under the MDEQ's National Pollutant Discharge Elimination System (NPDES) program authority. The relatively small amount of water withdrawn from Lake Erie for cooling purposes would not cause a destabilizing effect on other potential uses of Lake Erie water. The review team therefore concludes that impacts on surface water use and quality would be SMALL.

(a) Figures presented here represent CO_2-e emissions directly related to energy production. Although it is estimated that a nuclear reactor will generate 7700 tons/yr of CO_2-e (see Table 5-22), those releases are the result of routine preventive maintenance of fossil-fueled emergency generators and routine operation of ancillary equipment using fossil fuels and not the direct result of the operation of the reactor. No GHGs are emitted from reactor operation.

Aquatic Ecology

Lake Erie would be the primary source of water to support the construction and operation of the coal-fired alternative. Impacts on aquatic ecosystems during construction would be minimal, due to the relatively small amount of water required (compared to the volume of water in Lake Erie) and controls on the quality of surface water discharges imposed by a SWPPP permit issued by MDEQ. Impacts on aquatic ecosystems during operation would be virtually equivalent to projected impacts from Fermi 3 operation and would take the form of both impingement and entrainment impacts associated with water withdrawals to support the cooling system, as well as thermal impacts associated with blowdown discharges from that cooling system (which may be required to undergo treatment prior to discharge).[(a)] All such impacts would be controlled by an NPDES permit issued by MDEQ. The review team concludes, therefore, that impacts on aquatic ecology from the construction and operation of the coal-fired alternative would be SMALL.

Terrestrial Ecology

Detroit Edison estimates a 1600-MW(e) coal-fired plant would require approximately 2720 ac. As discussed earlier, a coal-fired alternative of equivalent power producing capability would have a gross nameplate rating of 1886 MW(e) to account for differences in capacity factors between the proposed nuclear reactor and the coal-fired alternative and to accommodate parasitic loads. By simple proportioning, a 1886 MW(e)-plant would require 3210 ac. The entire Fermi site including the existing facilities occupies only 1260 ac. Utilizing the Fermi site to the fullest possible extent to build a coal-fired plant and ancillary activities would not be possible without disturbing substantially greater areas of wetlands, including forested wetlands, than would be necessary for a nuclear facility. To avoid extensive wetland impacts, Detroit Edison would have to acquire additional contiguous parcels of land. Those parcels would most likely consist of a mix of land uses including agriculture and could include wetlands (Detroit Edison 2011a).

Onsite impacts on terrestrial ecology would generally be as described in Sections 4.3.1 and 5.3.1 for a nuclear project but would be substantially more extensive. Additional impacts would result from development of newly acquired parcels adjacent to the site, but terrestrial ecology impacts on those parcels could be limited because they consist largely of agricultural land. The review team assumes that a coal plant on the Fermi site would require building and operating the same new transmission lines described for the Fermi 3 nuclear project.

Coal-mining operations would also disturb terrestrial habitats in offsite coal-mining areas. Detroit Edison estimates that 35,200 ac would be required to mine the amount of coal needed to

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(a) Because of differences in operating temperatures, cooling demands for coal-fired plants are slightly smaller than cooling demands for similarly sized nuclear plants.

support a 1600-MW(e) plant. Using a 1886 MW(e) gross nameplate rating and a 79 percent capacity factor, the review team estimates that a coal-fired alternative would require 41,492 ac to mine the coal. For comparison, uranium mining to support a 1600-MW(e) nuclear reactor is estimated to require a 1600-ac uranium mine (Detroit Edison 2011a).

Onsite temporary storage of coal, CCR, spent catalysts, and scrubber sludge, as well as any offsite waste disposal by landfilling of CCR, would also affect terrestrial ecology by requiring conversion of existing habitat. Deposition of acid rain resulting from NO_x or SO_x emissions and deposition of other pollutants could also affect terrestrial ecology. Considering the emission controls discussed previously, air deposition impacts might noticeably affect terrestrial vegetation and wildlife but would likely not be regionally destabilizing. Operation of the cooling towers would cause some deposition of dissolved solids on surrounding vegetation and soil from cooling tower drift; however, these impacts would be generally be minimal, about the same as those that are now occurring from the operation of Fermi 2.

Primarily because of the potential disturbances to offsite habitats from coal mining and onsite and offsite impacts on wetlands caused by building the coal plant and associated facilities, impacts on terrestrial resources from a coal-fired power plant would be MODERATE. While the greatest impacts would result from the offsite coal mining, wetland losses resulting from building the onsite facilities would also be noticeable, although it might be possible to reduce the impacts through wetland mitigation. Impacts on terrestrial habitats caused by air emissions could also be noticeable.

Noise

Coal-fired power generation would introduce mechanical sources of noise that would be audible offsite. Sources contributing to the noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations and MCDTs. Intermittent sources include the equipment related to coal handling, solid waste disposal, transportation related to coal and lime/limestone delivery, use of outside loudspeakers, and the commuting of plant employees. Noise impacts associated with rail delivery of coal and lime/limestone would be most significant for residents living in the vicinity of the facility and along the rail route. Although noise from passing trains significantly increases noise levels near the rail corridor, the short duration of the noise reduces the impacts. Nevertheless, given the expected frequency of coal and limestone deliveries, the potential impacts of noise on residents in the vicinity of the facility and the rail line are considered MODERATE. Noise and light from the plant would be detectable offsite.

Land Use

The following analysis of land use impacts focuses on land requirements for construction and operation of a new supercritical coal-fired power plant on the Fermi site. The review team assumes that situating such a plant on the Fermi site would require building and operating the same new transmission lines described for the Fermi 3 nuclear project.

Detroit Edison indicated that approximately 1700 ac of land would be needed to support a 1000-MW(e) coal-fired plant (Detroit Edison 2011a). The review team has reviewed these estimates and found them to be reasonable and consistent with the GEIS (NRC 1996). Although the power blocks of a nuclear plant and a similarly sized coal plant are approximately the same size, the coal plant would require additional land to support ancillary activities such as onsite storage and handling of coal (including sizing and blending, when required) and lime (or limestone) and temporary onsite storage of CCR and scrubber sludge. As discussed earlier, a coal-fired alternative of equivalent power-producing capability would have a gross nameplate rating of 1886 MW(e) to account for differences in capacity factors between the proposed nuclear reactor and the coal-fired alternative and to accommodate parasitic loads. By simple proportioning, a 1886-MW(e) plant would require 3210 ac.[a]

The Fermi site is approximately 1260 ac, including wetland areas. As noted earlier, new land parcels would need to be acquired to support a new coal-fired power plant on the Fermi site. Offsite land acquisition would likely involve mostly agricultural or forest land and may affect prime farmland.

Depending on how much offsite adjacent land can be obtained, development of the coal plant would almost certainly cause the loss of much of the land on the Fermi site that is managed as part of the Detroit River International Wildlife Refuge (DRIWR), especially upland areas that are not subject to wetland permitting limitations.

Offsite land use impacts would occur from coal mining. However, most of the land in existing coal-mining areas has already experienced some level of disturbance. Detroit Edison estimates that 35,200 ac would be required to mine the amount of coal needed to support a 1600-MW(e) plant. Using a 1886-MW(e) gross nameplate rating and a 79 percent capacity factor, the review team estimates that a coal-fired alternative would require 41,492 ac to mine the coal. Uranium mining to support a 1600-MW(e) nuclear reactor is estimated to require a 1600-ac uranium mine. The elimination of the need for uranium mining to supply fuel for the proposed reactor would partially offset the impact of this offsite land use. Additional land areas would be required for disposal of CCR, scrubber sludge (gypsum), and other operational solid wastes, although the land areas requirements for disposal would be affected by the extent to which operational wastes could be recycled.

(a) Increasing the nameplate capacity of the boiler can be expected to result in only incremental changes in land requirements for the power block, supporting infrastructures, and ancillary activities such as coal and waste storage or onsite fuel blending. Consequently, using a simple ratio to calculate resulting increases in land area requirements is expected to produce a conservative result.

Based on this information, land use impacts of the coal-fired alternative would be MODERATE. Even without consideration of the land demands for coal mining, the land use impacts from building and operating the coal plant facilities would be MODERATE.

Socioeconomics

Socioeconomic impacts are defined in terms of changes to the baseline demographic and economic characteristics and social conditions of a region. For example, the number of jobs created by the construction and operation of a new coal-fired power plant could affect regional employment, income, and expenditures. The socioeconomic baseline discussed for the Fermi 3 plant in Section 2.5 of this EIS serves as the baseline for this alternative analysis.

Detroit Edison projected a peak employment construction workforce of 2900 workers (an average employment level of 1000 workers) for the building of Fermi 3. The review team anticipates that the majority (about 85 percent) of the workforce would come from a three-county economic impact area comprising Monroe and Wayne County in Michigan (which includes the Detroit Metropolitan Statistical Area [MSA]) and Lucas County in Ohio (which includes the Toledo MSA). Because the majority of the workforce would already live in the region, the relative economic contributions of these workers to local business and tax revenues in the region would remain generally the same. The review team expects the remainder of the building-related workforce would in-migrate from outside the 50-mi region in the same residential distribution as the current operations workers at the Fermi site (see Section 4.2.2 for a detailed discussion of these assumptions). About 87 percent of the in-migrating construction workers would settle with their families in Monroe or Wayne County in Michigan or Lucas County in Ohio.

Detroit Edison estimates that 2500 workers would be required for the construction of a coal-fired alternative. For comparative purposes, the review team applied the same residential distribution assumptions used for the analysis of Fermi 3 to the 2500 construction workers for the alternative coal-fired electrical generating units.

The review team does not expect many in-migrating construction workers will permanently relocate to the region, so any socioeconomic effect induced by the in-migrating workers would be temporary. Based on the site's proximity to the Detroit and Toledo MSAs and expected limited worker relocation, the review team concludes that construction impacts on the local infrastructures and services would be SMALL and adverse.

Section 4.4.2.3 discusses the impact on the regional tax base from the construction and operation of Fermi 3. Impacts from construction of the coal-fired alternative would also occur in each of the four categories discussed in Section 4.4.2.3 but would be proportionally smaller, based on the projected differences in construction workforce sizes, 2900 for the nuclear reactor and 2500 for the coal fired alternative. Once operational, the coal-fired alternative would provide a beneficial impact on the regional tax base comparable to that of Fermi 3. To the extent to which local suppliers are used to provide necessary materials for construction and operations of the alternative plant and members of the local workforce are employed at the plant, local sales taxes would increase. Impacts on the local tax base would result primarily from the property taxes that would be paid for the new alternative coal-fired units. Because coal-fired plants are not subject to the safety requirements necessary for the construction and operation of a nuclear power plant, the review team expects the cost of construction of the alternative coal-fired plants would be somewhat less than for Fermi 3, but still would result in a substantial increase in Monroe County property tax revenues. However, the construction period for the coal-fired alternatives would be shorter, and therefore the assessment of property taxes during operations would begin sooner than for Fermi 3. As would be the case for the proposed action of constructing and operating Fermi 3, the review team concludes that impacts on the regional and local tax bases from construction and operation of the coal-fired alternative would be SMALL and beneficial, with the exception of property taxes to Monroe County, Michigan, which would be LARGE and beneficial.

Traffic

During construction, 2500 workers would be commuting to the plant site, most coming primarily from the Detroit and Toledo MSAs. The review team assumes for this comparison that all the traffic-related conditions described in Sections 4.4 and 5.4 for the Fermi 3 project would also apply to the alternative coal-fired power plants, with the following exceptions:

- The construction workforce for the alternative coal-fired plants would be smaller (2500 employees at peak employment versus 2900 employees for Fermi 3).
- The operations and maintenance workforce for the coal-fired plants would be smaller than that for Fermi 3.
- The construction phase for the coal-fired plants would be shorter.
- Fewer truck deliveries would be made for the coal-fired plants.

As described in Section 4.4.4.1, the review team determined that traffic-related impacts from the construction of Fermi 3 would be short term, MODERATE, and adverse, occurring only during peak construction employment periods. Given the conditions discussed above, the review team concludes that traffic-related impacts associated with a coal-fired alternative constructed on the Fermi site are likely to also be short term, MODERATE, and adverse. The mitigation opportunities that resulted from the transportation study commissioned by Detroit Edison in coordination with the State would also apply to the coal-fired alternative, and a commitment by Detroit Edison to work with the Michigan Department of Transportation (MDOT) and the Monroe County Road Commission (MCRC) to identify and execute appropriate mitigations would reduce transportation impacts to manageable levels. Traffic impacts would be greatly reduced after construction but would not disappear during plant operations.

Operations-related traffic impacts would result from (1) the commuting of the operating workforce, (2) rail deliveries of coal and limestone, and (3) large vehicles transporting CCR, scrubber sludge, and spent catalyst to recycling and/or disposal sites. Onsite coal storage facilities would be designed to have the capacity to receive several trainloads per day. Limestone delivered by rail could also add traffic, but it would be less than that generated by coal deliveries. By comparison, transportation-related impacts from the operation of a nuclear plant would be considerably smaller due to less frequent deliveries; however, transportation impacts from the commuting workforce would be greater due to the expected larger operating workforce for the reactor. The review team determines that because of the scale of deliveries of coal and limestone, combined with the large number of disposal truckloads leaving the plant, operating a new coal-fired power plant would result in MODERATE and adverse impacts on transportation. These impacts would be reduced by mitigation measures still in place after the construction period, but their presence would not reduce the assessed impact from MODERATE and adverse.

Aesthetics

Aesthetic impacts result primarily from the degree of contrast between the coal-fired power plant and the surrounding rural landscape, as well as the visibility of the coal-fired power plant in offsite areas. However, because there is industrial activity already on the site associated with operation of Fermi 2, the contrast between a coal plant at the site and the rural surroundings would be dramatically reduced.

Each power block building of a new coal-fired power plant would be up to 200-ft tall, which is somewhat taller than the proposed Fermi 3 reactor building. Each power block would also have an exhaust stack up to 500 ft in height, which would likely be taller and more prominent than the reactor's offgas stack and, during some weather conditions, release a visible plume resulting from water vapor and combustion gases. These structures would be high enough to require illumination, which would exacerbate their visibility in the night. The cooling towers would generate a condensate plume, but this would be no more noticeable than the plume expected from a similarly sized cooling system for the Fermi 3 reactor. The transmission lines supporting the coal-fired plant would be the same as those proposed for Fermi 3 and would, therefore, have identical aesthetic impacts. In Section 4.4.1.6 and 5.4.1.6, the review team concludes that visual impacts from the construction and operation of Fermi 3 would be SMALL and adverse. Given the similar appearance of a coal-fired alternative to a nuclear plant and the industrial character of the existing viewscape because of Fermi 2, the review team determined the aesthetic impacts associated with the construction and operation of the coal-fired power plant alternative at the Fermi site would be SMALL and adverse.

Environmental Justice

This environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from the construction and operation of a new coal-fired power plant. The minority and low-income demographic characterization of the 50-mi region surrounding the proposed Fermi 3 site is discussed in Section 2.6 of this EIS. The characterization of minority and low-income populations for Fermi 3 is the same as that for the alternative coal-fired power plant. In Section 4.4.3 and 5.4.3 the review team concludes that there are no pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations from the construction and operation of Fermi 3. Since the construction of a coal-fired power plant system of comparable size to the Fermi 3 plant would have very similar physical and socioeconomic impacts, the review team determines that the impacts on minority or low-income populations from the construction of a coal-fired alternative would also be similar. Therefore, the review team determines the environmental justice impacts on minority or low-income populations of interest from constructing a coal-fired plant would be SMALL.

Although many of the characteristics of operating a coal-fired power plant system would be similar to those for operating Fermi 3, there is one significant difference: a coal-fired plant emits substantially more air pollution and produces substantially more solid waste (some of which are heavy metals or hazardous wastes) than its nuclear powered analog. Therefore, while emission limits imposed by operating permits would help ensure the general population would not receive adverse air quality and noise impacts from emission levels beyond those permitted by environmental standards from the operation of the coal-fired alternative, the general population would experience increased environmental impacts from the byproducts of operating a coal-fired power plant. However, the review team did not identify any pathway or circumstance through which any minority or low-income population might experience a disproportionately high and adverse impact, relative to the general public. Therefore, the review team concludes that the environmental justice impacts on minority and low-income populations of interest from operating a coal-fired alternative plant would be SMALL.

Historic and Cultural Resources

The Fermi site contains one *National Register of Historic Places*- (NRHP-) eligible historic property, the nonoperating Fermi Unit 1 (Fermi 1). In Section 7.5, the review team concludes that impacts on onsite historic and cultural resources from building and operating Fermi 3 would be MODERATE, because portions of the Fermi 3 plant would be located on the land currently occupied by Fermi 1, and if demolition of Fermi 1 were necessary, the adverse impacts of demolition would be mitigated in accordance with measures stipulated in a Memorandum of Agreement (MOA) between the NRC, the Michigan State Historic Preservation Officer (SHPO), and Detroit Edison. Similar adverse impacts on the NRHP-eligible Fermi 1 historic property would result from construction of a coal plant on the same footprint that was proposed for

Fermi 3. In addition, because the land area requirements for a coal-fired alternative are greater than those for a nuclear reactor, impacts on disturbed and undisturbed land parcels may occur both on the Fermi site and on adjacent offsite properties for support of ancillary activities such as fuel and waste storage. While surveys of previously undisturbed land parcels would provide a basis for mitigation of impacts on historic and cultural resources, the review team nevertheless concludes that impacts on historic and cultural resources from construction and operation of a new coal-fired power plant at the Fermi site would be MODERATE, primarily due to the demolition of the NRHP-eligible Fermi 1 and the implementation of mitigation measures for the adverse impacts of demolition that would be similar to those developed for a new nuclear reactor.

Summary of the Construction- and Operation-Related Impacts of the Coal-Fired Power Generation Alternative

The construction and operation impacts of coal-fired power generation at the Fermi site are summarized in Table 9-2.

9.2.2.2 Natural Gas-Fired Power Generation

In this section, the review team evaluates the environmental impacts of natural gas combined-cycle (NGCC) generation at the Fermi site.

In 2009, natural gas was responsible for 8.3 percent of electricity generated by all sources within the electric industry (utilities, combined heat and power, independent power producers) in Michigan, 8,419,551 MWh of the statewide total of 101,202,605 MWh (DOE/EIA 2011b), but only 0.7 percent, 563,510 MWh, of the 82,787,341 MWh of electricity generated by electric utilities. Like coal-fired power plants, natural gas-fired plants are sources of criteria pollutants and GHGs and are subject to emission-limiting regulations promulgated under the CAA and analogous State legislative directives, although they emit markedly fewer criteria pollutants and GHGs per unit of energy produced than comparably sized coal-fired plants. The technology most likely to be employed in a natural gas-fired alternative is “combined cycle.”

NGCC power plants differ significantly from coal-fired and existing nuclear power plants. They derive the majority of their electrical power output in the primary power cycle, a gas combustion turbine (CT), without the production of steam. Additional power is generated by recovering latent heat from gases exiting the CT delivered to a heat recovery steam generator (HRSG), with the resulting steam subsequently directed to a conventional Rankine cycle STG set, the secondary power cycle. Power resulting from this secondary cycle is completely pollution-free since it involves no fuel combustion, although management of the steam cycle does introduce a small internal load. This “combined cycle” approach provides significantly greater thermal efficiency than any single cycle system, with overall thermal efficiencies routinely attaining 60 percent (as compared to typical thermal efficiencies of coal-fired plants using only Rankine

Table 9-2. Summary of Environmental Impacts of a Coal-Fired Power Generation Alternative

Impact Category	Impact	Comment
Air Quality	MODERATE	SO_2, 2719 tons/yr NO_x, 3353 tons/yr CO, 1618 tons/yr $PM_{filterable}$, 208 tons/yr $PM_{2.5}$, 48 tons/yr Small, unquantified amounts of hazardous air pollutants, including mercury. CO_2, 12.1 million tons/yr (without CO_2 removal). Air quality impacts will be mitigated by emission limits contained in operating permits.
Waste Management	MODERATE	CCR waste volume projections include 416,918 tons/yr of ash that would be recovered as bottom ash or fly ash; with 50 percent of the recovered amount (208,251 tons/yr) recycled and an equal amount requiring disposal annually. SO_2 scrubber sludge projected generation of 110,310 tons/yr, 90 percent of which is projected for recycling, leaving 11,031 tons/yr requiring disposal.
Human Health	SMALL	Regulatory controls and oversight would be protective of human health.
Water Use and Quality	SMALL	Impacts would be less than the impacts for Fermi 3 due to lesser heat rejection demands.
Ecology	SMALL (aquatic) to MODERATE (terrestrial)	Expected to require disturbance of substantially greater areas of natural habitat, including wetlands, on the Fermi site, as well as result in habitat losses in offsite areas on contiguous parcels. Offsite areas used for CCR disposal are expected to be already in use as disposal facilities to which the local ecology has already adjusted.

Table 9-2. (contd)

Impact Category	Impact	Comment
Ecology (contd)		Impacts on aquatic ecology from operation of the cooling system would be comparable to those anticipated from Fermi 3 and would be SMALL. Impacts on terrestrial ecology from cooling tower drift would be comparable to those anticipated from Fermi 3. Additional impacts on terrestrial ecosystems are associated with coal mining and construction of onsite areas for temporary storage of CCR and other operation-related solid wastes.
Noise	MODERATE	Continuous and intermittent noise would be created by mechanical equipment associated with normal plant operations, mechanical cooling towers, coal handling, solid waste disposal, and coal and limestone deliveries.
Land Use	MODERATE	Onsite land requirements for the power block and cooling system would be substantially greater than the requirements for Fermi 3. Additional onsite and possibly some offsite land areas would be required for storage of coal and temporary storage of CCR and other operation-related wastes. Approximately 41,492 ac would be required to mine the required amount of coal. Substantial land areas may be required for the permanent disposal of CCR and scrubber sludge that cannot be recycled. Offsite land requirements for transmission would be comparable to or the same as those for Fermi 3.
Socioeconomics (economy and taxes)	SMALL to LARGE (beneficial)	Increased economic activity from new jobs and spending in the region would stimulate economic growth and tax revenues. Local property tax base would benefit mainly during operations to an extent slightly less than is expected for Fermi 3, due to the smaller operating workforce expected. This stimulus would be SMALL beneficial for all areas except for property tax impacts in Monroe County, which would be LARGE beneficial.

Table 9-2. (contd)

Impact Category	Impact	Comment
Socioeconomics (all other areas)	SMALL to MODERATE	Construction-related impacts would be limited and temporary. Construction workforce projected at 2500; likely to originate primarily from the Detroit and Toledo MSAs. Impacts on local communities with regard to housing and services are expected to be short term, SMALL and adverse for construction and SMALL and adverse for operation. Traffic-related impacts will be greatest during peak construction employment periods, which the review team has determined would constitute a short-term, MODERATE, adverse impact. Cumulative impacts from traffic result from the simultaneous commuting to the site by three separate workforces during certain periods: coal plant construction, Fermi 2 operation, and Fermi 2 refueling, as well as from non-Fermi-related traffic. The plant and new transmission line would have aesthetic impacts comparable to those anticipated for Fermi 3. The aesthetic impact would be SMALL and adverse, since the Fermi site is already industrialized.
Environmental Justice	SMALL	Impacts are expected to be similar to those evaluated for the nuclear alternative. No disproportionate adverse impacts were identified.
Historic and Cultural Resources	MODERATE	Impacts onsite would be similar to the nuclear alternative. Demolition of the NRHP-eligible Fermi 1 would result in adverse impacts on a historic resource, which would be mitigated. Some of the facility and supporting infrastructure would be built on previously disturbed ground onsite, but additional previously undisturbed onsite and offsite areas that may be required may not have been surveyed for resources.

cycle STGs of 39 percent) (Siemens 2007; NETL 2010). Because the natural gas-fired power plant alternative derives much of its power from a gas turbine without production of steam and because it has greater thermal efficiency than either the coal-fired power plant alternative or the proposed Fermi 3 reactor, it requires significantly less cooling.

Typical powertrains for large-scale NGCC power generation would involve one, two, or three CTs operating simultaneously, with the heat extracted from each directed to one HRSG (commonly known as a “1 × 1,” “2 × 1,” or “3 × 1” configuration, respectively). CTs, HRSGs, and STGs are available in a wide variety of sizes and can be configured in a variety of powertrain configurations to attain virtually any desired level of net power production. To complete the assessment of an NGCC alternative, the review team presumed that appropriately sized CTs HRSGs, and STGs would be assembled in appropriate powertrain configurations to produce net electrical power virtually equivalent to the 1535 MW(e) proposed for Fermi 3. Because NGCC plants can be expected to operate at a capacity factor of 85 percent, power equivalency to the Fermi 3 reactor in terms of the equivalent amount of electricity delivered to the grid would be 1661 MWe.

Although operation of the NGCC plant introduces some parasitic loads, unlike coal-fired plants, the resulting performance penalty is relatively minor, and no adjustments have been made to calculations of NGCC operational impacts to account for parasitic loads. In addition, given the significant uncertainty regarding the details of any CCS and when such controls might be required, the review team did not include parasitic losses from CCS in its calculations.

The review team further assumed that 75 percent of the net power produced (1246 MW) would result from the operation of the CTs, with the remainder (415 MW) resulting from operation of the HRSG-STG powertrains; the CTs are Advanced F-Class designs equipped with water or steam injection as a precombustion control to suppress NO_x formation and selective catalytic reduction (SCR) (ammonia introduction) for postcombustion control of NO_x emissions.[(a)] The facility would use natural gas meeting interstate pipeline specifications[(b)] and would operate at a capacity factor of 85 percent, with load factors for the CTs greater than 80 percent, thermal efficiencies of the CTs of 42 percent, and an overall facility thermal efficiency of 60 percent. The facility would consume 73,900 million ft^3 of natural gas to produce 12,400 GWh of power annually.

Air Quality

A review of the status of ambient air quality at the Fermi site is provided in Section 9.2.2.1. The following sections provide brief overviews of the Federal and State regulations that would apply to the NGCC alternative operating at the Fermi site and also evaluate the impacts of construction and operation of a NGCC alternative.

(a) SCR involves introducing ammonia into the exhaust ducts of the CTs, where it combines with NO_x in a nickel catalyst bed to form zero-valent nitrogen and water. Referring to data provided by the Institute of Clean Air Companies, EPA acknowledges that typical SCR devices can demonstrate removal efficiencies of between 70 and 90 percent (EPA 2000b).

(b) Interstate pipeline specifications for natural gas include chemical composition (volume percent): CH_4, 93.9; ethane, 3.2; propane, 0.7; *n*-butane, 0.4; CO_2, 1.0; and nitrogen, 0.8; and higher heating value, 22,792 Btu/lb (1040 Btu/standard ft^3); lower heating value, 20,552 Btu/lb (939 Btu/ standard cubic foot); and average value, 1020 Btu/standard ft^3. EPA further defines “pipeline natural gas” as having sulfur content less than 0.6 grains/100 standard ft^3.

Air Pollution Controls Regulations in Michigan Applicable to an NGCC Alternative

Federal and State regulations in Michigan are discussed in Section 9.2.2.1 with respect to a coal-fired alternative. Except as noted below, the majority of those requirements would also apply to a NGCC alternative operating at the Fermi site. A new natural gas-fired generating plant would qualify as a new major source of criteria pollutants and would be subjected to Prevention of Significant Deterioration of Air Quality Review under requirements of CAA and Michigan State regulations. As such, it would need to comply with the NSPS for NGCC plants set forth in 40 CFR 60 Subpart Da: particulate matter and opacity (40 CFR 60.42(a)), SO_2 (40 CFR 60.43(a)), and NO_x (40 CFR 60.44(a)). The new NGCC generating plant would qualify as a major source because its PTE is greater than 100 tons/yr of criteria pollutants and its CO_2 is greater than 75,000 tons/yr, and would be required to secure a Title V operating permit from MDEQ. However, although new permits issued after January 2011 must address GHG emissions and require the permittee to report them, regulations specifically requiring carbon capture and sequestration have not been promulgated. A new NGCC plant in Michigan would also be subject to the CSAPR finalized by EPA on July 6, 2011.

The combustion turbines of the combined cycle plant would be subject to EPA's National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines (40 CFR 63, Subpart YYYY) if the NGCC was a major source of HAPs (having the potential to emit 10 tons/yr or more of any single HAP or 25 tons/yr or more of any combination of HAPs (40 CFR 63.6085(b)). In December 2000, EPA published its determination that HAPs such as arsenic, formaldehyde, and nickel could be emitted from natural gas-fired electric utility-scale steam generating units (i.e., natural-gas-fired boilers), but that such emissions were negligible, making regulations directed at their control neither appropriate nor necessary (65 FR 79825). However, this interpretation does not automatically extend to natural-gas-fired combustion turbines.

Estimated Impacts on Air Quality from the Construction of a NGCC Alternative

Construction of a NGCC power plant would result in the release of various criteria pollutants from the operation of internal combustion engines in construction vehicles and equipment, delivery vehicles, and vehicles used by the commuting construction workforce. Volatile organic chemical releases will also result from the onsite storage and dispensing of vehicle and equipment fuels. Onsite and offsite (e.g., pipeline) activities would also generate fugitive dust and equipment-related criteria pollutants. These impacts would be intermittent and short-lived, however, and adherence to well-developed and well-understood construction industry best practices (including development and execution of an appropriate fugitive dust control plan) would mitigate such impacts. Construction-related impacts on air quality from an NGCC alternative would be of relatively short duration and would be SMALL.

Estimated Impacts on Air Quality from the Operation of a NGCC Alternative

Operation of the NGCC alternative would result in the release of modest amounts of criteria pollutants, hazardous air pollutants, and GHGs, principally CO_2. As with the coal-fired alternative discussed above, particulate drift would also be released from either an NDCT or an MDCT that would provide cooling for the steam in the secondary power cycle. As noted in Section 9.2.2.1, Detroit Edison estimates drift releases from plant cooling towers that would support the proposed reactor to be 8.47 tons/yr. Because the cooling demands of a NGCC facility of equivalent capacity are significantly lower than those of a nuclear reactor, those estimates represent a bounding condition for either cooling tower alternative of a NGCC alternative.

In its application, Detroit Edison identified a 1500-MW(e) natural-gas-fired alternative and estimated that such a plant equipped with appropriate pollution control technology would have approximately the following emissions:

- SO_2, 41 tons/yr
- NO_x, 3800 tons/yr
- CO, 1600 tons/yr
- PM, 290 tons/yr
- CO_2, 4,800,000 tons/yr (without CCS).[(a)]

The review team's estimates of emissions from a 1661-MW(e) NGCC facility, based on emissions factors provided in EPA AP-42 (EPA 1998), are shown in Table 9-3.

The emissions from the NGCC alternative would be significantly less than those from the coal-fired alternative. The impact of the emissions from the NGCC plant would be noticeable but would not be sufficient to destabilize air resources. Overall, the review team concludes that the air quality impacts resulting from the construction and operation of a new NGCC plant located at the Fermi site would be SMALL to MODERATE.

Waste Management

In the GEIS for license renewal, the staff concluded that waste generation from natural-gas-fired technology would be minimal (NRC 1996). During construction of a new natural-gas-fired power plant, land clearing and other construction activities would generate waste that could be

(a) The Detroit Edison analysis defined a different nameplate capacity and a different configuration for the natural gas alternative evaluated in the ER than the review team presents here. Consequently, Detroit Edison's projected air emissions are not directly comparable to those presented in this analysis.

Table 9-3. Estimated Emissions (in tons/yr) from a 1661-MW(e) (net) NGCC Alternative[(a)]

Pollutant	Annual Uncontrolled Emissions	Annual Controlled Emissions	Notes
SO_2	128	128	Emission factor of 0.0034 lb/MMBtu; 99 percent SO_2 and trace amounts of SO_3; assumes no H_2S formation.
NO_x	4900	490	Emission factor of 0.13 lb/MMBtu; assumes water-steam injection and 90 percent conversion in SCR.
Particulate[(b)]	249	249	Emission factor of 0.0066 lb/MMBtu, all as PM_{10}
CO	1130	1130	Emission factor of 0.03 lb/MMBtu; assumes 95 percent conversion of carbon in fuel.
N_2O	113	113	Emission factor of 0.003 lb/MMBtu
VOC	79	79	Emission factor of 0.0021 lb/MMBtu
CO_2	4.15 million	4.15 million	Emission factor of 110 lb/MMBtu; assumes 95 percent conversion of carbon in the fuel and no CCS in place.

(a) Combustion of natural gas also releases other GHGs, such as CH_4 and N_2O, so that the total GHG emission is typically represented as CO_2-e. However, CO_2 predominates, and for simplicity, contributions of CH_4 and N_2O were ignored in the calculations.

(b) Although expected to be relatively minor, particulate emissions from the CT cannot be specified with precision at this time. Consequently, the estimates presented do not include CT particulate emissions.

recycled or shipped to an offsite waste disposal facility. A small fraction of the anticipated construction-related wastes would exhibit hazardous characteristics that would require special handling, treatment, or disposal. Because Detroit Edison believes that the NGCC alternative and ancillary facilities could be constructed largely on previously disturbed portions of the Fermi site, the amounts of wastes produced during land clearing of native vegetation would be minimal.

During NGCC operation, spent SCR catalysts used to control NO_x emissions from the CTs would make up the majority of the waste generated under this alternative. Such wastes might exhibit hazardous characteristics that dictate special handling and disposal. All disposals of spent catalysts would be expected to occur at existing offsite facilities. Small amounts of wastes would result from the treatment of cooling water in circulating systems and from typical maintenance and cleaning operations. Overall, the review team concludes that waste impacts from natural gas-fired power generation would be SMALL.

Human Health

Like the coal-fired power plant alternative discussed above, an NGCC plant would emit criteria air pollutants but in lesser quantities. Human health effects of gas-fired generation are generally low, although in Table 8-2 of NRC (1996), the NRC staff identified cancer and emphysema as potential health risks from gas-fired plants. NO_x emissions contribute to ozone formation, which in turn contributes to human health risks. Emission controls on this gas-fired alternative can be expected to maintain NO_x emissions well below air quality standards established for the purposes of protecting human health (the primary NAAQS), and emissions trading or offset requirements mean that overall NO_x releases in the region would not increase. Health risks to workers might also result from handling spent catalysts that might contain heavy metals.

Overall, human health risks to occupational workers and to members of the public from gas-fired power plant emissions sited at the Fermi site would be less than the risks described for the coal-fired power plant alternative and would likely be SMALL.

Climate Change-Related Impacts

This section presents anticipated impacts on climate change from the construction and operation of the NGCC alternative.

Because construction of an NGCC alternative would occur over a shorter period of time and involve a smaller workforce than Fermi 3, the construction-related GHG emissions for Fermi 3 (see Section 4.7.1) are considered to be a bounding condition, and there would be fewer GHG emissions from construction of the NGCC alternative. The impact on climate change from the construction of a NGCC alternative would be SMALL.

Of the 214.7 MMT of energy-related CO_2-e emissions in Michigan in 2005, 2.38 MMT was related to in-state electricity production using natural gas (CCS 2008). The U.S. total GHG emissions and total emissions of CO_2 from combustion of fossil fuels for electricity production in 2005 were 7108.6 MMT and 2381 MMT, respectively (EPA 2009a). Thus, the Michigan total GHG emissions from combustion of natural gas for electricity production accounted for 0.033 percent of the nationwide total GHG emissions and approximately 0.10 percent of the nationwide total CO_2 emissions related to electricity production using fossil fuels.

EIA reports that the total GHG emissions in the United States in 2007 were 7282.4 MMT of CO_2 equivalents ($MMTCO_2$-e), a growth of 1.4 percent from 2006. Of this amount, 5916.7 $MMTCO_2$-e (81.2 percent) was CO_2, 699.9 $MMTCO_2$-e (9.6 percent) was CH_4, and 383.9 $MMTCO_2$-e (5.3 percent) was N_2O (DOE/EIA 2008). CO_2, CH_4, and N_2O emissions would all result from the operation of an NGCC facility. Both N_2O and CH_4 (which is the primary component of pipeline natural gas) are also potent GHGs with global warming potentials in a 20-year time horizon that are 310 and 21 times as great as CO_2, respectively (EPA 2009a). However, only insignificant amounts of N_2O are released from CT operation, and significant emissions of natural gas would result only through incomplete combustion and/or fuel supply system leaks and are therefore presumed to be improbable. As noted above, an estimated 95 percent of the carbon contained in the natural gas being combusted would be converted to CO_2.

As discussed above, the review team estimates that 4.15 million tons/yr (3.76 MMT/yr) of CO_2 would result from the operation of a natural-gas-fired alternative. The power produced by the Fermi 3 reactor that might otherwise have been generated by a natural-gas-fired alternative represents GHG emissions avoided. Consequently, operation of the Fermi 3 reactor instead of a natural-gas-fired alternative would result in the net savings of 4.15 million tons/yr (3.76 MMT/yr) of CO_2.[a] This amount represents approximately 3.04 percent and 0.02 percent of the total anthropogenic GHGs related to electricity production emitted in Michigan and in the United States, respectively, in 2005.

Although any single project would be inconsequential when compared to global GHG emissions, the review team doesn't believe that this is the correct way to measure the impacts. A 3 percent increase in emissions from electricity production within the State cannot be construed as undetectable. The review team concludes that the impacts on GHG concentrations in the atmosphere from the operation of an NGCC alternative would be SMALL to MODERATE.

Groundwater Use and Quality

No groundwater is expected to be used in the construction or operation of the NGCC alternative. Some foundation excavations may intrude on groundwater zones and require dewatering while they are being constructed. Surface water drainage from active construction sites could contain contaminants that could affect groundwater, but major construction sites would be required to have an SWPPP general permit that would preempt such adverse impacts. Otherwise, no impacts on groundwater quality would be expected. The impact of the natural gas-fired alternative on groundwater would be SMALL.

Surface Water Use and Quality

During construction, production of concrete and other construction activities would result in consumption of minimal amounts of surface water, presumably acquired from Lake Erie. Ground disturbance might result in some impacts on surface water quality in the form of increased sediment loading to stormwater runoff from active construction zones; however, an SWPPP general permit is expected to require BMPs that would prevent or significantly mitigate such impacts. The impacts on water quality from sedimentation during construction of a natural-gas-fired plant were characterized in NUREG-1437 as SMALL (NRC 1996).

The NGCC alternative would be expected to use a closed loop cooling system virtually identical to the one proposed for Fermi 3, employing either MDCTs or NDCTs. During operation, Lake

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(a) Figures presented here represent CO_2 emissions directly related to energy production. Although it is estimated that a nuclear reactor will generate 7700 tons/yr of CO_2-e (see Table 5-22), those releases are the result of routine preventive maintenance of fossil-fueled emergency generators and routine operation of ancillary equipment using fossil fuels and not the direct result of the operation of the reactor. No GHGs are emitted from reactor operation.

Erie would provide the water source for cooling and other industrial applications and would receive blowdown from the cooling tower, while industrial wastewaters would be discharged to the sanitary sewer under a treatment agreement with the municipal treatment facility that currently serves the Fermi site. Discharges to Lake Erie would be controlled by an NPDES permit. Discharges to the sanitary sewer would be controlled by a pretreatment agreement with the operator of the sewage treatment plant accepting the discharges. However, only the steam produced in the HRSGs and exhausted from the Rankine cycle STGs would require cooling. Consequently, because the majority of power would be produced by the CTs, which require no cooling, the cooling system would use less water than has been projected for Fermi 3. The slightly lower operating temperatures and relatively high thermal efficiencies of an NGCC plant would also result in smaller cooling water requirements than those of the comparably sized nuclear plant. NRC also noted in NUREG-1437 that the impacts on water quality from operations would be similar to, or less than, the impacts from other generating technologies. The review team concludes the impact on surface water from construction and operation of a NGCC alternative would be adequately controlled by permits and would, therefore, would be SMALL.

Aquatic Ecology

As noted above, Lake Erie would be the primary source of water to support the construction and operation of the NGCC alternative. Impacts on aquatic ecosystems during construction would be minimal due to the relatively small amount of water required (compared to the volume of water in Lake Erie) and controls on the quality of surface water discharges imposed by a SWPPP permit issued by MDEQ. Impacts on aquatic ecosystems during operation would be less than the projected impacts from Fermi 3 operation because of expected smaller heat rejection demands, and would take the form of both impingement and entrainment impacts associated with water withdrawals to support the cooling system, as well as thermal impacts associated with blowdown discharges from that cooling system (which may be required to undergo treatment prior to discharge). All such impacts would be controlled by an NPDES permit issued by MDEQ. The review team concludes, therefore, that impacts on aquatic ecology from the construction and operation of a NGCC alternative would be SMALL.

Terrestrial Ecology

Detroit Edison estimates that a 1600-MWe natural-gas-fired (closed cycle) alternative would require approximately 176 ac of land for permanent structures, not substantially different than the estimated 155 ac of land required for a nuclear facility.[a] It is unclear whether permanent or temporary wetland impacts would be necessary on the site, but the review team believes that

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(a) As noted above, Detroit Edison estimates for impact land area were based on a hypothetical 1600-MW(e) plant, rather than the 1661-MW(e) plant assumed for this assessment. The differences in land requirements are, however, negligible.

the onsite wetland impacts would be similar to those for a nuclear facility. The review team believes that the footprint of the natural gas plant considered here would be generally the same size as the conventional natural gas boiler envisioned by Detroit Edison, and therefore concludes that sufficient land area would available on the Fermi site to accommodate its natural gas alternative. Although the review team does not know exactly how much natural habitat on the Fermi site would have to be disturbed, it expects that the overall onsite terrestrial ecological impacts would be generally similar to those resulting from a nuclear facility.

The transmission line for a gas facility on the Fermi site would result in the same forest and wetland impacts as a transmission line for a nuclear facility. However, Detroit Edison estimates that an additional 200 ac would be disturbed to build the 10-mi natural gas pipeline needed to connect the Fermi site to the existing natural gas pipeline infrastructure. Although some of the affected land would be agricultural fields, where impacts would be largely temporary, installing the gas pipeline could require some forest clearing and fragmentation, as well as temporary disturbance of wetlands. Forest cover in the pipeline corridor, including wetlands in the corridor, would have to be kept clear during operation of the pipeline. The forest and wetland impacts from the gas pipeline would not be necessary for a nuclear facility.

Detroit Edison offered no estimates for additional land potentially needed for a new or upgraded compressor station. Given the large amount of agricultural land in the area, it is reasonable to conclude that a compressor station could be located on agricultural land, thereby minimizing terrestrial ecological impacts. Additional offsite impacts would occur at the locations where natural gas is extracted. In NRC (1996), the NRC staff estimated that approximately 3600 ac would be needed for a natural gas well field of sufficient size to support a 1000-MW(e) gas-fired plant. Correspondingly, a 1661-MW(e) facility would require approximately 6000 ac of gas well field. Existing natural gas fields would initially be expected to provide the necessary amount of gas for this facility. However, operation of the NGCC plant would contribute to a cumulative increase in the demand for gas, thereby contributing to a need to develop and exploit new gas sources.

Operation of the cooling towers would cause some deposition of dissolved solids on surrounding vegetation and soil from cooling tower drift. These impacts would be similar to but somewhat less than those that are now occurring from the operation of Fermi 2 and those that would result from operation of Fermi 3. As noted in Section 5.3.1, the terrestrial ecological impacts from cooling tower drift from Fermi 3 would be minimal.

Based on the above analysis, the review team concludes that impacts on terrestrial resources from the construction and operation of a NGCC alternative would be SMALL to MODERATE, similar to the impacts for the proposed nuclear unit. In addition to the onsite and transmission line impacts, as well as impacts from gas field development, impacts would also result from installation and maintenance of a new gas supply pipeline along an as-yet-unspecified route.

Noise

The construction-related noise sources for an NGCC alternative would be virtually the same as those for construction of the coal-fired alternative. However, the construction period for the NGCC alternative would be shorter and the construction less extensive (i.e., no facilities needed for management of coal and only limited facilities needed for management of operational wastes). Consequently, with construction-related noise for the coal-fired alternative as a bounding condition, the review team concludes that construction-related noise associated with the NGCC alternative would be SMALL.

Operation-related noise for the NGCC would be less than operation-related noise for the coal-fired alternative, because outdoor fuel-handling activities would not occur, outdoor waste-handling activities would be limited and there would be few, if any, rail deliveries of emissions control materials. Pipelines delivering natural gas fuel could be audible offsite near gas compressor stations, but such sound impacts would be similar to impacts already occurring in the vicinity of the existing pipeline to which the Fermi site would connect. The review team concludes that operation-related noise from the NGCC alternative would be SMALL.

Land Use

The analysis of land use impacts focuses on the amount of land area that would be affected by the construction and operation of a NGCC power plant at the Fermi site.

Detroit Edison estimated that approximately 176 ac of land would be permanently needed to support a natural-gas-fired alternative to Fermi 3, not substantially different than the 155 ac required for Fermi 3 (but presumably in approximately the same location).[a] Detroit Edison also indicated that an area of sufficient size in a previously disturbed area of the site was available for the natural gas plant, thus minimizing the amount of disturbance in undeveloped portions of the site (Detroit Edison 2011a). Detroit Edison stated, however, that it could not estimate the additional land requiring temporary disturbance during construction of the gas-fired plant (Detroit Edison 2011a). The review team does not believe that the additional land temporarily required would be substantially greater than that estimated for the nuclear Fermi 3 plant. The resulting onsite land use impacts from construction would therefore be minor. Impacts on wetlands and prime farmland on the Fermi site, as well as on lands on the site managed as part of the DRIWR, would likely be no greater than described for Fermi 3, and hence minor.

In addition to onsite, land would be required offsite for natural gas pipelines and gas wells. This would include land for a new 10-mi-long pipeline segment connecting the site to existing natural

(a) Detroit Edison land estimates were based on a hypothetical 1600-MW(e) plant, rather than the 1661-MW(e) plant assumed for this assessment. The differences in land requirements are, however, negligible.

gas distribution infrastructure. A new or expanded compressor station may also be required. Detroit Edison estimates offsite land impacts from the gas pipeline and compressor station to total 200 ac (Detroit Edison 2011a). The review team expects that at least some wetlands and prime farmland would be temporarily disturbed to install the pipeline.

In the GEIS (NRC 1996), the staff estimated that approximately 3600 ac would be needed for a natural gas well field of sufficient size to support a 1000-MW(e) gas-fired plant (NRC 1996). The 1661-MWe NGCC plant considered here would require more gas than the 1000-MWe reference plant evaluated in the GEIS, although that may not necessarily result in a proportional increase in land area for the gas field. Detroit Edison estimates that 5760 ac would be required to support the 1600-MWe natural gas alternative it evaluated. Although natural gas is widely available throughout the Detroit Edison service territory, it represented only 8.3 percent of the electricity generated in the State in 2009 (DOE/EIA 2011b).[(a)] The 12.4 million MWh of electricity that would be produced by a 1661-MWe NGCC power plant would be a substantial increase over the 8.4 million MWh of electricity produced from natural gas in 2009. The review team concludes that the impacts on land use from onsite activities and the 10-mi pipeline would be minor. It isn’t clear to what extent well fields might have to be expanded. However, inasmuch as most of the land around wells can be used for other purposes (e.g., grazing livestock), the review team concludes that these impacts may also be minor.

The EIA reported that flow of natural gas into Michigan through 2007 amounted to 4820 million ft^3/day , but delivery capacity into Michigan by existing interstate transmission pipelines was 9347 million ft^3/day (through 2008), an unused delivery capacity of 4527 million ft^3 (DOE/EIA 2011c). As noted earlier, the NGCC alternative is projected to consume 73,900 million ft^3 of natural gas annually, or a daily average of 202 million ft^3. The NRC review team concludes, therefore, that the existing interstate natural gas pipeline transmission infrastructure has sufficient, uncommitted capacity to accommodate a new NGCC facility without significant expansion. The review team further concludes that regardless of the interstate pipeline by which natural gas enters Michigan, the interstate and intrastate transmission pipeline infrastructures in Michigan are sufficiently complex that the required amount of gas could be delivered to the Fermi site. However modifications to the existing network (increasing flow capacity in certain segments, adding compressor stations) may nevertheless be required to ensure natural gas is provided to the Fermi site with sufficient flow and pressure to support the NGCC alternative.

Offsite land impacts for transmission lines would be minimal, since the NGCC plant is expected to connect to the ITC*Transmission* Milan Substation in existing transmission corridors owned by ITC*Transmission*. The review team expects that a gas-fired power plant at the Fermi site would require building the same transmission lines following the same route proposed for Fermi 3.

(a) However, Detroit Edison notes in its ER that natural gas power plants represent as much as 29 percent of the State’s generating capacity (Detroit Edison 2011a).

The transmission line impacts would be equivalent to those anticipated from the proposed Fermi 3 reactor.

Overall land use impacts from construction of a gas-fired power plant on the Fermi site would be SMALL; modifications to the existing pipeline infrastructure would also result in minor offsite land impacts; however, offsite land impacts would increase if expanded natural gas extraction activities were necessary to meet increased demand of the NGCC alternative.

Socioeconomics

Socioeconomic impacts are defined in terms of changes to the baseline demographic and economic characteristics and social conditions of a region, especially resulting from the creation of new jobs. Three types of job creation would result: (1) direct construction-related jobs, which are short term and less likely to have a long-term socioeconomic impact; (2) direct operation-related jobs in support of power plant operations and maintenance, which have the greater potential for permanent, long-term socioeconomic impacts; and (3) indirect jobs created by the economic stimulus of new workers and new jobs during the building and operation of the new plant. For the NGCC alternative, Detroit Edison estimates a peak employment construction workforce that would be less than the 2900 required for Fermi 3 and an operations workforce of 150. The review team finds both of these estimates to be reasonable and has used them to support its own analysis of socioeconomic impacts.

The review team expects the construction and operations workforces for an NGCC alternative at the Fermi site would be drawn from the same communities as those for the coal-fired alternative. The review team expects that the impacts on the local economy from construction and operation of an NGCC alternative would be less than the impacts for the proposed Fermi 3 reactor, because the NGCC alternative would require smaller construction and operations workforces and a shorter construction period, and have a much lower construction cost. Impacts on local tax bases, including property taxes, are expected to be SMALL and beneficial, except that the property tax impacts in Monroe County would be MODERATE and beneficial. Likewise, given the review team's assumptions regarding the distribution of construction and operations workers, the review team also expects the impacts on local infrastructure (e.g., housing, schools, and utilities) are likely to be SMALL and adverse for all areas in the 50-mi region.

Traffic

Traffic impacts associated with construction of the NGCC alternative would result from commuting construction and operating workforces and truck and rail deliveries of construction materials to the Fermi site. As noted above, the construction workforce for the NGCC alternative would be smaller than that projected for Fermi 3, and the construction period would be substantially shorter. Some major NGCC plant components, such as CTs and STGs, are likely to be delivered by rail via the existing onsite rail spur. Pipeline construction and modification of existing natural gas pipeline systems could also have a temporary impact on local traffic, especially if the new pipeline segment crosses existing road or rail infrastructure. The review team determined that in aggregate, all the traffic-related impacts for the NGCC alternative during construction would be SMALL and adverse. The operating workforce for the NGCC alternative, estimated by Detroit Edison to be approximately 150 full-time workers, would be substantially smaller than the workforce projected for Fermi 3 operation. Some equipment and material deliveries are expected to continue throughout operation, but traffic-related impacts from such deliveries would be negligible. The review team therefore concludes that the overall traffic-related impacts during operation would be SMALL and adverse.

Aesthetics

The aesthetics impact analysis focuses on the degree of contrast between the natural-gas-fired alternative and the surrounding landscape and the visibility of the natural-gas-fired plant. However, because there already is industrial activity on the site associated with operation of Fermi 2, the contrast between a natural-gas-fired power plant at the site and the rural surroundings is dramatically reduced.

The power block of the NGCC alternative (the turbine building) would have an appearance similar to the power block and containment building of the existing nuclear plant. Likewise, the NGCC NDCT, which is expected to be similar in appearance to that proposed for Fermi 3 cooling towers, would generate a condensate plume visible from great distances during certain meteorological conditions. The plume’s visual impact would be additive to a similar plume emanating from the existing NDCTs for Fermi 2.

The NGCC cooling towers would each have an exhaust stack (or might share a common stack) that would be higher and more prominent than the offgas stack for the proposed Fermi 3. Given their expected height, the exhaust gas stacks of the NGCC alternative would also likely require lighting to comply with Federal Aviation Administration (FAA) regulations. The transmission lines supporting the NGCC plant would be the same as those proposed for Fermi 3 and would, therefore, have identical aesthetic impacts. Because transmission lines run from the Fermi site to support Fermi 2, the impacts of the NGCC alternative’s transmission lines would be minimal.

In general, aesthetic changes would be limited to the immediate vicinity of the Fermi site and would likely be generally similar to impacts already occurring as well as similar to those expected from the proposed nuclear plant. Given the current industrial character of the Fermi site, aesthetic impacts of an NGCC alternative would be SMALL and adverse.

Environmental Justice

The review team expects the environmental justice impacts of construction and operation of a NGCC power plant at the Fermi site would be similar to, but smaller than, those resulting from the construction and operation of Fermi 3 (see Sections 4.5 and 5.5 of this EIS for a detailed discussion of these impacts) or the coal-fired alternative discussed in the previous section. These impacts are judged to be SMALL.

Historic and Cultural Resources

As is the case for the coal-fired alternative, impacts on historic and cultural resources would occur because of the presence of the NRHP-eligible Fermi 1 property onsite and if previously undisturbed areas of the site were disturbed during construction without having first been surveyed and any identified resources evaluated for NRHP eligibility. The review team concludes, therefore, that impacts on historic and cultural resources on the Fermi site would be MODERATE, as is the case for the coal-fired alternative. A ROW for the required new 10-mi pipeline segment has not been specified, so it is impossible to determine whether historic or cultural resources would be present along that path. The review team assumes that appropriate surveys would be completed prior to commencement of construction of a supporting natural gas pipeline segment. However, because of the adverse impacts on the NRHP-eligible Fermi 1 property, the review team concludes that impacts on cultural, historic, and archaeological resources from construction and operation of the NGCC alternative would be MODERATE, as is the case for the coal-fired alternative.

Summary of the Construction- and Operation-Related Impacts of a Natural Gas-Fired Generation Alternative

The construction and operation impacts of a natural gas-fired power generation alternative at the Fermi nuclear site are summarized in Table 9-4.

9.2.3 Other Alternatives

This section discusses other electricity-generating alternatives that have been considered by the review team for possible application as a baseload power alternative to Fermi 3. The review team's evaluation of the overall technical feasibility of such applications, as well as its conclusions about the overall environmental impacts, of each alternative are provided here. Detroit Edison has proposed a new nuclear reactor at the Fermi site for the generation of baseload electricity with a target of 1535 MW(e) net. Any feasible alternative to the proposed new reactor would also need to be capable of generating an equivalent amount of baseload power with reliability and capacity factors similar to those expected from a nuclear reactor. In performing its initial evaluation for the ER, Detroit Edison relied on the GEIS for license renewal (NRC 1996). The review team reviewed the information submitted by Detroit Edison; however,

Table 9-4. Summary of Environmental Impacts of a Natural Gas-Fired Power Generation Alternative

Impact Category	Impact	Comment
Air Quality	SMALL to MODERATE	SO_x, 128 tons/yr NO_x, 490 tons/yr CO, 1130 tons/yr Particulates, 249 tons/yr N_2O, 113 tons/yr VOC, 79 tons/yr CO_2, 4.15 million tons/yr (without CCS) The NGCC facility is a major source of NO_x, a precursor to photochemical smog; however, emission controls (water injection and selective catalytic reduction) are expected to reduce emissions to acceptable levels.
Waste Management	SMALL	Minimal construction- and operation-related wastes are projected.
Human Health	SMALL	NGCC is a source of NO_x, a precursor to photochemical smog. However, regulatory controls and oversight would reduce emissions to a level protective of human health.
Water Use and Quality	SMALL	Impacts would be smaller than the impacts for Fermi 3, due to reduced cooling demands.
Ecology	SMALL (aquatic) and SMALLL to MODERATE (terrestrial)	Potential MODERATE impacts limited to effects on eastern fox snake Impacts on terrestrial ecology and wetlands on the Fermi site would generally be similar to those from Fermi 3. Offsite parcels would be affected by construction of 10-mi natural gas pipeline. Impacts on terrestrial and aquatic ecology from operation of the cooling system would be minimal. Additional impacts would be associated with natural gas extractions if expansions of gas fields were determined to be necessary.

Table 9-4. (contd)

Impact Category	Impact	Comment
Noise	SMALL	Most noise-producing equipment is located inside the power block buildings. No outside fuel-handling activities will occur. Minor offsite noise source could be pipeline compressor stations.
Socioeconomics (economy and taxes)	SMALL to MODERATE (beneficial)	Increased economic activity from new jobs and spending in the region would stimulate economic growth and tax revenues. Local property tax base would benefit Monroe County during construction and operations, but at a lower level than the impacts characterized for Fermi 3 because of the lower property values associated with the NGCC alternative. All beneficial tax-related impacts elsewhere in the 50-mi region would also be less than for the Fermi 3 plant because of the smaller workforce needed to operate the NGCC alternative. This stimulus would be SMALL beneficial for all areas except for property tax impacts in Monroe County, which would be MODERATE beneficial.
Socioeconomics (all other categories)	SMALL (adverse)	Construction-related impacts would be limited and temporary. Construction workforce projected to be less than the 2500 required for the coal-fired alternative and the 2900 required for the Fermi 3 reactor. Operating workforce projected to be approximately 150, less than expected for the coal-fired alternative and substantially less for Fermi 3 operation. Construction workforce would be likely to originate primarily from the Detroit and Toledo MSAs.

Table 9-4. (contd)

Impact Category	Impact	Comment
Socioeconomics (all other categories) (contd)		Impacts on local communities with regard to housing and services would be expected to be short-term, SMALL, and adverse for construction and SMALL and adverse for operation. Construction-related traffic impacts will be temporary and less than those expected for Fermi 3 due to a smaller workforce and an expected shorter construction period; operation-related transportation impacts will be less due to a smaller workforce than for Fermi 3 and relatively few deliveries required to support operation. The plant and new transmission line would have aesthetic impacts comparable to those anticipated for Fermi 3. Overall increase in adverse impact on aesthetics is SMALL, because Fermi site is already industrialized.
Environmental Justice	SMALL	Impacts are expected to be similar to those evaluated for the nuclear alternative. No disproportionate adverse impacts were identified.
Historic and Cultural Resources	MODERATE	Construction activities would involve removal of some portions of NRHP-eligible Fermi 1 and would thus have a MODERATE impact on historic and cultural resources. Most of the facility and infrastructure would be built on previously disturbed ground onsite, but additional offsite areas that might be required to support a new natural gas pipeline might not have been surveyed for resources.

through an independent review, the review team has utilized information contained in the GEIS as well as more recently developed information on certain electricity-generating technologies and has determined that the other energy alternatives discussed here are not reasonable alternatives to a new nuclear unit for provision of reliable baseload power.

The review team has not assigned significance levels to the environmental impacts associated with the alternatives discussed in this section because, in general, the generation alternatives would have to be installed at a location other than the proposed site. Any attempt to assign significance levels would require speculation about the unknown site.

9.2.3.1 Oil-Fired Power Generation

In its *Annual Energy Outlook 2010*, EIA projects that electricity from oil-fired power plants will remain essentially unchanged through 2035, rising by only 0.4 percent (DOE/EIA 2010c). Oil-fired generation is more expensive than nuclear, natural-gas-fired, or coal-fired generation options. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive. The high cost of oil has resulted in a decline in its use for electricity generation. In Section 8.3.11 of the GEIS for license renewal, the staff estimated that construction of a 1000-MW(e) oil-fired plant would require about 120 ac of land and further concluded than an oil-fired power plant would have environmental impacts that would be similar to those of a comparably sized coal-fired plant (NRC 1996).

For the preceding economic and environmental reasons, the staff concludes that an oil-fired power plant at or in the vicinity of the Fermi site would not be a reasonable alternative to construction of a 1535-MW(e) nuclear power generation facility that would be operated as a baseload plant.

9.2.3.2 Wind Power

All renewable energy accounted for 7.3 quadrillion Btu, approximately 7 percent of the 99.3 quadrillion Btu of energy consumed, in the United States in 2008. Wind accounted for 0.49 quadrillion Btu, approximately 7 percent of the total contribution of all renewable energy sources. The American Wind Energy Association (AWEA) reported that a total of 25,369 MW of wind energy capacity had been installed in the United States by the end of 2008, with 8545 MW installed just in 2008 (AWEA 2009). Texas is by far the leader in installed capacity with 2671.3 MW, followed by Iowa (1599.8 MW), Minnesota (455.65 MW), Kansas (450.3 MW), and New York (407 MW). At the end of 2008, Michigan had three operating wind farms with a collective wind energy generating capacity of 129.6 MW (AWEA 2009). AWEA also reported that in 2008, four manufacturing facilities for various wind turbine components were established in Michigan. EIA reports that the net summer capacity for wind-generated electricity in Michigan in 2008 was 124 MW and that the total amount of electricity generated by wind in 2008 was 117,000 MWh, approximately 3.1 percent of the 3,800,000 MWh of power generated from all renewables in Michigan in 2008 (DOE/EIA 2009a). Comparing the installed capacity to the amount of electricity generated yields a capacity factor of about 11 percent for the wind turbines.

At the current state of wind energy technology development, wind resources of Category 3 or better[(a)] are required to produce utility-scale amounts of electricity. Maps of wind resources produced by the DOE Office of Energy Efficiency and Renewable Energy (EERE) and its National Renewable Energy Laboratory (NREL) (DOE/EERE 2010) indicated that a large geographic area of the State along the western shore of Lake Erie, in Huron, Tuscola, and Sanilac Counties, known as the "Thumb," possesses wind resources of sufficient value to

(a) By industry convention, wind resource values are categorized on the basis of the power density and speed of the prevailing wind at an elevation of 50 meters, from Category 1 with wind power densities of 200 to 300 W/m^2 (typically existing with constant wind speeds between 12.5 and 14.3 mph) through Category 7 with power densities of 800 to 1800 W/m^2 (wind speeds of 19.7 to 24.8 mph). Category 3 wind has a power density of 300 to 400 W/m^2 with wind speeds of 15.7 to 16.8 mph.

support utility-scale wind generation. Similarly valued wind resource areas also exist in the western part of the State along the eastern shoreline of Lake Michigan; however, only the Thumb is within the Detroit Edison service area.

Detroit Edison undertook a study to identify wind resources of sufficient strength and accessibility within its service area with which it could expand its energy generation portfolio and comply with the then-proposed Michigan Renewal Portfolio Standard (RPS) (Detroit Edison 2009a). Comparing existing wind energy maps with exclusionary factors that could preempt wind farm development, Detroit Edison determined that 500 MW of wind energy potential could be realized and economically delivered to its major load centers over the existing transmission network, but a theoretical maximum development capacity of 2800 MW could be realized with appropriate upgrades and expansions to the transmission network. As discussed below, a 2009 collaborative study by ITC*Transmission* and Wolverine Power Supply Cooperative confirmed the inadequacy of the existing 120-kV transmission system in the Thumb and estimated the costs of various options for the major upgrades to transmission system capacity that would be required to effectively exploit wind resources in the Thumb (ITC and WPSCI 2009). Detroit Edison further anticipates a 30 percent capacity factor and 95 percent turbine availability factor, suggesting reasonably attainable estimates for maximum and minimum power outputs of 7000 GWh and 1300 GWh. (For comparison, the proposed 1535-MW(e) Fermi 3 reactor, operating at an expected capacity factor of 92 percent, would be expected to produce 12,400 GWh of baseload electricity each year.)

The MPSC Wind Energy Resource Zone Board undertook its own independent assessment of wind resources within the Thumb and concluded in its final report that potential generating capacity for land-based wind farms in the Thumb was between 2367 MW and 4236 MW (depending on how exclusionary siting criteria were applied) and that maximum buildout would result in potential annual electricity production of 12,000 GWh (Michigan Wind Energy Resource Zone Board 2009). In response to a legislative directive in Michigan's Clean, Renewable and Efficient Energy Act (295 MCL 1-6) and MPSC Order U-15899,[a] ITC Holdings Corporation's subsidiary, ITC*Transmission*, and Wolverine Power Supply Cooperative, Inc. (WPSCI) completed a joint transmission planning study for the Thumb, concluding that the two existing relatively low-capacity 120-kV transmission lines in the Thumb were inadequate to deliver wind-generated electricity to the grid for delivery to other portions of the Michigan's lower peninsula (ITC and WPSCI 2009). On August 19, 2010, the Midwest Independent System Operator (MISO) approved a proposal by ITC*Transmission* to expand the transmission infrastructure in the Thumb by construction of approximately 140 mi of double-circuit 345-kV transmission lines and three new 345-kV substations, forming a loop through the Thumb region (ITC Holdings 2010). Under the provisions of the Clean, Renewable and Energy Efficiency Act,

(a) All documents filed with the MPSC relating to Order U-15899 are available through the MPSC Electronic Docket Web site at http://efile.mpsc.state.mi.us/efile/viewcase.php?casenum=15899&submit.x=21&submit.y=13.

ITC*Transmission* was authorized to apply to MPSC for expedited siting approval of the project (which must be accomplished within 6 months of the application date). On August 30, 2010, ITC submitted its application to MPSC for an expedited siting certificate (see MPSC case U-16200).[(a)] The Commission granted the certificate on February 25, 2011.[(b)] ITC has targeted completion of the upgrade project by 2015 but has published no firm schedules.

The Wind Energy Resource Zone Board's estimate of 12,000 GWh, together with the announced and MISO-approved plans of ITC*Transmission* to upgrade the transmission infrastructure in the Thumb and the MPSC's Expedited Siting Certificate for that upgrade, promise improved efficiency of power distribution throughout the ITC*Transmission* grid in the lower peninsula and improved viability of wind energy in the Thumb. However, the Bureau of Energy Systems of the Michigan Department of Energy, Labor and Economic Growth (MDELEG) has reported that, as of the close of 2009, only two wind farms were operative in the Thumb, with a capacity of 122 MW of wind-generated electricity (MDELEG 2010).

The lack of a firm schedule for transmission infrastructure enhancements in the Thumb, the limited generating potential in the Thumb projected by MDELEG, the uncertainty about the extent to which that potential would ultimately be realized by yet-to-be-built wind farms, the anticipated relatively low capacity factors for the turbines of those future wind farms, and the substantial land requirements for utility-scale wind farms all contribute to a conclusion by the review team that wind farms in the Thumb area would not be a feasible discrete alternative to the Fermi 3 reactor.

Wind energy technology can also be deployed in offshore locations. Land-based wind turbines have individual capacities as high as 3 MW, with the 1.67-MW turbine being the most popular size installed in 2008 (offshore wind turbines have capacities as high as 5 MW).[(c)] The capacity factors of wind farms primarily depend on the constancy of the wind resource, and although offshore wind farms can have relatively high capacity factors due to high-quality winds throughout much of the day (resulting primarily from differential heating of land and water areas), land-based wind farms have capacity factors less than 40 percent, with 30 percent typically used for planning purposes.

The Great Lakes Wind Council (GLWC), an advisory body within the then-Michigan Department of Energy, Labor and Economic Growth, was charged with providing recommendations to State

(a) All documents related to Case U-16200 can be accessed electronically at http://efile.mpsc.state.mi.us/efile/viewcase.php?casenum=16200.
(b) Three parties filed motions for stay of the Commission's February 25 Order. All three motions were denied by the Commission's Order of April 12, 2011.
(c) To date, the great majority of offshore turbine installations have occurred on the shallow continental shelves of Europe and the United States; however, it is feasible that turbines designed for offshore locations could also be installed off the shores of the Great Lakes, although current foundation technology would limit the depth of the water that could be tolerated at offshore locations.

policymakers with respect to wind energy development in Michigan. The GLWC's October 2010 report identified prime offshore locations for wind farms (Wind Resource Areas, WRAs) and provided recommendations on model legislation that would authorize implementing regulations for an offshore wind energy program in Michigan (GLWC 2010). Five WRAs were identified in the Great Lakes bordering Michigan, two of which are adjacent to the Detroit Edison service area: Central Lake Huron, out from Saginaw Bay, and southern Lake Huron, near Sanilac County. All WRAs are in waters with depths of 148 ft or less. To support mapping of the WRAs, the GLWC established 22 evaluation criteria, including sensitive or important biological habitats, commercial fishing areas, scenic vistas, military operations, national park lakeshores, State bottomland preserves, shoreline parks and wilderness, shipping lanes, underwater archaeological sites, harbors and marinas, and underwater power cables. Appropriate buffer zones were then established for each criterion.

The GLWC's recommendations for supporting legislation were submitted to the State legislature in March 2010. As of April 2012, no legislation had been proposed.[a]

Despite the relatively high availability factors for wind turbines, there are shortcomings to the use of wind energy as an alternative to Fermi 3; these include the following: capacity factors are much lower than desirable for baseload power; many hundreds of turbines would be required to provide equivalent amounts of power; wind farms would occupy very large areas to avoid inter-turbine interferences to wind flow through the wind farm[b]; and there is often poor time-of-day correlation between the periods when meteorological conditions produce high-value winds and periods of peak loads.[c]

One way to better ensure that maximum power production coincides with peaks in demand is to couple conventional wind technology with energy storage technologies. Pumped storage and compressed air energy storage (CAES) are two energy storage technologies that have been independently developed and that could be paired with wind energy to improve the availability and dispatchability of wind energy. Detroit Edison is co-owner (with Consumers Energy) of the Ludington Hydroelectric plant, the largest pumped storage facility in the State. During off-peak

(a) However, on March 30, 2012, representatives of various Federal agencies entered into a Memorandum of Understanding (MOU) with governors and heads of relevant agencies from the States of Illinois, Michigan, Minnesota, and New York and the Commonwealth of Pennsylvania, the main purpose of which is facilitation of offshore wind development in the Great Lakes. The MOU is designed to enhance collaboration between Federal and State authorities to speed review of offshore wind projects. The MOU can be accessed through the DOE Web site http://energy.gov/articles/obama-administration-and-great-lakes-states-announce-agreement-spur-development-offshore.

(b) However, the permanent components of wind farms, the individual turbines, electrical substations, and maintenance/control/storage buildings, occupy roughly five percent of the area of a typical wind farm, with the remaining land areas available for most other nonintrusive land uses once construction is completed.

(c) In a typical diurnal cycle, strong winds are generally not available during hot summer afternoons when peaks in power demand occur to support air conditioning loads.

periods, Ludington uses grid power to pump Lake Michigan water through six reversible turbines to a 27-billion-gal, 842-ac reservoir located on a bluff over 350 ft above the plant. Water is released during peak demand through the six turbines for a maximum capacity of 1,870 MW at a generation efficiency of more than 70 percent (Bernier 2010). However, because the Ludington facility is already part of Detroit Edison's generating portfolio and routinely provides power to Detroit Edison and Consumers Energy customers, it cannot be claimed as an alternative to Fermi 3.[(a)]

EIA reports that the Ludington pumped storage facility had an effective capacity of 1872 MW in 2009 and was responsible for 100 percent of the state's electricity from pumped storage (DOE/EIA 2011d). Section 9.2.3.4 provides additional details on hydroelectric facilities in Michigan and the potential for further development. As discussed in that section, there is limited potential for expansion of hydroelectric power, and EIA isn't projecting any growth in this energy alternative. The review team concludes that pumped storage is not likely to be available as an energy storage mechanism to couple with wind energy.

A CAES plant uses motor-driven air compressors powered by low-cost off-peak electricity to compress air, storing it in a suitable underground repository such as a salt cavern or a porous rock formation. When coupled with wind, power from the wind turbines at off-peak times would be used to drive the compressors. During high-electricity-demand periods, the potential energy contained in the compressed air is recovered by using it to support operation of a combustion turbine or using it directly to generate electricity. Experience with utility-scale CAES is limited. Only two large-scale CAES plants are currently in operation; a 290-MW facility near Bremen, Germany, and a 110-MW plant in McIntosh, Alabama, which has been operating since 1991. Both facilities use salt caverns for storage (Succar and Williams 2008), and both use the compressed air to enhance the performance of modified combustion turbines in combined cycle configurations. A number of CAES facilities have been proposed, including the Iowa Stored Energy Park near Des Moines, Iowa, a 268-MW plant that would operate in conjunction with a wind farm. The facility would use a porous rock storage reservoir for the compressed air it produces (Succar and Williams 2008). However, this project has been terminated (ISEPA 2011). Other pilot, demonstration, prototype, and research projects involving CAES have been announced, including projects in California, New York, and Texas.

At its current state of technological advancement and limited real-world experiences, CAES has been proven capable of producing fully dispatchable electricity in the range of hundreds of

(a) Consumers Energy and Detroit Edison recently announced plans for an $800 million maintenance and upgrade project for the Ludington facility that will replace existing turbines, increasing capacity to 2,172 MW. The project is expected to be completed by 2019. Consumers also announced plans for a land-based 56-turbine Lake Winds Energy Park to be located near the Ludington facility; however, necessary permits for the wind farm have not yet been secured from Mason County. For more details, see: http://www.mlive.com/business/west-michigan/index.ssf/2011/02/ludington_pumped_storage_plant.html.

megawatts consistently over tens of hours, but long-term reliability and costs are as yet undetermined. Higher levels of power generation are technically feasible with CAES but have not yet been proven. Further, the overall technical and economic feasibility of CAES is highly dependent on the existence of conveniently located appropriate geologic formations in which to store the compressed air. The review team is not aware of any evaluations of Michigan geology in areas of highest wind value for that purpose. Although CAES can enhance the value of wind as a source of baseload power, the review team concludes that the use of CAES in combination with wind turbines to reliably generate 1535 MW(e) net at an effective capacity factor of 92 percent in the Detroit Edison service territory is technically unproven at this time.

For the preceding reasons, the review team concludes that wind power is not capable of supplying baseload capacity of 1535 MW(e) net and is therefore not a reasonable alternative to the proposed project.

9.2.3.3 Solar Power

Solar technologies use the sun's energy to produce electricity. Solar power technologies include photovoltaic (PV) and concentrated solar power (CSP). In PV systems, sunlight incident on special photovoltaic materials results in the direct production of direct current (DC) electricity. Two types of CSP technology that have enjoyed the greatest technological development are the parabolic trough and the power tower. Both involve using the sun's energy to produce steam to power a conventional Rankine cycle STG. The Solar Energy Generating System (SEGS), a collection of nine parabolic trough plants in three locations in the Mojave Desert in California with a combined nameplate capacity of 310 MW, represents the earliest utility-scale solar plants in the United States (The Energy Library 2009). However, in recent years, many utility-scale CSP plants have been proposed, primarily for the desert southwest areas of southern California.[a] Typical solar-to-electric power plants require 5 to 10 ac for every megawatt of generating capacity (TSECO 2008). Thus, approximately 8000 to 16,000 ac would be needed for a hypothetical 1600-MW(e) solar power plant. To increase their value as baseload power sources, CSP facilities can also be equipped with thermal storage that allows production of electricity during periods when the sun is not shining. However, the addition of thermal storage capabilities dramatically increases the required size of the solar field.

All renewable energy accounted for 7.3 quadrillion Btu, approximately 7 percent of the 99.3 quadrillion Btu of energy consumed in the United States in 2008. Solar accounted for 1 percent of that total (0.0703 quadrillion Btu). Currently, the Fermi site receives approximately 4.0 kWh of solar insolation per square meter per day (kWh/m^2/day) for fixed-plate solar collectors oriented at an angle equal to the installation's latitude (NREL 2008). This is a

(a) Additional information regarding utility-scale CSP plants proposed for the desert regions of southern California can be obtained from the California Energy Commission Web site at http://www.energy.ca.gov/siting/solar/.

relatively modest value for a solar resource. Although adequate to support off-grid applications or even distributed energy systems, Michigan's solar resource would be insufficient for cost-effective generation of baseload power using PV technologies, given the current state of PV technology development and operational conversion efficiencies averaging 25 percent (although that is expected to improve with the development of inexpensive, more efficient photocells). EIA reports that in 2008 no electricity was generated in Michigan by the electric power industry using solar PV technology (DOE/EIA 2009b). As noted above, significant land areas would be required for a utility-scale PV power plant while virtually preempting all other uses for that land. In the GEIS, the NRC staff noted that, by its nature, PV solar power is intermittent (i.e., it does not work at night and cannot serve baseload when the sun is not shining), and the efficiency of collectors varies greatly with weather conditions. The PV alternative would require energy storage or backup power supply to provide electric power at night. Although development of battery storage options is ongoing, none is currently available that would provide baseload amounts of power. Given the challenges and requirements in meeting baseload requirements, the review team believes that because of its intrinsic limitation, PV solar power is not qualified as a reasonable alternative to Fermi 3.

Where PV technology captures the light energy of the sun and converts it directly to electricity, CSP typically transfers the sun's heat energy to a heat transfer fluid, subsequently using that heat to produce steam to power a conventional STG. Because CSP technology is based on heat capture and transfer, it has the intrinsic potential to store some of the captured heat in such materials as molten salt for delayed production of electricity. Thus it has the potential to overcome some of PV's inherent intermittency and is better suited to meeting the demands of baseload power. However, to do so without sacrificing nameplate capacity requires a CSP with thermal storage to have a substantially greater solar field area to allow the heat captured in that additional field area to be stored in the salt rather than used immediately to produce electricity. To improve power availability, CSP facilities often employ small-scale boilers or heaters burning conventional fossil fuels to maintain the sensible heat in the heat transfer fluid system, thus overcoming thermal inertia and allowing the CSP facility to begin producing power at or near its nameplate rating earlier in the day. CSP also relies on direct normal radiation from the sun and is therefore generally more immune to reduced capacity as a result of cloud cover than is PV technology, with capacity factors slightly greater than PV. However, because it is a thermoelectric technology, CSP requires a cooling system similar in function to those used at nuclear or fossil fuel power plants. At its current state of technology development, CSP requires approximately 5 ac of land for every megawatt of power produced. If wet closed loop cooling is used to cool the steam cycle, an amount of water equal to or greater than the amount now projected for the Fermi 3 reactor (as much as 15 ac-ft/yr/MW, or approximately 4.89 million gal/yr/MW) would also be required. The relatively modest value of solar resources within the Detroit Edison service area, the exceptionally large land area required for utility-scale power, power intermittency, and expected capacity factors all contribute to the review team's conclusion that solar power technologies do not present a reasonable alternative to the proposed nuclear reactor.

9.2.3.4 Hydropower

Three technology variants of hydroelectric power exist in Michigan: dam-and-release, run-of-the-river, and pumped storage. Dam-and-release facilities affect large amounts of land behind the dam to create man-made reservoirs but can provide substantial amounts of power at capacity factors greater than 90 percent. Power-generating capacities of run-of-the-river dams fluctuate with the flow of water in the river, and the operation of such dams is typically constrained so as not to create undue stress on the aquatic ecosystems present. Pumped storage facilities pump water from surface water features such as lakes or rivers to higher elevations during off-peak load periods, in order to release the water during peak load periods through turbines to generate electricity.

The latest and only comprehensive statewide study of hydropower resources in Michigan, published in 1998 by the DOE Idaho National Engineering and Environmental Laboratory (now Idaho National Laboratory) (INEEL 1998), indicated that there was an estimated 613 MW of developable hydroelectric resources in Michigan at the time of the study. The INEEL study identified 86 sites on 11 major river basins: 11 with dams producing power, 53 with dams (for flood control) that were not producing power, and 22 undeveloped sites with favorable characteristics. The INEEL study determined that 64 percent of the undeveloped hydropower resources were in the St. Mary's River Basin, but that all potential sites had relatively low Project Environmental Suitability Factors, a dimensionless value calculated by a model developed for the study, which took into account the various environmental impacts that could result from development of each identified site for hydropower production. A map of hydroelectric dams in Michigan published by the Michigan Department of Natural Resources (MDNR) shows a number of hydroelectric dams within the Detroit Edison service area, but many of them have since been retired (MDNR 2003).

All three hydropower technologies are technically possible for development in Michigan; however, river characteristics, topography, and existing land uses favor run-of-the-river hydropower facilities. As stated in Section 8.3.4 of the GEIS for license renewal (NRC 1996), the percentage of U.S. generating capacity supplied by hydropower is expected to decline, because dam-and-release hydroelectric facilities have become difficult to site as a result of public concerns about flooding, destruction of natural habitat, and alteration of natural river courses. In the GEIS, the staff estimated that land requirements for dam-and-release hydroelectric power are approximately 1 million ac per 1000 MW(e) (NRC 1996). Similar land requirements can be anticipated for pumped storage facilities of equivalent capacities. Although run-of-the-river hydroelectric facilities avoid concerns for excessive land use and widespread habitat alteration, their productivity is directly affected by a number of factors; seasonal low-flow conditions and sustenance requirements of the rivers' aquatic ecosystems can lead to temporary or extended interruptions in power production.

The resulting low annualized capacity factors suggest marginal suitability of these technologies as discrete baseload power sources. EIA's reference case in its *Annual Energy Outlook 2010* projects that U.S. electricity production from hydropower plants will remain essentially stable through the year 2035 (DOE/EIA 2010c). EIA reports that in 2008, conventional hydroelectric power in Michigan had a collective net summer capacity of 249 MW and generated 1,280,978 MWh of power, approximately 34 percent of power from all renewables in Michigan in 2008 (DOE/EIA 2009a).

Existing conventional dam-and-release and run-of-the-river hydroelectric facilities in Michigan have limited capacities compared to the Ludington Pumped Storage facility discussed above, and many in the Detroit Edison service territory have been retired. Few if any new hydroelectric facilities are expected to be built, and even with repowering of existing facilities to improve efficiency and performance, hydroelectric resources in Michigan are not sufficient to serve as a replacement for Fermi 3.

Because of the relatively low amount of undeveloped hydropower resources in Michigan, the large land use and related environmental and ecological resource impacts associated with siting hydroelectric facilities large enough to produce 1535 MW(e), and the absence of announced plans for construction of new large pumped storage or dam-and-release facilities that could match Fermi 3's expected production, the review team concludes that hydropower is not a feasible alternative to the proposed Fermi 3 reactor.

9.2.3.5 Geothermal Energy

As with most renewable energy sources, value, accessibility, and availability within a geographic area determine the feasibility of geothermal energy for baseload power generation. Two geothermal energy generation technologies have been developed: "hydrothermal technology" and "hot dry rock" (HDR) technology. Hydrothermal technology involves extracting heat from hot, pressurized groundwater located in readily accessible formations relatively close to the surface. Either the heated water is pumped to the surface, where the sharp reduction in pressure allows it to flash into steam that is directed to an STG, or a heat transfer fluid is pumped into the formation in a closed loop system, where it is heated by the groundwater before being returned to the surface and its latent heat used to produce steam. The water must be at least 302°F for such systems to run efficiently. HDR, also known as engineered geothermal systems (EGS), extracts heat from dry, hot formations, first by fracturing those formations and then by circulating water through those fractures and extracting heat.

A comprehensive study by the Massachusetts Institute of Technology (MIT) concluded that geothermal energy has an average capacity factor of 90 percent and a relatively small environmental footprint (MIT 2006). Geothermal resources can be used for baseload power generation where sufficient geothermal resources are available, but the MIT study concluded that a $300- to $400-million investment over 15 years would be needed to make early-generation EGS power plant installations competitive in the evolving U.S. electricity supply markets (MIT 2006). However, geothermal technology is not widely used as baseload power generation because of the limited geographical availability of the resource and immature status of the technology (NRC 1996). Geothermal plants are most likely to be sited in the western continental United States, Alaska, and Hawaii, where hydrothermal reservoirs are prevalent (DOE 2010). No geothermal energy generation currently occurs in Michigan (DOE/EIA 2009b). A map of geothermal resources in Michigan developed by the DOE shows geothermal resources exist at nominal depths of 3.7 mi and at temperatures between 212 and 302°F, marginally adequate for efficient production of baseload amounts of power. HDR geothermal resources do not exist in Michigan. Given the low quality of geothermal resources and the current stage of geothermal technology development, the review team has concluded that extant geothermal resources in Michigan cannot support utility-scale electricity generation and would therefore be an infeasible alternative to the proposed Fermi 3 reactor.

9.2.3.6 Wood Waste

In the GEIS, the staff determined that a wood-burning facility could provide baseload power and operate with an average annual capacity factor of about 70 to 80 percent and with 20 to 25 percent thermal efficiency (NRC 1996). The fuels required are variable and site-specific. Wood-to-energy technologies include direct combustion in boilers and combustion of fuels derived through gasification and pyrolysis of cellulosic materials. A significant impediment to the use of wood waste to generate electricity is the high cost of fuel delivery and high construction cost per megawatt of generating capacity. The fuel delivery impediment is being addressed by technologies that convert wood residue into high-density pellets. The larger wood-waste power plants are only 40 to 50 MW(e) in size. Estimates in the GEIS suggest that the overall level of construction impacts per megawatt of installed capacity would be approximately the same as that for a coal-fired plant, although facilities using wood waste for fuel would be built at smaller scales (NRC 1996). Similar to coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment (plants have been constructed that simultaneously burn coal and pelletized wood wastes in the same boiler). The greatest commercial success for wood-to-energy plants has been in distributed energy production geographically close to the wood residue sources. In 2008, net generation from renewable energy technologies (excluding large hydroelectric) increased 19.9 percent, following a 9.0 percent increase in 2007. In 2008, for the first time, wind surpassed biomass (including wood) in representing the largest share of renewable generation. Wood and wood-derived fuels represented 0.9 percent of net renewable generation, accounting for 37 million MWh, down 4.4 percent from 2007 (DOE/EIA 2010d).

A study completed in 2006 by the Michigan Biomass Energy Program (Michigan Department of Labor and Economic Growth 2006) concluded that Michigan has ample wood residue resources to support wood-to-energy facilities, but determined that the most significant wood resources are located in the northern portions of the State, far removed from the Detroit Edison load centers. As of 2006, there were six combustion-based wood-to-energy utilities operating in Michigan with a combined capacity of 173 MW. Of the six wood-to-energy utilities located in the Lower Peninsula, only the Genesee Power Station in Flint, Michigan, with a rated capacity of 39.5 MW, is located close to major Detroit Edison load centers. EIA reported that in 2008, the net summer capacity for wood and wood-derived power plants in Michigan was 231 MW, accounting for the generation of 1,682,504 MWh of power, approximately 44 percent of the 3,793,896 MWh of power from all renewable sources in Michigan in 2008 (DOE/EIA 2009a).

Because of uncertainties associated with obtaining sufficient wood and wood waste to fuel a baseload power plant, the location of the majority of high-value wood resources in the State (relative to Detroit Edison's major load centers of Detroit and Ann Arbor), the typical capacities of wood-to-electricity facilities, and the ecological impacts of large-scale timber cutting (e.g., soil erosion and loss of wildlife habitat), the review team determined that wood waste would not be a reasonable alternative to the proposed Fermi 3 reactor.

9.2.3.7 Municipal Solid Waste

In 2008, municipal solid waste (MSW) generation in the United States totaled 249.6 million tons. Of that amount, 31.6 million tons (12.7 percent) was combusted for energy recovery. The percentage of solid wastes burned for energy recovery has remained generally constant since 1990 (EPA 2009b). MSW combustors incinerate the waste and use the resulting heat to produce steam, hot water, or electricity. The combustion process reduces the volume of waste and subsequently the need for new solid waste landfills. MSW combustors use three basic types of technologies: mass burn, modular, and refuse-derived fuel (RDF). Approximately one-fifth of the facilities burning MSW burn RDF (EPA 2008b). Mass burning technologies are most commonly used in the United States. This group of technologies processes raw MSW "as is," with little or no sizing, shredding, or separation before combustion. In the GEIS for license renewal, the staff determined that the initial capital cost for municipal solid-waste plants is greater than that for comparable steam-turbine technology at wood-waste facilities because of the need for specialized waste-separation and -handling equipment for MSW (NRC 1996).

EPA estimates that, on average, air impacts from MSW-fired power plants are 3685 lb/MWh of CO_2, 1.2 lb/MWh of SO_2, and 6.7 lb/MWh of NO_x.[(a)] However, depending on the composition of the municipal waste stream, air emissions can vary greatly (EPA 2010c). MSW combustors generate an ash residue that is buried in landfills. Similar to coal combustion, both bottom ash

(a) Assumes 0.535 MWh/ton of MSW feed combusted, based on EPA emission factors contained in *Compilation of Air Pollutant Emission Factors* (AP-42) (EPA 1998).

and fly ash are formed. Pollution control equipment similar to that used in coal-fired boilers (fabric filters and/or scrubbers) is used to capture fly ash from the boiler exhaust gases, but with unsorted MSW fuel, the ash produced may exhibit hazardous characteristics and require special treatment and handling (EPA 2010c).

Estimates in the GEIS suggest that the overall level of impact from construction of a waste-fired plant would be approximately the same as that for a coal-fired power plant. In addition, waste-fired plants have the same or greater operational impacts as coal-fired technologies (including impacts on the aquatic environment, air, and waste disposal).

The decision to burn MSW to generate energy is usually driven by the need for an alternative to landfills rather than by energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term as energy prices increase (and especially since landfills of sufficient size and maturity can be sources of easily recoverable methane fuel); however, it is possible that MSW combustion facilities may become attractive again.

Regulatory structures that once supported MSW incineration no longer exist. For example, the Tax Reform Act of 1986 made capital-intensive projects such as MSW combustion facilities more expensive relative to less-capital-intensive waste disposal alternatives such as landfills. Also, the 1994 Supreme Court decision *C&A Carbone, Inc. v. Town of Clarkstown, New York* struck down local flow-control ordinances that required waste to be delivered to specific MSW combustion facilities rather than to landfills that may have had lower fees. In addition, environmental regulations have increased the capital cost necessary to construct and maintain MSW combustion facilities.

Currently, approximately 86 waste-to-energy (WTE) plants operate in 24 States, processing 97,000 tons of MSW per day. Latest estimates are that 26 million tons of trash was processed in 2008 by WTE facilities. With a reliable supply of waste fuel, WTE plants have an aggregate capacity of 2572 MW and can operate at capacity factors greater than 90 percent (ERC 2010). Three MSW plants are operational in Michigan: the 68-MW Greater Detroit Resource Recovery Facility in Detroit, Michigan; the 3.7-MW Jackson County Resource Recovery Facility in Jackson, Michigan; and the 18-MW Kent County Waste-to-Energy Facility in Grand Rapids, Michigan (ERC 2010).

Given the level of WTE facility penetration into the commercial electric utility market, the small average installed size of MSW plants, and the unfavorable regulatory environment, the review team does not consider MSW combustion to be a feasible alternative to the proposed Fermi 3 reactor.

9.2.3.8 Other Biomass-Derived Fuels

In addition to wood and MSW fuel, several other biomass-derived fuels are available for fueling electric generators, including burning crops, converting crops to a liquid fuel such as ethanol, and gasifying crops (including wood waste). The NRC staff determined that none of these technologies have progressed to the point of being competitive on a large scale or of being reliable enough to replace a large baseload generating plant (NRC 1996). In 2008, 353 facilities were operational nationwide that burned wood and wood-derived fuels for electricity production, representing a collective nameplate capacity of 7730 MW, while 1412 facilities burned other biomass energy sources (MSW, landfill gas, sludge waste, agricultural byproducts, other biomass solids, other biomass liquids, and other biomass gases [including digester gases, methane, and other biomass gases]) for electricity production with a collective nameplate capacity of 4854 MW, an average of 3.4 MW per facility (DOE/EIA 2010e). Co-firing with coal is the most economic option for the near future to introduce new biomass power generation (presuming the infrastructure necessary to deliver biomass fuel sources to coal-fired facilities already exists). These projects require small capital investments per unit of power generation capacity. Co-firing systems can produce from 3 to 20 percent of their heat from combustion of biomass, with biomass representing from 3 to 15 MW of the facility's nameplate capacity (DOE/EERE 2004).

The review team concludes that given the relatively small capacity of biomass generation facilities and the lack of a well-developed biomass infrastructure, biomass-derived fuels (besides wood, wood-derived fuels, and MSW discussed separately above) do not offer a reasonable alternative to the proposed Fermi 3 reactor.

9.2.3.9 Fuel Cells

Fuel cells oxidize fuels without combustion and its environmental side effects. Power is produced electrochemically by passing a hydrogen-rich gas over an anode and air (or oxygen) over a cathode and separating the two by an electrolyte. The only byproducts (depending on fuel characteristics) are heat, water, and CO_2. Hydrogen can be produced from a variety of hydrocarbon resources by subjecting them to steam under pressure. Steam reforming of natural gas is the most likely source of hydrogen for fuel cells. However, steam reforming of CH_4 results in the formation of significant quantities of CO_2; the amount of CO_2 produced from steam reforming of pipeline specification natural gas would be 2.51 times the amount of hydrogen produced (NYSERDA 2010).

At the present time, fuel cells are not economically or technologically competitive with other alternatives for electricity generation. EIA projects that electricity from a 10-MW central station fuel cell power plant whose construction was begun in 2009 and that is scheduled to come on-line in 2012 will have an total overnight cost (in 2008 dollars) of $5478/kWh, compared to $3820/kWh for new nuclear, $1749/kWh for geothermal, $1966/kWh for wind (onshore),

$5132/kWh for solar thermal, and $6171/kWh for solar photovoltaic (DOE/EIA 2010a). While it may be possible to use a distributed array of fuel cells to provide an alternative to the proposed Fermi 3 reactor, it would be extremely costly to do so and would require many units and wholesale modifications to the existing transmission system. Accordingly, the review team does not consider fuel cells to be a feasible alternative to the proposed Fermi 3 reactor.

9.2.4 Combination of Alternatives

The coal-fired power plant alternative and the natural gas-fired power plant alternative discussed above are the only alternatives that individually could be reasonably expected to produce the amount of baseload power represented by the proposed Fermi 3 reactor. As discussed in Section 9.2.3, other alternatives individually would not be a reasonable alternative to the Fermi 3 plant. Nevertheless, it is conceivable that a combination of alternatives might be both technically feasible and environmentally preferable to the proposed action. There are many possible combinations of alternatives. As part of the license renewal process and pursuant to 10 CFR Part 54, NRC has already determined that comprehensive consideration of all possible combinations would be too unwieldy, given the purposes of the alternative analysis. However, the analysis of combinations of alternatives should be sufficiently complete to aid the Commission in its analysis of alternative sources of energy pursuant to NEPA. Examining every possible combination of energy alternatives in an EIS would also be counter to the CEQ's direction that an EIS be analytically (rather than encyclopedically) concise and no longer than absolutely necessary to comply with NEPA and CEQ's regulations (40 CFR 1502.2(a)(b)).

As a basis for developing the combination alternative, the review team considered the availability and technical feasibility of all alternatives evaluated in previous sections. Of the renewable technologies considered, facilities utilizing wood-derived fuel would have the greatest potential to provide a baseload replacement power source to Fermi 3. However, the locations of the highest valued wood residues are far removed from the major load centers served by Detroit Edison. Transportation costs associated with delivering wood residues to generating facilities closer to those load centers would be significant. Likewise, the existing transmission system in the areas of highest value wood resources would make long-distance transfer of power from wood-burning facilities operating close to those high-value resources to Detroit Edison load centers inefficient and costly. In addition, the EIA is not projecting any growth in electricity production from wood waste in Michigan through 2035 (DOE/EIA 2009b). Thus, the review team did not include the power generation from wood in the combination alternative.

Of the remaining renewable energy alternatives, wind would have the highest power generation capacity, but because of its intermittent nature, it would have to be coupled with an energy storage technology or quick-response natural-gas-fired plants to be a viable baseload generation alternative. The highest value wind resources in Michigan are in the Thumb and offshore of Lake Michigan. Although the Thumb is within the Detroit Edison service area, the transmission infrastructure in that area is operated at only 120 kV, and substantial costs and inefficiencies would be associated with upgrading that system and linking it to major Detroit Edison load centers. While there is currently considerable enthusiasm within the Great Lakes States to develop offshore wind power, that initiative is in its infancy and the review team does not have evidence on which to base a conclusion that significant amounts of wind power will be available in the near term. Further, delivering the power from any such offshore wind resources would introduce added costs and complexity and would argue against what the review team believes is a reasonable Detroit Edison preference that any alternative be located within the Detroit Edison service area.

In addition to new generation, an energy conservation and demand side management alternative would have limited capability to singly offset the power that would be produced by the proposed Fermi 3 reactor, but nevertheless would avoid the adverse impacts associated with energy-generating options and would allow reduced reliance on those energy-generating sources, resulting in the avoidance of some environmental impacts.

As discussed in detail in Section 8.2.2, a national assessment of demand response potential published by the Federal Energy Regulatory Commission (FERC) in June 2009 (FERC 2009) determined that under the most aggressive scenario of DSM program implementation possible, Michigan could realize a maximum reduction in demand of 4409 MW.[(a)] The net generating capacity of all the State's electric utilities is 21,894 MW. Of the total 94,503,953 MWh of power generated by electric utilities in Michigan in 2008, Detroit Edison was responsible for 47,499,119 MWh, or approximately 50.3 percent of the total (DOE/EIA 2010b). Based on the assumption that Detroit Edison's energy conservation programs account for 50 percent of the DSM reductions projected in FERC's maximum-reduction scenario, Detroit Edison would be able to reduce its systemwide generating capacity by 2205 MW. However, in its February 20, 2008, testimony to the MPSC for Docket U-15244 (Detroit Edison 2008), Detroit Edison estimated an increase in systemwide savings from interruptible load programs to total 156 MW by 2018. In addition, in its application to the MPSC for Docket U-16358, Detroit Edison included as Exhibit A-5 its Energy Optimization Annual Report for 2009 (Detroit Edison 2010b) in which it estimated additional savings from energy efficiency programs to total about 500 GWh per year by 2015, equivalent to a reduction of 62 MW of demand. Based on the assumption that all the estimated capacity savings of 218 MW from conservation and demand side management were attributable to Fermi 3, the new reactor would need to produce only 1317 MW of power to meet

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(a) In its report, FERC states, "It is important to note that the results of the four scenarios are in fact estimates of potential, rather than projections of what is likely to occur. The numbers reported in this study should be interpreted as the amount of demand response that could potentially be achieved under a variety of assumptions about the types of programs pursued, market acceptance of the programs, and the overall cost-effectiveness of the programs. This report does not advocate what programs/measures should be adopted/implemented by regulators; it only sets forth estimates should certain things occur. As such, the estimates of potential in this report should not be interpreted as targets, goals, or requirements for individual states or utilities."

anticipated demand (with all other parameters influencing supply and demand remaining unchanged).

Detroit Edison is also working to increase the power available from renewable resources. In its March 4, 2009, testimony to the MPSC under Docket U-15806 (Detroit Edison 2009d), Detroit Edison projected that by 2029 it could have installed 565 MW of wind energy capacity and 15 MW of solar energy capacity. Using capacity factors of 31 percent for wind and 13 percent for solar (Detroit Edison 2009d), these capacities would equate to 190 MW from wind and 2 MW from solar (baseload equivalent, considering the nuclear plant capacity factor of 92 percent). Including these in addition to the conservation and DSM contributions, the nuclear plant would need to generate 1125 MW. Considering the capacity factors for nuclear and NGCC, this would equate to an NGCC plant with a capacity of 1218 MW.

The review team notes that, in order to be considered as baseload power, the wind and solar installations would have to be coupled with some energy storage mechanism such as CAES. The CAES facility would have a capacity of about 192 MW.

Given the above, the review team concludes that a reasonable combination alternative would consist of the NGCC option, energy conservation and DSM, and wind and solar power coupled with energy storage. Specifically, a combination alternative could involve operation of a NGCC facility with the capacity of 1218 MW, together with aggressive conservation and DSM programs that would reduce demand by 218 MW and installation of 565 MW of wind and 15 MW of solar. A new 10-mi natural gas pipeline would still need to be constructed connecting the NGCC plant at the Fermi site with existing infrastructure. The wind and solar facilities would have impacts on the resources at the locations in which they were built.

Section 9.2.2.2 identifies the impacts of a 1661-MW NGCC facility. Disregarding any different dividends from economies of scale, the projected operational impacts of a 1218-MW NGCC facility, configured the same as the 1661-MW facility assessed in Section 9.2.2 and operating at a capacity factor of 85 percent, would be either essentially the same or less by simple ratio. The NGCC portion of the combination alternative would consume 54,190 million ft^3 of natural gas per year to produce 9,070 GWh of power. The CTs are presumed to operate at a thermal efficiency of 42 percent and at load factors always greater than 80 percent, while the overall thermal efficiency of the NGCC facility would be 60 percent. Table 9-5 provides a summary of the impacts associated with the combination of alternatives.

9.2.5 Summary Comparison of Alternatives

Table 9-6 contains a summary of the review team's environmental impact characterizations for constructing and operating new nuclear (Fermi 3), coal-fired, and NGCC generating units at the Fermi site, and a combination of alternatives. For the combination of alternatives, the review

Table 9-5. Summary of Environmental Impacts of a Combination Alternative

Impact Category	Impact	Comment
Land Use	MODERATE	A natural-gas-fired plant would have land use impacts for a power block, new transmission line corridor, cooling towers and support systems, and connection to a natural gas pipeline. The footprint of the NGCC facility in the combination would be somewhat smaller than the discrete NGCC facility evaluated in Section 9.2.2.2 but would still have onsite land demands not substantially different from those of the proposed Fermi 3. Some expansion of gas well fields and modifications to the existing pipeline infrastructure may be necessary. No land use impacts would result from implementation and/or expansions of DSM programs. The wind power portion of this alternative has the potential to affect substantial areas of land, although most of that land could still be used for purposes such as farming. The small solar component would also have land use impacts.
Air Quality	SMALL to MODERATE	Emissions from the natural-gas-fired plant would be approximately: SO_2, 93.9 tons/yr NO_x, 359 tons/yr Particulate, 183 tons/yr (all as PM_{10}) CO, 829 tons/yr N_2O, 82.9 tons/yr VOC, 58 tons/yr CO_2, 3.04 million tons/yr (without CCS) No air impacts are projected from any of the energy conservation and DSM programs or from the wind and solar power generation.
Water Use and Quality	SMALL	Impacts would be less than those of the proposed Fermi 3 nuclear plant located at the proposed site.

Table 9-5. (contd)

Impact Category	Impact	Comment
Ecology	SMALL (aquatic) and SMALL to MODERATE (terrestrial)	Potential MODERATE impacts limited to effects on eastern fox snake Impacts on terrestrial ecology and wetlands at the Fermi site would be generally similar to Fermi 3. In addition, the wind farms and solar facilities could have some impacts on terrestrial ecology. Offsite parcels may also be affected by construction of a 10-mi natural gas pipeline. Impacts on aquatic ecology from operation of the cooling system would be smaller than those anticipated from Fermi 3. Impacts on terrestrial ecology from cooling tower drift would be smaller than those anticipated from Fermi 3. Additional impacts are associated with natural gas extractions, which are expected to occur on gas fields.
Waste Management	SMALL	The only significant waste would be from spent SCR catalyst used for control of NO_x emissions.
Socioeconomics (economy and taxes)	SMALL to MODERATE (beneficial)	Increased economic activity from new jobs and spending in the region would stimulate economic growth and tax revenues. The local property tax base would benefit Monroe County during construction and operations, but to a lower level than the impacts characterized for Fermi 3 because of the lower property values associated with the combination of technologies alternative. All beneficial tax-related impacts elsewhere in the 50-mi region would also be less than for the Fermi 3 plant because of the smaller workforce needed to operate the combination of technologies alternative. This stimulus would be SMALL beneficial for all areas except for property tax impacts in Monroe County, which would be MODERATE beneficial.

Table 9-5. (contd)

Impact Category	Impact	Comment
Socioeconomics (all other categories)	SMALL to MODERATE	Construction-related impacts would be limited and temporary (4 years for the NGCC plant). The construction workforce for the NGCC plant is projected to be less than the 2500 required for the coal-fired alternative and the 2900 required for the Fermi 3 reactor. The operating workforce for the NGCC plant is projected to be approximately 150, less than that expected for the coal-fired alternative and substantially less than would be required for Fermi 3 operation. The construction workforce is likely to originate primarily from the Detroit and Toledo MSAs. Impacts on local communities with regard to housing and services would be expected to be small and temporary for construction and small for operation. The NGCC plant and new transmission line would have aesthetic impacts comparable to those anticipated for Fermi 3. Wind turbines (565 MW(e)) would have noticeable aesthetic impacts. Overall increase in adverse impact on aesthetics is MODERATE.
Human Health	SMALL	Regulatory controls and oversight would be protective of human health.
Historic and Cultural Resources	MODERATE	Construction activities would involve removal of some portions of the NRHP-eligible Fermi1 and would thus have a MODERATE impact on historic and cultural resources. Any other potential impacts could likely be managed effectively. The NGCC power block and ancillary facilities would likely be built on previously disturbed ground on the Fermi site. Newly disturbed ground would result from construction of the necessary natural gas pipeline, transmission lines, wind turbines, and solar facilities. Surveys prior to construction and archiving of any identified resources would preempt adverse impacts.
Environmental Justice	SMALL	Population density around the site is low, and the closest Census Block Group to the Fermi site that qualifies as a minority or low-income population of interest is about 8 mi from the site, which is beyond the distance the review team expects for physical pathways to environmental justice impacts. Emission limits imposed by operating permits would ensure that those populations would not receive adverse air quality and noise impacts from the operation of the NGCC alternative. In Section 4.4.3 the review team concludes that there are no disproportionately large adverse impacts on minority or low-income populations from the construction and operation of Fermi 3, which serves as a bounding case for establishing environmental justice impacts for the NGCC alternative.

team assumes the siting of the NGCC units at the Fermi site and siting of other generating facilities elsewhere within Detroit Edison's ROI.

The review team reviewed the available information on the environmental impacts of power generation alternatives compared to building a new nuclear unit at the Fermi site. Based on this review, the review team concludes that, from an environmental perspective, none of the viable energy alternatives are clearly preferable to building a new baseload nuclear power generation plant at the Fermi site.

It is appropriate to specifically discuss the differences among the alternative energy sources regarding CO_2 emissions. The CO_2 emissions for the proposed action and energy generation alternatives are discussed in Sections 5.7.2, 9.2.2.1, 9.2.2.2, and 9.2.4. Table 9-7 summarizes the CO_2 emissions estimates for a 40-year period for the alternatives considered by the review team to be viable for baseload power generation. These estimates are limited to the emissions from power generation and do not include CO_2 emissions for workforce transportation, building, fuel cycle, or decommissioning. Among the viable energy generation alternatives, the CO_2 emissions for nuclear power are a small fraction of the emissions of the other viable energy generation alternatives.

On June 3, 2010, EPA issued a rule tailoring the applicability criteria that determine which stationary sources and modifications to existing projects become subject to permitting requirements for GHG emissions under the PSD and Title V programs of the Clean Air Act (75 FR 31514). According to the source permitting program, if the source (1) is otherwise subject to PSD (for another regulated NSR pollutant) and (2) has a GHG PTE equal to or greater than 75,000 tons/yr of CO_2e (adjusting for different global warming potentials for

Table 9-6. Summary of Environmental Impacts of Construction and Operation of Nuclear (Fermi 3), Coal-Fired Alternative, Natural Gas-Fired Alternative, and a Combination Alternative

Impact Category	Nuclear (Fermi 3) (proposed action)	Coal	Natural Gas	Combination of Alternatives
Land Use	SMALL	MODERATE	SMALL	MODERATE
Air Quality	SMALL	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Water Use and Quality	SMALL	SMALL	SMALL	SMALL
Ecology	SMALL (aquatic) and SMALL to MODERATE (terrestrial)	SMALL (aquatic) to MODERATE (terrestrial)	SMALL (aquatic) and SMALL to MODERATE (terrestrial)	SMALL (aquatic) and SMALL to MODERATE (terrestrial)
Waste Management	SMALL	MODERATE	SMALL	SMALL
Socioeconomics (economy and taxes)	SMALL to LARGE (beneficial)	SMALL to LARGE (beneficial)	SMALL to MODERATE (beneficial)	SMALL to MODERATE (beneficial)
Socioeconomics (all other categories)	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE
Human Health	SMALL	SMALL	SMALL	SMALL
Historic and Cultural Resources	MODERATE	MODERATE	MODERATE	MODERATE
Environmental Justice	SMALL	SMALL	SMALL	SMALL

different GHGs), such sources would be subject to BACT. The use of BACT has the potential to reduce the amount of GHGs emitted from stationary source facilities. The implementation of this rule could reduce the amount of GHGs from the values indicated in Table 9-7 for coal and natural gas, as well as from other alternative energy sources that would otherwise have appreciable uncontrolled GHG emissions. The emission of GHGs from the production of electrical energy from a nuclear power source is orders of magnitude less than those of the reasonable alternative energy sources. Accordingly, the comparative relationship between the energy sources listed in Table 9-7 would not change meaningfully because GHG emissions from the other energy source alternatives would not be sufficiently reduced to make them environmentally preferable to the proposed project.

Table 9-7. Comparison of CO_2 Emissions from the Proposed Action and Energy Alternatives

Generation Type	Years	CO_2 Emissions[a] (MMT)
Nuclear power[b]	40	0.29
Coal-fired generation[c]	40	440
Natural-gas-fired generation[d]	40	166
Combination of alternatives[e]	40	122

(a) All values without CCS; CO_2 directly related to electricity production only.
(b) From Appendix L, using a scaling factor of 1.79 as discussed in Section 5.7.2.
(c) From Section 9.2.2.1 (12.4 MMT/yr).
(d) From Section 9.2.2.2 (4.15 MMT/yr).
(e) From Section 9.2.4 (3.04 MMT/yr) (assuming only natural gas generation has significant CO_2 emissions).

Considering the addition of life-cycle GHG emissions from the production of electricity from a nuclear power source, that is, those from the fuel cycle and transportation of workers, total emissions for plant operation over a 40-year period would increase to about 25.7 MMT. This amount is still significantly lower than the emissions from any of the other alternatives; such emissions could be reduced further if the electricity from the assumed fossil fuel source powering the fuel cycle is subject to BACT controls.

The CO_2 emissions for generation alternatives such as wind power, solar power, and hydropower would be associated with workforce transportation, construction, and decommissioning of the facilities. Because these generation alternatives do not involve combustion, the review team considers the GHG emissions to be minor and concludes that the GHG emissions would have a minimal cumulative impact. Other energy-generation alternatives involving combustion of oil, wood waste, municipal solid waste, or biomass-derived fuels would have CO_2 emissions from combustion as well as from workforce transportation, plant construction, and plant decommissioning. It is likely that the CO_2 emissions from the combustion process for these alternatives would dominate the other CO_2 emissions associated with the generation alternative. It is also likely that the CO_2 emissions from these alternatives would be the same order of magnitude as the emissions for the fossil fuel alternatives considered in Sections 9.2.2.1, 9.2.2.2, and 9.2.4. However, because the review team determined that these alternatives do not meet the need for baseload power generation, the review team has not evaluated the CO_2 emissions quantitatively.

As discussed in Chapter 8, the review team concludes that the need for additional baseload power generation has been demonstrated. Also, as discussed earlier in this chapter, the review team concludes that the viable alternatives to the proposed action all would involve the use of fossil fuels (coal or natural gas). Consequently, the review team concludes that the proposed action results in the lowest level of emissions of GHGs among the viable alternatives.

9.3 Alternative Sites

NRC EISs prepared in response to an application for a COL must analyze alternatives to the proposed action (10 CFR 51.71(d)). NRC guidance in the ESRP (NRC 2000) states that the ER submitted in conjunction with an application for a COL should include an evaluation of alternative sites. In Section 9.3 of the ESRP, NRC's site selection process guidance calls for identification of an ROI, followed by successive screening of candidate areas, potential sites, candidate sites, and the proposed site. This section presents a discussion of Detroit Edison's ROI for possible siting of a new nuclear power plant and describes its alternative site selection process. This is followed by the review team's evaluation of Detroit Edison's process, a description of the alternative sites selected, and the review team's evaluation of the environmental impacts of locating a new nuclear generating unit at each alternative site. And finally, the impacts at the proposed and alternative sites are compared to determine whether any alternative sites are environmentally preferable or obviously superior to the proposed site.

The specific resources and components that could be affected by the incremental effects of the proposed action and other actions in the same geographic area are assessed. For this alternative sites evaluation, impacts evaluated include NRC-authorized construction and operation and other cumulative impacts including preconstruction activities. Sections 9.3.3 through 9.3.6 provide a site-specific description of the environmental impacts at each alternative site, based on issues such as land use, air quality, water resources, terrestrial and aquatic ecology, socioeconomics and environmental justice, and historic and cultural resources. Section 9.3.7 contains a table with the staff's characterization of the impacts at the alternative sites and comparison to the proposed site to determine whether there are any alternative sites that are environmentally preferable or obviously superior to the proposed Fermi site.

The review of alternative sites consists of a two-part sequential test (NRC 2000). The first part of the test determines whether any environmentally preferred sites are among the candidate sites. The staff considers whether the applicant has (1) reasonably identified candidate sites, (2) evaluated the likely environmental impacts of construction and operation at these sites, and (3) used a logical means of comparing sites that led to the applicant's selection of the proposed site. Based on its own independent review, the review team then determines whether any of the alternative sites are environmentally preferable to the applicant's proposed site. If the review team determines that one or more alternative sites are environmentally preferable, then it would proceed with the second part of the test. The second part of the test determines whether an alternative site is obviously superior to the proposed site. The review team must determine that (1) one or more important aspects, either singly or in combination, of an acceptable and available alternative site are obviously superior to the corresponding aspects of the applicant's proposed site, and (2) the alternative site does not have offsetting deficiencies in other important areas. Included in this part of the test is the consideration of estimated costs (i.e., environmental, economic, and time of building the proposed plant) at the proposed site and at the environmentally preferable site or sites (NRC 2000). A staff conclusion that an alternative site is obviously superior to the applicant's proposed site would normally lead to a recommendation that the application for the COL(s) be denied.

9.3.1 Alternative Site Selection Process

The review team's evaluation of Detroit Edison's alternative site selection process began with an evaluation of Detroit Edison's stated ROI. Within that ROI, the review team evaluated the results of the application of screening criteria applied sequentially to establish candidate areas, potential sites, and finally candidate sites, leading to the selection of alternative sites. The process Detroit Edison used to select its alternative sites is described in the following sections.

9.3.1.1 Detroit Edison's Region of Interest

In general, the ROI is the geographic area considered in searching for candidate sites (NRC 2000). The ROI is typically the State in which the proposed site is located or the relevant service area for the proposed plant (NRC 2000).

Detroit Edison selected its traditional service area as its ROI (see Figure 8-1). The ROI consists of approximately 7600 mi^2 in 11 counties within southeastern Michigan, including the City of Detroit. Major water features within the ROI that could provide cooling water include Lake Erie, Lake Huron, and the interconnecting St. Clair River. In addition to numerous State routes, major transportation routes within the ROI include Interstates 96, 275, 94, and 75. Rail and water transportation infrastructures also exist throughout the ROI.

9.3.1.2 Detroit Edison's Site Selection Process

Candidate Areas

As the initial step of its alternative site selection process, Detroit Edison identified candidate areas within the ROI. Detroit Edison referred to these as "greenfield areas" (Detroit Edison 2011a, b). Detroit Edison identified these candidate (greenfield) areas based on proximity to transmission lines, rail, transportation corridors, and water supply. A commercial database provided by EnergyVelocity was consulted by Detroit Edison to identify the candidate areas.

Potential Sites

Detroit Edison next searched the candidate areas for locations for potential sites. The search involved a review of publicly available sources of data such as 7.5-min U.S. Geological Survey (USGS) quadrangle maps, aerial photographs, atlases, and road maps, review of Google Earth images, and searches of the Internet. The general criteria used to identify potential sites within the ROI included the following:

- Proximity to transmission lines and rail and road and water transportation infrastructures
- Adequate supplies of water for cooling and industrial applications
- No obvious environmental concerns such as large expanses of wetlands and the absence of sensitive areas such as natural resource conservation areas
- The absence of complex terrain that would require substantial modification before facility construction could begin
- Few residences/sensitive receptors (Detroit Edison 2011a).

Detroit Edison also identified potential “brownfield” sites (i.e., sites with prior or current industrial or commercial development) using two methods. One method involved a review of the MDEQ database of formerly utilized industrial sites. The MDEQ database is comprehensive and includes brownfield sites of all sizes and conditions. The brownfield sites in the database were evaluated by using the same general criteria used to identify greenfield sites (e.g., proximity to transmission, rail, roads, and water). Detroit Edison also considered its existing sites for inclusion in the list of potential sites. Of its existing sites, nine were retained as potential sites: Belle River-St. Clair, River Rouge, Trenton Channel, Fermi, Greenwood, Monroe, Harbor Beach, Conners Creek, and Marysville.

In all, Detroit Edison identified 24 potential sites. A variety of existing land uses was represented in the potential sites selected: sites currently in use for industrial purposes (including power generation), greenfield sites, and brownfield sites (i.e., formerly used industrial sites).

Candidate Sites

The 24 potential sites were subjected to additional research as well as high-level site reconnaissance visits by Detroit Edison staff and its contractors. During this stage, Detroit Edison eliminated 16 sites (Detroit Edison 2011a, b). Of these, 13 sites were eliminated based on a failure to meet criteria for minimum property size (500 ac) and/or minimum cooling water supply (40,000 gpm). Detroit Edison eliminated the other three potential sites because of proximity to major resort areas (two of the sites) and because a new power plant would significantly change the character of the area (all three sites).

Proposed and Alternative Sites

To identify the proposed and alternative sites, Detroit Edison evaluated each candidate site against more specific criteria from both technical and environmental perspectives. For each criterion, each site was given a score of 1, 3, or 5, reflecting a decreasing potential for adverse impact, with a score of 5 representing the most favorable score for each criterion evaluated (Detroit Edison 2011a). Environmental criteria and subcriteria included the following:

- Ecology and natural resources: threatened and endangered species; wetlands/waters of the United States; impacts on designated scenic, natural, recreational, or wildlife areas; disruption of natural habitat; impacts on water quality
- Land use: existing land ownership, existing land use within 1 mi (industrial, agricultural, open space/parks, residential areas), nearby airports, extent of buffer zones for potential offsite receptors
- Socioeconomics: impacts on resources such as traffic, demographics, employment and housing, noise levels, cultural resources and viewshed
- Potential for hazardous material contamination
- Associated linear facilities: for transmission line and water line routes
- Community perception/receptivity to new facilities; based on Detroit Edison's judgment of probable resistance to new nuclear facilities by residents of the site area.

Technical review criteria included the following:

- Site development issues: topography; subsurface conditions that affect foundations, earthwork, and pipe installation; construction impacts on groundwater; flood potential; geological/seismic activity; need for extensive relocation of existing utilities; cogeneration potential
- Transmission system development: distance to adequate transmission; transmission system reliability/available current-carrying capacity
- Transportation development: proximity to highway network; extent of required road displacement/replacement
- Water resources development: adequacy of water source for baseload plant needs; distance to adequate water resources; groundwater static head (as it affects construction dewatering); quality of makeup water (affecting the life of plant components); groundwater quality and accessibility
- Security conditions: logistics associated with making the site secure against intrusion
- Economics of the site: development costs, including major actions such as cut-and-fill to alter grade; delivered fuel costs; costs of linear facilities such as pipelines and transmission lines
- Waste disposal: dry spent fuel storage capacity.

All eight candidate sites were evaluated by using all the criteria itemized above and given relative scores, with the highest score representing the most desirable site. Based on the individual weights of the criteria, environmental factors carried a total weight of 41 percent and technical criteria, 59 percent. After an initial score for each candidate site from both environmental and technical perspectives was established, Detroit Edison conducted a sensitivity analysis to identify any biases that may have been inadvertently introduced during the scoring process. Weightings of both 30 percent and 70 percent were applied to the scores of each site for both environmental factors and technical factors, and the sum of the weighted environmental and technical scores was used to ultimately rank the sites (Detroit Edison 2011a).

Scores assigned to each of the eight candidate sites for each of the evaluation criteria discussed above were provided in tabular form in Chapter 9 of the ER, as was the basis for elimination of some of those sites (Detroit Edison 2011a). Table 9-8 shows the overall results of the evaluation exercise for the eight candidate sites.

Table 9-8. Scores and Relative Rankings of Detroit Edison's Candidate Sites

Candidate Site	County	Existing Use	Weighted Environmental Score	Weighted Technical Score	Weighted Total (Overall Rank)
Site M: Fermi nuclear site	Monroe	Detroit Edison power plant	1.75	2.11	3.86 (1)
Site N: Belle River-St. Clair Energy Facility	St. Clair	Detroit Edison power plant	1.63	2.07	3.70 (2)
Site F: Greenwood Energy Center	St. Clair	Detroit Edison power plant	1.39	2.17	3.56 (3)
Site A: Petersburg	Monroe	Greenfield site	1.13	2.31	3.44 (4)
Site C: South Britton	Lenawee	Greenfield site	1.15	2.19	3.34 (5)
Site W3	Huron	Greenfield site	1.09	2.03	3.12(6)
Site W2	Huron	Greenfield site	1.09	1.81	2.90 (7)
Site W1	Huron	Greenfield site	0.87	1.85	2.72 (8)

Source: Detroit Edison 2011a

Based on the scores from its site selection process, Detroit Edison proposed construction of the Fermi 3 reactor on the existing Fermi site in Monroe County, Michigan, and also considered two alternative sites.

9.3.1.3 Conclusions about Detroit Edison's Site Selection Process

The review team evaluated Detroit Edison's methodology for selecting its ROI, identifying candidate areas, and evaluating potential sites, candidate sites, and alternative sites. The results of the review team's evaluation follow.

For its ROI, Detroit Edison chose its traditional service territory. The designated ROI is consistent with the guidance in NRC's ESRP for review of ERs for nuclear power stations

(NRC 2000). The review team concludes that the ROI used in Detroit Edison's COL application is reasonable for consideration and analysis of potential sites. The review team also finds that Detroit Edison's basis for defining its ROI did not arbitrarily exclude desirable candidate locations.

Detroit Edison next identified candidate areas (which it referred to as greenfield areas). Detroit Edison employed criteria based on proximity to transmission lines, rail, transportation corridors, and water supply (i.e., inclusionary criteria). This is the inverse of the approach described in the ESRP, but it would be expected to yield the same results. Therefore the review team concludes that the method used to identify candidate areas is reasonable.

In order to identify potential sites, Detroit Edison used a process in which it avoided areas of potential concern (e.g., natural resource conservation areas, areas with complex terrain). After eliminating those areas, it identified parcels of land that could be developed for a new nuclear plant. Detroit Edison also looked for brownfield sites and considered its own existing sites in this step. In all, Detroit Edison identified 24 potential sites. Here again, the Detroit Edison process is rather like an inverse of that described in the ESRP (i.e., Detroit Edison used exclusionary criteria, while the ESRP envisioned inclusionary criteria). But, again, the Detroit Edison approach would be expected to yield similar results. The review team notes that the 24 sites cover a wide geographic area and range of environmental conditions. The process used by Detroit Edison did identify sites that would be too small for a new nuclear plant. However, these would be eliminated in the next step (Candidate Sites), leading to the same result. The review team concludes that the Detroit Edison process for identifying potential sites is reasonable.

Detroit Edison reviewed the potential sites in more detail to narrow the list to a group of candidate sites. This portion of its review included visits to all 24 potential sites. In this step Detroit Edison eliminated 16 of the potential sites, with most of these (13) eliminated because of lack of adequate site size (500 ac) or adequate water supply (40,000 gpm) (Detroit Edison 2011b). Detroit Edison eliminated the other three sites because it determined that a new nuclear plant at these locations would significantly change the character of the area. Detroit Edison also considered a number of other attributes in this step, as mentioned in the notes in Table 9.3-2 of the ER (Detroit Edison 2011a). One consideration noted in the table (i.e., private ownership as a disadvantage) would not be considered under the guidance in the ESRP. But this consideration appears not to have been the deciding factor and so would not affect the results. The process used by Detroit Edison at this stage does not appear to be as detailed as the process described in the ESRP. However, the review team concludes that this lack of depth would lead Detroit Edison to identify more candidate sites than the ESRP process. Because the process used by Detroit Edison would not improperly eliminate sites from consideration, the review team concludes that it is reasonable.

Detroit Edison then evaluated the remaining eight candidate sites using 40 criteria. Each criterion was given its own weighting factor, and each site was scored for each criterion. Detroit Edison took the total scores for each site and determined that the Fermi site was the most suitable. It also identified the Belle River-St. Clair and Greenwood sites as alternatives.

The ESRP guidance indicates that the identification of three to five alternative sites could, in general, be viewed as adequate. Because Detroit Edison identified only two alternative sites in its ER (Detroit Edison 2011a), the review team requested additional information (NRC 2009) for Site A (Petersburg) and Site C (South Britton), which were ranked fourth and fifth by Detroit Edison, with similar overall scores. Detroit Edison provided its response on August 25, 2009 (Detroit Edison 2009c). The review team considered all four alternative sites in its evaluation. The locations of the four alternative sites are shown in Figure 9-1.

Detroit Edison considered both environmental criteria and technical criteria in its scoring of the sites. But the ESRP guidance considers only environmental factors in the comparison of the sites to determine whether any is environmentally preferable. Technical and cost factors would be considered only if an alternative site was determined to be environmentally preferable (NRC 2000). However, even if only environmental criteria are considered, the top five sites remain unchanged and Fermi remains the highest ranked site.

In the Detroit Edison analysis, the criterion "Public Receptivity" was given a high weight of 10 percent of the total. Because of the relatively high uncertainty involved in measuring public acceptance, the review team requested Detroit Edison to perform a sensitivity analysis regarding the weight of this criterion (NRC 2011b). Detroit Edison's response to that request (Detroit Edison 2011b) provides the site scores for various weights for Public Receptivity, from 0 percent to 10 percent. At a weight of 2 percent (approximately the average weight for all criteria), the top five sites remain unchanged and the top three sites (Fermi, Belle River-St. Clair, and Greenwood) are essentially tied. The review team concludes that the high weight of this criterion did not skew the outcome of the analysis.

Overall, the review team determines that Detroit Edison used a logical approach that adequately satisfied applicable NRC guidance for the identification of sites that are among the best in the ROI. Consequently, in addition to Fermi, the review team has chosen the top four alternative sites identified by Detroit Edison for its independent analysis.

9.3.2 Review Team Alternative Site Evaluation

In accordance with Section 9.3 of the ESRP (NRC 2000), the review team performed an independent comparison of the proposed and alternative sites. The four alternative sites (Belle

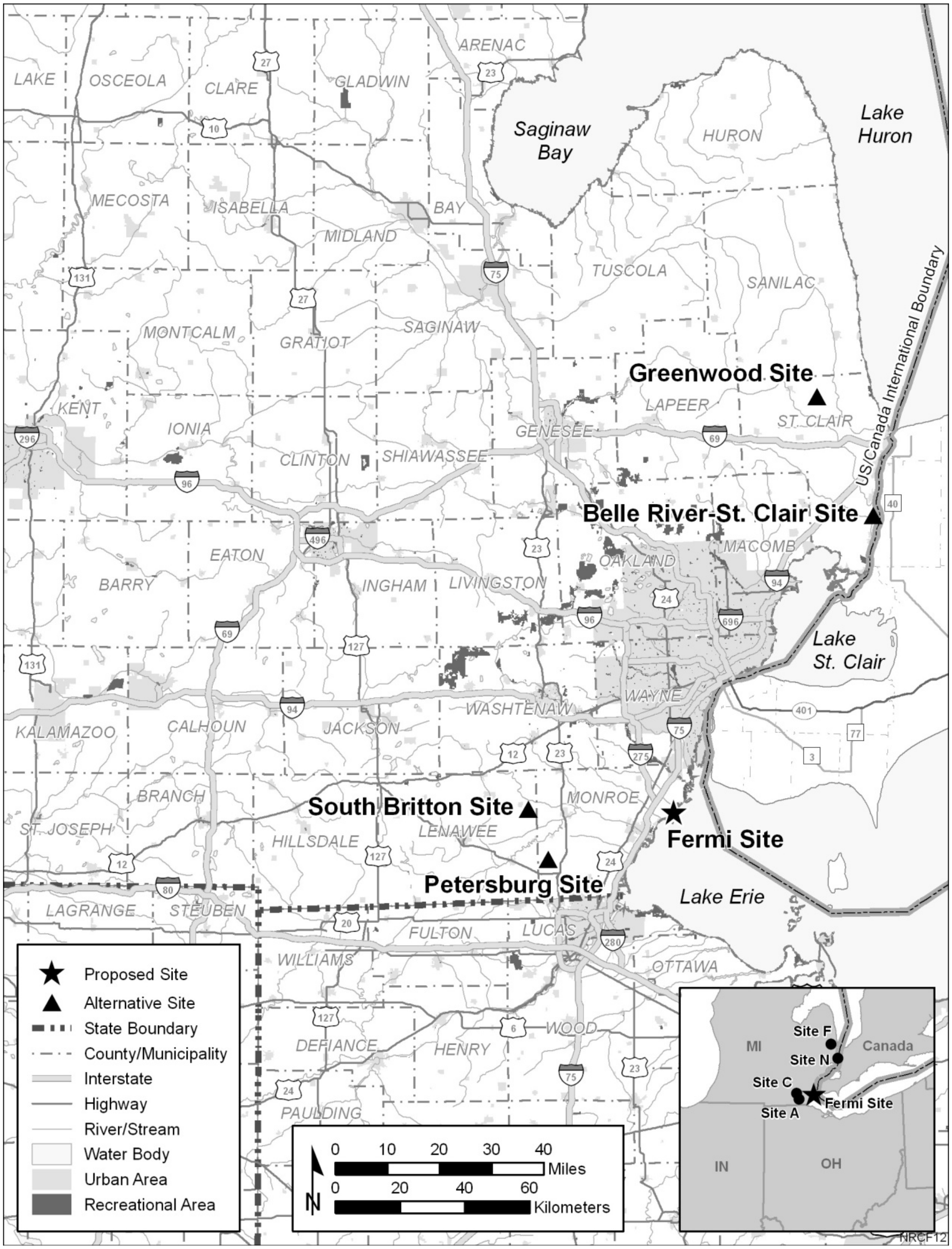

Figure 9-1. Locations of the Proposed Site and Alternative Sites for Fermi 3

River-St. Clair, Greenwood, Petersburg, and South Britton) are examined in detail in Sections 9.3.3 through 9.3.6 in the following subject areas: land use, water resources, terrestrial and aquatic ecology, socioeconomics and environmental justice, historic and cultural resources, air quality, nonradiological health, radiological health, and postulated accidents. The review team visited each alternative site as well as the proposed site in January 2009. Section 9.3.7 contains a table with the review team's characterization of the cumulative impacts of the proposed action at the proposed and alternative sites.

Following the guidance promulgated in Section 9.3 of the ESRP, the review team collected and analyzed reconnaissance-level information for each site. The review team then used the information provided in the ER (Detroit Edison 2011a), a request for additional information (RAI) response (Detroit Edison 2009c), information from other Federal and State agencies, and information gathered during the visits to each alternative site to evaluate the cumulative impacts of building and operating a new nuclear power plant at those sites. The analysis therefore included the impacts of NRC-authorized construction and operation as well as potential impacts associated with other actions affecting the same resources. Cumulative impacts occur when the effects of an action are added to or interact with other effects in a particular place and within a particular time; as a result, the cumulative impact assessment entails a more extensive and broader review of possible effects of the action beyond the site boundary.

The cumulative analysis for the impacts at the alternative sites was performed in the same manner as discussed in Chapter 7 for the proposed site, except, as specified in Section 9.3 of the ESRP (NRC 2000), a reconnaissance-level analysis was conducted for the alternative sites. To inform the cumulative impacts analysis, the review team researched EPA databases for recent EISs within the State, used an EPA database for permits for water discharges in the geographic area to identify water use projects, and used www.recovery.gov to identify projects in the geographic area funded by the American Recovery and Reinvestment Act of 2009 (Public Law 111-5). The review team developed tables of the major projects near each alternative site that were considered relevant in the cumulative analysis. The review team used the information to perform an independent evaluation of the direct and cumulative impacts of the proposed action at the alternative sites to determine whether one or more of the alternative sites were environmentally preferable to the proposed site.

Included are past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could have meaningful cumulative impacts together with the proposed action. For the purposes of this analysis, the past is defined as the time period prior to receipt of the COL application. The present is defined as the time period from the receipt of the COL application until the beginning of activities associated with building Fermi 3. The future is defined as the beginning of building activities (construction and preconstruction activities) associated with Fermi 3 through operation and eventual decommissioning.

The specific resources and components that could be affected by the incremental effects of the proposed action and other actions in the same geographic area were identified. The affected environment that serves as the baseline for the cumulative impacts analysis is described for each alternative site, and a qualitative discussion of the general effects of past actions is included. The geographic area over which past, present, and future actions could reasonably contribute to cumulative impacts is defined and is described in later sections for each resource area. The analysis for each resource area at each alternative site concludes with a cumulative impact finding (SMALL, MODERATE, or LARGE). For those cases in which the impact level on a resource was greater than SMALL, the review team also discussed whether building and operating a nuclear unit would be a significant contributor to the cumulative impact. In the context of this evaluation, “significant” is defined as a contribution that is important in reaching that impact level determination.

Cumulative impacts are summarized for each resource area in the sections that follow. The level of detail is commensurate with the significance of the impact for each resource area. The findings for each resource area at the Fermi site and each alternative site are then compared in Table 9-44. The results of this comparison are used to determine whether any of the alternative sites is environmentally preferable to the proposed site. If any alternative site is determined to be environmentally preferable, the review team would evaluate whether that alternative site was obviously superior.

The impacts described in Chapter 6 of this EIS (e.g., nuclear fuel cycle; decommissioning) would not vary significantly from one site to another. This is true because all the alternative sites and the proposed site are in low population areas and because the review team assumes the same reactor design (therefore, the same fuel cycle technology, transportation methods, and decommissioning methods) for all the sites. As such, these impacts would not differentiate between the sites and would not be useful in the determination of whether an alternative site is environmentally preferable to the proposed site. For this reason, these impacts are not discussed in the evaluation of the alternative sites.

Similarly, the nonradiological waste impacts described in Sections 4.10 and 5.10 would not vary significantly from one site to another. The types and quantities of nonradiological and mixed waste would be approximately the same as those for the construction and operation of an Economic Simplified Boiling Water Reactor (ESBWR) at any of the alternative sites. For each alternative, all wastes destined for land-based treatment or disposal would be transported offsite by licensed contractors to existing, licensed disposal facilities operating in compliance with all applicable Federal, State, and local requirements, and all nonradioactive liquid discharges would be discharged in compliance with the provisions of an applicable NPDES permit. Also, the amount of nonradioactive, nonhazardous municipal solid waste generated annually at the Fermi site would be roughly equivalent to the small percentage of total solid waste generated in the geographic area of influence of the alternative sites. Finally, as stated in Section 7.9, the

Fermi site would generate a very small percentage of hazardous waste produced in Michigan, and no known capacity constraints exist for the treatment or disposal of hazardous wastes either within Michigan or for the nation as a whole. For these reasons, these impacts are not discussed separately in the evaluation of each alternative site.

9.3.3 Belle River-St. Clair Site

This section presents the review team's evaluation of the potential environmental impacts of siting a nuclear reactor at the Belle River-St. Clair site. The following sections describe a cumulative impact assessment conducted for each major resource area. The specific resources and components that could be affected by the incremental effects of the proposed action if it were implemented at the Belle River-St. Clair site and other actions in the same geographic area were considered. This assessment includes the impacts of NRC-authorized construction, operations, and preconstruction activities. Also included in the assessment are other past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could have meaningful cumulative impacts when considered together with the proposed action, if implemented at the Belle River-St. Clair site. Other actions and projects considered in this cumulative analysis are described in Table 9-9. The location and vicinity of the Belle River-St. Clair alternative site are shown in Figure 9-2.

Referred to by Detroit Edison in its site selection process as Site N, the Belle River-St. Clair property contains two Detroit Edison-owned power plants on contiguous parcels of 1860 ac and 226 ac. The site is approximately 1 mi west of the United States–Canada border, 4 mi north of Marine City, 4 mi south of St. Clair, and 8 mi south of Port Huron, the largest population center in the area. The site occupies Sections 13, 18, 19, 30, and 31 of Township 4 North and Ranges 18 East and 17 East in the China and East China Townships. Other than the industrial footprints of the power plants, the site is composed of agricultural land and some wooded areas.

Small portions of the site may be inside the Belle River floodplain. Five residences are within 2 mi of the site. The East China Fractional District No. 2 School is located about 1.5 mi southeast of the site.

Access to the site is provided by State Route 29, which runs through the site; by barge via the St. Clair River; and by rail via the CSX rail line that runs along the eastern border of the site.

The nearest sensitive environmental area is East China Township Park to the south of the site. Other small parks are also located in the area.

While the industrial areas of the site are generally free of vegetation, the wooded areas are composed of cottonwoods (*Populus deltoides*) and green ash (*Fraxinus pennsylvanica*). Diversity in understory areas and open areas is low, with the plant communities composed largely of weedy, nonnative plants. There is also limited wildlife habitat diversity on the site.

Table 9-9. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Belle River-St. Clair Alternative Site Cumulative Analysis

Project Name	Summary of Project	Location	Status
Energy Projects			
Belle River Power Plant	1664-MW coal-fired plant	On Belle River-St. Clair site	Operational
St. Clair Power Plant	1929-MW coal-fired plant	On Belle River-St. Clair site	Operational
Fermi Unit 2	1098-MW nuclear power plant, including recently completed Independent Spent Fuel Storage Installation (ISFSI) and decommissioned Fermi 1 collocated on site	68 mi southwest of Belle River St. Clair site on Lake Erie	Operational
Davis-Besse Nuclear Plant Unit 1	925-MW nuclear power plant	86 mi southwest of Belle River St. Clair site on Lake Erie	Operational
Greenfield Energy Centre LP	1005-MW natural-gas-fired combined cycle electricity-generating facility	1 mi east of Belle River-St. Clair site across the St. Clair River	Operational
Lambton Generating Station	1920-MW coal-fired power plant	1 mi northeast of Belle River-St. Clair site across the St. Clair River	Operational
Dawn Gateway Pipeline	Operation of 30-km, 610-mm international natural gas transmission pipeline system (construction of 1-km new pipeline)	4 mi east of Belle River-St. Clair site in Lambton County, Ontario	Proposed
Marysville Power Plant	200-MW coal-fired plant	10 mi north of Belle River-St. Clair site on St. Clair River	Operational
Greenwood Energy Center	Oil-fired peaking unit and three natural gas CTs with 1071 MW of combined capacity	24 mi northwest of Belle River-St. Clair site	Operational
Suncor Ethanol Plant Phase II Project	Expansion of existing St. Clair Ethanol Plant to increase the supply of ethanol for blending with gasoline. The expansion will increase the plant's production capacity from 200 million to 400 million L/yr.	11 mi north of Belle River-St. Clair site in St. Clair Township, Ontario, Canada	Recently completed

Table 9-9. (contd)

Project Name	Summary of Project	Location	Status
Suncor Ethanol Production Project	Ethanol production facility with production capacity of 200 million L/yr	16 mi north of Belle River-St. Clair site in Sarnia, Ontario, Canada	Recently completed
Diesel Fuel and Hydrogen Pipelines	3.3 km of one 10-in. hydrogen pipeline and two 8-in. diesel fuel pipelines from the Shell Canada Refinery in Corunna to the Suncor Refinery in Sarnia	16 mi north of Belle River-St. Clair site in Sarnia, Ontario, Canada	Recently completed
St. Clair Liquid Petroleum Gas Terminal	Liquid petroleum gas terminal	2.4 mi north of Belle River-St. Clair site located near confluence of Pine and St. Clair Rivers	Operational
Dome Petroleum Corporation	Petroleum bulk station and terminal with discharge to Jordan Creek	2.4 mi north of Belle River-St. Clair site	Operational
Mining Projects			
Cross Sand and Gravel Inc.	Construction sand and gravel mine	17 mi northwest of Belle River-St. Clair site	Operational
Transportation Projects			
I-94 Black River Bridge Replacement in Port Huron	First phase of the Blue Water Bridge plaza expansion, a project to modernize and improve capacity at the nation's second-busiest U.S.-Canadian truck border crossing	15 mi north of Belle River-St. Clair site in Port Huron	Proposed; schedule undetermined
Parks and Recreation Facilities			
St. Clair County Trail System	Proposed upgrades and extensions of an existing offroad and onroad bike route network	Throughout St. Clair County	Proposed construction through 2024
Other Actions/Projects			
Algonac Water Filtration Plant	Water filtration plant that discharges to the St. Clair River	9.6 mi. south of Belle River-St. Clair site on St. Clair River	Operational
Marine City Wastewater Treatment Plant	Wastewater treatment plant that discharges to St. Clair and Black Rivers	4 mi south of Belle River-St. Clair site on St. Clair River	Operational

Table 9-9. (contd)

Project Name	Summary of Project	Location	Status
City of St. Clair Wastewater Treatment Plant	Wastewater treatment plant that discharges to St. Clair River	2.4 mi north of Belle River-St. Clair site on St. Clair River	Operational
City of Port Huron Wastewater Treatment Plant	Wastewater treatment plant that discharges to St. Clair and Black Rivers	17 mi north of Belle River-St. Clair site on St. Clair River	Operational
St. Clair County-Algonac Wastewater Treatment Plant	Wastewater treatment plant that discharges to St. Clair River	10 mi south of Belle River-St. Clair site on St. Clair River	Operational
Detroit Water and Sewerage District Lake Huron Water Treatment Plant	Water treatment plant	22 mi north of Belle River-St. Clair site on Lake Huron	Operational
Indian Trail North Mobile Home Park Wastewater Sewage Lagoon	Wastewater sewage lagoon located on Lake Huron	22 mi north of Belle River-St. Clair site on Lake Huron	Operational
Cargill Salt	Manufactures salt as food additive	2.4 mi north of Belle River-St. Clair site	Operational
Courtright Sewage Treatment Plant Upgrades	Upgrade and expansion of the Sewage Treatment Plant	3 mi north of Belle River-St. Clair site on St. Clair River in Ontario, Canada	Recently completed
Marysville Wastewater Treatment Plant	Wastewater treatment plant that discharges to St. Clair River	10 mi north of Belle River-St. Clair site on St. Clair River	Operational
Dunn Paper Company	Paper mill that discharges to St. Clair River	17 mi north of Belle River-St. Clair site	Operational
E B Eddy Paper, Inc.	Paper mill that discharges to St. Clair and Black Rivers	17 mi north of Belle River-St. Clair site	Operational
Sarnia Combined Sanitary/Storm Sewer Separation	The combined sewer separation project proposed will halt the Combined Sewer Overflow to the St. Clair River	25 mi north of Belle River-St. Clair site in Sarnia, Ontario, Canada	Recently completed
Sarnia Wastewater System Improvements	Trunk sanitary sewer expected to reduce the number of combined sewer overflows to the St. Clair River	25 mi north of Belle River-St. Clair site in Sarnia, Ontario, Canada	Recently completed

Table 9-9. (contd)

Project Name	Summary of Project	Location	Status
Dry Hydrant Installation, North Slip, Sarnia Harbor	Construction, installation, and maintenance of a dry hydrant and protection bollards along the North Slip embankment in Sarnia Harbor	25 mi north of Belle River-St. Clair site in Sarnia, Ontario, Canada	Recently completed
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and rail; construction of water and/or wastewater treatment and distribution facilities and associated pipelines, as described in local land use planning documents. No specific data found concerning development/ expansion of the towns within 20 mi of site.	Throughout region	Construction would occur in the future, as described in State and local land use planning documents
Great Lakes Restoration Initiative	Restoration activities to address toxic substances, invasive species, nearshore health and non-point-source pollution, and habitat and wildlife protection	Great Lakes watershed	Start in FY2011
Global Climate Change/Natural Environmental Stressors	Short- or long-term changes in precipitation or temperature	Throughout region	Impacts would occur in the future

Source: Modified from NRC 2010a, b

The site is located approximately 50 mi from Detroit. St. Clair County has a population of approximately 164,200 (2000 data) and the nearest towns, St. Clair and Marine City, have populations of 5800 and 4650, respectively (2000 data).

9.3.3.1 Land Use

The following impact analysis includes impacts on land use from building and operating the proposed nuclear project at the Belle River-St. Clair site. The analysis also considers past, present, and reasonably foreseeable future actions that affect land use, including other Federal and non-Federal projects, and those projects listed in Table 9-9 within the geographic area of interest.

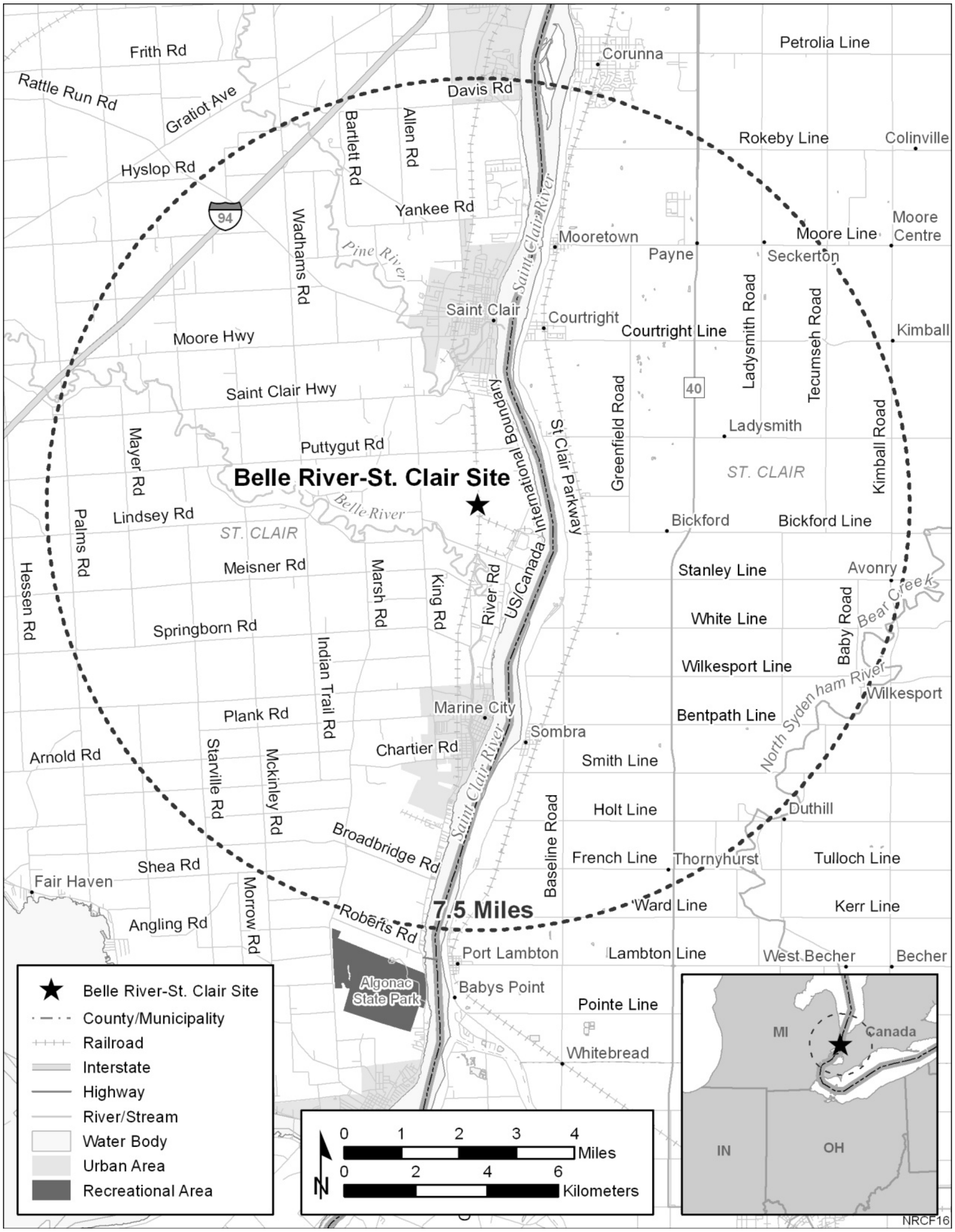

Figure 9-2. The Belle River-St. Clair Alternative Site and Vicinity

The site is owned by Detroit Edison, is zoned industrial, and hosts the existing Belle River and St. Clair power plants (Detroit Edison 2011a). There are a number of buildings onsite associated with the power plants. The proposed location for the new facility is approximately 1200 ac, located in the northwestern part of the existing site (Detroit Edison 2009b). Within the 1200 ac, the conceptual plant layout suggests that permanent land disturbance would be as much as 95 ac, and temporary land disturbance would be as much as 200 ac. There are no residential areas on the site, although there are a few residences within 2 mi (Detroit Edison 2011a). Topography is flat with very little variation, and outside of the developed areas around the existing coal plants, the site is primarily agricultural land (including possibly some prime farmland), grassland, and young mixed deciduous forest. There are 37 wetlands on the site, and several former utility ponds may have been abandoned for a sufficient period to be considered waters of the United States (see Section 9.3.3.3). Some parts of the site are within the Belle River floodplain (Detroit Edison 2011a). If the facilities associated with this alternative would extend into the Coastal Zone defined by the State of Michigan under the Coastal Zone Management Act, Detroit Edison would have to obtain a coastal zone consistency determination from the MDEQ.

National Wetland Inventory (NWI) maps suggest that a substantial area of wetlands, perhaps several hundred acres of mostly forested and scrub-shrub wetlands, lies within the 1200 ac. Drainage connections between the site and the St. Clair River could also be disturbed. The river is an adequate water source for the proposed plant and already supplies the existing Belle River and St. Clair power plants. No new offsite roadway would likely be needed during development or operation of the proposed facility (Detroit Edison 2011a).

The nearest recreational area to the site is East China Township Park, south of the site near the intersection of Recor Road and River Road (Detroit Edison 2011a). A number of smaller parks are present in the surrounding area, while Algonac State Park is approximately 8 mi south of the site. These recreational resources may be affected by increased user demand, by views of the proposed 600-ft cooling tower and condensate plume, or by access delays associated with increased traffic.

One or more new transmission line corridors would likely be needed to connect a new power plant at the Belle River-St. Clair site to the grid (Detroit Edison 2011a). Although a 345-kV transmission line already crosses the site, it is fairly congested, partly because of the recent loss of a critical double-circuit tower. Although transmission capacity and reliability in the area are considered to be fair, a load flow study of the transmission line is recommended (Detroit Edison 2011a). Environmental conditions along the transmission line corridor are similar to those of the site, with a mixture of cropland, wooded areas, and some wetlands. Because the transmission interconnection would be on the site, the review team concludes that the land use impacts of building and operating transmission lines for a new nuclear plant at the Belle River-St. Clair site would be minor.

For cumulative land use analysis, the geographic area of interest is the 15-mi region surrounding the Belle River-St. Clair site. This geographic area of interest includes the primary communities (China Charter Township and East China Charter Township) that would be affected by the proposed project if it were located at the Belle River-St. Clair site.

A number of offsite projects identified in Table 9-9 would likely affect land use in the geographic area of interest around the Belle River-St. Clair site. The two Suncor Ethanol projects in St. Clair Township and the I-94 Black River bridge replacement project in Port Huron are all more than 10 mi from the proposed site but, along with other projects identified in Table 9-9, have contributed or would contribute to some decreases in open lands, wetlands, and forested areas and generally result in increased urbanization and industrialization. However, existing parks, reserves, and managed areas would help preserve open lands, wetlands, and forested areas. The projects within the geographic area of interest identified in Table 9-9 appear to be generally consistent with applicable land use plans and control policies.

As discussed in Section 7.1 for the Fermi site, climate change could increase precipitation and flooding, while increased lake evaporation and reduced lake ice accumulation could reduce lake levels and thereby increase the extent of low-lying lakeshore areas (USGCRP 2009). Forest growth may increase as a result of more CO_2 in the atmosphere (USGCRP 2009). In addition, climate change could reduce crop yields and livestock productivity (USGCRP 2009), which might change portions of agricultural land uses in the area of interest.

Based on the information provided by Detroit Edison and the review team’s independent evaluation, the review team concludes that the cumulative land use impacts associated with siting a reactor on the Belle River-St. Clair site would be SMALL, and further mitigation would not be warranted.

9.3.3.2 Water Use and Quality

The predominant surface water feature near the Belle River-St. Clair site is the St. Clair River, which is 2 mi east of the site, connects Lake Huron with Lake Erie, and has an average daily flow of 188,000 ft^3/sec (approximately 121 billion gpd) (Neff and Nichols 2005). The river supports multiple uses from industry to commerce to recreational boating. Surface water quality is moderate to poor. The two existing power plants at the site currently use the St. Clair River as a source of cooling water and for industrial purposes. There are 37 wetlands on the site, and several utility ponds may have been abandoned for a sufficient period to be considered waters of the United States (see Section 9.3.3.3). During a site visit in January 2009, terrain at the proposed site was observed to be flat with forested wetlands in undeveloped areas.

Water for a reactor at the Belle River-St. Clair Power Plant site would most likely be obtained from the St. Clair River, which is used for once-through cooling by the two existing power plants and also for cooling by the Canadian power industry. The flow of the St. Clair River is large enough to support the closed cycle cooling system of the proposed plant. New intake and discharge structures would be necessary (constructed under USACE and MDEQ permits), because the current power plants do not have enough additional capacity. Discharge would include cooling tower blowdown at an elevated temperature relative to the river, treated process wastewater, and liquid radwaste. Discharges would be controlled by an NPDES permit issued by MDEQ.

Water wells locally support domestic use of groundwater, but low yields and moderate quality limit the potential usefulness of this resource for the proposed facility. Groundwater could possibly be used during the building phase. Groundwater resources in the area are described as marginal. Most wells access the surficial aquifer, which is between 200 and 400 ft thick, with well yields in the 10 to 15 gpm range.

Building activities, including site grading and dewatering, would have the potential to affect water quality through increased erosion by stormwater, increased turbidity in surface water, and possible spills or leaks of fuel and other liquids. These changes would be expected to be limited by following appropriate BMPs. Surface water quality may be affected by discharges, but the discharges should be controlled by NPDES and stormwater permits.

For the cumulative analysis of impacts on surface water, the geographic area of interest for the Belle River-St. Clair site is the St. Clair River (which connects Lake Huron with Lake Erie) and downstream Lake Erie itself, because these are the areas potentially affected by the proposed project. Key actions that have current and reasonably foreseeable potential impacts on water supply and water quality in this area of interest include coal- and natural-gas-fired power plants, proposed and recently completed ethanol plants, proposed and recently completed pipeline construction projects, wastewater treatment plants, paper mills, and other industries. For the cumulative analysis of impacts on groundwater, the geographic area of interest is the thick surficial aquifer in the vicinity of the site.

Water Use

Operational cooling water requirements would be the major demand of a new nuclear power plant on surface water resources. As described above, the water availability of the St. Clair River would be sufficient to support the makeup water needs of a new reactor in addition to the cooling water needed by existing U.S. and Canadian power plants and other projects listed in Table 9-9. The maximum consumptive loss anticipated from Fermi 3 is 24.6 MGD, or approximately 0.02 percent of the river's average flow rate of over 121,000 MGD. The cumulative consumptive use of surface water is anticipated to have a small effect on the resource.

As described in Section 7.2.1, the greatest potential future impact on the Great Lakes water availability is predicted to be from climate change. The impact predicted for the lowest-emissions scenario discussed in the USGCRP report (2009) and by Hayhoe et al. (2010) would not be detectable or would be so minor that it would not noticeably alter the availability of water from the Great Lakes. However, if CO_2 emissions follow the trend evaluated in the highest-emissions scenario, the effect of climate change could noticeably increase air and water temperatures and decrease the availability of water in surface water resources in the Great Lakes region. As a result, the review team concludes that the potential impacts of use and climate change on surface water quantity would be SMALL to MODERATE. Based on its evaluation, the review team concludes that building and operating a nuclear plant at the Belle River-St. Clair site would not be a significant contributor to the cumulative impact on surface water use.

Groundwater withdrawals associated with site dewatering during construction or preconstruction of a new nuclear power plant would be temporary and localized. As noted above, groundwater usage in the Belle River-St. Clair vicinity is generally limited to withdrawals by domestic wells. The review team concludes that cumulative groundwater impacts associated with withdrawals while building a new nuclear power plant at this site and with projects identified in Table 9-9 would be SMALL.

Water Quality

An NPDES permit from the MDEQ would be required for discharges from a new nuclear power plant at the Belle River-St. Clair site as well as for discharges to surface waters from the other projects identified in Table 9-9. Such permits would limit both chemical and thermal discharges. Construction activities associated with the proposed facilities in Table 9-9 and urbanization in the vicinity have the potential to degrade surface water quality, but adhering to BMPs would limit this impact.

The EPA's Great Lakes National Program Office has initiated the Great Lakes Restoration Initiative, a consortium of 11 Federal agencies that developed an action plan to address environmental issues. These issues fall into five areas: cleaning up toxics and areas of concern, combating invasive species, promoting nearshore health by protecting watersheds from polluted runoff, restoring wetlands and other habitats, and tracking progress and working with strategic partners. The results of this long-term initiative would presumably address water quality concerns of Lake Erie.

Climate change, as described in Section 7.2.1, has the potential to affect water quality within the Great Lakes, including Lake Huron, which discharges via the St. Clair River, leading to a MODERATE cumulative impact on surface water quality. Reduced lake levels and reduced flow in the river could increase the impact of permitted discharges. However, the high flow rate of the St. Clair River and associated mixing would limit the influence of chemical and thermal discharges on downstream surface water bodies (e.g., Lake St. Clair, the Detroit River, and Lake Erie). The review team concludes that building and operating a nuclear plant at the

Belle River-St. Clair site would not be a significant contributor to the MODERATE cumulative impact on surface water quality.

Groundwater in the region, which is generally of moderate chemical quality, could be affected by a new nuclear power plant at the Belle River-St. Clair site and the other past, present, and reasonably foreseeable actions in the region identified in Table 9-9. These impacts would be expected to be localized in extent and may be avoided or minimized through adherence to BMPs. The review team concludes that cumulative groundwater quality impacts would be SMALL.

9.3.3.3 Terrestrial and Wetland Resources

The parts of the site that would be developed are a mix of agriculture used for row crops and hay, old field, and young forest stands composed of green ash and early successional species such as cottonwood. The forested areas had been disturbed historically by farming or other land management activities. Species diversity in the understory and more open areas is low and composed largely of weedy nonnative plants (Detroit Edison 2011a).

The species of wildlife in the project vicinity is typical of partially urbanized areas in the region: whitetail deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), opossum (*Didelphis virginiana*), and various rodents. Various songbirds, raptors such as the red-tailed hawk (*Buteo jamaicensis*), and game birds such as ring-necked pheasant (*Phasianus colchicus*) use the site (Detroit Edison 2011a). Some amphibians and reptiles are probably present, but unusual species would not be expected due to the disturbed character of the area. Wildlife in the project area is limited by habitat diversity and the proximity of the site to industrial development.

The NWI identifies 37 wetlands on the site (Detroit Edison 2009b). NWI maps suggest a substantial area of wetlands, perhaps several hundred acres of mostly forested and scrub-shrub wetland. Several utility ponds onsite may have been abandoned for a sufficient period to be considered waters of the United States (Detroit Edison 2011a). The ponds are dominated by cattail (*Typha* sp.) and common reed (*Phragmites australis*) and could meet the criteria for regulation as waters of the United States if they have been abandoned for more than 5 years. If there are drainage ditch connections to the St. Clair River (a navigable water body under Section 10 of the Rivers and Harbors Act) that would be disturbed, the ditches also could be regulated. It is possible, but uncertain at this time, that other areas on this site contain wetlands, since most soils on the site are mapped as hydric soils (USDA 2010). A more definitive evaluation of possible wetland resources on the site would require a wetland delineation.

Two terrestrial species listed as threatened or endangered under the Endangered Species Act (ESA) are known to occur or could occur in St. Clair County. The eastern prairie fringed orchid

(*Platanthera leucophaea*) is Federally listed as endangered and is known mostly from lakeplain prairies around Saginaw Bay and western Lake Erie (MNFI 2007a). No lakeplain prairie habitat occurs on the site or in the surrounding area, but fallow agricultural fields with hydric soil are present and the orchid could occur there (MNFI 2007a). The Indiana bat (*Myotis sodalis*) is Federally listed as endangered. It occurs in southern Michigan when it is not hibernating (wintering) in caves and other hibernacula (wintering sites) located in southern Michigan and other states (MNFI 2007b). The bats generally require large trees (greater than 9-in. diameter) with exfoliating bark for summer roosting. According to the FWS (2009), however, trees as small as 5 in. in diameter should be considered as potential habitat. The emerald ash borer (*Agrilus planipennis*) is active in the project area (MDA 2009). Ash (*Fraxinus* spp.) trees onsite have died from the borer, creating the potential for dead trees with loose bark and resulting in potential roosting habitat for the Indiana bat.

The bald eagle (*Haliaeetus leucocephalus*) is no longer on the Federal endangered species list, although it is protected under the Bald and Golden Eagle Protection Act (BGEPA) and Migratory Bird Treaty Act (MBTA) (MNFI 2007c). The bald eagle was also recently removed from the State list of threatened and endangered species but is still considered a species of concern. Although bald eagles are known to occur in the region, they usually nest and roost closer to fish-bearing waters. The potential for any impacts on protected species appears to be minimal due to the type of habitat present.

More than 50 State-listed species occur in St. Clair County (see Table 9-10). Among the State-listed species is the eastern fox snake. Four other species formerly present in the county are presumed extirpated (locally extinct). Detroit Edison has not consulted with the MDNR on potential impacts on State-listed species that could result from siting the power plant at the Belle River-St. Clair site.

Building Impacts

Agricultural land, old field, and forest land would have to be cleared and converted to industrial use in order to build a new reactor and associated facilities at the Belle River-St. Clair site. According to Detroit Edison, the total area of the site would be approximately 1200 ac (Detroit Edison 2011a). Detroit Edison did not provide detailed data on the size of the areas or specific locations that would be used to build the power plant. Its conceptual plan layout (Detroit Edison 2009b), however, suggests that the permanently disturbed area could be as much as 95 ac, and the temporarily disturbed area could be as much as 200 ac. Conversion of agricultural land would have minimal impact on wildlife and habitat. Conversion of forested areas would have some impact on most of the common species present onsite by removing habitat used for shelter or other functions. Furthermore, NWI maps suggest that many of the forested areas on the site are wetlands. With the possible exception of the Indiana bat, adverse impacts on Federally listed species are not anticipated. The forested areas of the site have the potential to provide roosting, foraging, and breeding habitat for the Indiana bat in the form of

Table 9-10. Federally and State-Listed Terrestrial Species That Occur in St. Clair County and May Occur on the Belle River-St. Clair Site or in the Immediate Vicinity

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Amphibians			
Blanchard's cricket frog	*Acris crepitans blanchardi*	NL	T
Birds			
Cerulean warbler	*Dendroica cerulea*	NL	T
Common moorhen	*Gallinula chloropus*	NL	T
Common tern	*Sterna hirundo*	NL	T
Forster's tern	*Sterna forsteri*	NL	T
Henslow's sparrow	*Ammodramus henslowii*	NL	E
King rail	*Rallus elegans*	NL	E
Least bittern	*Ixobrychus exilis*	NL	T
Louisiana waterthrush	*Seiurus motacilla*	NL	T
Peregrine falcon	*Falco peregrinus*	NL	E
Red-shouldered hawk	*Buteo lineatus*	NL	T
Mammals			
Indiana bat	*Myotis sodalis*	E	E
Plants			
American chestnut	*Castanea dentata*	NL	E
Beak grass	*Diarrhena obovata*	NL	T
Beard tongue	*Penstemon calycosus*	NL	T
Bog bluegrass	*Poa paludigena*	NL	T
Broad-leaved sedge	*Carex platyphylla*	NL	E
Carey's smartweed	*Polygonum careyi*	NL	T
Chestnut sedge	*Fimbristylis puberula*	NL	PE
Creeping whitlow grass	*Draba reptans*	NL	T
Eastern prairie fringed orchid	*Platanthera leucophaea*	T	E
Few-flowered nut rush	*Scleria pauciflora*	NL	E
Frost grape	*Vitis vulpina*	NL	T
Gattinger's gerardia	*Agalinis gattingeri*	NL	E
Ginseng	*Panax quinquefolius*	NL	T
Goldenseal	*Hydrastis canadensis*	NL	T
Heart-leaved plantain	*Plantago cordata*	NL	E
Large toothwort	*Dentaria maxima*	NL	T
Large water starwort	*Callitriche heterophylla*	NL	T
Leiberg's panic grass	*Dichanthelium leibergii*	NL	T
Limestone oak fern	*Gymnocarpium robertianum*	NL	T
Narrow-leaved puccoon	*Lithospermum incisum*	NL	PE
Northern prostrate clubmoss	*Lycopodiella margueritae*	NL	T
Orange- or yellow-fringed orchid	*Platanthera ciliaris*	NL	E

Table 9-10. (contd)

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Painted trillium	*Trillium undulatum*	NL	E
Pine-drops	*Pterospora andromedea*	NL	T
Pink milkwort	*Polygala incarnata*	NL	PE
Prairie buttercup	*Ranunculus rhomboideus*	NL	T
Purple milkweed	*Asclepias purpurascens*	NL	T
Purple prairie clover	*Dalea purpurea*	NL	PE
Scirpus-like rush	*Juncus scirpoides*	NL	T
Short-fruited rush	*Juncus brachycarpus*	NL	T
Showy orchis	*Galearis spectabilis*	NL	T
Skinner's gerardia	*Agalinis skinneriana*	NL	E
Slough grass	*Beckmannia syzigachne*	NL	T
Spearwort	*Ranunculus ambigens*	NL	T
Stiff gentian	*Gentianella quinquefolia*	NL	T
Sullivant's milkweed	*Asclepias sullivantii*	NL	T
Three-awned grass	*Aristida longespica*	NL	T
White gentian	*Gentiana flavida*	NL	E
White goldenrod	*Solidago bicolor*	NL	E
White lady slipper	*Cypripedium candidum*	NL	T
Wild rice	*Zizania aquatica* var. *aquatica*	NL	T
Reptiles			
Eastern fox snake	*Pantherophis gloydi*	NL	T
Spotted turtle	*Clemmys guttata*	NL	T

Source: MNFI 2010a
(a) E = listed as endangered, NL = not listed, PE = presumed extirpated, T = listed as threatened.

dead ash trees. If the bat uses the areas that would be disturbed, impacts could be kept to minimal levels by limiting tree clearing to the times of year when the bats are not in the region.

The agricultural land is not likely to provide habitat for State-listed species. An additional study would be necessary to adequately assess potential impacts on State-listed species, including the eastern fox snake.

Detroit Edison's plan layout for the new reactor avoids disturbing any known wetlands on the site (Detroit Edison 2009b), although considering the prevalence of hydric soils on the site, the layout likely affects unmapped wetlands.

Detroit Edison's ER states that studies would be needed to determine whether more transmission capacity would have to be to be built for a new power plant at this site. It is likely, however, that a new transmission line would be necessary for a number of reasons. A reactor built on the Belle River-St. Clair site would still be expected to serve the same load centers as if it were at the Fermi site, and the existing non-nuclear power plants on the site would continue operating, resulting in a low likelihood that sufficient uncommitted carrying capacity remains on the existing lines.

No information was provided on where a possible transmission line would be routed, how long it would be, or what terrestrial ecological resources might be affected by development or operation of such a transmission line. It may be possible, however, that new transmission lines could share or adjoin an existing transmission line corridor for some of its length and might use existing substations, thereby resulting in less ecological impact than completely new corridors and substations. The vicinity of the Belle River-St. Clair site is largely agricultural, with some forested areas. A complete assessment would require defining a route and obtaining site-specific information about wildlife and habitat. It is likely that building a new transmission line on any route would require clearing trees from substantial areas of forested wetlands.

Operational Impacts

During plant operation, wildlife, including the eastern fox snake, would be subjected to increased mortality from traffic, but it is not expected that such effects would destabilize the local or regional populations of the common species of the site (Forman and Alexander 1998). Information about the local occurrence of important species and habitats would be needed to conduct a more complete assessment of potential project effects on those resources at the Belle River-St. Clair site.

Direct mortality resulting from birds colliding with tall structures has been observed (Erickson et al. 2005). Factors that appear to influence the rate of bird impacts with structures are diverse and related to bird behavior, structure attributes, and weather. Migratory flight during darkness by flocking birds has contributed to the largest mortality events. Tower height, location, configuration, and lighting also appear to play a role in bird mortality. Weather, such as low cloud ceilings, advancing fronts, and fog, also contribute to this phenomenon (NRC 1996).

There would be a potential for bird mortality from collisions with the nuclear power plant structures at this site. Typically, the cooling tower and the meteorological tower are the structures likely to pose the greatest risk. The potential for bird collisions increases as structure heights and widths increase. MDCTs are of little concern because of their relatively low height compared with existing and proposed structures onsite. An NDCT, however, would be on the order of 600 ft high. Nonetheless, the NRC concluded that effects of bird collisions with existing cooling towers “involve sufficiently small numbers for any species that it is unlikely that the losses would threaten the stability of local populations or would result in a noticeable impairment of the function of a species within local ecosystems” (NRC 1996). Thus, the impacts on bird populations from collisions with the cooling tower are expected to be minimal.

Impacts of the transmission system on wildlife (e.g., bird collisions and habitat loss) resulting from the addition of new lines and towers cannot be fully evaluated without additional information on the length and location of any new transmission facilities. Nonetheless, Section 4.5.6.2 of the GEIS for license renewal (NRC 1996) provides a thorough discussion of the topic and concludes that bird collisions associated with the operation of transmission lines would not cause long-term reductions in bird populations. The same document also concludes that once a transmission corridor has been established, the impacts on wildlife populations from continued transmission line corridor maintenance are not significant (NRC 1996).

Other potential impacts associated with transmission line operation would consist of habitat loss due to corridor maintenance, noise, and electromagnetic field (EMF) effects on flora and fauna.

ITC*Transmission* operates in accordance with industry standards for vegetation management (NERC 2010), including seasonal restriction on activities that could adversely affect important wildlife (Detroit Edison 2010a). According to ITC*Transmission*'s vegetation management policy, wetland areas within the corridor would be manually cleared of woody vegetation periodically for line safety, thereby keeping them in a scrub/shrub or emergent wetland state (ITC*Transmission* 2010). Other forested areas would be managed similarly to prevent tree regrowth that could present safety or transmission reliability problems. Access to these areas for maintenance would likely be on foot or by the use of matting for vehicles so as not to disturb the soil. Pesticides or herbicides would be used only occasionally in specific areas where needed. It is expected that the use of such chemicals in the transmission line corridor would be minimized to the greatest extent possible in wetland areas to protect these important resources (Detroit Edison 2010a). The impacts associated with corridor maintenance activities are loss of habitat, especially forested habitat, from cutting and herbicide application. The maintenance of transmission line corridors could be beneficial for some species, including those that inhabit early successional habitat or use edge environments. Detroit Edison provided no data on noise for the possible new reactor on the Belle River-St. Clair site, but it is likely that impacts would be minimal and similar to those of the Fermi 3 project.

EMFs are unlike other agents that have adverse biological impacts (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NIEHS 2002). A review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures (NIEHS 2002). At a distance of 300 ft, the magnetic fields from many lines are similar to typical background levels in most homes (NIEHS 2002). Thus, impacts of EMFs from transmission systems with variable numbers of power lines on terrestrial flora and fauna are of small significance at operating nuclear power plants (NRC 1996). Since 1997, more than a dozen studies have been published that looked at cancer in animals that were exposed to EMFs for all or most of their lives (Moulder 2007). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2007). A review of the literature on health effects of electric and magnetic fields conducted for the Oregon Department of Energy looked at the effects of strong electric and magnetic fields on various bird species. While some studies concluded that some species of birds exhibited changes in activity levels and some physiological metrics, no studies demonstrated adverse effects on health or breeding success (Golder Associates, Inc. 2009).

Cumulative Impacts

Several past, present, and reasonably foreseeable projects could affect terrestrial resources in ways similar to siting a new reactor at the Belle River-St. Clair site (see Table 9-9). The geographic area of interest for the following analysis is defined by a 25-mi radius extending out from the site

Past projects include, among others, the Belle River and St. Clair Power Plants, which are major coal-fired generating facilities belonging to Detroit Edison that occupy hundreds of acres on the east side of the site bordering the St. Clair River. Future activities in the region that could noticeably contribute to wildlife and habitat impacts in the geographic area of interest include the proposed Suncor Ethanol Projects in Sarnia and St. Clair Townships, Ontario, Canada; and future urbanization in the region. Although information on the area of land that would be converted to industrial and urban use is lacking, it is reasonable to conclude that such area would be substantial.

Urbanization would likely result in conversion of agricultural land, forest land, wetlands, and other habitat to urban uses. Urbanization would involve some of the same activities as building a new reactor, including land clearing and grading (temporary and permanent), increased human presence, heavy equipment operation, traffic (including resulting wildlife mortality), noise from construction equipment, and fugitive dust. Some of the effects of these activities, such as noise and dust, are short term and localized. The cumulative impacts of noise and dust from building a new reactor would be brief and negligible. Other effects, such as clearing wildlife habitat that will not be restored, would be permanent. The urbanization effects of land clearing and grading, filling of wetlands, increased human presence, and increased traffic would occur over a period of several years and in several locations.

Development of new energy facilities could result in increased employment and population within the geographic area of concern, which, in turn, could indirectly result in additional urbanization. Given the current populations of St. Clair County, Michigan, and Lambton County, Ontario, approximately 164,000 and 127,000, respectively, the additional impacts on ecological resources from urbanization indirectly resulting from a new nuclear power plant at the Belle River-St. Clair site and reasonably foreseeable projects are expected to be minor.

Summary of Impacts on Terrestrial and Wetland Resources at the Belle River-St. Clair Site

Impacts on terrestrial ecological resources and wetlands were estimated based on the information provided by Detroit Edison and the review team's independent review. Impacts at this site combined with past, present, and reasonably foreseeable future activities in the geographic area of interest are expected to be noticeable. Based on the conceptual layout (Detroit Edison 2009b), the permanently disturbed area could be as much as 95 ac and the temporarily disturbed area could be as much as 200 ac. Most of the project area is currently used for row crops and hay and provides relatively low wildlife habitat value. After construction and preconstruction at the site, habitat in temporarily disturbed areas would be expected to naturally regenerate. Wildlife would also recover but might not use the regenerated habitat to the same degree. Permanently disturbed areas would be converted to industrial use for the indefinite future. However, the presence of hydric soils on the site suggests that substantial impacts on wetlands might be unavoidable. Because the review team has no definitive information on the routing and length of a new transmission corridor, it cannot definitively evaluate impacts.

The review team concludes that the cumulative impacts on terrestrial ecological resources would be MODERATE for a new reactor at the Belle River-St. Clair site. Building and operating a new nuclear unit at the Belle River-St. Clair site would be a significant contributor to the MODERATE impact.

9.3.3.4 Aquatic Resources

Aquatic habitats associated with the Belle River-St. Clair site include 37 onsite wetlands, several small utility ponds, the St. Clair River, and the Belle River (Section 9.3.3.2). No information was available regarding the aquatic organisms in the onsite wetlands and utility ponds, and surveys would be needed to characterize the aquatic communities present. However, a variety of aquatic macroinvertebrates, such as mayflies, stoneflies, caddisflies, isopods, and chironomids, are likely to be present, along with fish common to Great Lakes coastal habitats, such as sunfishes (Family Centrarchidae), shiners (Family Cyprinidae), suckers (Family Catostomidae), and catfish (Family Ictaluridae) (Bolsenga and Herdendorf 1993).

The St. Clair River, which connects Lake Huron with Lake St. Clair, would likely serve as the source of cooling water intake and discharge for a new reactor on the Belle River-St. Clair site. The St. Clair River is 44 mi long and 833 ft to 3000 ft wide and is east of the site. Surface water quality in the St. Clair River is currently considered moderate to poor (see Section 9.3.3.2). The two existing power plants on the site (Belle River Power Plant and St. Clair Power Plant) employ once-through cooling systems, use the St. Clair River as a source of cooling water, and also discharge heated effluent into the river (Section 9.3.3.2).

Other aquatic habitats in the vicinity of the Belle River-St. Clair site include the Belle River, a tributary of the St. Clair River that drains approximately 2525 mi^2 of land. Impacts on the Belle River from preconstruction, construction, and operations of a new reactor are expected to be minimal, because the land area that would be affected by reactor construction would be located approximately 1 mi northeast of the Belle River and no water would be withdrawn from or discharged into the Belle River.

Approximately 18 mi downstream of the Belle River-St. Clair site, the St. Clair River terminates in the St. Clair River delta on the northern shore of Lake St. Clair. The St. Clair River delta is one of the most diverse and productive wetlands in the Midwest (Wildlife Habitat Council 2002). Aquatic habitats located within the St. Clair River and its tributaries include coastal marsh, bogs, fens, and swamps. Submerged macrophytes are the dominant primary producers within the St. Clair River, and they provide critical food and habitat for higher trophic levels. Beds of aquatic vegetation are particularly extensive at the St. Clair River delta. Mussels, crayfish, leeches, and aquatic insect larvae are common benthic invertebrates. Historically there was a high diversity of freshwater mussels within the St. Clair River drainage (Wildlife Habitat Council 2002).

There are 116 species of fish known to occur in the St. Clair River and its tributaries (Wildlife Habitat Council 2002). Common forage species include gizzard shad (*Dorosoma cepedianum*), killifish (*Fundulus* spp.), sticklebacks, rainbow smelt (*Osmerus mordax*), and alewife (*Alosa pseudoharengus*). Centrachids, catfish, yellow perch (*Perca flavescens*), walleye (*Sander vitreus*), northern pike (*Esox niger*), and muskellunge (*Esox masquinongy*) and freshwater drum (*Aplodinotus grunniens*) are commercial or recreationally important species. The river also serves as an important corridor for migratory fishes such as lake sturgeon (*Acipenser fulvescens*) and several species belonging to the families Salmonidae and Clupeidae (Wildlife Habitat Council 2002). Some of the primary introduced aquatic nuisance fish species include the common carp (*Cyprinus carpio*), round goby (*Neogobius melanostomus*), and tubenose goby (*Proterorhinus semilunaris*) (Wildlife Habitat Council 2002; Fuller et al. 2012).

Federally and State-Listed Threatened and Endangered Species

Two freshwater mussels that are Federally listed as endangered, the rayed bean (*Villosa fabalis*) and snuffbox mussel (*Epioblasma triquetra*), are present in St. Clair County in the Belle River (FWS 2010; 77 FR 8632); these species are also listed as endangered by the State of Michigan (Carman 2001b). There are no designated critical habitats for any listed species in the vicinity of the Belle River-St. Clair site. In the St. Clair River and Belle River within St. Clair County, there are seven State-listed species of fish and six State-listed mussel species (Table 9-11). The St. Clair River provides suitable habitat for all seven fish species, and all seven are known to occur in the St. Clair or Belle River (Carman and Goforth 2000a; Carman 2001a; Derosier 2004a, b, c, d; Goforth 2000). The St. Clair River contains significant

Table 9-11. Federally and State-Listed Threatened and Endangered Aquatic Species That Are Known to Occur in St. Clair County and That May Occur on the Belle River-St. Clair Site or in the St. Clair River and Belle River

Common Name	Scientific Name	Federal Status[(a)]	State Status[(b)]
Fish			
Channel darter	*Percina copelandi*	NL	E
Eastern sand darter	*Ammocrypta pellucida*	NL	T
Lake sturgeon	*Acipenser fulvescens*	NL	T
Mooneye	*Hiodon tergisus*	NL	T
Northern madtom	*Noturus stigmosus*	NL	E
Pugnose shiner	*Notropis anogenus*	NL	E
Sauger	*Sander canadensis*	NL	T
Invertebrates			
Eastern pondmussel	*Ligumia nasuta*	NL	E
Pink papershell	*Potamilus ohiensis*	NL	T
Rayed bean	*Villosa fabalis*	E	E
Slippershell	*Alasmidonta viridis*	NL	T
Snuffbox mussel	*Epioblasma triquetra*	E	E
Wavyrayed lampmussel	*Lampsilis fasciola*	NL	T

(a) Federal status rankings determined by the FWS under the Endangered Species Act; NL = not listed, E = endangered. Source: FWS 2010.
(b) State species information provided by MNFI (2010b); E = endangered, T = threatened.

spawning grounds for lake sturgeon (Goforth 2000) and is the only river in Michigan for which there are recent records of mooneye (*Hiodon tergisus*) and sauger (*Sander canadensis*) (Derosier 2004a, b). Historical or recent records indicate that the wavyrayed lampmussel (*Lampsilis fasciola*), rayed bean, slippershell (*Alasmidonta viridis*), and snuffbox mussel are present or potentially present in the Belle River (Carman and Goforth 2000b; Carman 2001b; Stagliano 2001a; Carman 2002b; 75 FR 67552). Rayed bean, snuffbox mussel, and slippershell are potentially present in large rivers like the St. Clair. The eastern pondmussel (*Ligumia nasuta*) can be found in ponds, lakes, and streams (Mulcrone 2006a). The pink papershell (*Potamilus ohiensis*) is usually found in rivers and large streams (Mulcrone 2006b). Therefore, suitable habitat for both species may exist in the St. Clair River and Belle River.

Building Impacts

Impacts on aquatic habitats and biota on the Belle River-St. Clair site and on the St. Clair River could result from building the new reactor, associated transmission lines, and the cooling water intake pipeline. As identified in Section 9.3.3.1, the area of the site that would be developed if the site was chosen for a new reactor facility consists primarily of agricultural land and woodland. The expected building location is adjacent to wetland areas, but there are no streams or ponds located directly within the construction footprint. Building a new cooling water intake and discharge pipeline would have the potential to affect aquatic habitat present along the pipeline corridor and could require dredging, pile driving, and other alterations to the shoreline and benthic habitat of the St. Clair River, potentially resulting in sedimentation, noise, turbidity, sediment removal, and accidental releases of contaminants. See Section 4.3.2 for a detailed description of potential impacts of construction activities on aquatic habitat and biota. The impacts on aquatic organisms would likely be temporary and largely mitigable through the use of BMPs. Preconstruction activities within the St. Clair River would require Section 10 and/or 404 permits from the USACE, as well as a separate permit from the MDEQ, and these permits would likely contain stipulations that would further reduce impacts. Overall, the impact of building the cooling water intake and discharge structures on aquatic resources would be minor.

As described in Section 4.3.2, building activities at the location of the new reactor, including an increase in impervious surface, vegetation removal, site grading, and dewatering, would have the potential to affect water quality and hydrology, and therefore aquatic biota in wetlands and ponds located in the vicinity. Stormwater runoff could carry soil as well as contaminants (e.g., spilled fuel and oil) from construction equipment into wetlands and ponds located onsite. Construction of the new reactor would not occur adjacent to the Belle River or the St. Clair River, making it unlikely that there would be effects of reactor facility construction on aquatic resources in these areas.

It is possible that the transmission line for a new reactor at the Belle River-St. Clair site could use existing substations and share or adjoin an existing transmission line corridor for some of its length. If so, building-related impacts on aquatic resources would be minimal. If a new transmission line is needed to service a new reactor at this site, there is the potential for the construction-related impacts described above to affect aquatic habitat and aquatic biota if the new transmission line passed near or crossed a surface water feature. Expansion of existing corridors would be expected to result in minor environmental impacts, while establishing new corridors could result in greater impacts. However, assuming required construction permits would be obtained from MDEQ and/or USACE and appropriate BMPs were implemented during building activities, the impacts on aquatic resources from development of additional transmission facilities would be temporary, easily mitigated, and minor.

NPDES and stormwater construction permits would stipulate the application of BMPs and other mitigation to reduce impacts on the St. Clair River and onsite wetlands and ponds resulting from the construction of a new reactor facility and cooling water intake structures. Adhering to appropriate BMPs would reduce the potential for sediments to enter surface water. Detroit Edison's suggested layout for a new reactor at the alternative Belle River-St. Clair site avoids disturbing any wetlands or water bodies on the site (Detroit Edison 2009b) and is located approximately 1 mi or more from the Belle River and St. Clair River, further reducing the potential for impacts on aquatic biota.

New reactor and transmission line construction is not expected to result in impacts on Federally or State-listed species, given the lack of suitable habitat at the reactor location and the use of BMPs to minimize potential construction-related impacts. However, threatened and endangered fish and mussels found in the St. Clair River may be affected by benthic disturbance associated with the building of cooling water intake and discharge structures. Threatened and endangered mussels potentially present in the St. Clair River include the eastern pondmussel, pink papershell, slippershell, and snuffbox mussel. As discussed above, the rayed bean is not likely to be present. Additional information would need to be collected and surveys may need to be conducted to evaluate the potential for threatened and endangered mussel species to be present in areas of the St. Clair River that would be disturbed by building activities. If threatened or endangered mussels were found, it is likely that mitigation measures would need to be developed to limit potential impacts. Habitat for State-listed fish species could be disturbed by shoreline and in-water construction activities. However, fish are highly mobile and would likely avoid the affected areas during construction. On the basis of this information and because construction and preconstruction activities would be temporary and largely mitigable, the review team concludes that impacts on threatened and endangered aquatic species would be minor.

Operational Impacts

Operational impacts on aquatic resources could result from water withdrawal from the St. Clair River, impingement and entrainment of aquatic biota by the cooling water system, transmission line and cooling water system maintenance, and alteration of water quality due to cooling water discharge.

Operational cooling water requirements would be the major water demand of a new reactor on the St. Clair River. Detroit Edison has indicated a closed-cycle recirculating cooling system would be used, which could reduce water use by 96 to 98 percent of the amount that the facility would use if it employed a once-through cooling system (66 FR 65256). Assuming that cooling water needs would be similar to those identified for the proposed Fermi 3 Unit, approximately 34,000 gpm, or 49 MGD, would be needed (Detroit Edison 2011a). The daily flow in the St. Clair River is adequate to support the closed-cycle cooling system and meet the proportional flow limitations of EPA's CWA Section 316(b) Phase I requirements for new facilities. Therefore the incremental impact from operating a new power plant at the Belle River-St. Clair site would be minor (see Section 9.3.3.2, Water Use and Quality). Consequently, the hydrologic impacts on aquatic habitat in the St. Clair River from water withdrawal should be minimal.

Periodic maintenance dredging of the water intake is necessary to maintain appropriate operating conditions for cooling water intake. Such dredging would likely be managed under permits from USACE and MDEQ and result in temporary localized increase in turbidity in the vicinity of the intake bay. Dredged material is expected to be disposed of in a spoil disposal pond, where sedimentation would occur prior to discharge of the water back into the St. Clair River. The periodic dredging of the intake bay, which would likely be similar to existing maintenance dredging activities for the existing power plants on the site, would result in minor impacts on aquatic biota and habitats in the St. Clair River.

Impingement and entrainment of organisms from the St. Clair River would be the most likely way in which populations of aquatic biota could be adversely affected by operations of a new reactor at the Belle River-St. Clair site. Particularly vulnerable are early life stages (eggs and larvae), which lack the ability to overcome intake suction and which are small enough to pass through the mesh of the intake screens. As discussed above, the St. Clair River contains a diverse aquatic biota and provides spawning habitat for several important aquatic species, particularly in the St. Clair River delta. However, the St. Clair River delta is approximately 18 mi downstream of the site, which would greatly reduce the potential for fish eggs, larvae, and juveniles to be entrained by the water intake system. A study of larval fish entrainment from the St. Clair River power station found that during spring and summer rainbow smelt, fourhorn sculpin (*Myoxocephalus quadricornis*), silver chub (*Macrohybopsis storeriana*), yellow perch, common white sucker (*Catostomus commersonii*), logperch (*Percina caprodes*), trout-perch (*Percopsis omiscomaycus*), burbot (*Lota lota*), and goldfish (*Carassius auratus*) were entrained, with rainbow smelt, accounting for approximately 96 percent of the individuals; fourhorn sculpin and silver chub each accounted for less than 2 percent of individuals (Leslie et al. 1979). Historically, larval walleye have also been entrained in great numbers by the St. Clair River Power Plant (Wapora, Inc. 1978). The closed cycle recirculating cooling system proposed by Detroit Edison would substantially reduce water withdrawal compared to a once-through cooling system, thereby decreasing the impingement and entrainment of organisms (Section 5.3.2). Assuming a closed cycle cooling system that meets the EPA's CWA Section 316(b) Phase I regulations for new facilities (66 FR 65256), the anticipated impacts on aquatic populations from entrainment and impingement are expected to be minimal.

Discharge would include cooling tower blowdown, treated process wastewater, and processed radwaste wastewater, all of which could affect aquatic biota through mortality or sublethal physiological, behavioral, and reproductive impairment (see Section 5.3.2). In addition, aquatic organisms could be affected by cold shock and the scour of benthic habitat in the vicinity of the discharge ports (see Section 5.3.2). Mixing and the high flow rate of the St. Clair River would likely limit impacts on downstream surface waters from the cooling water discharge. Proposed design features such as the presence of riprap around the submerged discharge port and orientation of the discharge ports in an upward direction are intended to reduce scouring (Detroit Edison 2011a). As identified in Section 9.3.3.2, a NPDES permit from the MDEQ would be required for discharges from a new nuclear power plant at the Belle River-St. Clair site. Such a permit would specify limits for chemical and thermal discharges in order to protect water quality, thereby limiting the potential for impacts on aquatic organisms. As identified in Section 9.3.3.2, the high flow rate of the St. Clair River and associated mixing would limit the influence of chemical and thermal discharges on downstream surface water bodies. Assuming that NPDES permitting requirements are met, the impacts of discharges on aquatic habitats and biota would be minor.

At the Belle River-St. Clair site, impacts on aquatic resources from operation of a new reactor may include those associated with maintenance of new and existing transmission line corridors. ITC*Transmission* would be expected to construct and operate any new transmission line needed for a new reactor at the Belle River-St. Clair site, and it is assumed that it would follow existing maintenance practices designed to minimize impacts on wetlands, such as minimizing disturbance to riparian habitat and minimizing the application of pesticides and herbicides, which can enter aquatic habitat and adversely affect aquatic biota (Detroit Edison 2010a). As a result, impacts on aquatic habitats and biota from maintenance of transmission lines would likely be minor.

There is no suitable habitat for threatened and endangered mussels near the location of the reactor, but several of the species, including the rayed bean and the snuffbox mussel (both proposed for Federal listing as endangered) and the State-listed eastern pondmussel, the pink papershell, and the slippershell, are potentially found in the St. Clair River, and may therefore be vulnerable to cooling water intake and discharge operational impacts. As eggs, mussels are not likely to be affected by system operation, because they are not free-floating but rather develop into larvae within the female. The glochidial stage, during which juvenile mussels attach to a suitable fish host, is vulnerable indirectly through host impingement and entrainment. Hosts for the slippershell (johnny darter [*Etheostom anigrum*], mottled sculpin [*Cottus bairdii*]), snuffbox mussel (logperch), and rayed bean (largemouth bass [*Micropterus salmoides*]) are present in the St. Clair River and could be impinged during reactor operations. Post-glochidial and adult stages of mussels are not likely to be susceptible to entrainment or impingement because they bury themselves in sediment.

The channel darter (*Percina copelandi*) and eastern sand darter (*Ammocrypta pellucida)* are unlikely to be entrained because they bury themselves in sediment and remain near the bottom. Lake sturgeon are known to spawn in the St. Clair River near the opening into Lake St. Clair approximately 18 mi downstream of the site, and eggs or young of the State-listed mooneye and sauger could be present in the St. Clair River. A closed cycle cooling system for a new reactor on the Belle River-St. Clair site would withdraw river water at a maximum rate of 34,264 gpm, as discussed in Section 3.2.2.2. Compared to the average river flow of 121,000 MGD, this represents only 0.04 percent of the flow of the St. Clair River, and therefore early life stages of these species are not likely to be entrained or impinged in sufficient numbers to cause population-level effects.

Cumulative Impacts

For the cumulative analysis of impacts on aquatic resources, the geographic areas of interest for the Belle River-St. Clair reactor are the St. Clair River (which connects Lake Huron with Lake St. Clair) and Lake St. Clair, because these are the areas potentially affected by a new reactor. Past, present, and reasonably foreseeable projects, facilities, and other environmental changes that contribute to cumulative impacts on aquatic resources in this area of interest are existing power plants on the St. Clair River (including the Belle River Power Plant and the St. Clair Power Plant on the Belle River-St. Clair site); ethanol production facilities in Ontario, Canada; and future urbanization in the region. In addition, aquatic resources in the region have been greatly affected by ecosystem changes from introduced dreissenid mussels (*Dreissena* spp.) and recreational and commercial fishing.

As discussed above, potential building-related impacts on aquatic habitat and biota could result from altered hydrology, erosion, and stormwater runoff of soil and contaminants and disturbance or loss of benthic habitat from construction of the reactor, associated transmission lines, and water intake and discharge system. The additional impacts on aquatic resources from building new ethanol plants would be minimal due to the small areas that would be developed and the distance to the Ontario sites. Urbanization can affect aquatic resources by increasing the impervious surface, non-point-source pollution and water use, and by altering riparian and in-stream habitat and existing hydrology patterns. Development of a new reactor on the Belle River-St. Clair site and the other projects in the region could result in some increased population and additional urbanization with subsequent impacts on aquatic resources.

The primary operational impacts on aquatic habitat and biota could result from impingement and entrainment of aquatic biota during cooling water intake, makeup water needs, transmission line maintenance, and alteration in water quality from cooling water discharge. Impingement and entrainment of aquatic biota from the St. Clair River due to a new reactor must be considered along with mortality resulting from existing power plants that already withdraw water from the St. Clair River, commercial and recreational fishing, and introduced zebra mussels (*Dreissena polymorpha*) and quagga mussels (*D. rostriformis*), which have dramatically reduced plankton abundance in the region.

The St. Clair River would be sufficient to support the makeup water needs of a new reactor in addition to the cooling water needed by existing U.S. and Canadian power plants and other projects listed in Table 9-9. However, as described in Section 7.2.1, the effect of climate change could noticeably decrease the availability of surface water resources in the Great Lakes region. If such a reduction in surface water were to occur, some aquatic habitat on the reactor site and in the St. Clair River may be altered, with potentially adverse consequences for aquatic habitat and biota.

Discharges into the St. Clair River from a new nuclear power plant at the Bell River-St. Clair site must be considered along with discharges into the St. Clair River from the other projects identified in Table 9-9. NPDES permits would limit both chemical and thermal discharges into the St. Clair River. However, if climate change results in reduced water levels and increased water temperatures, impacts associated with contaminant concentrations and thermal stress from cooling water discharge into the St. Clair River could also increase. As identified in Section 9.3.3.2, the overall, cumulative surface water quality impacts associated with a new nuclear power plant at the Belle River-St. Clair site together with predicted climate change and other past, present, and reasonably foreseeable actions in the region are expected to be moderate. However, the construction and operation of a new nuclear power plant at the Belle River-St. Clair site is not expected to contribute significantly to the overall cumulative impacts on water quality in downstream surface water bodies (Section 9.3.3.2). Consequently, the incremental contribution of a new reactor at the Belle River-St. Clair site to cumulative impacts on aquatic biota from water quality changes due to operational discharges would be minor.

Based on its evaluation, the review team concludes that the cumulative impacts on aquatic resources, including threatened and endangered species, could be substantial due to the continued inadvertent introduction of invasive species, overfishing, and increased urbanization resulting in further degradation of water quality, and global climate change. However, the incremental impact from building and operating a new power plant at the Belle River-St. Clair site would not contribute measurably to the overall cumulative impacts in the geographic area of interest.

Summary of Impacts on Aquatic Resources at the Belle River-St. Clair Site

Impacts on aquatic habitats and associated biota within onsite ponds and wetlands and the St. Clair River could result from reactor, transmission line, and cooling water intake preconstruction and construction activities. However, the impacts on aquatic organisms would be temporary and could be largely mitigated by avoiding aquatic habitats during siting of facilities and activity areas and through the use of BMPs during preconstruction and construction.

Operational impacts on aquatic resources could result from cooling water withdrawal from the St. Clair River, impingement and entrainment of aquatic biota by the cooling water system, transmission line and cooling water system maintenance, and alteration of water quality by cooling water discharge. Impingement and entrainment would add to existing mortality sources for aquatic biota such as invasive species, commercial and recreational fishing, and the operation of other power plants using water from or discharging to the St. Clair River.

Impingement and entrainment of aquatic organisms in the St. Clair River would be minimized by complying with EPA's CWA Section 316(b) Phase I regulations. The St. Clair River could support the makeup water needs of a new reactor. However, climate change could noticeably decrease the availability of surface water resources in the Great Lakes region. Similarly, while a NPDES permit would limit both chemical and thermal discharges from the Belle River-St. Clair reactor, climate change has the potential to increase impacts of the discharges on aquatic communities. Transmission line and cooling water pipeline maintenance impacts on aquatic habitat and biota could be minimized by implementing BMPs.

Although there is no suitable habitat that is likely to be present near the reactor location, State-listed fish and mussels may be present in the St. Clair River and could be vulnerable to benthic disturbance associated with the building of the cooling water intake and discharge system. State-listed mussels could be surveyed and translocated prior to construction of the intake and discharge structures. The State-listed darters are unlikely to be entrained because they prefer benthic habitats. Although lake sturgeon, mooneye, and sauger could be more vulnerable to entrainment and impingement, the use of closed cycle cooling and a properly designed intake structure would significantly reduce potential losses, and population-level effects would be minor.

The review team's conclusion, based on information provided by Detroit Edison and the review team's independent evaluation, is that the impacts on aquatic resources, including threatened or endangered species, from the Belle River-St. Clair reactor considered with cumulative impacts on aquatic resources from other activities and climate change would be MODERATE. Building and operating a new nuclear unit at the Belle River-St. Clair alternative site would not be a significant contributor to the overall cumulative impact.

9.3.3.5 Socioeconomics

The economic impact area for the Belle River-St. Clair site is St. Clair County. The site is located in St. Clair County, approximately 8 mi south of Port Huron and approximately 1 mi west of the international border crossing at Port Huron/Sarnia, Canada. St. Clair County is also part of the Detroit-Warren-Livonia MSA, which encompasses nine principal cities over a six-county area, the core of which is the City of Detroit, approximately 35 mi southwest of the site.

Because of the geographical location of the plant, members of the workforce that would be drawn from the region may live in Canada or elsewhere within the Detroit-Warren-Livonia MSA. However, the review team expects that most of the in-migrating construction and operations workers would likely relocate in or near the City of Port Huron, which is near the plant, has the highest population base, and would have the most housing and other amenities relative to the rest of the primarily rural region. Impacts beyond St. Clair County are not likely to be significant in any single jurisdiction, because the number of in-migrating workers within any single jurisdiction outside of St. Clair County would be minor. Therefore, this analysis focuses on St. Clair County.

Physical Impacts

Physical impacts include impacts on workers and the general public, noise, air quality, buildings, roads, and aesthetics. Because the physical impacts of building and operating a nuclear power plant are very similar between the proposed site and the alternative sites, the review team determined that, as assessed for the Fermi 3 site, all physical impacts related to the Belle River-St. Clair site would be minor. See Sections 4.4.1 and 5.4.1 for a detailed discussion of physical impacts for Fermi 3.

Demography

The Belle River-St. Clair site is partially within the China Charter Township and partially within East China Charter Township. Port Huron, approximately 8 mi north of the Belle River-St. Clair site, is the largest population center in the county. Other large population areas are those immediately surrounding Port Huron, including the City of Marysville and the Townships of Fort Gratiot, Port Huron, and Kimball. Historically, St. Clair County's population has been concentrated along the coast, including within Port Huron, Marysville, St. Clair, and Marine City. Table 9-12 provides the 2000 and 2010 Census population, and the projected 2020 population for the largest population areas in St. Clair County.[(a)]

Table 9-12. Demographics for St. Clair County and Local Jurisdictions

	Population		
County/City/Township	**2000**	**2010**	**2020 Projected**
St. Clair County	164,235	163,040	180,294
City of Port Huron	32,338	30,184	31,402
City of Marysville	9684	9959	10,820
Fort Gratiot Township	10,691	11,108	12,743
Port Huron Township	8615	10,654	11,995
Kimball Township	8628	9358	10,066

Source: The 2020 projections are provided by SEMCOG (2008). The 2000 and 2010 data for all areas are from the USCB (2000a, 2010a).

Between 2000 and 2010, the population in St. Clair County declined by approximately 1 percent. Population growth occurred in the City of Marysville and townships surrounding the City of Port Huron, while the population of Port Huron declined. These jurisdictions are also where future growth in the county is expected (LSL Planning Inc. undated).

(a) This section has been updated for the Final EIS to include the results of the mandated U.S. decadal census for 2010 for the data sets that have been released by the U.S. Census Bureau as of May 2012. For the data sets that have not yet been released, the review team has presented the results of the five-year estimates from the American Community Survey (i.e., 2006–2010).

Detroit Edison estimates that the size of the construction workforce needed for the nuclear power plant over a 10-year construction period would range from a minimum of 35 workers to a peak construction workforce of 2900 workers, and that the average size of the onsite workforce during the 10-year construction period would be approximately 1000 workers (Detroit Edison 2011a).

The review team's assumptions for in-migrating and local workers are similar to those for the Fermi 3 plant site. Although the plant is located in a primarily rural county, it is also within commuting distance of highly urbanized areas (i.e., within a 50-mi radius of the plant). St. Clair County is within the Detroit-Warren-Livonia MSA, and the City of Detroit is approximately 35 mi southwest of the plant. The City of Flint, Michigan, is slightly beyond the 50-mi radius of the site, but is still within a reasonable commuting distance to the plant, approximately 60 mi. Therefore, for comparative purposes between analyses of site alternatives, the review team based this analysis upon the assumptions presented in Section 4.4.2 of this EIS, with approximately 85 percent of the construction workforce drawn from within a 50-mi region or more of the plant, and 15 percent of the construction workforce (approximately 435 workers during the peak construction and 150 workers on an average annual basis) expected to relocate within the 50-mi radius of the project site.

If the facility were to be built at the Belle River-St. Clair site and operations commenced, Detroit Edison expects an operations workforce of 900 workers in 2020 (Detroit Edison 2011a). For reasons similar to those presented for the Fermi 3 site in Section 2.5 of this EIS, the review team determined that based on the analysis of impacts presented in Section 5.4.2, approximately 70 percent of the operations workforce would be drawn from the region within 50 mi of the plant, and 30 percent of the operations workforce (approximately 270 workers) would relocate within a 50-mi radius of the project site.

Using an average household size of 2.6 persons, based on the national average household size in the USCB's 2010 population data, the total in-migrating population is estimated to be approximately 1131 persons during the peak construction period and less during periods of non-peak construction. The projected population increase associated with the in-migrating operations workers is estimated to be 702 persons.

If all the in-migrating construction workers and their families settled in St. Clair County for the 2-year peak construction period, the projected increase would be less than 1 percent of the projected 2020 population for the county. Demographic impacts during periods of non-peak employment construction would be smaller. The in-migrating construction workers and their families would likely settle in various cities and townships throughout the county, and the population effects are expected to be minimal. The projected population increase for the operations workforce would be smaller than that projected for the peak construction employment period and would also be less than 1 percent of the projected 2020 population for the county.

Given the small number of in-migrating workers compared to the projected 2020 population for St. Clair County, the review team concludes that the demographic impact during peak construction and operation would be minor.

Economic Impacts on the Community

Economy

There were 77,492 employed workers in St. Clair County in 2010 (USBLS 2012) (see Table 9-13). Its unemployment rate increased from 4.2 percent in 2000 to 15.6 percent in 2010. The most recent unemployment rate of 13.1 percent in 2011 showed improvement in the job outlook (USBLS 2012). Approximately 21 percent of the workforce is employed in manufacturing, and 22 percent in educational services, health care, and social assistance (USCB 2010b). Approximately 12 percent is employed in retail trade, and 9 percent in construction (USCB 2010b). Tourism and manufacturing are large components of St. Clair's economy (St. Clair County Metropolitan Planning Commission 2009). The Blue Water Bridge international crossing at Port Huron/Sarnia is the third-busiest border crossing in the country. St. Clair's manufacturing base consists primarily of suppliers of plastics and rubber to the automotive industry, although other manufacturing establishments, including paper, fabricated metal and metal parts, and machinery, are also located in St. Clair County (St. Clair County Metropolitan Planning Commission 2009). In 2000, approximately 36 percent of St. Clair County's workers lived in the county and commuted to work outside of the county. The four largest employers in St. Clair County in 2008 were Port Huron School District, with approximately 1462 employees; Port Huron Hospital, approximately 1057 employees; Detroit Edison, approximately 1044 employees; and the K-Mart Corporation, approximately 850 employees (St. Clair Administrator/Controller's Office 2009).

Table 9-13. Labor Force Statistics for St. Clair County (2000 and 2010)

	St. Clair County	
	2000	**2010**
Total labor force	87,071	77,492
Employed workers	83,383	65,375
Unemployed workers	3688	12,117
Unemployment rate	4.2	15.6

Source: USBLS 2012

The economy of St. Clair County would benefit over the estimated 10-year construction period through direct purchase of materials and supplies and direct employment of the construction workforce. Detroit Edison estimates the size of the construction workforce would range from a minimum of 35 workers to a peak construction workforce of 2900 workers, with an average annual onsite construction workforce of 1000 workers. The review team estimates that based on an average salary of $50,500, approximately $50.5 million would be expended directly in payroll annually during the construction period.

When the plant becomes operational, Detroit Edison expects direct employment to be 900 full-time and contract employees. In addition, Detroit Edison estimates 1200 to 1500 workers would be employed during scheduled maintenance outages, which would occur every 24 months and require workers for a period of about 30 days. Based on an average salary estimate of $63,625, approximately $57.3 million would be expended directly in payroll annually during the 40-year operating license of the plant. In addition, every 24 months, an additional $6.3 to $7.9 million in payroll would be expended for the outage workforce for the plant.

New workers (i.e., in-migrating workers and those previously unemployed) would have an additional indirect effect on the local economy, because these new workers would stimulate the regional economy with their spending on goods and services in other industries.

The review team concludes that the impact of building activities on the economy would be noticeable and beneficial in St. Clair County and minimal and beneficial elsewhere.

Taxes

Construction and operation of a plant at the Belle River-St. Clair site would result in increased tax revenues to State and local governments. State income tax revenue would accrue through income taxes on salaries of the new workers (i.e., in-migrating workers and those previously unemployed). As discussed in Section 4.4.3, based on an estimated annual average of 362 new workers (i.e., 150 in-migrating and 212 previously unemployed) during the 10-year construction period and an average salary of $50,500, the State of Michigan would receive an estimated $0.7 million in income tax revenue annually during the construction period. As discussed in Section 5.4.3, based on an estimated annual average of 327 new workers (i.e., 270 in-migrating and 57 previously unemployed) for operation of the plant and an average salary of $63,625, the State of Michigan would receive an estimated $0.8 million in income tax revenue annually during the period of the 40-year operating license. The State of Michigan would also receive tax revenue through increased sales expenditures by workers and for the plant construction, operation and maintenance, and business taxes during operation.

Property tax revenue would be the primary tax benefit to the local jurisdictions. The plant would be assessed during the construction period and be at its highest assessed value when the plant becomes operational. For analysis, the review team recognizes that the full estimated construction cost of $6.4 billion for a nuclear power plant of 1605 MW(e), as discussed in Section 4.4.3.1, may not be the actual assessed value for property tax purposes. However, for comparative purposes in the alternative sites analysis, the review team based its conclusions upon this construction cost estimate. In 2008, the taxable value of real and personal property at

Detroit Edison's existing Belle River-St. Clair Power Plants and the Greenwood Energy Center was $731 million, approximately 11 percent of the total county taxable assessed property value ($8.5 billion) (St. Clair Administrator/Controller's Office 2009). Consequently, with completion of the construction of a new nuclear plant at the Belle River site, the total assessed property value in the county would be increased by about 75 percent. The review team recognizes that this would be an upper bound to the assessed value of the property and that a fee in lieu of agreement or other considerations may significantly reduce that assessed value. However, the review team believes that the property tax impact to St. Clair County would be substantial and beneficial.

Summary of Economic Impacts and Taxes

Based on the information provided by Detroit Edison and the review team's evaluation, the review team concludes that the impact of building activities on the economy would be noticeable and beneficial in St. Clair County and minimal and beneficial elsewhere. The impact of tax revenues would be substantial and beneficial in St. Clair County and minimal and beneficial elsewhere. An annual average of 150 new construction workers would relocate into the area, and 212 workers who are currently unemployed would be employed for building activities over the 10-year construction period. A portion of the estimated $6.4 billion construction cost of the nuclear power plant would be spent on materials and supplies in the local area or would be transported into the area through the international border crossing at Port Huron/Sarnia; tax revenue to the State and local jurisdictions would accrue through personal income, sales, and property taxes and would have the largest benefit on the local jurisdictions within St. Clair County.

During operations at the Belle River plant, an estimated 270 new operations workers would relocate into the area, and 57 workers who are currently unemployed would be employed in operating the plant. Based on the information provided by Detroit Edison and the review team's evaluation, the review team concludes that the economic impact of operating the Belle River plant, including tax revenues, would be substantial and beneficial in St. Clair County and minimal and beneficial elsewhere.

Infrastructure and Community Services

Traffic

State Route 29 (M-29) separates the St. Clair plant site from the Belle River plant site and would provide direct access to the new plant site. M-29 would also be the principal route for workers commuting from communities along the shoreline and the City of Port Huron. It extends along the St. Clair River north to Marysville and south to Lake St. Clair at the southern end of St. Clair County.

Two major interstates cross the county, merging at Port Huron. Interstate 69 provides east–west access extending from the Canadian border crossing at Port Huron/Sarnia to Flint, Lansing, and Chicago. Interstate 94 extends southwest from Port Huron to the Detroit metropolitan area, approximately 35 mi southwest of Port Huron. The Blue Water Bridge crossing at Port Huron/Sarnia is a major international bridge crossing, with 4.9 million crossings in 2008 (MDOT 2009). The St. Clair River is part of the Great Lakes St. Lawrence Seaway System; the nearest port to the site is in the City of Sarnia, Canada.

Canadian National (CN) and CSX Transportation (CSX) rail systems cross St. Clair County. The CN railroad crosses the St. Clair River through an underground tunnel between Port Huron and Sarnia. A rail spur for CSX provides direct access to the plant site. The Belle River-St. Clair site can also be accessed from the St. Clair River via barge.

Most of the traffic-related concerns would be related to the commutes of the workforce. Detroit Edison's Belle River and St. Clair Power Plants already employ a large portion of the 1044 Detroit Energy employees in the county at this site, and the projected construction and operations workforces would more than double the number of employees at the site, especially during the peak construction employment period and during outages. M-29 appears to provide the most direct route for commuting between the Belle River-St Clair site and places of residence and is already a high-volume road. However, Detroit Edison, in coordination with the MDOT and St. Clair County Road Commission, would need to conduct a traffic study that would identify strategies that would mitigate the traffic to an acceptable level.

The review team expects traffic impacts from building activities and operations, including both construction workers, operations workers, and deliveries, would be noticeable but not destabilizing and would warrant mitigation in coordination with the MDOT, the Blue River Bridge Authority, and the St. Clair County Road Commission, as well as Canadian transportation agencies (i.e., Transport Canada, Ontario Ministry of Transportation, and Canadian Blue River Bridge Authority), depending on the extent of truck traffic crossing the Blue River Bridge with materials and supplies.

<u>Recreation</u>

St. Clair County Parks and Recreation Commission operates three parks in the county: Goodells County Park (327 ac), Fort Gratiot County Park (30 ac), and the Wadhams to Avoca Trail (12 mi). A fourth park, the Columbus County Park, is in development and will include 384 ac along the Belle River when complete. The State of Michigan owns 22,178 ac of park and conservation land in St. Clair County, including Algonac State Park (1450 ac in Cottrellville and Clay Townships), Lakeport State Park (1215 ac in Burtchville Township), Port Huron State Game Area (6627 ac in Grant, Clyde, and Kimball Townships), St. Clair Flats State Wildlife Area (10,300 ac in Clay Township), St. Johns March Recreation Area (2477 ac in Clay and Ira Townships), and Mini Game Area (109 ac in St. Clair Township) (St. Clair County Parks and

Recreation Commission 2007). In addition, numerous township parks are located throughout St. Clair County, and various beaches, marinas, and boat access points are located along the St. Clair River and Lake Huron shoreline (St. Clair County Parks and Recreation Commission 2007).

The recreational areas nearest to the Belle River-St. Clair site are East China Township Park, just south of the site; Algonac State Park, approximately 8 mi south of the site; and a portion of the 54-mi Bridge to Bay Trail, which extends along the St. Clair River shoreline and passes through East China Township Park.

Recreational resources in St. Clair County may be affected by construction and operation of a plant at the Belle River-St. Clair site. Impacts may include increased user demand associated with the projected increase in population from the in-migrating workforce and their families; an impaired recreational experience associated with the views of the proposed 600-ft cooling tower and steam plume; or access delays associated with increased traffic from the construction and operations workforce on local roadways.

Several small communities and recreational facilities are located along the St. Clair River near the Belle River-St. Clair site. Users of recreational resources in the vicinity of the site may be affected by the views of the 600-ft cooling tower and condensate plume that would occur during operation of the plant. A new nuclear power plant and 600-ft cooling tower and condensate plume would be visible in a wide area, because the topography in the vicinity of the site is flat and the plant would be located near the St. Clair River. Existing coal-fired power plant stacks and MDCTs, which are also capable of producing condensate plumes, are located at the site but are smaller than the proposed 600-ft cooling tower.

Because the construction of a nuclear plant adjacent to the coal plants would result in substantial increases in power capacity, it is likely that new or upgraded transmission lines would also be required, which could result in additional offsite construction and visual impacts.

Impacts associated with the increased use of the recreational resources in the vicinity and region would be minor. The projected increase in population in St. Clair County associated with in-migrating workers and their families for construction and operation is less than 1 percent of the projected 2020 population and would not affect the availability and use of recreational resources in the area.

People using recreational facilities near the site may experience traffic congestion on the roads during the construction period, during morning and afternoon commutes of the operations workforce, and during the scheduled maintenance and forced outage periods. Measures to mitigate traffic impacts, particularly along M-29, would be needed and would alleviate some of the impacts on users of recreational facilities as well as members of the general public.

However, even with mitigations, recreational users may be affected during the morning and afternoon commutes to and from the plant site.

Based upon the above information, the review team determined that the recreation-related impacts of building and operating at the alternative site would be minor.

Housing

As shown in Table 9-14, an estimated 72,027 housing units are located in St. Clair County, based on 2010 data for housing. The number of vacant units increased from 5035 to 7421 between 2000 and 2010. An estimated 31 percent of the vacant housing units were used for seasonal, recreational, or occasional purposes.

Table 9-14. Housing Units in St. Clair County (2010 Estimate)

Type of Housing Unit	St. Clair County
Total Housing Units	72,027
Occupied	64,606
Owner-occupied (units)	50,968
Owner-occupied (percent)	79
Renter-occupied (units)	13,638
Renter-occupied (percent)	21
Vacant	7421
Vacancy Rate	
Homeowner (percent)	2.2
Rental (percent)	11.6

Source: USCB 2010c

Demand for short-term housing is expected to be highest during the peak construction period, and demand for long-term housing is expected to be highest when operations commence.

Based on the analysis of impacts presented in Section 4.4.2, most of the construction and operations workforces would already reside in the area and would be accommodated in existing housing. Approximately 15 percent of the construction workforce (approximately 435 workers during the peak construction) and approximately 30 percent (approximately 270 workers) of the operations workforce would be expected to relocate within a 50-mi radius of the project site. Considering that the construction workforce may choose short-term accommodations such as campsites or hotels, the review team expects that the existing housing supply is sufficient to accommodate the construction workforce of 435 workers during the peak building-related employment period and the operations workforce of 270 workers in-migrating to the area without affecting the housing supply or prices in the local area or stimulating new housing construction. Therefore, the impacts on housing would be minor.

Public Services

In-migrating construction workforce and operations workforce would increase the demand for water supply and wastewater treatment services within the communities where they choose to reside. The size of the total construction and operations workforce also would increase the demand for water supply and wastewater treatment services at the Belle River-St. Clair site. Much of the county obtains water supplies through private wells (St. Clair County Metropolitan Planning Commission 2009). Communities with water supply and wastewater treatment services in St. Clair County are shown in Table 9-15, which indicates that most areas have excess capacity, and the water supply and wastewater treatment systems should be able to accommodate the in-migrating construction and operations workforces and their families.

Increased demand for police, fire response, and health care services from the in-migrating construction and operations workforces and their families are also expected to be accommodated within the existing systems.

Therefore, the review team expects the impacts on public services to be minor.

Education

St. Clair County has seven school districts (Algonac, Anchor Bay, Capac, East China, Marysville, Port Huron, and Yale) with a combined enrollment of 32,047 for the 2007–2008 school year (U.S. Department of Education 2010). As stated in Section 4.4.4.5, approximately 202 school-age children are expected to in-migrate into the 50-mi region during building activities, and 124 school-age children are expected to in-migrate for operations. Although they could in-migrate anywhere within the 50-mi region, if they were all to go into St. Clair County schools, it would raise the county's student population by less than 1 percent. Given the number of schools in St. Clair County and the large student enrollment, it is likely that new students from building and operating a new nuclear unit at the Belle River-St. Clair site would be absorbed easily, and education impacts would be minimal for St. Clair County and the larger 50-mi region.

Table 9-15. Water Supply and Wastewater Treatment Capacity and Demand in 2005

	Water (MGD)		Wastewater (MGD)	
Community	**Capacity**	**Demand**[(a)]	**Capacity**	**Demand**[(a)]
Algonac City	2.75	1.3	–[(b)]	–
Algonac	1.0	0.46	–	–
Clay Township	1.75	0.84	–	–
St. Clair County	–	–	2.7	1.9
Algonac	–	–	0.82	0.63
Clay Township	–	–	0.94	0.63
Ira Township	–	–	0.94	0.63
Burtchville	1.0	0.22	None	None
Capac	0.4	0.2	0.24	0.21
East China	2.7	0.6	3.35	0.85
China Township	0.27	0.06	0.34	0.08
East China Township	2.43	0.54	3.01	0.77
Ira	2.25	0.7	–	–
Marine City	2.0	0.80	7.0	0.80
Cottrellville	0.05	0.02	0.175	0.02
Marine City	1.95	0.78	6.825	0.78
Marysville	7.5	2.2	6.1	2.22
Memphis	0.39	0.09	None	None
Port Huron[(c)]	30.0	7.7	20.0	11.3
Clyde Township	0.69	0.2	None	None
Ft. Gratiot Township	5.7	1.5	3.8	1.28
Kimball Township	2.01	0.4	1.4	0.34
Port Huron City	15.9	4.1	10.8	5.74
Port Huron Township	5.7	1.5	4.0	2.1
St. Clair	3.0	1.4	1.6	1.4
St. Clair County	2.42	1.15	1.28	1.12
St. Clair Township	0.58	0.25	0.32	0.28
Yale	1.65	0.23	1.8	0.35

Source: LSL Planning, Inc. undated
(a) Average daily demand is provided for all utility systems and jurisdictions except for Port Huron. Port Huron reported peak demand.
(b) A dash indicates information was not reported for these jurisdictions.
(c) Peak demand.

Summary of Impacts on Infrastructure and Community Services at the Belle River-St. Clair Site

The review team concludes from the information provided by Detroit Edison, review of existing reconnaissance-level documentation, and its own independent evaluation that the impact of building and operations activities on regional infrastructure and community services – including recreation, housing, water and wastewater facilities, police, fire, and medical facilities, and education – would be minor. The estimated peak workforce of 2900 would have a noticeable adverse impact on traffic on local roadways near the Belle River site. These traffic-related impacts could be reduced but not eliminated with proper planning and mitigation measures.

Cumulative Impacts

The geographic area of interest for analysis of cumulative socioeconomic impacts of the Belle River-St. Clair site is St. Clair County, where most of the socioeconomic impacts of construction and operation of the Belle River-St. Clair site are expected to occur.

The impact analyses presented for the Belle River-St. Clair site are cumulative. Past and current economic impacts associated with activities listed in Table 9-9 have already been considered as part of the socioeconomic baseline or in the analyses discussed above for the Belle River-St. Clair site. Construction and operation of the Belle River-St. Clair plant could result in cumulative impacts on the demographics, economy, and community infrastructure of St. Clair County, in conjunction with those reasonably foreseeable future actions shown in Table 9-9, and generally result in increased urbanization and industrialization. However, many impacts, such as those on housing or public services, are able to adjust over time, particularly with increased tax revenues. Furthermore, State and county plans, along with modeled demographic projections, include forecasts of future development and population increases. Because the projects within the geographic area of interest identified in Table 9-9 would be consistent with applicable land use plans and control policies, the review team considers the cumulative socioeconomic impacts from the projects to be manageable. Physical impacts include impacts on workers and the general public, noise, air quality, buildings, roads, and aesthetics.

Based on the above considerations, Detroit Edison's ER, and the review team's independent evaluation, the review team concludes that under some circumstances, building a nuclear reactor at the Belle River-St. Clair alternative site could make a temporary small adverse contribution to the cumulative effects associated with some socioeconomic issues. Those impacts would include physical impacts (workers and the general public, noise, air quality, buildings, roads, and aesthetics), demography, and local infrastructures and community services (traffic; recreation; housing; water and wastewater facilities; police, fire, and health care services; and education) and would depend on the particular jurisdictions affected.

The cumulative effects on regional economies and tax revenues would be beneficial and SMALL, with the exception of St. Clair County, which would receive a MODERATE and beneficial cumulative effect on the economy and a LARGE and beneficial cumulative effect from property taxes. The cumulative effects on physical impacts, demography, and infrastructure and community services would be SMALL within the 50-mi region, except for a MODERATE and adverse cumulative effect on local traffic near the Belle River-St. Clair site. Building and operating a new nuclear unit at the Belle River-St. Clair alternative site would be a significant contributor to the cumulative impacts.

9.3.3.6 Environmental Justice

The economic impact area for the Belle River-St. Clair alternative site is St. Clair County, Michigan. To evaluate the distribution of minority and low-income populations near the Belle River-St. Clair site, the review team conducted a demographic analysis of populations within the 50-mi region surrounding the proposed site in accordance with the methodology discussed in Section 2.6.1 of this EIS. The results of this analysis are displayed in Tables 9-16 and 9-17 and Figures 9-3, 9-4, 9-5, and 9-6.

In general, the review team found the population within the 50-mi region surrounding the Belle River plant to be similar in demographic distribution to the 50-mi region surrounding the proposed Fermi 3 site: rural, with few representative minority or low-income populations of interest outside the urban areas (for the Belle River site, these urban areas are near the southwestern boundary of the 50-mi region). Because the review team identified St. Clair County as the economic impact area for the Belle Rive-St. Clair alternative site, the review team focused its analysis upon the minority and low-income populations within St. Clair County. The economic impact area of St. Clair County was representative of that characterization, with only one minority population of interest (a Black or African American population between 10 and

Table 9-16. Results of the Census Block Group Analysis for Minority Populations of Interest within the Region Surrounding the Belle River-St. Clair Alternative Site (50-mi radius)

County	Total Number of Census Block Groups in the 50-mi Region	Number of Census Block Groups with Minority Populations of Interest					
		Black	American Indian	Asian	Pacific Islander	Hispanic	Aggregate
Genesee	1	0	0	0	0	0	0
Lapeer	57	1	0	0	0	3	1
Macomb	627	36	0	5	0	6	36
Oakland	771	132	0	27	0	26	156
Sanilac	33	0	0	0	0	0	0
St. Clair[(a)]	138	2	0	0	0	0	2
Tuscola	1	0	0	0	0	0	0
Wayne	1158	859	0	17	0	65	909
Total	**2786**	**1030**	**0**	**49**	**0**	**100**	**1104**

Source: USCB 2010d
(a) Shaded row indicates the economic impact area.

Table 9-17. Results of the Census Block Group Analysis for Low-Income Populations of Interest within the 50-mi Region of the Belle River-St. Clair Alternative Site

County	Total Number of Census Block Groups in the 50-mi Region	Census Block Groups with Low-Income Populations of Interest	
		Number	Percentage
Genesee	1	0	0
Lapeer	57	0	0
Macomb	627	26	4.1
Oakland	771	40	5.2
Sanilac	33	0	0
St. Clair[(a)]	138	11	8.0
Tuscola	1	0	0
Wayne	1158	453	39.1
Total	**2786**	**530**	**19.0**

Source: USCB 2010e
(a) Shaded row indicates the economic impact area.

15 mi north of the plant near the Canadian border). This was the closest population of interest to the Belle River alternative site. The four identified low-income populations of interest included that same minority Census block group, as well as three others slightly farther north of the alternative site.

Based on this analysis, the review team determines that there do not appear to be any identified minority or low-income populations of interest in St. Clair County that would be likely to experience disproportionate and adverse human health, environmental, physical, or socioeconomic effects as a result of construction or operation of a plant at the Belle River-St. Clair site. The review team did not identify any subsistence activities in St. Clair County. For the other physical and environmental pathways described in Section 2.6.1, the review team determined that impacts at the Belle River-St. Clair site would be similar to those at the Fermi 3 site. Therefore, the review team determines the environmental justice impacts of building and operating a nuclear reactor at the Belle River-St. Clair site would be SMALL

9.3.3.7 Historic and Cultural Resources

This section presents the review team's evaluation of the potential impacts of siting a new ESBWR at the Belle River-St. Clair site on historic and cultural resources. For the analysis of impacts on historic and cultural resources, the geographic area of interest is considered to be the area of potential effects (APE) that would be defined for a new nuclear power facility at the site. This includes the physical APE, defined as the area directly affected by building and

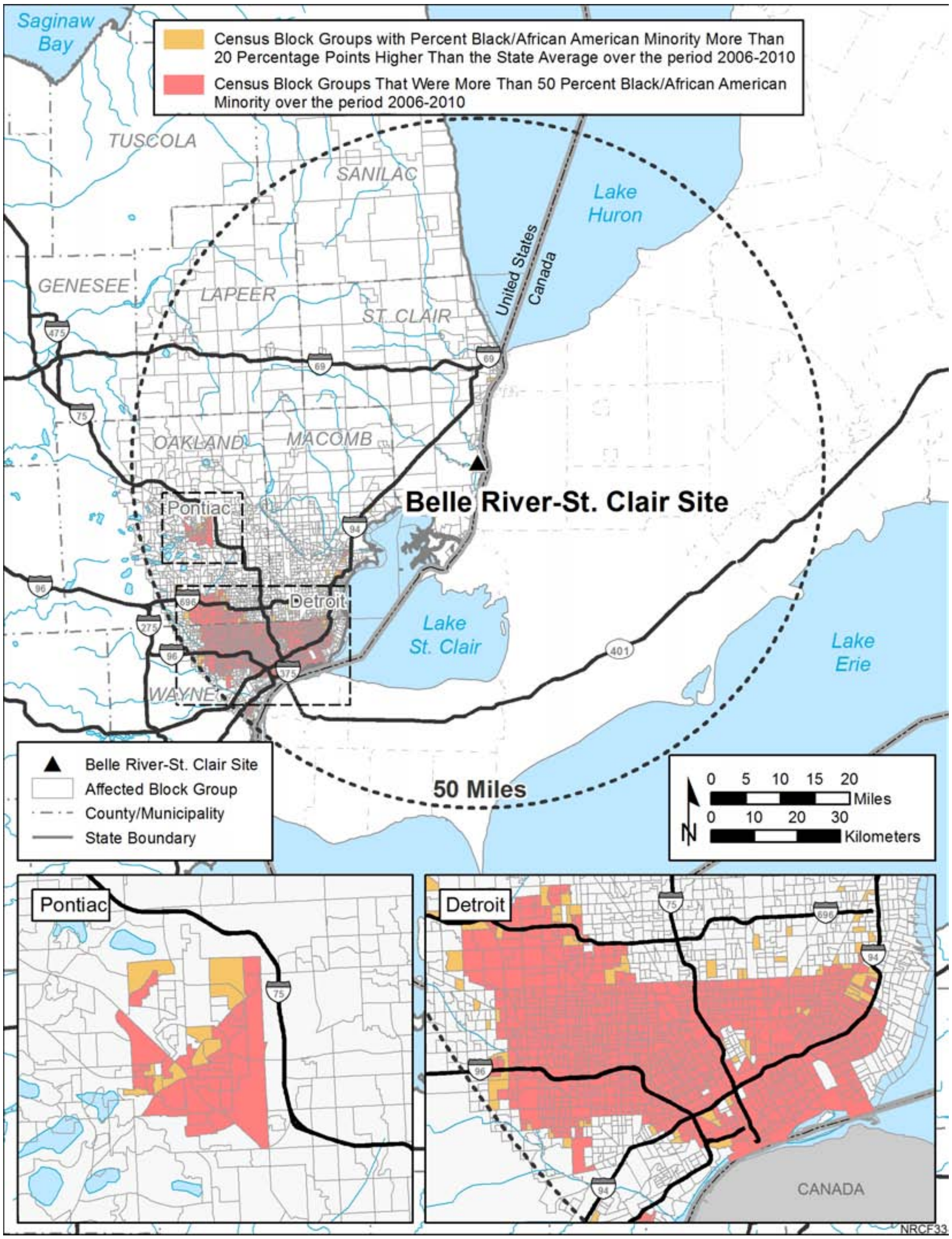

Figure 9-3. Black and African-American Minority Census Block Group Populations of Interest within a 50-mi Radius of the Belle River-St. Clair Site (USCB 2010d)

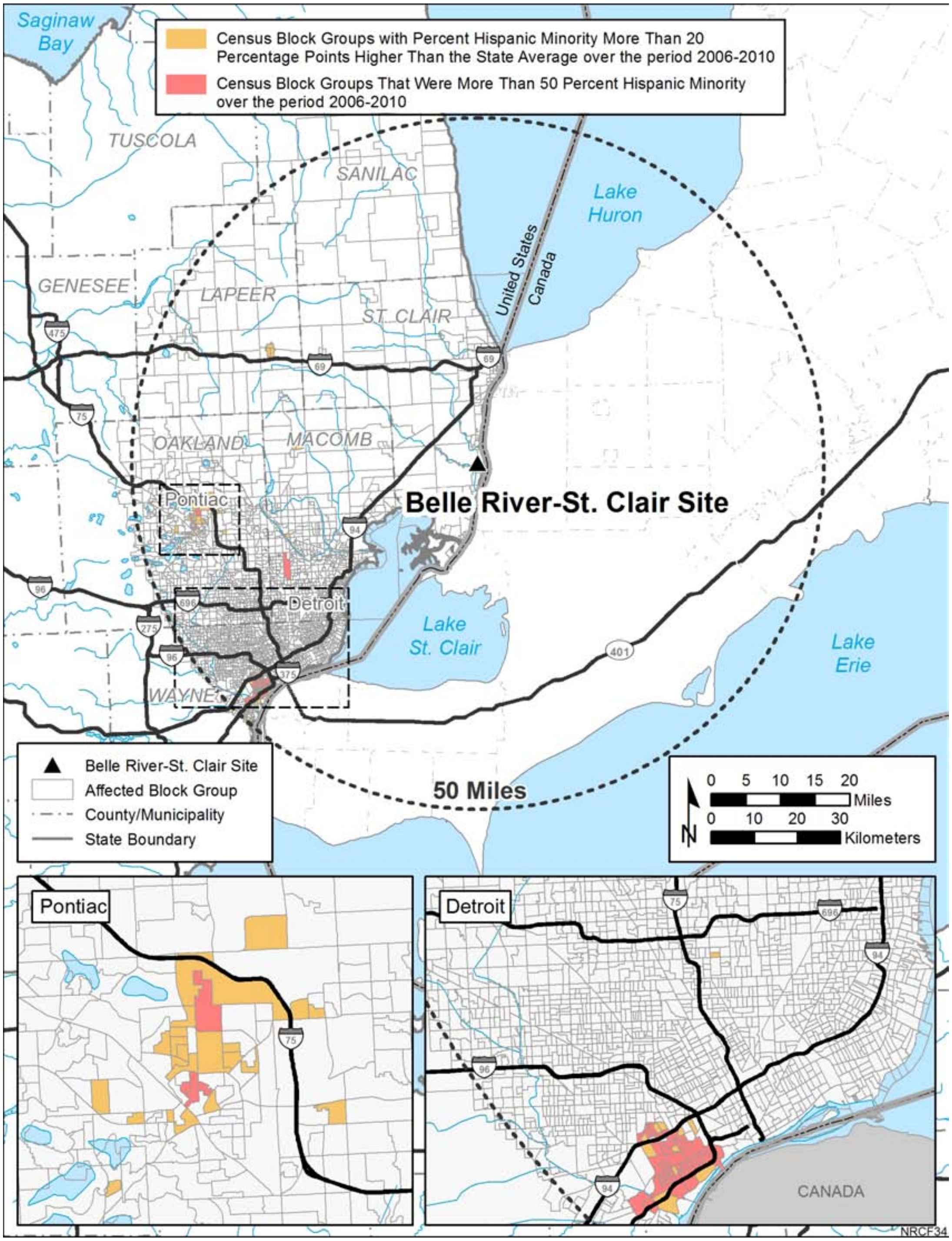

Figure 9-4. Hispanic Minority Census Block Group Populations of Interest within a 50-mi Radius of the Belle River-St. Clair Site (USCB 2010d)

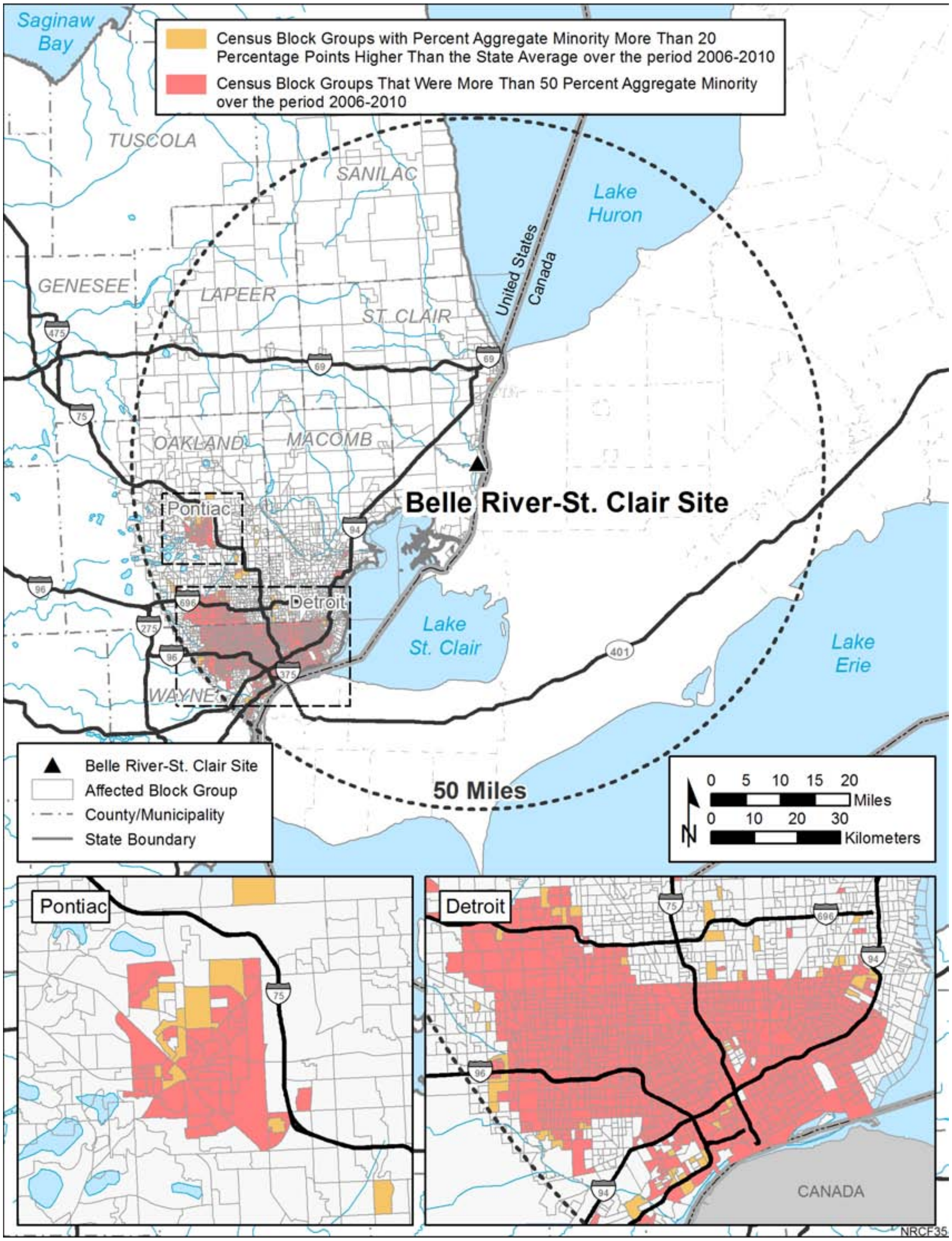

Figure 9-5. Aggregate Minority Census Block Group Populations of Interest within a 50-mi Radius of the Belle River-St. Clair Site (USCB 2010d)

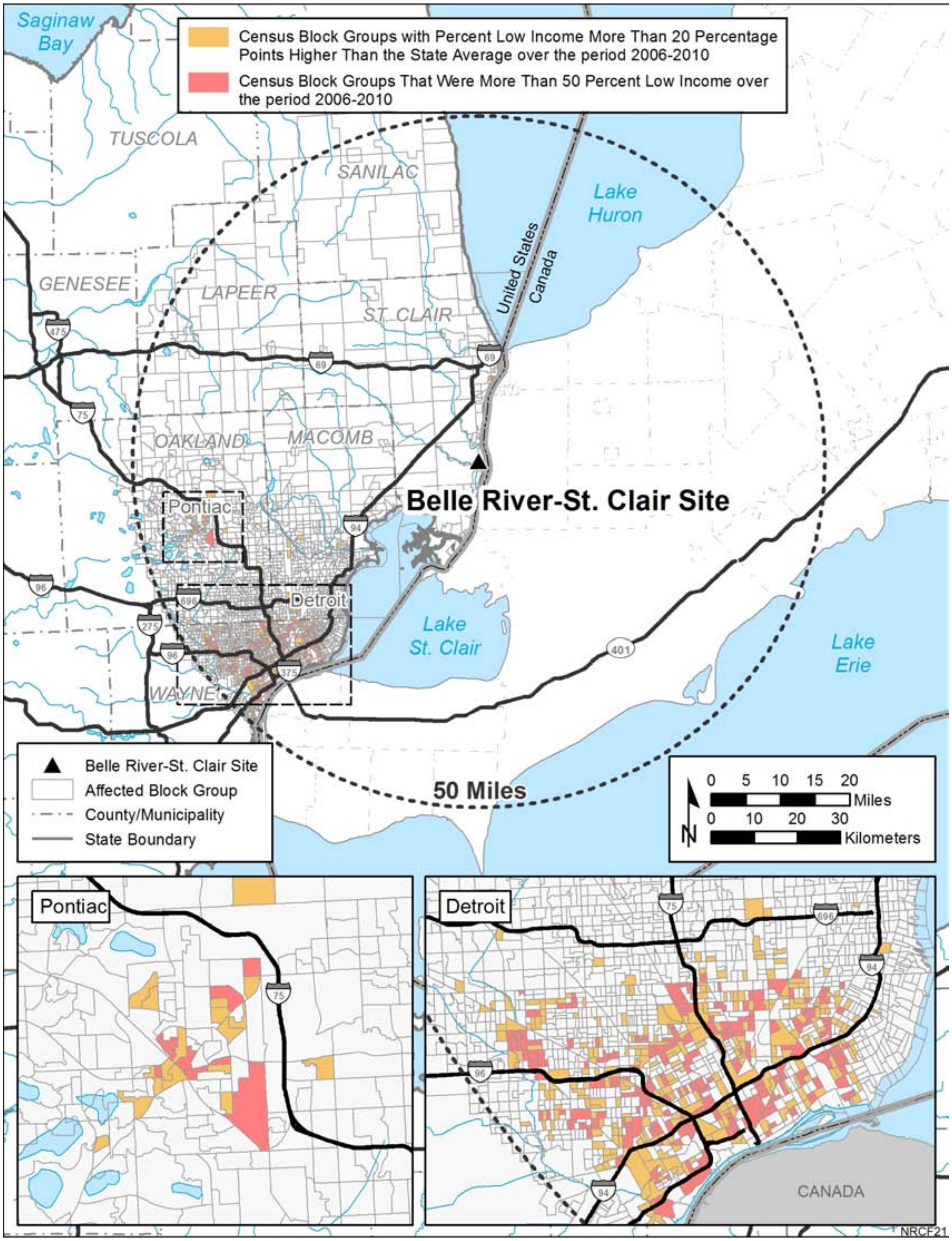

Figure 9-6. Low-Income Census Block Group Populations of Interest within a 50-mi Radius of the Belle River-St. Clair Site (USCB 2010e)

operating a new nuclear power plant and transmission lines, and the visual APE (i.e., the area from which the structures can be seen). The visual APE includes the area within 1 mi of the physical APE.

The review team relied upon reconnaissance-level information to perform the alternative site evaluation. Reconnaissance-level activities in a cultural resources review have particular meaning. For example, these activities may include site file searches, background research for environmental and cultural contexts, and preliminary field investigations to confirm the presence or absence of cultural resources in an APE or the sensitivity of an APE for cultural resources. For the preparation of this alternatives analysis, reconnaissance-level information is considered to be data readily available from Federal and State agencies and other public sources. The following sources were used to identify reconnaissance-level information on historic and cultural resources in the APE at the Belle River-St. Clair site:

- National Park Service's (NPS's) National Historic Landmarks Program database for designated National Historic Landmarks (NPS 2010a).
- NPS's NRHP database for properties listed in the NRHP (NPS 2010b).
- NationalRegisterofHistoricPlaces.com database for properties listed in the NRHP (NRHP 2010).
- Michigan's Historic Sites Online database for cultural resources significant to the State of Michigan (MSHDA 2010a).
- Parks Canada's Federal Historic Buildings Review Office Register for designated Federal Heritage Buildings (Parks Canada 2010a).
- Parks Canada's Historic Sites and Monuments Board of Canada databases for designated National Historic Sites and Monuments (Parks Canada 2010b).
- Parks Canada's Canadian Register of Historic Places for recognized historic places of local, provincial, territorial, and national significance (Parks Canada 2010c).
- Parks Canada's list of National Historic Sites of Canada administered by Parks Canada (Parks Canada 2010d).
- Ontario Ministry of Culture's Ontario Heritage Properties Database for heritage properties designated by municipal bylaw under Parts IV or V of the Ontario Heritage Act of 1975, as amended; protected by a municipal heritage easement; owned by the Ontario Heritage Trust; protected by an Ontario Heritage Trust conservation easement; listed on the Ontario Heritage Bridge List; protected by the Federal Heritage Railway Stations Protection Act of 1985, as amended; designated as a National Historic Site; or listed in the Canadian Register of Heritage Properties (Ontario Ministry of Culture 2008).
- Ontario Ministry of Culture's list of community museums (Ontario Ministry of Culture 2009).

- The Architectural Conservancy of Ontario (The Architectural Conservancy of Ontario 2010).
- Ontario Heritage Trust's Online Plaque Guide (Ontario Heritage Trust 2010).
- Detroit Edison's ER (Detroit Edison 2011a).
- *Cultural Resources Site File Review of Seven Alternative Sites in Monroe, Lenawee, St. Clair, and Huron Counties, Michigan, Fermi Nuclear Power Plant Unit 3 (Fermi 3) Project, Frenchtown and Berlin Townships, Monroe County, Michigan* (Lillis-Warwick et al. 2009).

Within the portion of the APE in Michigan, no National Historic Landmarks or other historic properties listed in the NRHP were identified (NPS 2010a, b; NRHP 2010). Three previously recorded cultural resources have been identified within the APE in Michigan (MSHDA 2010a). Two are archaeological resources (Sites 20SC153 and 20SC71); one is an architectural resource (the East China Fractional District School No. 2, Site ID#P24687). None of these previously recorded cultural resources have been included in, or determined eligible for inclusion in, the NRHP. Therefore, none of these three previously recorded cultural resources are considered a historic property, pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA).

Archaeological Site 20SC153 is a late-nineteenth to early-twentieth century farmstead located entirely within the physical APE for the Belle River-St. Clair site. It was determined not eligible for inclusion in the NRHP in 1999. Archaeological Site 20SC71 is a prehistoric archaeological site of unknown cultural affiliation and unknown function, which is located partially within the physical APE for the Belle River-St. Clair site. It has not been evaluated for NRHP eligibility (Lillis-Warwick et al. 2009).

The East China Fractional District School No. 2 (Site ID #P24687) property is a late-nineteenth century brick schoolhouse approximately 0.5 mi outside of the physical APE, within the visual APE for the Belle River-St. Clair site. It is the remaining example of only three nineteenth-century schoolhouses constructed in East China Township in St. Clair County. It is the second schoolhouse on the property, replacing an earlier frame schoolhouse, and was constructed circa 1873. The last classes were held there in 1954, and it was restored for use as a local museum between 1988 and 1991. It was listed on the *Michigan State Register of Historic Places* (SRHP) in 1991, and the State of Michigan erected a historical marker in front of it in 1993. However, it has not been evaluated for NRHP eligibility (Lillis-Warwick et al. 2009; East China Township 2010; MSHDA 2010b). Additional properties that are listed in the NRHP are located approximately 4 mi to the north in Marine City and approximately 4 mi to the south in St. Clair (Detroit Edison 2011a). These additional NRHP-listed properties are outside of the visual APE for the Belle River-St. Clair site.

No archaeological or architectural surveys have been conducted at the alternative site to identify additional cultural resources in the portion of the APE in Michigan and/or to determine or confirm the significance (NRHP-eligibility) of the previously identified cultural resources in the APE in Michigan. As currently designed, a new nuclear power plant at the Belle River-St. Clair site has the potential to affect two of the previously identified resources. The proposed layout for the Belle River-St. Clair site is proximate to archaeological sites 20SC153 and 20SC71 and may result in disturbance or destruction during preconstruction and construction activities. Site 20SC153 was previously determined not eligible for listing in the NRHP by the Michigan SHPO in 1999 (Lillis-Warwick et al. 2009). Because this archaeological resource is not considered a historic property, a new nuclear power facility at the Belle River-St. Clair site would have no effect on this resource pursuant to 36 CFR Part 800. Site 20SC71 would have to be evaluated for NRHP eligibility to determine the effect of a new nuclear power facility at the Belle River-St. Clair site on this resource, pursuant to 36 CFR Part 800. The proposed layout for the Belle River-St. Clair site includes structures (buildings and cooling towers) and operational activities (condensation plumes) that would be new landscape elements in viewsheds from East China Fractional District No. 2 School and would result in indirect (visual) impacts on this architectural resource. This architectural resource would have to be evaluated for NRHP eligibility to determine the effect of a new nuclear power facility at the Belle River-St. Clair site on this resource pursuant to 36 CFR Part 800.

Consultation with the Michigan SHPO would be necessary to determine the need for cultural resources investigations (including archaeological and architectural surveys) to identify cultural resources within the portion of the APE in Michigan and prior to any onsite ground-disturbing activities, to determine whether any identified cultural resources are eligible for inclusion in the NRHP, to evaluate the potential impacts on cultural resources and historic properties, and to determine the effect of a new nuclear power facility at the Belle River-St. Clair site pursuant to Section 106 of the NHPA. As part of this consultation, Detroit Edison would be expected to put protective measures in place to protect discoveries in the event that cultural resources were found during building or operation of a new plant. If an unanticipated discovery was made during building activities, site personnel would have to notify the Michigan SHPO and consult with it in conducting an assessment of the discovery to determine whether additional work is needed.

The incremental impacts from installation and operation of offsite transmission lines would be minimal if there were no significant alterations (either physical alteration or visual intrusion) to the cultural environment. If these activities resulted in significant alterations to the cultural environment, then the impact could be greater. Construction and operation of the offsite transmission lines would be the responsibility of a transmission company. For impacts greater than small, mitigation might be developed by the transmission company in consultation with the appropriate Federal and State regulatory authorities. Only Federal undertakings would require a Section 106 review.

A portion of the visual impact APE extends east across the St. Clair River into St. Clair Township, which is in Lambton County, in Ontario, Canada. No previously identified Federal, provincial, or municipal heritage properties, historic sites, or other cultural resources were identified within the Ontario portion of the visual APE for the Belle River-St. Clair site (Parks Canada 2010a, b, c; Ontario Ministry of Culture 2008, 2009; The Architectural Conservancy of Ontario 2010; Ontario Heritage Trust 2010; The Corporation of the County of Lambton 2010). The NRC would consider the need to consult with Parks Canada, the Ontario Ministry of Culture, and local municipalities regarding indirect impacts on potential heritage properties, historic sites, or other cultural resources within the Ontario portion of the APE.

The portion of the APE in Michigan does not contain any Indian reservation land, and no Federally recognized Indian Tribes have indicated an interest in St. Clair County (BIA undated; NPS 2010c). However, consultation with Federally recognized Indian Tribes in the State of Michigan would be necessary in accordance with Section 106 of the NHPA. As part of this consultation, the NRC would consult with all 12 Federally recognized Indian Tribes that are located within the State of Michigan, as identified for the Fermi site (Michigan Department of Human Services 2001–2009). The portion of the APE in Ontario does not contain any First Nation Reserve land. However, prior to Euro-American settlement, the APE in both Michigan and Ontario may have been settled and/or used by groups now located within Canada.[a] In Canada, these groups are often called First Nations.[b] Two First Nation reserves are located outside, but in the general vicinity of, the portion of the APE in Ontario, Canada: Sarnia Reserve 45 and Walpole Island Reserve 46 (INAC 2010). Sarnia Reserve 45 is located approximately 15 mi north of the Belle River-St. Clair site, on the eastern side of the St. Clair River near Sarnia, Ontario. The Aamjiwnaang First Nation is associated with Sarnia Reserve 45. Walpole Island Reserve 46 is located approximately 15 mi south of the Belle River-St. Clair site, on the eastern side of the St. Clair River near Wallaceburg, Ontario. The Walpole Island First Nation is associated with Walpole Island Reserve 46. Additional First Nation reserves are located farther to the north and east in southern Ontario (see Table 9-18)

(a) The Canadian government recognizes the original inhabitants of North America as Aboriginal peoples. There are three formally recognized Aboriginal groups: Indians, Métis, and Inuits. Indians comprise three legally defined groups: Status Indians (people who are registered as Indians under the Indian Act of 1876, as amended [Indian Act], which specifies the requirements for determining who is an Indian for the purposes of the Indian Act); non-Status Indians (people who are Indians but are not registered as Indians under the Indian Act); and Treaty Indians (Status Indians who belong to a First Nation that signed a Treaty with the Crown). Métis comprise people of “mixed First Nation and European ancestry who identify themselves as Métis, as distinct from First Nations people, Inuit, or non-Aboriginal people.” Inuit comprise “Aboriginal people in Northern Canada, who live in Nunavut, Northwest Territories, Northern Quebec and Northern Labrador” (INAC 2009).

(b) First Nations is a term that came into common usage in the 1970s to replace the word “Indian,” which some people found offensive. Although the term First Nation is widely used, no legal definition of it exists. Among its uses, the term “First Nations peoples” refers to the Indian peoples in Canada, both Status and non-Status. Some Indian peoples have also adopted the term “First Nation” to replace the word “band” in the name of their community (INAC 2009).

Table 9-18. First Nations and First Nation Reserves in Southwestern Ontario

First Nation	Reserve	Approximate Distance and Direction from the Belle River/ St. Clair Site	Approximate Distance and Direction from the Greenwood Site	Closest Town or City
Aamjiwnaang First Nation	Sarnia Reserve 45	15 mi north	15 mi southeast	Sarnia, Ontario
Walpole Island First Nation	Walpole Island Reserve 46	15 mi south	30 mi southeast	Wallaceburg, Ontario
Moravian of the Thames	Moravian Indian Reserve 47	30 mi southeast	50 mi southeast	Thamesville, Ontario
Chippewas of Kettle and Stony Point	Kettle Point Reserve 44	40 mi northeast	30 mi east	Forest, Ontario
Caldwell	None	55 mi southeast	65 mi southeast	Blenheim, Ontario
Chippewas of the Thames First Nation	Chippewas of Thames First Nation Reserve 42	50 mi east	70 mi east	Muncey, Ontario
Munsee-Delaware Nation	Munsee-Delaware Nation 1	50 mi east	70 mi east	Muncey, Ontario
Oneida Nation of the Thames	Oneida Indian Reserve 41	45 mi east	70 mi east	Southwold, Ontario

Source: INAC 2010

(INAC 2010). The review team would consider the need to consult with INAC and First Nations to determine any concerns regarding physical (direct) or visual (indirect) impacts on cultural resources within the APE.

The following cumulative impact analysis for historic and cultural resources includes building and operating a new nuclear power facility at the Belle River-St. Clair site. This analysis also considers other past, present, and reasonably foreseeable future actions that could affect historic and cultural resources, as identified in Table 9-9. The APE for the cumulative impact analysis for historic and cultural resources for the Belle River-St. Clair site consists of the alternative site area and any new transmission line corridors, and a 1-mi buffer area around the site and the corridors.

The Belle River-St. Clair site includes areas of agricultural land, some young forest, and previous development (e.g., power plants, aboveground transmission lines, pipelines, roads, and railroads). Agricultural activities such as plowing, disking, and harvesting (whether historic or modern [mid-nineteenth to mid-twentieth century]) and logging or clearing of original forests (prior to the reestablishment of the existing young forested areas) are likely to have resulted in minimal subsurface disturbance, suggesting that at least some areas at the Belle River-St. Clair site, which are currently used for agricultural purposes or as woodland, may have sustained minimal prior ground disturbance. Other areas at the site are likely to have undergone significant prior disturbance during previous development. Past actions at the Belle River-St. Clair site that may have destroyed, disturbed, or otherwise affected onsite historic and cultural resources in the APE may have included construction and operation of the existing Belle River and St. Clair Power Plants, River Road, State Route 29, CSX rail lines, and an existing 345-kV transmission line.

Additional past actions onsite or in the general vicinity of the Belle River-St. Clair site, as identified in Table 9-9, may have also indirectly (visually) affected cultural resources within the visual APE. These past actions would have included construction and operation of the Greenfield Energy Center and the Lambton Generating Station, located approximately 1 mi east and northeast, across the St. Clair River, respectively. Additional past actions, such as construction and operation of the Marysville Power Plant, approximately 10 mi north on the St. Clair River, and recently completed or proposed projects, such as the Suncor Ethanol Production Project and the Suncor Ethanol Plant Phase II Project, more than 20 mi north of the Belle River-St. Clair site, in Ontario, Canada, would likely be too far to incur cumulative indirect (visual) impacts on historic or cultural resources within the APE at the Belle River-St. Clair site. Because a new nuclear power facility at the Belle River-St. Clair site would be located on property that already contains the existing Belle River and St. Clair power plants, it is likely that the proposed project would not result in new significant indirect (visual) impacts on cultural resources within the visual APE.

Based on reconnaissance-level information provided by Detroit Edison and identified by the review team and on the review team's independent evaluation of this information, the review team concludes that the cumulative impacts on historic and cultural resources from building and operating a new nuclear power facility at the Belle River-St. Clair site would be SMALL. A SMALL impact determination is based on available reconnaissance information, which indicates that no known historic properties would be affected (one previously identified cultural resource within the APE has been determined not to be NRHP eligible; the other two previously identified cultural resources within the APE have not been evaluated for NRHP eligibility) and that the five existing and operating power plants or generating facilities onsite or within 1 to 10 mi of the Belle River-St. Clair site are already landscape elements of the existing visual setting for the Belle River-St. Clair site. However, if a new nuclear power facility were to be developed at the Belle River-St. Clair site, then cultural resources investigations within the APE and for any proposed transmission lines may reveal important historic or cultural resources that could result in greater cumulative impacts.

9.3.3.8 Air Quality

Criteria Pollutants

For a plant with the same capacity as the proposed Fermi 3 plant, the emissions from building and operating a nuclear power plant at the Belle River-St. Clair site are assumed to be comparable to those from Fermi 3, as described in Chapters 4 and 5. The alternative site is located in St. Clair County, about 1 mi west of the United States–Canada border. St. Clair County is in the Metropolitan Detroit-Port Huron Intrastate Air Quality Control Region (AQCR) (40 CFR 81.37). Currently St. Clair County is designated as a nonattainment area for $PM_{2.5}$ NAAQS and as a maintenance area for 8-hr ozone NAAQS (EPA 2010b). In July 2011, the MDEQ submitted a request asking the EPA to redesignate Southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011). In July 2012, the EPA issued a proposed rule designating southeastern Michigan as having attained both the 1997 annual $PM_{2.5}$ NAAQS and the 2006 24-hour $PM_{2.5}$ NAAQS, based on 2009–2011 ambient air monitoring data (77 FR 39659, dated July 5, 2012), but the final determination has yet to be made.

In Sections 4.7 and 5.7, the review team concludes that air quality impacts of building and operating a plant at Fermi 3, including those associated with transmission lines and cooling towers, would be SMALL, as long as appropriate measures are taken to mitigate dust during building activities. During operation, cooling towers would be the primary source of $PM_{2.5}$, which accounts for most of the total $PM_{2.5}$ emissions of 9.51 tons/yr at Fermi 3. However, these emissions would be relatively small and thus are not anticipated to elevate $PM_{2.5}$ concentrations in a designated nonattainment area. With dust mitigation, the impacts of building and operating a plant at the Belle River-St. Clair site would also be SMALL. Any new industrial projects would either be small or subject to permitting by the MDEQ. State permits are issued under regulations approved by the EPA and deemed sufficient to attain and maintain the NAAQS and comply with other Federal requirements under the CAA. Thus, the cumulative air quality impacts of building and operating a plant at the Belle River-St. Clair site would be SMALL.

Greenhouse Gases

The extent and nature of climate change is not sensitive to where GHGs are emitted, because the long atmospheric lifetimes of GHGs result in extensive transport and mixing of these gases. Since the emissions of a plant at the Belle River-St. Clair site would be comparable to those of a similar plant at the Fermi 3 site, the discussions of Sections 4.7 and 5.7 for Fermi 3 also apply to building and operating a similar plant at the Belle River-St. Clair site. Thus, the impacts of the plant's GHG emissions on climate change would be SMALL, but the cumulative impacts considering global emissions would be MODERATE. Building and operating a new nuclear unit at the Belle River site would not be a significant contributor to these impacts.

9.3.3.9 Nonradiological Health

The following impact analysis considers nonradiological health impacts from building activities and operations on the public and workers from a new nuclear facility at the Belle River-St. Clair alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect nonradiological health, including other Federal and non-Federal projects and those projects listed in Table 9-9 within the geographic area of interest. The building-related activities with the potential to affect the health of members of the public and workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the transport of construction materials and personnel to and from the site. The operation-related activities with the potential to affect the health of members of the public and workers include exposure to etiological agents, noise, EMFs, and the transport of workers to and from the site.

Most of the nonradiological impacts of building and operation (e.g., noise, etiological agents, and occupational injuries) would be localized and would not have significant impact at offsite locations. However, activities such as vehicle emissions from transport of personnel to and from the site would encompass a larger area. Therefore, for nonradiological health impacts, the geographic area of interest for cumulative impacts analysis includes projects within a 50-mi radius of the Belle River-St. Clair site based on the influence of vehicle and other air emissions sources, because the site is in a nonattainment area (Section 9.3.3.8). For cumulative impacts associated with transmission lines, the geographical area of interest is the transmission line corridor. These geographical areas are expected to encompass areas where public and worker health could be influenced by the proposed project and associated transmission lines, in combination with any past, present, or reasonably foreseeable future actions.

Building Impacts

Nonradiological health impacts on the construction workers from building a new nuclear unit at the Belle River-St. Clair site would be similar to those for building Fermi 3 at the Fermi site as evaluated in Section 4.8. These impacts include occupational injuries, noise, odor, vehicle exhaust, and dust. Applicable Federal, State, and local regulations on air quality and noise would be complied with during the plant construction phase. The Belle River-St. Clair site does not have any characteristics that would be expected to lead to fewer or more construction accidents than would be expected for the Fermi site. The site is in a predominantly rural area, and construction impacts on the surrounding populations, which are classified as medium- and low-population areas, would likely be minimal. Access routes to the site for construction workers would include State Route 29, which is already a high-volume road. Mitigation may be necessary to ease congestion, thereby improving traffic flow and reducing nonradiological health impacts (i.e., traffic accidents, injuries, and fatalities) during the building period.

Operational Impacts

Nonradiological health impacts on occupational health of workers and members of the public from operation of a new nuclear unit at the Belle River-St. Clair site would be similar to those evaluated in Section 5.8 for the Fermi site. Occupational health impacts on workers (e.g., falls, electric shock, or exposure to other hazards) at the Belle River-St. Clair site would likely be the same as those evaluated for workers at the new unit at the Fermi site. The average flow rate of St. Clair River is 188,000 ft^3/sec, which is large enough to support closed cycle NDCTs. Discharges to the river would be controlled by NPDES permits issued by MDEQ (Section 9.3.3.2). The growth of etiological agents would not be significantly encouraged at the Belle River-St. Clair site because of the large flow rate of the St. Clair River (i.e., >100,000 ft^3/sec; see p. 5.3.4-7 of NRC 2000). Noise and EMF exposure would be monitored and controlled in accordance with applicable Occupational Safety and Health Administration (OSHA) regulations. Effects of EMFs on human health would be controlled and minimized by conformance with National Electrical Safety Code (NESC) criteria. Nonradiological impacts of traffic during operations would be less than the impacts during building. Mitigation measures taken during building to improve traffic flow would also minimize impacts during operation of a new unit.

Cumulative Impacts

Past and present actions within the geographic area of interest that could contribute to cumulative nonradiological health impacts include the energy and mining projects in Table 9-9, as well as vehicle emissions and existing urbanization. Reasonably foreseeable future projects in the geographical area of interest that could contribute to cumulative nonradiological health impacts include construction of the proposed I-94 Black River Bridge Replacement in Port Huron and the two proposed energy projects, future transmission line development, and future urbanization.

The review team is also aware of the potential climate changes that could affect human health. A recent compilation of the state of the knowledge in this area (USGCRP 2009) has been considered in the preparation of this EIS. Projected changes in the climate for the region include an increase in average temperature, increased likelihood of drought in summer, more heavy downpours, and an increase in precipitation, especially in the winter and spring, which may alter the presence of microorganisms and parasites. In view of the water source characteristics, the review team did not identify anything that would alter its conclusion regarding the presence of etiological agents or change in the incidence of waterborne diseases.

Summary of Nonradiological Health Impacts at the Belle River-St. Clair Site

Based on the information provided by Detroit Edison and the review team's independent evaluation, the review team expects that the impacts on nonradiological health from building and operation of a new nuclear unit at the Belle River-St. Clair site would be similar to the impacts evaluated for the Fermi site. Although there are past, present, and future activities in the geographical area of interest that could affect nonradiological health in ways similar to the building and operation of a new unit at the Belle River-St. Clair site, those impacts would be localized and managed through adherence to existing regulatory requirements. Similarly, impacts of a new nuclear unit operating at the Belle River-St. Clair site on public health would be expected to be minimal. The review team concludes, therefore, that the cumulative impacts of building and operation of a nuclear unit at Belle River-St. Clair on nonradiological health would be SMALL.

9.3.3.10 Radiological Health

The following impact analysis considers radiological impacts on the public and workers from building activities and operations for one nuclear unit at the Belle River-St. Clair alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health, including other Federal and non-Federal projects and those projects listed in Table 9-9 within the geographic area of interest. The geographic area of interest is the area within a 50-mi radius of the Belle River-St. Clair site. As described in Section 9.3.3, the Belle River-St. Clair property contains two Detroit Edison-owned non-nuclear power plants. There are currently no nuclear facilities on the site or within a 50-mi radius. In addition, there are likely to be medical, industrial, and research facilities within 50 mi of the Belle River-St. Clair site that use radioactive materials.

The radiological impacts of building and operating the proposed ESBWR unit at the Belle River-St. Clair site include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways would result in low doses to people and biota offsite that would be well below regulatory limits. These impacts are expected to be similar to those at the proposed Fermi site.

The NRC staff concludes that the dose from direct radiation and effluents from medical, industrial, and research facilities that use radioactive materials would be an insignificant contribution to the cumulative impact around the Belle River-St. Clair site. This conclusion is based on data from radiological environmental monitoring programs conducted around currently operating nuclear power plants. Based on the information provided by Detroit Edison and the NRC staff's independent analysis, the NRC staff concludes that the cumulative radiological impacts from building and operating the proposed ESBWR advanced reactor and other existing projects and actions in the geographic area of interest around the Belle River-St. Clair site would be SMALL.

9.3.3.11 Postulated Accidents

The following impact analysis considers radiological impacts from postulated accidents during operation of a nuclear unit at the Belle River-St. Clair alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health from postulated accidents, including other Federal and non-Federal projects and those projects listed in Table 9-9 within the geographic area of interest. As described in Section 9.3.3, the Belle River-St. Clair site is an active power generation site; however, there are currently no nuclear facilities on the site. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Belle River-St. Clair site. Existing facilities potentially affecting radiological accident risk within this geographic area of interest are Fermi 2 and Davis-Besse, because the 50-mi radii for Fermi 2 and Davis-Besse overlap part of the 50-mi radius for the Belle River-St. Clair site. No other reactors have been proposed within the geographic area of interest.

As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of design-basis accidents (DBAs) at the proposed Fermi site would be minimal for an ESBWR. DBAs are addressed specifically to demonstrate that a reactor design is sufficiently robust to meet NRC safety criteria. The ESBWR design is independent of site conditions, and the meteorologies of the alternative and the proposed Fermi sites are similar; therefore, the NRC staff concludes that the environmental consequences of DBAs at the site would be SMALL.

Because the meteorology, population distribution, and land use for the Belle River-St. Clair site are expected to be similar to the proposed Fermi site, risks from a severe accident for an ESBWR located at the Belle River-St. Clair site are expected to be similar to those analyzed for the proposed Fermi site. These risks for the proposed Fermi site are presented in Tables 5-34 and 5-35 of this EIS and are well below the mean and median values for current-generation reactors. In addition, as discussed in Section 5.11.2, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028). For existing plants within the geographic area of interest (i.e., Fermi 2 and Davis-Besse), the Commission has determined the probability-weighted consequences of severe accidents are small (10 CFR Part 51, Appendix B, Table B-1). Because of the NRC's safety review criteria, it is expected that risks for any new reactors at any other locations within geographic area of interest for the Belle River-St. Clair site would be well below risks for current-generation reactors and would meet the Commission's safety goals. The severe accident risk due to any particular nuclear power plant becomes smaller as the distance from that plant increases. However, the combined risk at any location within 50 mi of the Belle River-St. Clair site would be bounded by the sum of risks for all these operating nuclear power plants and would still be low.

On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Belle River-St. Clair site would be SMALL.

9.3.4 Greenwood Site

This section presents the review team's evaluation of the potential environmental impacts of siting a nuclear reactor at the Greenwood Energy Center. The following sections describe a cumulative impact assessment conducted for each major resource area. The specific resources and components that could be affected by the incremental effects of the proposed action, if it were implemented at the Greenwood site, and by other actions in the same geographic area were considered. This assessment includes the impacts of NRC-authorized construction, operations, and preconstruction activities. Also included in the assessment were other past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could have meaningful cumulative impacts when considered together with the proposed action, if implemented at the Greenwood site. Other actions and projects considered in this cumulative analysis are described in Table 9-19. The location and vicinity of the Greenwood alternative site are shown in Figure 9-7.

Referred to by Detroit Edison in its site selection process as "Site F," the Detroit Edison-owned Greenwood Energy Center is approximately 3 mi west of Port Huron State Game Area in St. Clair County, Michigan. The site encompasses 1280 ac on Sections 21, 22, 27, and portions of Section 28 of Township 8 North, Range 14 East. The site is currently used by Detroit Edison to generate electricity through the operation of an 800-MW oil-fired unit and three gas combustion turbines. The closest human receptors are approximately 2 mi from the site in the town of Avoca.

Access to the site is provided by State Route 136, approximately 1 mi south of the site. A spur of the CSX rail line provides rail access. The power generated at the Greenwood Energy Center is delivered to the grid via a 345-kV transmission line entering the site from the south.

Outside the industrial footprint, land on the site is a mixture of cropland, wooded areas, and two large wetland areas. In addition to the wetlands on the site, the nearest sensitive environmental areas are wetlands to the south and southeast of the industrial areas of the site. Other sensitive areas include the Port Huron Game Area and the Black River, both approximately 3 mi east of the site. The Lake Huron shore contains recreational beaches, as does Lakeport State Park and Beach, both about 7 mi east of the site. State parks and wildlife areas also exist about 27 mi south near Anchor Bay in Lake St. Clair. Ecology on the site and in the immediate vicinity is a mixture of grassland, shrub, and woodland communities.

The nearest towns are Yale, with a population of 2000, and the city of Port Huron, located approximately 11 mi to the southeast, with a 2000 population of approximately 32,300. The population of St. Clair County is approximately 164,200 (2000 data).

Table 9-19. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Greenwood Alternative Site Cumulative Analysis

Project Name	Summary of Project	Location	Status
Energy Projects			
Greenwood Energy Center	Oil-fired peaking unit and three natural gas combustion turbines with 1071 MW combined capacity	On Greenwood site	Operational
Fermi Unit 2	1098-MW nuclear power plant, including recently completed ISFSI and decommissioned Fermi 1 collocated on site	83 mi southwest of Greenwood site on Lake Erie	Operational
Marysville Power Plant	200-MW coal-fired plant	17 mi southeast of Greenwood site on St. Clair River	Operational
Suncor Ethanol Plant Phase II Project	Expansion of existing St. Clair Ethanol Plant to increase the supply of ethanol for blending with gasoline. The expansion will increase the plant's production capacity from 200 million L/yr to 400 million L/yr.	17 mi southeast of Greenwood site in St. Clair Township, Ontario, Canada	Recently completed
Suncor Ethanol Production Project	Ethanol production facility with production capacity of 200 million L/yr	17 mi southeast of Greenwood site in Sarnia, Ontario, Canada	Recently completed
Diesel Fuel and Hydrogen Pipelines	3.3 km of one 10-in. hydrogen pipeline and two 8-in. diesel fuel pipelines from the Shell Canada Refinery in Corunna to the Suncor Refinery in Sarnia	17 mi southeast of Greenwood site in Sarnia, Ontario, Canada	Recently completed
Belle River Power Plant	1664-MW coal-fired plant	24 mi south-southeast of Greenwood site	Operational
St. Clair Power Plant	1929-MW coal-fired plant	25 mi south-southeast of Greenwood site	Operational

Table 9-19. (contd)

Project Name	Summary of Project	Location	Status
Greenfield Energy Centre LP	1005-MW natural-gas-fired combined cycle electricity-generating facility	25 mi south-southeast of Greenwood site in Ontario, Canada	Operational
Lambton Generating Station	1920-MW coal-fired power plant	24 mi south-southeast of Greenwood site in Ontario, Canada	Operational
St. Clair Liquid Petroleum Gas Terminal	Liquid petroleum gas terminal	23 mi southeast of Greenwood site located near confluence of Pine and St. Clair Rivers	Operational
Dawn Gateway Pipeline	Operation of 30-km, 610-mm international natural gas transmission pipeline system (construction of 17-km new pipeline)	24 mi south-southeast of Greenwood site	Proposed
Mining Projects			
Clicks Sand and Gravel and RGE Aggregates, Inc.	Construction sand and gravel mine	5.8 mi south of Greenwood site	Operational
Mid Michigan Materials, Inc., Shipley Pit	Construction sand and gravel mine	5.4 mi northeast of Greenwood site	Operational
Cross Sand and Gravel Inc.	Construction sand and gravel mine	11 mi southwest of Greenwood site	Operational
Transportation Projects			
I-94 Black River Bridge replacement in Port Huron	First phase of the Blue Water Bridge plaza expansion, a project to modernize and improve capacity at the nation's second-busiest U.S.–Canadian truck border crossing	17 mi southeast of Greenwood site in Port Huron	Proposed; schedule undetermined
Parks and Recreation Facilities			
Fort Gratiot State Park	Planned infrastructure improvements for 30-ac State Park	11 mi southeast of Greenwood site on Lake Huron	Ongoing infrastructure improvements.

Table 9-19. (contd)

Project Name	Summary of Project	Location	Status
St. Clair County Trail System	Proposed upgrades and extensions of an existing offroad and onroad bike route network	Throughout St. Clair County	Proposed construction through 2024
Other Actions/Projects			
Dunn Paper Company	Paper mill discharging to St. Clair River	16 mi southeast of Greenwood site	Operational
E. B. Eddy Paper, Inc.	Paper mill discharging to St. Clair and Black Rivers	15 mi southeast of Greenwood site	Operational
Indian Trail North Mobile Home Park Wastewater Sewage Lagoon	Wastewater sewage lagoon located on Lake Huron	10 mi southeast of Greenwood site on Lake Huron	Operational
Sarnia Combined Sanitary/Storm Sewer Separation	The combined sewer separation project proposed will halt the combined sewer overflow to the St. Clair River.	16 mi southeast of Greenwood site in Sarnia, Ontario, Canada	Recently completed
Sarnia Wastewater System Improvements	Trunk sanitary sewer expected to reduce the number of combined sewer overflows to the St. Clair River	16 mi southeast of Greenwood site in Sarnia, Ontario, Canada	Recently completed
Dry Hydrant Installation, North Slip, Sarnia Harbor	Construction, installation, and maintenance of a dry hydrant and protection bollards along the North Slip embankment in Sarnia Harbor	16 mi southeast of Greenwood site in Sarnia, Ontario, Canada	Recently completed
Marysville Wastewater Treatment Plant	Wastewater treatment plant that discharges to St. Clair River	18 mi southeast of Greenwood site on St. Clair River	Operational
City of St. Clair Wastewater Treatment Plant	Wastewater treatment plant that discharges to St. Clair River	23 mi southeast of Greenwood site on St. Clair River	Operational
Detroit Water and Sewerage District Lake Huron Water Treatment Plant	Water treatment plant	11 mi east of Greenwood site on Lake Huron	Operational
Cargill Salt	Manufactures salt as food additive.	23 mi southeast of Greenwood site	Operational

Table 9-19. (contd)

Project Name	Summary of Project	Location	Status
Courtright Sewage Treatment Plant Upgrades	Upgrade and expansion of the Sewage Treatment Plant	22 mi southeast of Greenwood site on St. Clair River in Ontario, Canada	Recently completed
Metal Fabrication Company	Metal fabrication for automobile industry	14 mi east of Greenwood site on Lake Huron	
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and rail; construction of water and/or wastewater treatment and distribution facilities and associated pipelines, as described in local land use planning documents. No specific data found concerning development/expansion of the towns within 20 mi of site.	Throughout region	Construction would occur in the future, as described in State and local land use planning documents
Global Climate Change/ Natural Environmental Stressors	Short- or long-term changes in precipitation or temperature	Throughout region	Impacts would occur in the future

Source: Modified from NRC 2010a, b, c

9.3.4.1 Land Use

The following impact analysis includes impacts on land use from building activities and operations at the Greenwood site and within the geographic area of interest, which is the 15-mi region surrounding the site. The analysis also considers past, present, and reasonably foreseeable future actions that affect land use, including other Federal and non-Federal projects and those projects listed in Table 9-19 within the geographic area of interest.

The site is owned by Detroit Edison; most of the site is zoned industrial and hosts the existing Greenwood Energy Center power plants (Detroit Edison 2011a). The proposed location for the new facility includes approximately 60 ac of permanent use and 200 to 300 ac of temporary use, located in the southern part of the existing 1280-ac site (Detroit Edison 2009b). There are a number of buildings onsite associated with the power plants. There are no residential areas on the site, although there are a few residences more than 2 mi from the site (Detroit Edison 2011a). Site topography is flat with very little variation and is primarily agricultural land,

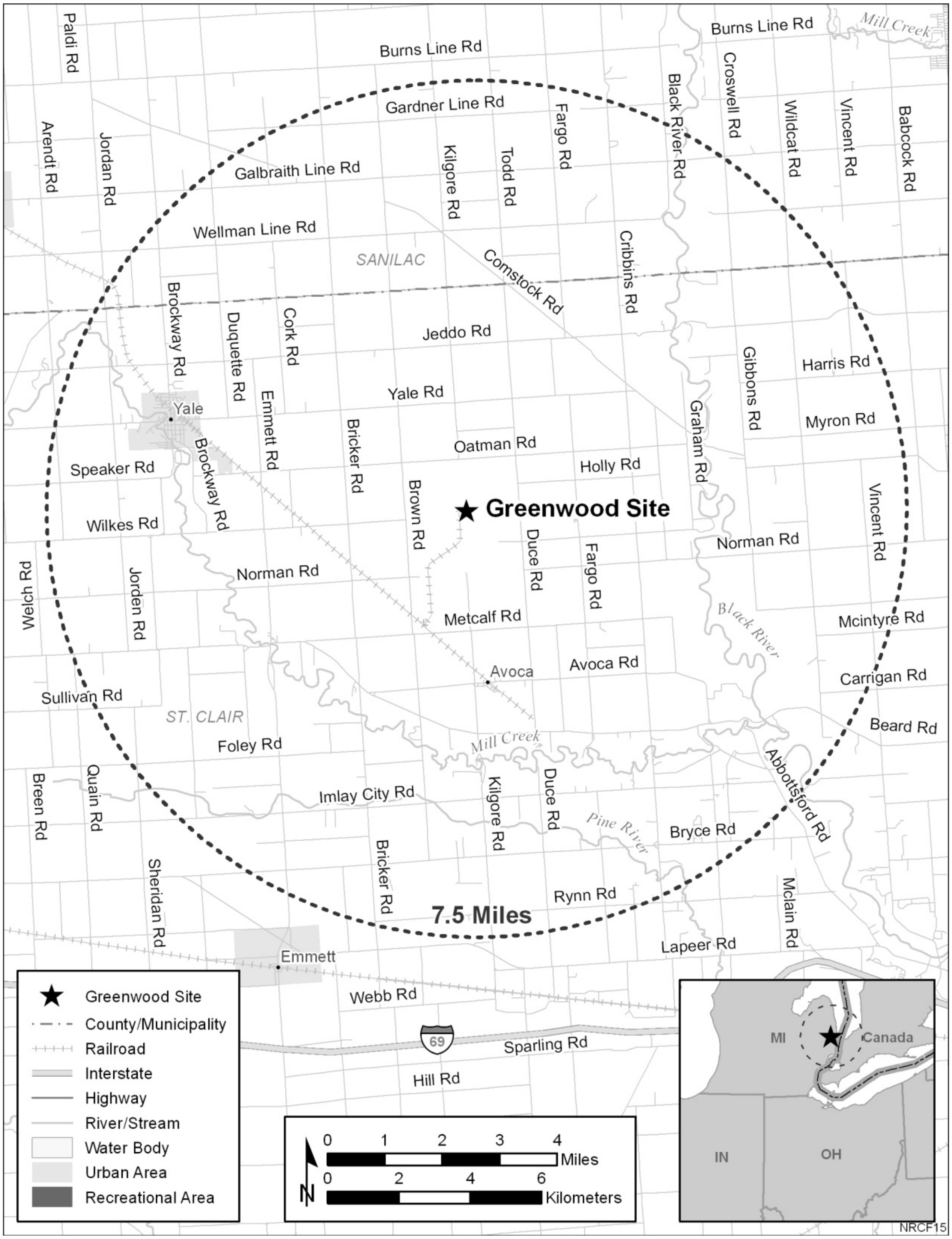

Figure 9-7. The Greenwood Alternative Site and Vicinity

with some young mixed deciduous woodland (Detroit Edison 2011a). Seven wetland areas have been identified on the site (see Section 9.3.4.3). Although the Federal Emergency Management Agency (FEMA) has not mapped the site for flood hazard, it is likely that the site is outside the Black River floodplain (Detroit Edison 2011a). If the facilities associated with this alternative would extend into the Coastal Zone defined by the State of Michigan under the Coastal Zone Management Act, Detroit Edison would have to obtain a coastal zone consistency determination from the MDEQ.

If a new nuclear power plant were constructed on the Greenwood site, about 360 ac of the 1280-ac tract would be disturbed, and some of the agricultural land (possibly including some prime farmland) and woodland areas on the tract would be disturbed. Drainage connections between the site and the Black River 3 mi east could also be disturbed. To supply cooling water, Detroit Edison would have to build a 10-mi water pipeline from Lake Huron, and although the amount of land required for a pipeline corridor is not known, some offsite land would be affected. The pipeline would likely disturb agricultural land, forest land, and wetlands and cross several railroad tracks and local roads. No new offsite roadway would likely be needed during construction or operation of the proposed facility (Detroit Edison 2011a).

The recreational areas nearest to the site are the Port Huron State Game Area and the Black River, about 3 mi east of the site. Lake Huron, as well as Lakeport State Park and Beach, are approximately 7 mi east. Several parks and beaches are located along the coast of Lake Huron. A number of State game areas are about 25 mi to the west of the site and a group of State parks and wildlife areas about 27 mi south of the site, near Anchor Bay in Lake St. Clair (Detroit Edison 2011a). Those recreational resources closest to the site may be affected by development and operation of a plant at the Greenwood site, including increased user demand associated with the projected increase in population with the in-migrating workforce and their families, an impaired recreational experience associated with the views of the proposed 600-ft cooling tower and condensate plume, or access delays associated with increased traffic from the construction and operations workforce on local roadways.

Although an existing 345-kV transmission line serves the site, it may need to be upgraded to serve a new nuclear facility (Detroit Edison 2011a). Upgrading the line might require expanding the corridor width and hence clearing forests and possibly interfering with some agricultural activities. Land uses along the transmission line corridor are generally similar to those on undeveloped portions of the site and lands adjoining the site, with a mixture of cropland, wooded areas, and some wetlands. Because of the short distances to the transmission interconnections, the review team concludes that the land use impacts of building and operating transmission lines for a new nuclear plant at the Greenwood site would be minor.

For cumulative land use analysis, the geographic area of interest is the 15-mi region surrounding the Greenwood site. This geographic area of interest includes the primary communities (Greenwood Township and Avoca Township) that would be affected by the proposed project if it were located at the Greenwood site.

A number of projects identified in Table 9-19 are likely to affect land use in the geographic area of interest around the Greenwood site. Upgrades and new construction of facilities at Fort Gratiot County Park on the lakeshore and the St. Clair County bike trail system are all proposed for locations within 10 mi of the proposed site, and all would require slight changes in land use around the Greenwood Energy Center. Other projects identified in Table 9-19 have contributed to or would contribute to some decreases in open lands, wetlands, and forested areas and generally result in increased urbanization and industrialization. However, several existing parks, reserves, and managed areas have been established to help preserve open lands, wetlands, and forested areas. Continued operation of existing facilities at the site is not likely to produce additional land use impacts. The review team concludes that the cumulative land use impacts of building and operating a new nuclear generating unit and associated transmission lines at the Greenwood site would be minimal, because the projects within the geographic area of interest identified in Table 9-19 would be consistent with applicable land use plans, undeveloped land at the existing energy center is readily available, and the distance to transmission interconnections are relatively short.

As described for the Fermi site in Section 7.1, climate change could increase precipitation and flooding around the Greenwood site, while increased lake evaporation and reduced lake ice accumulation could reduce lake levels, thus changing land use through an increase in low-lying lakeshore areas (USGCRP 2009). Forest growth may increase as a result of more carbon dioxide in the atmosphere, while existing parks, reserves, and managed areas would help preserve wetlands and forested areas to the extent that they are not affected by the same factors (USGCRP 2009). In addition, climate change could reduce crop yields and livestock productivity (USGCRP 2009), which might change portions of agricultural land uses in the geographical area of interest.

Based on the information provided by Detroit Edison and the review team’s independent evaluation, the review team concludes that the cumulative land use impacts associated with siting a reactor at the Greenwood site would be SMALL and mitigation would not be warranted.

9.3.4.2 Water Use and Quality

Surface water features in the vicinity of the Greenwood Energy Center site include small creeks and ditches and an onsite cooling pond system for the existing power plants. Because the surface water resources near the site are poor, water for a reactor at the Greenwood site would most likely be obtained from Lake Huron, which is approximately 10 mi to the east. The site’s existing power plants are supplied with lake water via a 10-mi-long pipeline system that has excess capacity of 40 MGD (Detroit Edison 2011a). However, the proposed Fermi 3’s makeup water requirement is 34,000 gpm, or 49 MGD (Detroit Edison 2011a). It is unclear from this information how the proposed plant's water requirements would be satisfied. One possibility is that a second pipeline would be constructed to provide the additional cooling water. The review team assumed that any new pipeline would be built next to the existing pipeline.

Discharge from an operating new nuclear power plant at the Greenwood site would include cooling tower blowdown, treated process wastewater, and liquid radwaste. The receiving body of water for these discharges is not described by Detroit Edison (2011a), but it is assumed that a second pipeline would convey discharges back to Lake Huron. Such discharges would be controlled by an NPDES permit issued by MDEQ. Given the length of pipeline that would be required for a discharge system, at least partial temperature attenuation might take place prior to discharge in the lake.

Groundwater resources in the area are present in a surficial aquifer with thickness ranging from 200 to 400 ft and well yields in the 50 to 100 gpm range. Both domestic and industrial uses are currently supported by groundwater. Groundwater in the thick surficial aquifer is of moderate chemical quality. Detroit Edison (2011a) considers that the feasibility of using wells to provide water is moderate to poor.

Building activities, including site grading and dewatering and building of new intake and discharge pipelines, would have the potential to affect water quality through increased erosion by stormwater, increased turbidity in surface water, and possible spills or leaks of fuel and other liquids. Pipeline construction between the Greenwood site and Lake Huron would create the potential for impacts of erosion and turbidity, especially at stream crossings. These changes would be expected to be limited by following appropriate BMPs. Surface water quality may be affected by discharges, but the discharges should be controlled by NPDES permits for cooling water discharge to Lake Huron or for local stormwater management.

For the cumulative analysis of impacts on surface water, the geographic areas of interest for the Greenwood site are the local creeks and ditches and Lake Huron, because these are the areas potentially affected by the proposed project. Key actions that have current and reasonably foreseeable potential impacts on water supply and water quality in this area of interest include active fossil fuel power plants, a sand and gravel pit, and wastewater treatment plants. For the cumulative analysis of impacts on groundwater, the geographic area of interest is the thick surficial aquifer in the vicinity of the site.

Water Use

Operational cooling water requirements would be the major demand on surface water resources from a new nuclear power plant. As described above, the water available from Lake Huron would be sufficient to support the makeup water needs of a new reactor, in addition to the cooling water needed by existing power plants and other projects listed in Table 9-19. The cumulative consumptive use of surface water is anticipated to have a small effect on the resource.

As described in Section 7.2.1, the greatest potential future impact on the Great Lakes water availability is predicted to be from climate change. The impact predicted for the lowest-emissions scenario discussed in the USGCRP report (2009) and by Hayhoe et al. (2010) would not be detectable or would be so minor that it would not noticeably alter the availability of water from the Great Lakes. However, if CO_2 emissions follow the trend evaluated in the highest-emissions scenario, the effect of climate change could noticeably increase air and water temperatures and decrease the availability of water in surface water resources in the Great Lakes region. As a result, the review team concludes that the potential impacts of use and climate change on surface water quantity would be SMALL to MODERATE. Based on its evaluation, the review team concludes that building and operating a nuclear plant at the Greenwood site would not be a significant contributor to the cumulative impact on surface water use.

Groundwater withdrawals associated with site dewatering during construction or preconstruction of a new nuclear power plant would be temporary and localized. As noted above, groundwater usage in the Greenwood vicinity supports both domestic and industrial wells. The review team concludes that cumulative groundwater impacts associated with withdrawals while building a new nuclear power plant at this site and with projects identified in Table 9-19 would be SMALL.

Water Quality

An NPDES permit from the MDEQ would be required for discharges from a new nuclear power plant at the Greenwood site, as well as for discharges from the other projects identified in Table 9-19. Such permits would limit both chemical and thermal discharges. Construction activities associated with the proposed facilities in Table 9-19 and urbanization in the vicinity have the potential to degrade surface water quality; adhering to BMPs would limit this impact.

The EPA’s Great Lakes National Program Office has initiated the Great Lakes Restoration Initiative, a consortium of 11 Federal agencies that developed an action plan to address environmental issues. These issues fall into five areas: cleaning up toxics and areas of concern, combating invasive species, promoting nearshore health by protecting watersheds from polluted runoff, restoring wetlands and other habitats, and tracking progress and working with strategic partners. The results of this long-term initiative would presumably address water quality concerns of Lake Huron, which is assumed to be the receiving body of water.

Climate change, as described in Section 7.2.1, has the potential to affect the water quality of the Great Lakes, including Lake Huron and Lake Erie. Reduced lake levels could increase the impact of discharges. The review team concludes that cumulative surface water quality impacts associated with a new nuclear power plant at the Greenwood site and other past, present, and reasonably foreseeable actions in the region could result in a MODERATE impact; however, building and operating a nuclear plant at the Greenwood site would not be a significant contributor to the MODERATE cumulative impact on surface water.

Groundwater quality in the region, which is generally moderate in the surficial aquifer, could be affected by a new nuclear power plant at the Greenwood site and the other past, present, and reasonably foreseeable actions in the region identified in Table 9-19. These impacts would be expected to be localized in extent and may be avoided or minimized through adherence to BMPs. The review team concludes that cumulative groundwater quality impacts would be SMALL.

9.3.4.3 Terrestrial and Wetland Resources

Grassland, shrub, and woodland communities are present on the site and in the immediate vicinity. Historic aerial photography shows that nearly the entire site was cleared and graded in the past. No undisturbed natural communities remain in the area. The grassland is dominated by tall fescue (*Festuca arundinacea*) and orchard grass (*Dactylis glomerata*), and many native and introduced weedy or early succession species of forbs are present. A portion of these areas may be wetlands. Shrubs present include rose (*Rosa* sp.), willow (*Salix* sp.), sumac (*Rhus* sp.), and blackberry (*Rubus* sp.). The wooded areas are mostly dominated by cottonwood and green ash (Detroit Edison 2011a).

With the site and surrounding vicinity being a mosaic of fields, woods, and cropland, the area can support a variety of wildlife. Whitetail deer are the largest mammals in the vicinity. Coyote (*Canis latrans)* are probably in the area, along with a variety of smaller mammals such as eastern cottontail (*Sylvilagus floridanus***)**, opossum, striped skunk (*Mephitis mephitis)*, and mice (*Peromyscus* sp.). Diverse amphibians and reptiles should also be expected, especially with the presence of local wetlands. The habitat variety also suggests a diversity of birds, from waterfowl and songbirds to raptors (Detroit Edison 2011a).

The NWI does not identify wetlands on the site, but offsite review by Detroit Edison (Detroit Edison 2009b) determined that there are seven wetlands within the site, some of high quality. It is possible that one or more additional areas contain wetlands, because many of the soils on the site are mapped as having areas of hydric soils (USDA 2010).

Two terrestrial species listed as threatened or endangered under the ESA are known to occur or could occur in St. Clair County. The eastern prairie fringed orchid is Federally listed as endangered and is known mostly from lakeplain prairies around Saginaw Bay and western Lake Erie (MNFI 2007a). No lakeplain prairie habitat occurs on or in the immediate vicinity of the project site, but hydric soils in fallow agricultural fields are possible and the orchid could occur there (MNFI 2007a). The Indiana bat, Federally listed as endangered, occurs in southern Michigan when it is not hibernating in hibernacula located in southern Michigan and other States

(MNFI 2007b). It generally requires large trees (greater than 9 in. in diameter) with exfoliating bark for summer roosting. According to the FWS (2009), however, trees as small as 5 in. in diameter should be considered as potential habitat. Moreover, the emerald ash borer is active in the project area (MDA 2009), and ash trees onsite have died from the borer, creating a potential for dead trees with loose bark and resulting in potential roosting habitat for the Indiana bat. The bald eagle is no longer on the Federal endangered species list, although it remains protected under the BGEPA and MBTA (MNFI 2007c). The bald eagle was also recently removed from the State list of threatened and endangered species and is now considered a species of concern. Although bald eagles are known to occur in the region, the species usually nests and roosts closer to fish-bearing waters. The potential for any impacts on protected species appears to be minimal due to the type of habitat present.

More than 50 State-listed species occur in St. Clair County (see Table 9-20). Among the State-listed species is the eastern fox snake. Four other species formerly present in the county are presumed extirpated. Detroit Edison has not consulted with MDNR about impacts on State-listed species that could result from construction of the power plant at the Greenwood Energy Center site.

Building Impacts

Agricultural land, old field, and forest land would have to be cleared and converted to industrial use in order to build a new reactor and associated facilities at the Greenwood Energy Center site. According to Detroit Edison, the total area of the Greenwood Energy Center site is approximately 1280 ac; the new reactor facilities would occupy about 60 ac of the southwestern part of the Greenwood site (Detroit Edison 2011a). Although Detroit Edison's conceptual plan layout (Detroit Edison 2009b) does not differentiate temporarily disturbed areas from the facility footprint, information about the proposed Fermi site location indicates that temporary disturbance could be as much as 200 to 300 ac. Conversion of agricultural land would have minimal impact on wildlife and habitat. Conversion of forested areas would have some impact on most of the common species present onsite by removing habitat used for shelter or other functions. With the possible exception of the Indiana bat, adverse impacts on Federally listed species would not be anticipated. The forested areas of the site have the potential to provide nesting and roosting habitat for the Indiana bat, primarily in the form of dead ash trees. If the bat uses the areas that would be disturbed, impacts could be kept to minimal levels by limiting tree clearing to the times of year when the bats are not in the region.

The agricultural land and the relatively young forest on this site are not likely to provide habitat for State-listed species, but additional study would be needed to adequately assess potential impacts on terrestrial ecological resources on the site and in the vicinity, including the eastern fox snake.

Table 9-20. Federally and State-Listed Terrestrial Species That Occur in St. Clair County and That May Occur on the Greenwood Energy Center Site or in the Immediate Vicinity

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Amphibians			
Blanchard's cricket frog	*Acris crepitans blanchardi*	NL	T
Birds			
Cerulean warbler	*Dendroica cerulea*	NL	T
Common moorhen	*Gallinula chloropus*	NL	T
Common tern	*Sterna hirundo*	NL	T
Forster's tern	*Sterna forsteri*	NL	T
Henslow's sparrow	*Ammodramus henslowii*	NL	E
King rail	*Rallus elegans*	NL	E
Least bittern	*Ixobrychus exilis*	NL	T
Louisiana waterthrush	*Seiurus motacilla*	NL	T
Peregrine falcon	*Falco peregrinus*	NL	E
Red-shouldered hawk	*Buteo lineatus*	NL	T
Mammals			
Indiana bat	*Myotis sodalis*	E	E
Plants			
American chestnut	*Castanea dentata*	NL	E
Beak grass	*Diarrhena obovata*	NL	T
Beard tongue	*Penstemon calycosus*	NL	T
Bog bluegrass	*Poa paludigena*	NL	T
Broad-leaved sedge	*Carex platyphylla*	NL	E
Carey's smartweed	*Polygonum careyi*	NL	T
Chestnut sedge	*Fimbristylis puberula*	NL	Presumed Extirpated
Creeping whitlow grass	*Draba reptans*	NL	T
Eastern prairie fringed orchid	*Platanthera leucophaea*	T	E
Few-flowered nut rush	*Scleria pauciflora*	NL	E
Frost grape	*Vitis vulpina*	NL	T
Gattinger's gerardia	*Agalinis gattingeri*	NL	E
Ginseng	*Panax quinquefolius*	NL	T
Goldenseal	*Hydrastis canadensis*	NL	T
Heart-leaved plantain	*Plantago cordata*	NL	E
Large toothwort	*Dentaria maxima*	NL	T
Large water starwort	*Callitriche heterophylla*	NL	T
Leiberg's panic grass	*Dichanthelium leibergii*	NL	T
Limestone oak fern	*Gymnocarpium robertianum*	NL	T
Narrow-leaved puccoon	*Lithospermum incisum*	NL	Presumed Extirpated
Northern prostrate clubmoss	*Lycopodiella margueritae*	NL	T
Orange- or yellow-fringed orchid	*Platanthera ciliaris*	NL	E
Painted trillium	*Trillium undulatum*	NL	E

Table 9-20. (contd)

Common Name	Scientific Name	Federal Status[a]	State Status[a]
Pine-drops	*Pterospora andromedea*	NL	T
Pink milkwort	*Polygala incarnata*	NL	Presumed Extirpated
Prairie buttercup	*Ranunculus rhomboideus*	NL	T
Purple milkweed	*Asclepias purpurascens*	NL	T
Purple prairie clover	*Dalea purpurea*	NL	Presumed Extirpated
Scirpus-like rush	*Juncus scirpoides*	NL	T
Short-fruited rush	*Juncus brachycarpus*	NL	T
Showy orchis	*Galearis spectabilis*	NL	T
Skinner's gerardia	*Agalinis skinneriana*	NL	E
Slough grass	*Beckmannia syzigachne*	NL	T
Spearwort	*Ranunculus ambigens*	NL	T
Stiff gentian	*Gentianella quinquefolia*	NL	T
Sullivant's milkweed	*Asclepias sullivantii*	NL	T
Three-awned grass	*Aristida longespica*	NL	T
White gentian	*Gentiana flavida*	NL	E
White goldenrod	*Solidago bicolor*	NL	E
White lady slipper	*Cypripedium candidum*	NL	T
Wild rice	*Zizania aquatica* var. *aquatica*	NL	T
Reptiles			
Eastern fox snake	*Pantherophis gloydi*	NL	T
Spotted turtle	*Clemmys guttata*	NL	T

Source: MNFI 2010a
(a) E = listed as endangered, NL = not listed, T = listed as threatened.

Information about the Greenwood Energy Center alternative provided by Detroit Edison did not indicate whether any part or all of the seven wetland areas on the site would be affected by building the new reactor facilities (Detroit Edison 2009b, 2011a). Detroit Edison did state that a conceptual facility layout could affect approximately 1313 ft of Engles Drain (Detroit Edison 2009b), raising the possibility of affecting any wetlands that may be associated with Engles Drain. With the prevalence of hydric soils on the site, the layout likely affects unmapped wetlands

Detroit Edison's ER states that although there appears to be an open circuit on a 345-kV transmission line that enters the site, capacity and reliability are not likely to be adequate for a new nuclear power plant. It is likely, therefore, that a new transmission line would be necessary for a number of reasons. A reactor built on the Greenwood site rather than at the proposed Fermi site would still be expected to serve the same load centers as if it were at the Fermi site, and the existing power plants on the site would continue operating, resulting in little likelihood that there is sufficient uncommitted current-carrying capacity left on the existing lines. No information was provided on where a possible transmission line would be built, how long it would be, or what terrestrial ecological resources might be affected. It might be possible, however, that a new transmission line could share or adjoin an existing transmission line corridor for some of its length and use existing substations, thereby resulting in less ecological impact than completely new corridors and substations would cause. The vicinity of the Greenwood Energy Center site is largely agricultural, with some forested areas. Although it appears possible to avoid most, if not all, important habitat with a new transmission line, a complete assessment would require a corridor location and site-specific information about the wildlife and habitat within the corridor.

Operational Impacts

During plant operation, wildlife, including the eastern fox snake, could be subjected to increased mortality from traffic, but it is not expected that such effects would destabilize the local or regional populations of the common species of the site (Forman and Alexander 1998). Information about the local occurrence of important species and habitats would be needed to conduct a more complete assessment of potential project effects on those resources at the Greenwood Energy Center site. Potential impacts associated with transmission line operation would consist of bird collisions with transmission lines, habitat loss due to corridor maintenance, noise, and EMF effects on flora and fauna.

Direct mortality resulting from birds colliding with tall structures has been observed (Erickson et al. 2005). Factors that appear to influence the rate of bird collisions with structures are diverse and related to bird behavior, structure attributes, and weather. Migratory flight during darkness by flocking birds has contributed to the largest mortality events. Tower height, location, configuration, and lighting also appear to play a role in bird mortality. Weather, such as low cloud ceilings, advancing fronts, and fog, also contributes to this phenomenon.

There would be a potential for bird mortality from collisions with the nuclear power plant structures at this site. Typically, the cooling tower and the meteorological tower are the structures likely to pose the greatest risk. The potential for bird collisions increases as structure heights and widths increase. MDCTs are of little concern because of their relatively low height compared to existing and proposed structures onsite. An NDCT, however, would be on the order of 600 ft high. Nonetheless, the NRC concluded that bird collisions with existing cooling towers “involve sufficiently small numbers for any species that it is unlikely that the losses would threaten the stability of local populations or would result in a noticeable impairment of the function of a species within local ecosystems” (NRC 1996). Thus, the impacts on bird populations from collisions with the cooling tower are expected to be minimal.

Because the transmission line that runs through the site is fairly congested (Detroit Edison 2011a), the review team assumes that either an upgrade of existing transmission facilities or the addition of one or more new transmission lines would likely be constructed to serve a new reactor. The vicinity of this alternative site is primarily agricultural. Impacts on terrestrial ecological resources from constructing a new transmission line in agricultural land would likely be minimal. Actual impacts, however, would depend on the exact route and length of new transmission lines.

Impacts of the transmission system on wildlife (e.g., bird collisions and habitat loss) resulting from the addition of new lines and towers cannot be fully evaluated without additional information on the length and location of any new transmission facilities. Nonetheless, Section 4.5.6.2 of the GEIS for license renewal (NRC 1996) provides a thorough discussion of the topic and concludes that bird collisions associated with the operation of transmission lines would not cause long-term reductions in bird populations. The same document also concludes that once a transmission corridor has been established, the impacts on wildlife populations are from continued transmission line corridors maintenance and are not significant (NRC 1996).

ITC*Transmission* would construct and operate any new transmission line needed for a new reactor at the Greenwood Energy Center site. ITC*Transmission* operates in accordance with industry standards for vegetation management (NERC 2010), including seasonal restrictions on activities that could adversely affect important wildlife (Detroit Edison 2010a). According to ITC*Transmission*'s vegetation management policy, wetland areas within the corridor that have the potential to regenerate in forest vegetation would be periodically manually cleared of woody vegetation for line safety, thereby keeping them in a scrub-shrub or emergent wetland state (ITC*Transmission* 2010). Other forested areas would similarly be managed to prevent tree regrowth that could present safety or transmission reliability problems. Access to these areas for maintenance would likely be on foot or by the use of matting for vehicles so as not to disturb the soil. Pesticides or herbicides would be used only occasionally in specific areas in the corridor where needed. It is expected that the use of such chemicals in the transmission line corridor would be minimized to the greatest extent possible in wetland areas to protect these important resources (Detroit Edison 2010a). The impacts associated with corridor maintenance activities are loss of habitat, especially forested habitat, from cutting and herbicide application. The maintenance of transmission line corridors could be beneficial for some species, including those that inhabit early successional habitat or use edge environments. Impacts of transmission line corridor maintenance would depend on the types and extents of habitat crossed. Detroit Edison has not provided sufficient details to make a complete assessment of transmission line corridor maintenance impacts. In general, however, if a new transmission line is needed, the impacts from operation and maintenance of the line would likely be minimal.

Detroit Edison provided no data on noise for the possible new reactor on the Greenwood Energy Center site, but it is likely that impacts would be minimal and similar to those of the Fermi 3 project.

EMFs are unlike other agents that have an adverse impact (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NIEHS 2002). A careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures (NIEHS 2002). At a distance of 300 ft, the magnetic fields from many lines are similar to typical background levels in most homes (NIEHS 2002). Thus, impacts of EMFs from transmission systems with variable numbers of power lines on terrestrial flora and fauna are of small significance at operating nuclear power plants (NRC 1996). Since 1997, more than a dozen studies have been published that looked at cancer in animals exposed to EMFs for all or most of their lives (Moulder 2007). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2007). A review of the literature on health effects of electric and magnetic fields conducted for the Oregon Department of Energy looked at the effects of strong electric and magnetic fields on various bird species. While some studies concluded that some species of birds exhibited changes in activity levels and some physiological metrics, no studies demonstrated adverse effects on health or breeding success (Golder Associates, Inc. 2009).

Cumulative Impacts

Several past, present, and reasonably foreseeable projects could affect terrestrial resources in ways similar to siting a new reactor at the Greenwood Energy Center site (see Table 9-19). The geographic area of interest for the following analysis is defined by a 25-mi radius extending out from the site.

Past projects include two generation facilities belonging to Detroit Edison: the Greenwood Energy Center, a major oil-fired and natural-gas-generating facility, and the Belle River Power Plant, a major coal-fired power plant. Just beyond the 25-mi radius is the St. Clair Power Plant, a major coal- and oil-fired facility. The Greenwood facility belonging to Detroit Edison occupies hundreds of acres on the east side of the site. Future urbanization in the region could also noticeably affect wildlife and habitat in or near the geographic area of interest. Development of the site could result in increased employment and population within the geographic area of concern, and this, in turn, could indirectly result in additional urbanization. However, given the current populations of Lapeer, Sanilac, and St. Clair Counties, Michigan, and Lambton County, Ontario, approximately 90,000, 42,000, 164,000, and 127,000, respectively, the additional impact on ecological resources from urbanization resulting from development of the Greenwood site cumulative to past projects would be minor.

Urbanization would likely result in conversion of agricultural land, forest land, wetlands, and other habitat to urban uses. Urbanization would involve some of the same activities as building a new reactor, including land clearing and grading (temporary and permanent), increased human presence, heavy equipment operation, traffic (including resulting wildlife mortality), noise from construction equipment, and fugitive dust. The cumulative impacts of noise and dust from building a new reactor would be negligible. Some of the effects of these activities, such as noise and dust, are short term and localized. Other effects, such as clearing wildlife habitat that would not be restored, would be permanent. The effects of urbanization of land clearing and grading, filling of wetlands, increased human presence, and increased traffic would occur over a period of several years and in several locations.

With the presence of known wetlands and hydric soils on the site, it is likely that wetland habitat would be disturbed by building a new reactor at the Greenwood Energy Center site. Impacts from potential transmission line development cannot be assessed without more specific routing information. Because of the largely agricultural landscape of the Greenwood Energy Center site vicinity, it is likely that a transmission line corridor could be routed to minimize impacts on wildlife and habitat.

Summary of Impacts on Terrestrial and Wetland Resources at the Greenwood Energy Center Site

Impacts on terrestrial ecological resources and wetland resources were estimated based on the information provided by Detroit Edison and the review team's independent review of that and other relevant data. Based on the conceptual layout (Detroit Edison 2009b), the permanently disturbed area could be as much as 60 ac and the temporarily disturbed area could be as much as 200 ac. Much of the area that would be affected is currently used for row crops and hay and provides relatively low wildlife habitat value. After construction and preconstruction at the Greenwood Energy Center site, habitat resources in temporarily disturbed areas would be expected to naturally regenerate. Wildlife would also recover but might not use the regenerated habitat to the same degree. Permanently disturbed areas would be converted to industrial use for the indefinite future. However, because of the likelihood of wetland impacts at the site, impacts are expected to be noticeable. Because the review team has no definitive information on the routing and length of a new transmission corridor, it cannot estimate the extent of affected habitats.

The review team concludes that the cumulative impacts on terrestrial wildlife and habitat would be MODERATE for a new reactor at the Greenwood Energy Center site. Building and operating a new nuclear unit at the Greenwood site would be a significant contributor to the MODERATE impact.

9.3.4.4 Aquatic Resources

Surface water features associated with the Greenwood site include a small creek (Plum Creek), agricultural drains (e.g., Engles Drain), and an onsite cooling pond system for the existing power plants (Section 9.3.4.2). The Black River is 3 mi east of the Greenwood site, but the cooling water intake and discharge pipelines for a new reactor may cross the Black River in route to Lake Huron. The NWI does not identify wetlands on the site, but Detroit Edison determined that there are seven wetlands within the site, some of high quality (Detroit Edison 2011a). No information exists regarding the aquatic organisms in the onsite wetlands and utility ponds, and surveys would be needed to characterize the aquatic communities present. However, a variety of aquatic macroinvertebrates, such as mayflies, stoneflies, caddisflies, isopods, and chironomids, are likely to be present, along with fish common to Great Lakes coastal habitats such as sunfishes, shiners, suckers, and catfish (Bolsenga and Herdendorf 1993).

The site's existing power plant (Greenwood Energy Center) is supplied with water from Lake Huron via a 10-mi-long pipeline system (Section 9.3.4.2), and cooling water for a new reactor at the Greenwood site would also likely be obtained from Lake Huron. Lake Huron is the second largest of the Great Lakes and supports an important commercial and recreational fishery. Common nearshore forage species include shiners (*Notropis* spp.), sticklebacks, and rainbow smelt. Alewife, an introduced species that also provides forage for commercially and recreationally important species in the Great Lakes, were once abundant in Lake Huron but have declined significantly in recent years (Schaeffer et al. 2009). The 2011 prey fish biomass estimate for the main basin of Lake Huron was more than double the estimate in 2010 and approximately 17 percent of the maximum estimate since standardized sampling began in 1973 (Riley et al. 2012). Biomass estimates for adult alewife and rainbow smelt in 2011 were slightly lower than 2010, remaining near the lowest observed levels since 1973; populations were dominated by relatively small individuals (Riley et al 2012). Lake herring (*Coregonus artedii*), yellow perch, common carp, channel catfish (*Ictalurus punctatus*), walleye, pike, and freshwater drum are commercially or recreationally important species found near the shoreline (USGS 2010).

Some of the primary aquatic nuisance species are the fishhook waterflea (*Bythotrephes cederstroemi*), zebra mussels, sea lamprey (*Petromyzon marinus*), common carp, and round goby. Zebra mussels in particular have substantially changed the ecosystem characteristics of Lake Huron by increasing benthic productivity, reducing plankton and planktivorous fish abundance, and altering the substrate available to demersal organisms (EPA 2008c).

Federally and State-Listed Threatened and Endangered Species

Two freshwater mussels that are Federally listed as endangered, the rayed bean and snuffbox mussel, are present in St. Clair County in the Belle River (FWS 2010; 77 FR 8632); these species are also listed as endangered by the State of Michigan (Carman 2001b). There are no designated critical habitats for any listed species in the vicinity of the Greenwood site. Within St. Clair County, seven State-listed species of fish may exist in the Black River drainage or Lake Huron (Table 9-21). Lake Huron contains lake sturgeon and their spawning grounds (Goforth 2000). Channel darters are also present in Lake Huron (Carman and Goforth 2000a). Northern madtoms (*Noturus stigmosus*), mooneye, and sauger are not historically abundant in Lake Huron, and these species have not been collected in Lake Huron in the last 20 years (Carman 2001a; Derosier 2004a, b). Eastern sand darters and pugnose shiners (*Notropis anogenus*) are found in the Black River drainage (Derosier 2004c, d).

Table 9-21. Federally and State-Listed Threatened and Endangered Aquatic Species That Are Known to Occur in St. Clair County and That May Occur on the Greenwood Site, the Black River, or Lake Huron

Common Name	Scientific Name	Federal Status[(a)]	State Status[(b)]
Fish			
Channel darter	*Percina copelandi*	NL	E
Eastern sand darter	*Ammocrypta pellucida*	NL	T
Lake sturgeon	*Acipenser fulvescens*	NL	T
Mooneye	*Hiodon tergisus*	NL	T
Northern madtom	*Noturus stigmosus*	NL	E
Pugnose shiner	*Notropis anogenus*	NL	E
Sauger	*Sander canadensis*	NL	T
Invertebrates			
Eastern pondmussel	*Ligumia nasuta*	NL	E
Pink papershell	*Potamilus ohiensis*	NL	T
Rainbow	*Villosa iris*	NL	SC
Rayed bean	*Villosa fabalis*	E	E
Round pigtoe	*Pleurobema sintoxia*	NL	SC
Slippershell	*Alasmidonta viridis*	NL	T
Snuffbox mussel	*Epioblasma triquetra*	E	E

(a) Federal status rankings determined by the FWS under the Endangered Species Act. NL = not listed, E = endangered. Source: FWS (2010).
(b) State species information provided by MNFI (2010b): E = endangered, T = threatened, SC = species of concern.

Six State-listed mussel species potentially present within St. Clair County may occur on the Greenwood Site, in the Black River, or in Lake Huron (Table 9-21). Of the threatened or endangered species, slippershell mussels are present in St. Clair County in Lake Huron drainages including large rivers and lakes (Carman 2002b). Eastern pondmussel and pink papershell are historically present in St. Clair County. The eastern pondmussel can be found in ponds, lakes, and streams (Mulcrone 2006a), while the pink papershell is usually found in rivers and large streams (Mulcrone 2006b). Therefore, suitable habitat for both species may exist in the Black River or Lake Huron. The rayed bean is not known to currently exist in Lake Huron (Carman 2001b). A single live rayed bean was found in the Black River in 2001, but additional specimens were not found in subsequent surveys (77 FR 8632).

Building Impacts

Impacts on aquatic habitats and biota could result from building the primary facilities, associated transmission lines, and the cooling water intake and discharge pipelines for a new reactor at the Greenwood site. As identified in Section 9.3.4.1, the area of the site that would be developed if the site was chosen for a new reactor facility consists primarily of agricultural land and woodland. The site's existing pipeline system may not be adequate to provide the needed cooling water for a new reactor. If the existing pipeline capacity is considered insufficient, construction of a 10-mi pipeline from the site to Lake Huron could result in building-related impacts near aquatic habitats located along the pipeline corridor including the likely crossing of the Black River. Building a new cooling water intake and discharge structure at Lake Huron would require dredging, pile driving, and other alterations to the shoreline and benthic habitat, potentially resulting in the temporary and permanent loss or alteration of aquatic habitat as well as injury, mortality, or temporary displacement of aquatic biota (see Section 4.3.2 for a detailed description of potential impacts of construction activities on aquatic habitat and biota). The impacts on aquatic organisms would be temporary and could be largely mitigated through the use of BMPs. Pipelines crossing streams would likely span the streams rather than being placed along the bottom, reducing impacts on aquatic communities. Preconstruction and construction activities within Lake Huron and the Black River would require Section 10 and/or Section 404 permits from USACE, as well as a regulatory permit from MDEQ, and these permits would likely contain stipulations that would further reduce impacts. Overall, the impact of building cooling water intake and discharge structures on the aquatic ecology of Lake Huron and the Black River would be minor.

As described in Section 4.3.2, building activities at the location of the new reactor, including an increase in impervious land surface, vegetation removal, site grading, and dewatering, would have the potential to affect water quality and hydrology and therefore aquatic biota in ditches, streams, and wetlands located within and downstream of the proposed site. Stormwater runoff could carry soil as well as contaminants (e.g., spilled fuel and oil) from construction equipment into onsite streams and drains. Drainage connections between the site and the Black River 3 mi to the east could also be disturbed. Information about the Greenwood site provided by Detroit Edison did not indicate whether any part or all of the seven wetland areas on the site would be affected by building the new reactor facilities (Detroit Edison 2011a). Additional project design details as well as surveys of aquatic habitat and biota would be needed to fully evaluate the potential for impacts on onsite aquatic resources. Although surface water quality may be affected by construction site discharges, the discharges would be regulated by NPDES and stormwater permits. Implementing appropriate BMPs would further reduce the potential for sediments to enter surface water.

It is possible that the transmission line for a new reactor at the Greenwood site could use existing substations and share or adjoin the existing 345-kV transmission line corridor for some of its length. If so, building-related impacts on aquatic resources would be minimal. If a new transmission line is needed to service a new reactor, there is the potential for the construction-related impacts described above to affect aquatic habitat and aquatic biota if the new transmission line passes near or crosses a surface water feature. Expansion of existing corridors would be expected to result in minor environmental impacts, while establishing new corridors could result in greater impacts. However, based on the assumptions that required construction permits are obtained from MDEQ and/or USACE and appropriate BMPs are implemented during building activities, the impacts on aquatic resources from development of additional transmission facilities would likely be temporary, easily mitigated, and minor.

Building a new reactor at the Greenwood site is not expected to result in impacts on threatened and endangered aquatic species, given the lack of suitable habitat at the reactor location and the use of BMPs to minimize potential construction impacts on aquatic habitats. However, any threatened or endangered fish and mussels found in Lake Huron and the Black River could be affected, because the cooling water intake and discharge structures may cross the Black River and would entail building activity in Lake Huron. Threatened or endangered mussels potentially present in the Black River and Lake Huron include the eastern pondmussel, pink papershell, and slippershell. As discussed above, the rayed bean is potentially, but not likely, present in Lake Huron, but the species has been found in the Black River as recently as 2001. Additional information would need to be collected and surveys may need to be conducted to evaluate the potential for Federally and State-listed mussel species to be present in areas of the Black River and Lake Huron that would be disturbed by building activities. If threatened or endangered mussels were found, it is likely that mitigation measures would need to be developed to limit potential impacts. Habitat for State-listed fish species could be disturbed by shoreline and in-water building activities. However, fish are highly mobile and would likely avoid the affected areas during construction. On the basis of this information and because construction and preconstruction activities would be temporary and mitigable, the review team concludes that impacts on threatened and endangered aquatic species would be minor.

Operational Impacts

Operational impacts on aquatic habitat and biota could result from cooling water consumption, transmission line maintenance, cooling water system maintenance, cooling water discharge, and impingement and entrainment of aquatic biota in Lake Huron by the cooling water intake system.

Withdrawal of cooling water by a new nuclear power reactor at the Greenwood site could affect the aquatic environment. Detroit Edison has proposed a closed cycle recirculating cooling system, which could reduce water use by 96 to 98 percent of the amount that the facility would use if it employed a once-through cooling system (66 FR 65256). Assuming that cooling water needs would be similar to those identified for the proposed Fermi 3, approximately 34,000 gpm, or 49 MGD, would be needed (Detroit Edison 2011a). The withdrawal of water would not disrupt natural thermal stratification or the turnover pattern for Lake Huron and would comply with EPA's CWA Section 316(b) Phase I regulations for new facilities. The water available from Lake Huron would be sufficient to support the makeup water needs of a new reactor, and therefore the incremental impact on water availability from operating a new power plant at the

Greenwood site would be minor (see Section 9.3.4.2). Consequently, the hydrologic impacts on aquatic habitat in Lake Huron from water withdrawal should be minimal.

Periodic maintenance dredging of the area around the cooling water intake in Lake Huron would be necessary to maintain appropriate operating conditions. Such dredging would be managed under permits from the USACE and MDEQ and result in a temporary localized increase in turbidity in the vicinity of the intake bay. Dredged material is expected to be disposed of in a spoil disposal pond, where sedimentation would occur prior to discharge of the water back into Lake Huron. The periodic dredging of the intake bay, which would likely be similar to maintenance dredging activities for other existing power plants in the region, would result in minimal impacts on aquatic biota and habitats in Lake Huron.

The effect of impingement and entrainment of aquatic organisms from Lake Huron was evaluated by the review team. Entrainment could result in mortality to zooplankton and phytoplankton. Particularly vulnerable are invertebrates and early life stages of fish (eggs and larvae), which lack the ability to overcome intake suction and which are small enough to pass through the mesh of the intake screens. Juvenile fish may still be vulnerable, while adults of larger fish species are likely less vulnerable. The fish screens and the closed cycle recirculating cooling system proposed by Detroit Edison would reduce water intake and physical damage to aquatic organisms (Section 5.3.2). Based on the assumption of a closed cycle cooling system that meets the EPA's CWA Section 316(b) Phase I regulations for new facilities the Greenwood Energy Center, the anticipated impacts on aquatic populations from entrainment and impingement are expected to be minimal.

Discharge would include cooling tower blowdown, treated process wastewater, and processed radwaste wastewater, all of which could affect aquatic biota through mortality or sublethal physiological, behavioral, and reproductive impairment (see Section 5.3.2). In addition, aquatic organisms could be affected by cold shock and the scour of benthic habitat near the discharge pipe (see Section 5.3.2). However, proposed design features such as the presence of riprap around the submerged discharge ports and orientation of the discharge ports in an upward direction are intended to reduce scouring (Detroit Edison 2011a). As identified in Section 9.3.4.2, a NPDES permit from MDEQ would be required for discharges from a new nuclear power plant at the Greenwood site. Such a permit would likely specify limits for chemical and thermal discharges in order to protect water quality, thereby limiting the potential for impacts on aquatic organisms. Also, given the length of pipeline that would be required for a discharge system that extends to Lake Huron, at least partial temperature attenuation might take place prior to discharge in the lake. Assuming that NPDES permitting requirements are met, the impacts of discharges on aquatic habitats and biota would be minor.

Impacts on aquatic resources from operation of a new reactor at the Greenwood site may include those associated with maintenance of transmission line corridors located near surface water features. ITC*Transmission* would be expected to construct and operate any new transmission lines needed for a new reactor at the Greenwood site, and it is assumed that it would follow current maintenance practices designed to minimize impacts on drains, creeks, rivers, and wetlands, such as minimizing disturbance to riparian habitat and minimizing the application of pesticides and herbicides, which can enter aquatic habitat and adversely affect aquatic biota (Detroit Edison 2011a). Although impacts of transmission line corridor maintenance would depend, in part, on the types and extent of aquatic habitat located near the transmission line, impacts on aquatic habitats and biota from maintenance of transmission lines would likely be minor as long as maintenance practices currently followed by ITC*Transmission* are implemented.

There is no suitable habitat for threatened and endangered mussels near the proposed location for a reactor, but Federally and State-listed threatened and endangered species potentially found in surface waters located along the transmission line and cooling water intake and discharge pipelines, including the Black River, may be adversely affected by maintenance activities. The potential for impacts on threatened and endangered species could be minimized by avoiding streams and mitigated by following BMPs and surveying for the presence of mussel species before maintenance activities begin. Threatened and endangered mussels potentially present in Lake Huron include the rayed bean (Federally listed as endangered), and the State-listed eastern pondmussel, and pink papershell. These species may be vulnerable to cooling water intake operational impacts if present in the immediately affected areas. As eggs, mussels are not likely to be affected by system operation, because they typically develop into larvae within the female. The glochidial stage during which juvenile mussels attach to a suitable fish host is vulnerable indirectly through host impingement or entrainment. The presumed host for the rayed bean (largemouth bass) is present in Lake Huron and could be impinged during reactor operations. Post-glochidial and adult stages of mussels are not likely to be susceptible to entrainment or impingement because they bury themselves in sediment.

No recent records of State-listed northern madtoms, mooneye, and sauger exist for Lake Huron, and these species are not likely to be affected by reactor operations. Channel darters are closely associated with the sediment and may be less likely to be entrained. Early life stages of lake sturgeon could be vulnerable to impingement and entrainment, but mortality significant enough to affect lake sturgeon populations is not anticipated. Overall, impacts on threatened and endangered aquatic species from reactor operations are expected to be minor.

Cumulative Impacts

Past, present, and reasonably foreseeable projects, facilities, and other environmental changes that may contribute to cumulative impacts on aquatic resources in the area include activities and projects shown in Table 9-19 and current and future ecosystem variations from climate change, introduced dreissenid mussels, and recreational and commercial fishing. Environmental conditions in Lake Huron may be improved in the future by the Great Lakes Restoration Initiative, which is a multi-agency effort to reduce pollution and restore habitat in the Great

Lakes region. Among the many projects are the City of Port Huron-Restoring Fish Habitat project, which seeks to restore rocky bottom fish habitat in the St. Clair River near Port Huron, and the Upper Great Lakes Stream Connectivity and Habitat Initiative, which seeks to improve Great Lakes tributaries by restoring fish passage and in-stream habitat (see http://greatlakesrestoration.us).

As discussed above, potential building-related impacts on aquatic habitat and biota could result from altered hydrology, erosion, and stormwater runoff of soil and contaminants and disturbance or loss of benthic habitat from construction of the reactor, associated transmission lines, and cooling water system. Future urbanization in the region can affect aquatic resources in similar ways by increasing impervious surface, non-point-source pollution and water use and by altering existing hydrology patterns, potentially resulting in changes in the structure and function of aquatic communities. Development of a new reactor at the Greenwood site could result in increased population and additional urbanization with subsequent impacts on aquatic resources.

The primary operational impacts on aquatic habitat and biota at the Greenwood site could result from makeup water needs, transmission line maintenance, alteration in water quality from cooling water discharge, and impingement and entrainment of aquatic biota during cooling water intake. Impingement and entrainment of aquatic biota from Lake Huron resulting from operations of a new reactor must be considered along with mortality resulting from existing power plants that already withdraw water from Lake Huron, from commercial and recreational fishing, and from introduced zebra mussels and quagga mussels, which have dramatically reduced plankton abundance in the region. Species currently in decline in Lake Huron are primarily deepwater or pelagic species such as lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*), and chinook salmon (*Oncorhynchus tshawytscha*) (Schaeffer et al. 2009). However, these species may also occupy nearshore areas at various life stages and could be vulnerable to cooling water intake.

As described above, the water available from Lake Huron would be sufficient to support the makeup water needs of a new reactor in addition to the cooling water needed by existing power plants and other projects listed in Table 9-19. The cumulative consumptive use of surface water is anticipated to have a small effect on aquatic resources (Section 9.3.4.2). However, as described in Section 7.2.1, climate change could noticeably decrease the availability of surface water resources in the Great Lakes region. If such a reduction in surface water were to occur, aquatic habitat on the reactor site and in Lake Huron may be altered or eliminated, with potentially adverse consequences for aquatic habitat and biota.

Discharges into Lake Huron from a new nuclear power plant at the Greenwood site must be considered along with discharges into Lake Huron from the other projects identified in Table 9-19. NPDES permits would limit both chemical and thermal discharges into Lake Huron. However, if climate change results in reduced water levels and increased water temperature, the impacts associated with contaminant concentrations and thermal stress from cooling water discharge into Lake Huron could also increase. As identified in Section 9.3.4.2, the overall cumulative surface water quality impacts associated with a new nuclear power plant at the Greenwood site together with other past, present, and reasonably foreseeable actions in the region are expected to be minor because of the expected localized extent of the project impacts and the adherence to BMPs and permitting requirements designed to avoid or minimize impacts. Similarly, the incremental contribution of a new reactor at the Greenwood site to cumulative impacts on aquatic biota from water quality changes due to operational discharges would also be minor.

Based on its evaluation, the review team concludes that the cumulative impacts on aquatic resources, including threatened or endangered species, could be substantial due to the continued inadvertent introduction of invasive species, overfishing, increased urbanization resulting in degradation of water quality, and global climate change. The incremental impact on aquatic resources from building and operating a new power plant at the Greenwood site would not contribute significantly to the overall cumulative impacts in the geographic area of interest.

Summary of Impacts on Aquatic Resources at the Greenwood Site

Impacts on aquatic habitats and associated biota within onsite ponds and wetlands at the Greenwood site, the Black River, and Lake Huron could result from reactor, transmission line, and cooling water intake and discharge system preconstruction and construction activities. However, the impacts on populations of aquatic organisms would be temporary and could be largely mitigated by avoiding aquatic habitats during siting of facilities and activity areas and through the use of BMPs during preconstruction and construction activities.

Operational impacts on aquatic resources could result from cooling water consumption, transmission line and cooling water system maintenance, alteration of water quality by cooling water discharge, and impingement and entrainment of aquatic biota by the cooling water system. Impingement and entrainment of aquatic organisms from the nearshore environment of Lake Huron would add to the existing mortality of aquatic biota due to invasive species, commercial and recreational fishing, and the operation of other power plants that use water from or discharge into Lake Huron.

Impingement and entrainment of aquatic organisms in Lake Huron would be minimized by complying with EPA's CWA Section 316(b) Phase I regulations and using appropriately designed fish screens. Lake Huron could support the makeup water needs of a new reactor. However, climate change could noticeably decrease the availability of surface water resources in the Great Lakes. Similarly, while a NPDES permit would limit both chemical and thermal discharges from a new reactor, climate change has the potential to increase ecological impacts from the discharge on aquatic communities. Transmission line and cooling water pipeline maintenance impacts on aquatic habitat and biota could be minimized by implementing BMPs.

Although suitable habitat for threatened and endangered species is not likely to be present near the reactor, threatened and endangered fish and mussels may be found in the Black River drainage and in Lake Huron, and these species may be vulnerable to benthic disturbance associated with the building, operation, and maintenance of the cooling water intake and discharge system. If required, mussels could be surveyed, and observed individuals could be relocated before building activities commence as a mitigation action. The potential for entrainment and impingement of threatened and endangered species in Lake Huron is possible but is not likely to be significant. Overall, minor impacts on threatened and endangered aquatic species are expected from building and operations.

The review team’s conclusion, based on the information provided by Detroit Edison and the review team’s independent evaluation, is that the impacts on aquatic resources, including threatened or endangered species, from a new reactor at the Greenwood site, considered with cumulative impacts on aquatic resources from other activities and climate change, would be MODERATE. Building and operating a new nuclear unit at the Greenwood site would not be a significant contributor to the overall cumulative impact.

9.3.4.5 Socioeconomics

The economic impact area for the Greenwood Energy Center alternative site is St. Clair County. The site is located in St. Clair County, approximately 10 mi northwest of Port Huron and approximately 10 mi west of the international border crossing at Port Huron and Sarnia. The Greenwood Energy Center site is approximately 24 mi northwest of the Belle River site, such that the baseline information for the Greenwood Energy Center site will be similar to the baseline data for the Belle River site, discussed in Section 9.3.3.5. As discussed in Section 9.3.3.5, St. Clair County is part of the Detroit-Warren-Livonia MSA, which encompasses nine principal cities over a six-county area, the core of which is the City of Detroit, approximately 50 mi southwest of the site.

Because of the geographical location of the plant, members of the workforce who would be drawn from the region may live in Canada or elsewhere within the Detroit-Warren-Livonia MSA. However, the review team expects that most of the in-migrating construction and operations workers would likely relocate in or near the City of Port Huron, which is near the plant, has the highest population base, and would have the most housing and other amenities relative to the rest of the region, which is rural. The review team determined that any impacts in any other jurisdiction beyond St. Clair County (e.g., Port Huron) would be minimal, because the number of in-migrating workers within any other jurisdiction would be small. Therefore, this analysis focuses on St. Clair County.

Physical Impacts

Physical impacts include impacts on workers and the general public, noise, air quality, buildings, roads, and aesthetics. Because the physical impacts of building and operating a nuclear power plant are very similar between the proposed site and alternative sites, the review team determined that, as assessed for the Fermi 3 site, all physical impacts related to the Greenwood site would be minor. See Sections 4.4.1 and 5.4.1 for a detailed discussion of physical impacts for Fermi 3.

Demography

The Greenwood site is located within Greenwood Township, near the Town of Avoca, in St. Clair County. Port Huron, approximately 10 mi southeast of the Greenwood site, is the largest population center in the county. Other large population areas are those immediately surrounding Port Huron, including the City of Marysville and the Townships of Fort Gratiot, Port Huron, and Kimball. Historically, St. Clair County's population has been concentrated along the coast, including within Port Huron, Marysville, St. Clair, and Marine City. Table 9-22 provides the 2000 and 2010 Census population and the projected 2020 population for the largest population areas in St. Clair County.[(a)]

Table 9-22. Demographics for St. Clair County and Local Jurisdictions

	Population		
County/City/Township	**2000**	**2010**	**2020 Projected**
St. Clair County	164,235	163,040	180,294
City of Port Huron	32,338	30,184	31,402
City of Marysville	9684	9959	10,820
Fort Gratiot Township	10,691	11,108	12,743
Port Huron Township	8615	10,654	11,995
Kimball Township	8628	9358	10,066

Source: The 2020 projections are provided by SEMCOG (2008). The 2000 and 2010 data for all areas are from the USCB (2000a, 2010a).

Between 2000 and 2010, the population in St. Clair County declined by approximately 1 percent. Population growth occurred in the City of Marysville and townships surrounding the City of Port Huron, while the population of Port Huron declined. These jurisdictions are also where future growth in the county is expected (LSL Planning Inc. undated).

(a) This section has been updated for the Final EIS to include the results of the mandated U.S. decadal census for 2010 for the data sets that have been released by the U.S. Census Bureau as of May 2012. For the data sets that have not yet been released, the review team has presented the results of the 5-year estimates from the American Community Survey (i.e., 2006–2010).

Detroit Edison estimates that the size of the construction workforce needed for the nuclear power plant over a 10-year construction period would range from a minimum of 35 workers to a peak construction workforce of 2900 workers, and that the average size of the onsite workforce during the 10-year construction period would be approximately 1000 workers (Detroit Edison 2011a).

The review team's assumptions for in-migrating and local workers are similar to those for the Fermi 3 plant site. Although the plant is located in a rural area, it is also within commuting distance of highly urbanized areas (i.e., within a 50-mi radius of the plant). St. Clair County is within the Detroit-Warren-Livonia MSA, and the City of Detroit is approximately 50 mi southwest of the plant. The City of Flint, Michigan, is slightly beyond the 50-mi radius of the site, but is still within a reasonable commute distance to the plant, approximately 70 mi from the plant. Therefore, for comparison between analyses for site alternatives, the review team based the analysis for this site upon the assumptions presented in Section 4.4.2 of this EIS, with approximately 15 percent of the construction workforce (approximately 435 workers during the peak construction and 150 workers on an average annual basis) expected to relocate within a 50-mi radius of the project site.

If the facility were to be built at the Greenwood site and operations commenced, Detroit Edison expects an operations workforce of 900 workers in 2020 (Detroit Edison 2011a). For reasons similar to those addressed in the analysis of impacts presented in Section 5.4.2, the review team determined that approximately 30 percent of the operations workforce (approximately 270 workers) would relocate within a 50-mi radius of the project site.

Using an average household size of 2.6 persons, based on the national average household size in the USCB's 2010 population data, the total in-migrating population is estimated to be approximately 1131 persons during the peak construction period and less during periods of non-peak construction. The projected population increase associated with the in-migrating operations workers is estimated to be 702 persons.

If all the in-migrating construction workers and their families settled in St. Clair County for the 2-year peak construction period, the projected increase would be less than 1 percent of the projected 2020 population for the county. Demographic impacts during periods of non-peak construction would be smaller. The in-migrating construction workers and their families would likely settle in various cities and townships throughout the county, and the population effects are expected to be minimal. The projected population increase for the operations workforce would be smaller than that projected for the peak construction period and would also be less than 1 percent of the projected 2020 population for the county.

Given the small number of in-migrating workers compared to the projected 2020 population for St. Clair County, the review team concludes that the demographic impact during peak construction and operation would be minor.

Economic Impacts on the Community

Economy

There were 77,492 employed workers in St. Clair County in 2010 (USBLS 2012) (see Table 9-23). Its unemployment rate increased from 4.2 percent in 2000 to 15.6 percent in 2010. The most recent annual unemployment rate of 13.1 percent in 2011 showed improvement in the job outlook (USBLS 2012). Approximately 21 percent of the workforce is employed in manufacturing and 22 percent in educational services, health care, and social assistance (USCB 2010b). Approximately 12 percent is employed in retail trade, and 7 percent in construction. Tourism and manufacturing are large components of St. Clair's economy (St. Clair County Metropolitan Planning Commission 2009). The Blue Water Bridge international crossing at Port Huron/Sarnia is the third-busiest border crossing in the country. St. Clair's manufacturing base consists primarily of suppliers of plastics and rubber to the automotive industry, although other manufacturing establishments including paper, fabricated metal and metal parts, and machinery are also located in St. Clair County (St. Clair County Metropolitan Planning Commission 2009). In 2000, approximately 36 percent of St. Clair County's workers lived in the county and commuted to work outside of the county. The four largest employers in St. Clair County in 2008 were Port Huron School District, with approximately 1462 employees; Port Huron Hospital, with approximately 1057 employees; Detroit Edison, with approximately 1044 employees; and the K-Mart Corporation, with approximately 850 employees (St. Clair Administrator/Controller's Office 2009).

Table 9-23. Labor Force Statistics for St. Clair County (2000 and 2010)

	St. Clair County	
	2000	**2010**
Total labor force	87,071	77,492
Employed workers	83,383	65,375
Unemployed workers	3688	12,177
Unemployment rate	4.2%	15.6%

Source: USBLS 2012

The economy of St. Clair County would benefit over the estimated 10-year construction period through direct purchase of materials and supplies and direct employment of the construction workforce. Detroit Edison estimates that the size of the construction workforce would range from an estimated minimum of 35 workers to a peak construction workforce of 2900 workers, with an average annual onsite construction workforce of 1000 workers. Based on an average salary estimate of $50,500, approximately $50.5 million would be expended directly in payroll annually during the construction period.

When the plant becomes operational, Detroit Edison estimates direct employment will be 900 full-time and contract employees. In addition, Detroit Edison estimates 1200 to 1500 workers would be employed during scheduled maintenance outages, which would occur every 24 months and require workers for a period of about 30 days. Based on an average salary estimate of $63,625, approximately $57.3 million would be expended directly in payroll annually during the 40-year operating license of the plant. In addition, every 24 months, an additional $6.3 to $7.9 million in payroll would be expended for the outage workforce for the plant.

New workers (i.e., in-migrating workers and those previously unemployed) would have an additional indirect effect on the local economy, because these new workers would stimulate the regional economy with their spending on goods and services in other industries.

Based on the information provided by Detroit Edison and the review team's evaluation, the review team concludes that the impact of building activities on the economy would be noticeable and beneficial in St. Clair County and minimal and beneficial elsewhere.

Taxes

Construction and operation of a plant at the Greenwood site would result in increased tax revenues to State and local governments. State income tax revenue would accrue primarily through income taxes on salaries of the new workers (i.e., in-migrating workers and those previously unemployed). Based on an estimated annual average of 362 new workers (i.e., 150 in-migrating and 212 previously unemployed) during the 10-year construction period and an average salary of $50,500, the State of Michigan would receive an estimated $0.7 million in income tax revenue annually during the construction period. Based on an estimated annual average of 327 new workers (i.e., 270 in-migrating and 57 previously unemployed) for operation of the plant and an average salary of $63,625, the State of Michigan would receive an estimated $0.8 million in income tax revenue annually during the period of the 40-year operating license. The State of Michigan would also receive tax revenue through increased sales expenditures by workers and for the plant construction, operation and maintenance, and business taxes during operation.

Property tax revenue would be the primary tax benefit to the local jurisdictions. The plant would be assessed during the construction period and be at its highest assessed value when the plant becomes operational. For analysis, the review team recognizes that the full estimated construction cost of $6.4 billion for a nuclear power plant of 1605 MW(e), as discussed in Section 4.4.3.1, may not be the actual assessed value for property tax purposes. However, for comparison in the alternative sites analysis, the review team based its conclusions upon this construction cost estimate. In 2008, the taxable value of real and personal property at Detroit Edison's existing Belle River-St. Clair Power Plants and the Greenwood Energy Center was $731 million, approximately 11 percent of the total county taxable assessed property value

($8.5 billion) (St. Clair Administrator/Controller's Office 2009). Consequently, with completion of the construction of the plant, the total assessed property value in the county would be increased by about 75 percent. The review team recognizes that this would be an upper bound to the assessed value of the property and that a fee in lieu of agreement or other considerations may significantly reduce that assessed value. However, the review team believes that the property tax impact on St. Clair County would be substantial and beneficial.

Summary of Economic Impacts and Taxes

Based on the information provided by Detroit Edison and the review team's evaluation, the review team concludes that the impact of building activities on the economy would be noticeable and beneficial in St. Clair County and minimal and beneficial elsewhere. The impact of tax revenues would be substantial and beneficial in St. Clair County and minimal and beneficial elsewhere. An annual average of 150 new construction workers would relocate into the area, and 212 workers who are currently unemployed would be employed for building activities over the 10-year construction period. A portion of the estimated $6.4-billion construction cost of the nuclear power plant would be spent on materials and supplies in the local area or would be transported into the area through the international border crossing at Port Huron/Sarnia; tax revenue to the State and local jurisdictions would accrue through personal income, sales, and property taxes and would have the largest benefit on the local jurisdictions within St. Clair County.

During operations at the Greenwood site, an estimated 270 new operations workers would relocate into the area, and 57 workers who are currently unemployed would be employed in operating the plant. Based on the information provided by Detroit Edison and the review team's evaluation, the review team concludes that the economic impact of operating the Greenwood plant, including tax revenues, would be substantial and beneficial in St. Clair County and minimal and beneficial elsewhere.

Infrastructure and Community Services

Traffic

Access to the Greenwood site would be from State Route 136. State Route 136 extends east to Port Huron and west to State Route 19, which traverses the interior of St. Clair County from north to south. State Route 19 also provides access to Interstate 69 at an interchange approximately 7 mi south of the site. The Blue Water Bridge crossing at Port Huron/Sarnia is a major international bridge crossing, with 4.9 million crossings in 2008 (MDOT 2009). The St. Clair River is part of the Great Lakes St. Lawrence Seaway System; the nearest port to the site is in the City of Sarnia, Canada.

CN and CSX rail systems cross St. Clair County. The CN railroad crosses the St. Clair River through an underground tunnel between Port Huron and Sarnia. A CSX rail line is located approximately 0.5 mi southwest of the site. The site is not accessible by barge.

The review team expects that traffic impacts from building activities and operations, including construction workers, operations workers, and deliveries, would be noticeable but not destabilizing and would warrant mitigation in coordination with MDOT and the St. Clair County Road Commission. Detroit Edison's Greenwood Energy Center employs approximately 49 employees at the site (MDEQ 2009); therefore, the roads would likely need to be upgraded to accommodate the projected construction and operations workforces. Detroit Edison, in coordination with the MDOT and St. Clair County Road Commission, would need to conduct a traffic study that would identify strategies that would mitigate the traffic to an acceptable level.

Recreation

St. Clair County Parks and Recreation Commission operates three parks in the county: Goodells County Park (327 ac), Fort Gratiot County Park (30 ac), and the Wadhams to Avoca Trail (12 mi). A fourth park, the Columbus County Park, is in development and will include 384 ac along the Belle River when complete. The State of Michigan owns 22,178 ac of park and conservation land in St. Clair County, including Algonac State Park (1450 ac in Cottrellville and Clay Townships), Lakeport State Park (1215 ac in Burtchville Township), Port Huron State Game Area (6627 ac in Grant, Clyde, and Kimball Townships), St. Clair Flats State Wildlife Area (10,300 ac in Clay Township), St. Johns March Recreation Area (2477 ac in Clay and Ira Townships), and Mini Game Area (109 ac in St. Clair Township) (St. Clair County Parks and Recreation Commission 2007). In addition, numerous township parks are located throughout St. Clair County, and various beaches, marinas, and boat access points are located along the St. Clair River and Lake Huron shoreline (St. Clair County Parks and Recreation Commission 2007). The recreational area nearest to the Greenwood site is the Port Huron State Gameland, approximately 3 mi east of the site.

Recreational resources in St. Clair County may be affected by construction and operation of a plant at the Greenwood site. Impacts may include increased user demand associated with the projected increase in population from the in-migrating workforce and their families; an impaired recreational experience associated with the views of the proposed 600-ft cooling tower and steam plume; or access delays associated with increased traffic from the construction and operations workforce on local roadways. A new nuclear power plant and 600-ft cooling tower and condensate plume would be visible in a wide area, because the topography in the vicinity of the site is flat and would extend above surrounding forest. The existing oil- and natural-gas-fired power plant stack is located at the site but is shorter and narrower than the proposed cooling tower.

Because the construction of a nuclear plant adjacent to the oil- and natural-gas-fired power plant stack would result in substantial increases in power capacity, it is likely that new or upgraded transmission lines would also be required, which could result in additional offsite construction and visual impacts.

People using recreational facilities near the site may experience traffic congestion on the roads during the construction period, during morning and afternoon commutes of the operations workforce, and during the scheduled maintenance and forced outage periods. Measures to upgrade roads to accommodate the increased traffic would alleviate impacts on users of recreational facilities as well as members of the general public.

Impacts associated with the increased use of the recreational resources in the vicinity and region would be minor. The projected increase in population in St. Clair County associated with in-migrating workers and their families for construction and operation is less than 1 percent of the projected 2020 population and would not affect the availability and use of recreational resources in the area. Based upon the above information, the review team determined that the recreation-related impacts of building and operating at the alternative site would be minor.

Housing

As shown in Table 9-24, an estimated 72,027 housing units are located in St. Clair County, based on 2010 data for housing. The number of vacant units increased from 5035 to 7421 between 2000 and 2010. In 2010, an estimated 31 percent of the vacant housing units were used for seasonal, recreational, or occasional purposes.

Demand for short-term housing is expected to be highest during the peak building employment period, and demand for long-term housing is expected to be highest when operations commence. Based on the analysis of impacts presented in Section 4.4.2, most of the construction and operations workforces would already reside in the area and would be accommodated in existing housing. Approximately 15 percent of the construction workforce (approximately 435 workers during the peak construction) and approximately 30 percent (approximately 270 workers) of the operations workforce would be expected to relocate within a 50-mi radius of the project site. Considering that the construction workforce may choose short-term accommodations such as campsites or hotels, the review team expects that the existing housing supply is sufficient to accommodate the construction workforce of 435 workers during the peak building-related employment period and the operations workforce of 270 workers in-migrating to the area without affecting the housing supply or prices in the local area or stimulating new housing construction. Therefore, the impacts on housing would be minor.

Table 9-24. Housing Units in St. Clair County in 2010

Type of Housing Unit	St. Clair County
Total Housing Units	72,027
Occupied	64,606
Owner-occupied (units)	50,968
Owner-occupied (percent)	79
Renter-occupied (units)	13,630
Renter-occupied (percent)	21
Vacant	7421
Vacancy Rate	
Homeowner (percent)	2.2
Rental (percent)	11.6

Source: USCB 2010c

Public Services

In-migrating construction workforce and operations workforce would increase the demand for water supply and wastewater treatment services within the communities where they choose to reside; the size of the total construction and operations workforce also would increase the demand for water supply and wastewater treatment services at the Greenwood site. Much of the county obtains water supplies through private wells (St. Clair County Metropolitan Planning Commission 2009). Communities with water supply and wastewater treatment services in St. Clair County are shown in Table 9-25, which indicates that most areas have excess capacity and the water supply and wastewater treatment systems should be able to accommodate the in-migrating construction and operations workforces and their families.

Increased demand for police, fire response, and health care services from the in-migrating construction and operations workforces and their families is also expected to be accommodated within the existing systems.

Therefore, the review team expects the impacts on public services to be minor.

Education

St. Clair County has seven school districts (Algonac, Anchor Bay, Capac, East China, Marysville, Port Huron, and Yale) with a combined enrollment of 32,047 for the 2007–2008 school year (U.S. Department of Education 2010). As stated in Section 4.4.4.5, approximately 202 school-age children are expected to in-migrate into the 50-mi region during the peak building employment period, and 124 school-age children are expected to in-migrate during

Table 9-25. Water Supply and Wastewater Treatment Capacity and Demand (2005)

	Water (MGD)		Wastewater (MGD)	
Community	**Capacity**	**Demand[(a)]**	**Capacity**	**Demand[(a)]**
Algonac City	2.75	1.3	–[(b)]	–
Algonac	1.0	0.46	–	–
Clay Township	1.75	0.84	–	–
St. Clair County	–	–	2.7	1.9
Algonac	–	–	0.82	0.63
Clay Township	–	–	0.94	0.63
Ira Township	–	–	0.94	0.63
Burtchville	1.0	0.22	None	None
Capac	0.4	0.2	0.24	0.21
East China	2.7	0.6	3.35	0.85
China Township	0.27	0.06	0.34	0.08
East China Township	2.43	0.54	3.01	0.77
Ira	2.25	0.7	–	–
Marine City	2.0	0.80	7.0	0.80
Cottrellville	0.05	0.02	0.175	0.02
Marine City	1.95	0.78	6.825	0.78
Marysville	7.5	2.2	6.1	2.22
Memphis	0.39	0.09	None	None
Port Huron[(c)]	30.0	7.7	20.0	11.3
Clyde Township	0.69	0.2	None	None
Ft. Gratiot Township	5.7	1.5	3.8	1.28
Kimball Township	2.01	0.4	1.4	0.34
Port Huron City	15.9	4.1	10.8	5.74
Port Huron Township	5.7	1.5	4.0	2.1
St. Clair	3.0	1.4	1.6	1.4
St. Clair County	2.42	1.15	1.28	1.12
St. Clair Township	0.58	0.25	0.32	0.28
Yale	1.65	0.23	1.8	0.35

Source: LSL Planning, Inc. undated

(a) Average daily demand is provided for all utility systems and jurisdictions except for Port Huron. Port Huron reported peak demand.

(b) A dash indicates information was not reported for these jurisdictions.

(c) Peak demand.

operations. Although they could in-migrate anywhere within the 50-mi region, if they were all to go into St. Clair County schools, the county's student population would be increased by less than 1 percent. Given the number of schools in St. Clair County and the large student enrollment, it is likely that new students from building and operating a new nuclear unit at the Greenwood site would be absorbed easily, and education impacts would be minimal for St. Clair County and the larger 50-mi region.

Summary of Impacts on Infrastructure and Community Services at the Greenwood Site

From the information provided by Detroit Edison, review of existing reconnaissance-level documentation, and its own independent evaluation, the review team concludes that the impact of building and operations activities on regional infrastructure and community services – including recreation, housing, water and wastewater facilities, police, fire, and medical facilities, and education – would be minor. The estimated peak workforce of 2900 would have a noticeable but not destabilizing adverse impact on traffic on local roadways near the Greenwood site. These traffic-related impacts could be reduced but not eliminated with proper planning and mitigation measures.

Cumulative Impacts

The geographic area of interest for analysis of cumulative socioeconomic impacts of the Greenwood site is St. Clair County, where most of the socioeconomic impacts of construction and operation of the nuclear power plant are expected to occur.

The impact analyses presented for the Greenwood Energy Center site are cumulative. Past and current economic impacts associated with activities listed in Table 9-19 already have been considered as part of the socioeconomic baseline or in the analyses discussed above for the Greenwood site. Construction and operation of a new nuclear unit at the Greenwood site could result in cumulative impacts on the demographics, economy, and community infrastructure of St. Clair County, in conjunction with those reasonably foreseeable future actions shown in Table 9-19, and generally result in increased urbanization and industrialization. However, many impacts, such as those on housing or public services, are able to adjust over time, particularly with increased tax revenues. Furthermore, State and county plans, along with modeled demographic projections, include forecasts of future development and population increases. Because the projects within the geographic area of interest identified in Table 9-19 would be consistent with applicable land use plans and control policies, the review team considers the cumulative socioeconomic impacts from the projects to be manageable. Physical impacts include impacts on workers and the general public, noise, air quality, buildings, roads, and aesthetics.

Based on the above considerations, Detroit Edison's ER, and the review team's independent evaluation, the review team concludes that under some circumstances, building the nuclear power plant at the Greenwood site could make a temporary small adverse contribution to the cumulative effects associated with some socioeconomic issues. Those issues would include physical impacts (workers and the general public, noise, air quality, buildings, roads, and aesthetics), demography, and local infrastructure and community services (traffic, recreation, housing, water and wastewater facilities, police, fire, and health care services, and education), and would be dependent on the particular jurisdictions affected.

The cumulative effects on regional economies and tax revenues would be beneficial and SMALL, with the exception of St. Clair County, which would receive a MODERATE and beneficial cumulative effect on the economy and a LARGE and beneficial cumulative effect from property taxes. The cumulative effects on physical impacts, demography, infrastructure, and community services would be SMALL within the 50-mi region, except for a MODERATE and adverse cumulative effect on local traffic near the Greenwood Energy Center site during peak building-related activities. Building and operating a new nuclear unit at the Greenwood alternative site would be a significant contributor to the cumulative impacts.

9.3.4.6 Environmental Justice

The economic impact area for the Greenwood alternative site is St. Clair County, Michigan. To evaluate the distribution of minority and low-income populations near the Greenwood site, the review team conducted a demographic analysis of populations within the 50-mi region surrounding the proposed site in accordance with the methodology discussed in Section 2.6.1 of this EIS. The results of this analysis are displayed below in Table 9-26 and 9-27 and Figures 9-8, 9-9, 9-10, and 9-11.

In general, the review team found the population within the 50-mi region surrounding the Greenwood site to be similar in demographic distribution to the 50-mi region surrounding the proposed Fermi 3 site: rural, with few representative minority or low-income populations of interest outside the urban areas (for the Greenwood site, these urban areas are near the boundary of the 50-mi region to the west and south). Because the review team identified St. Clair County as the economic impact area for the Greenwood alternative site, the review team focused its analysis upon the minority and low-income populations within St. Clair County. The economic impact area of St. Clair County was representative of that characterization, with only one minority population of interest (a Black or African American population about 15 mi east of the plant near the Canadian border). This was the closest population of interest to the Greenwood site. The four identified low-income populations of interest included that same minority Census block group, as well as three others slightly farther away from the alternative site.

Based on this analysis, the review team determined that there do not appear to be any identified minority or low-income populations of interest in St. Clair County that would be likely to experience disproportionate and adverse human health, environmental, physical, or

Table 9-26. Results of the Census Block Group Analysis for Minority Populations of Interest within the Region Surrounding the Greenwood Alternative Site (50-mi radius)

County	Total Census Block Groups in the 50-mi Region	Number of Census Block Groups with Minority Populations of Interest					
		Black	American Indian	Asian	Pacific Islander	Hispanic	Aggregate
Genesee	147	20	0	0	0	2	22
Huron	14	0	0	0	0	0	0
Lapeer	64	1	0	0	0	3	1
Macomb	627	36	0	5	0	6	36
Oakland	628	62	0	22	0	26	86
Sanilac	42	0	0	0	0	0	0
St. Clair[(a)]	138	2	0	0	0	0	1
Tuscola	42	0	0	0	0	0	2
Wayne	192	157	0	1	0	0	155
Total	**1894**	**278**	**0**	**28**	**0**	**37**	**302**

Source: USCB 2010d
(a) Shaded row indicates the economic impact area.

Table 9-27. Results of the Census Block Group Analysis for Low-Income Populations of Interest within the 50-mi Region of the Greenwood Alternative Site

County	Total Census Block Groups in the 50-mi Region	Census Block Groups with Low-Income Populations of Interest	
		Number	Percentage
Genesee	147	29	19.7
Huron	14	0	0
Lapeer	64	0	0
Macomb	627	26	4.1
Oakland	628	34	5.4
Sanilac	42	0	0
St. Clair[(a)]	138	11	8.0
Tuscola	42	1	2.4
Wayne	192	68	35.4
Total	**1894**	**169**	**8.9**

Source: USCB 2010e
(a) Shaded row indicates the economic impact area.

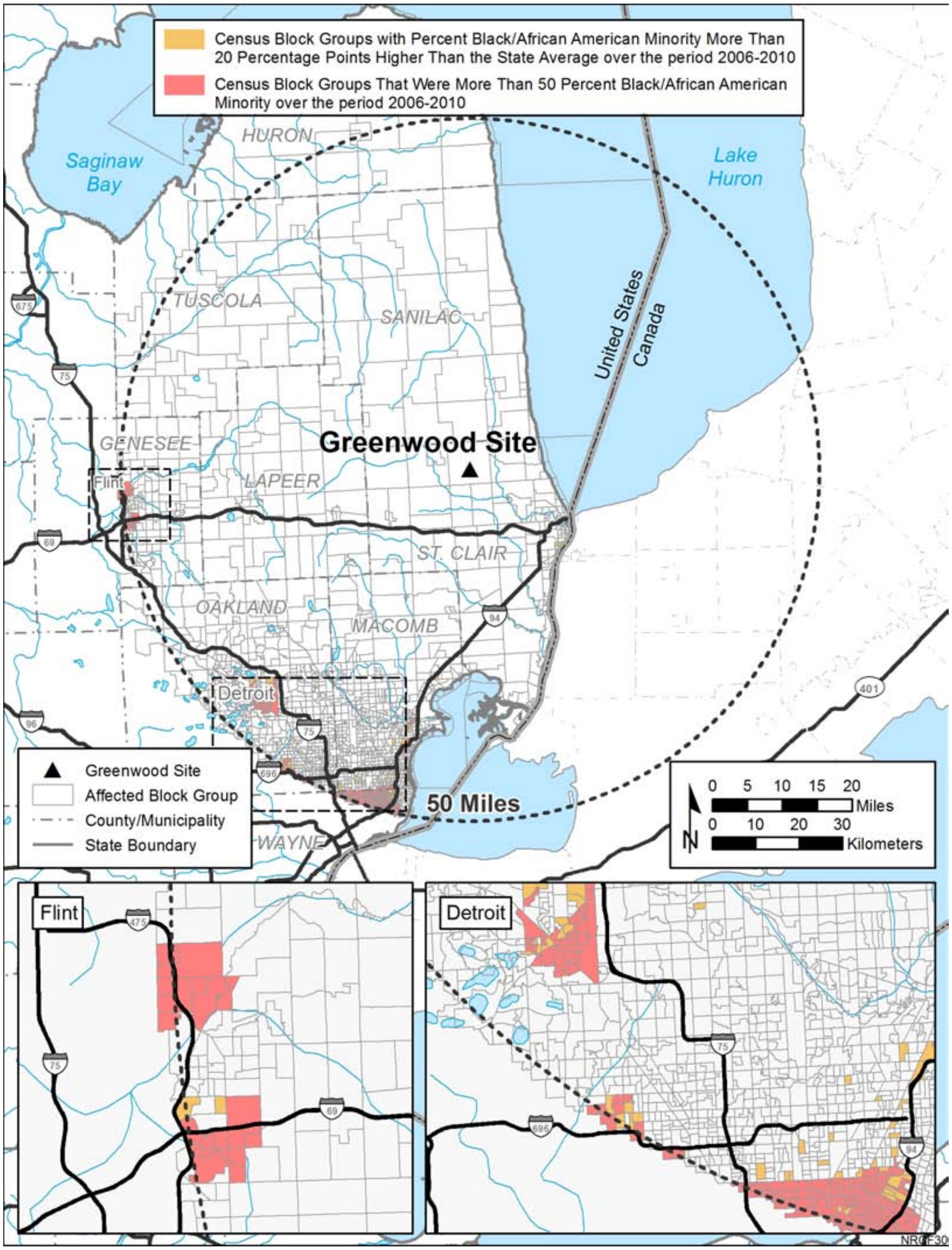

Figure 9-8. Black and African-American Minority Census Block Group Populations of Interest within a 50-mi Radius of the Greenwood Alternative Site (USCB 2010d)

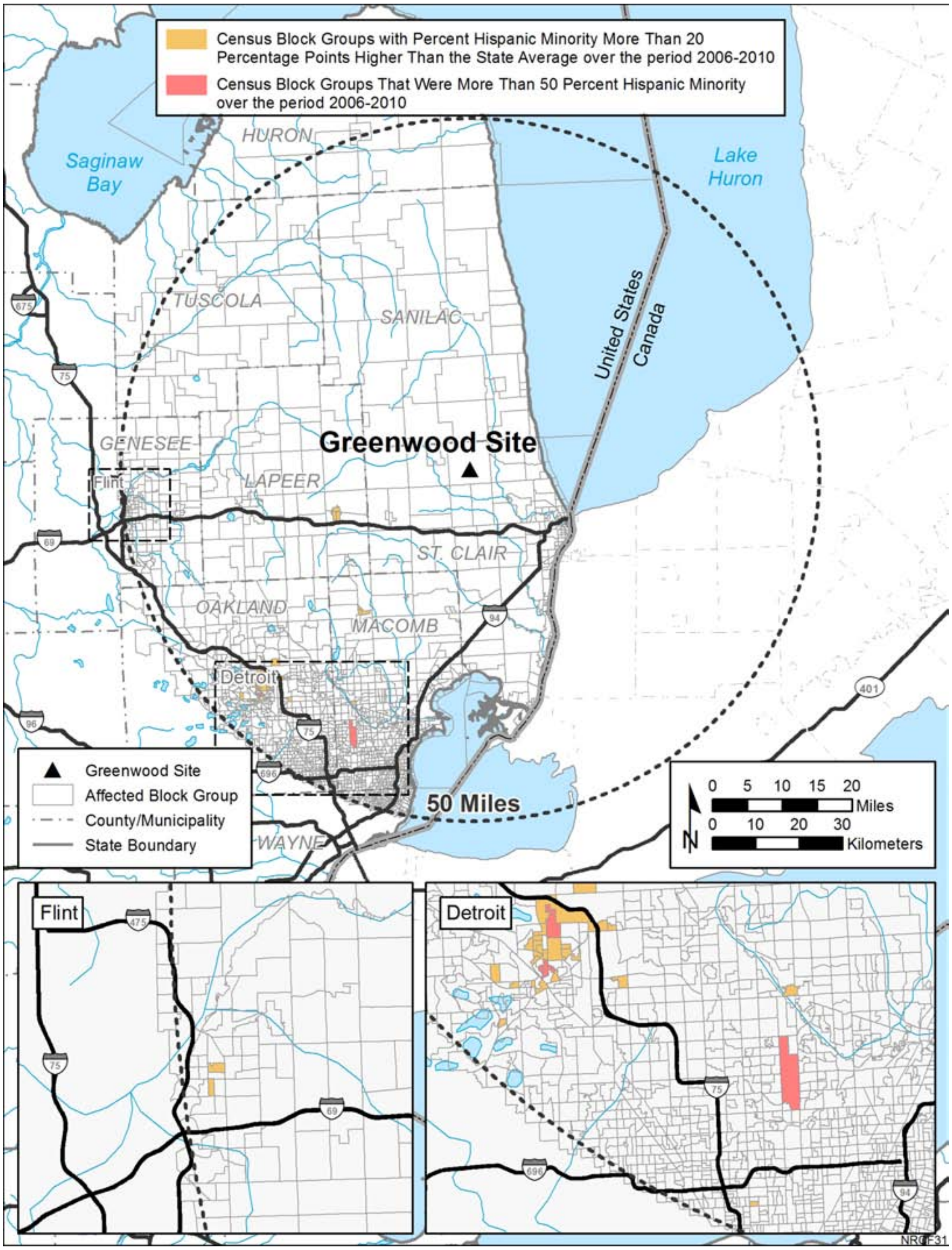

Figure 9-9. Hispanic Minority Census Block Group Populations of Interest within a 50-mi Radius of the Greenwood Alternative Site (USCB 2010d)

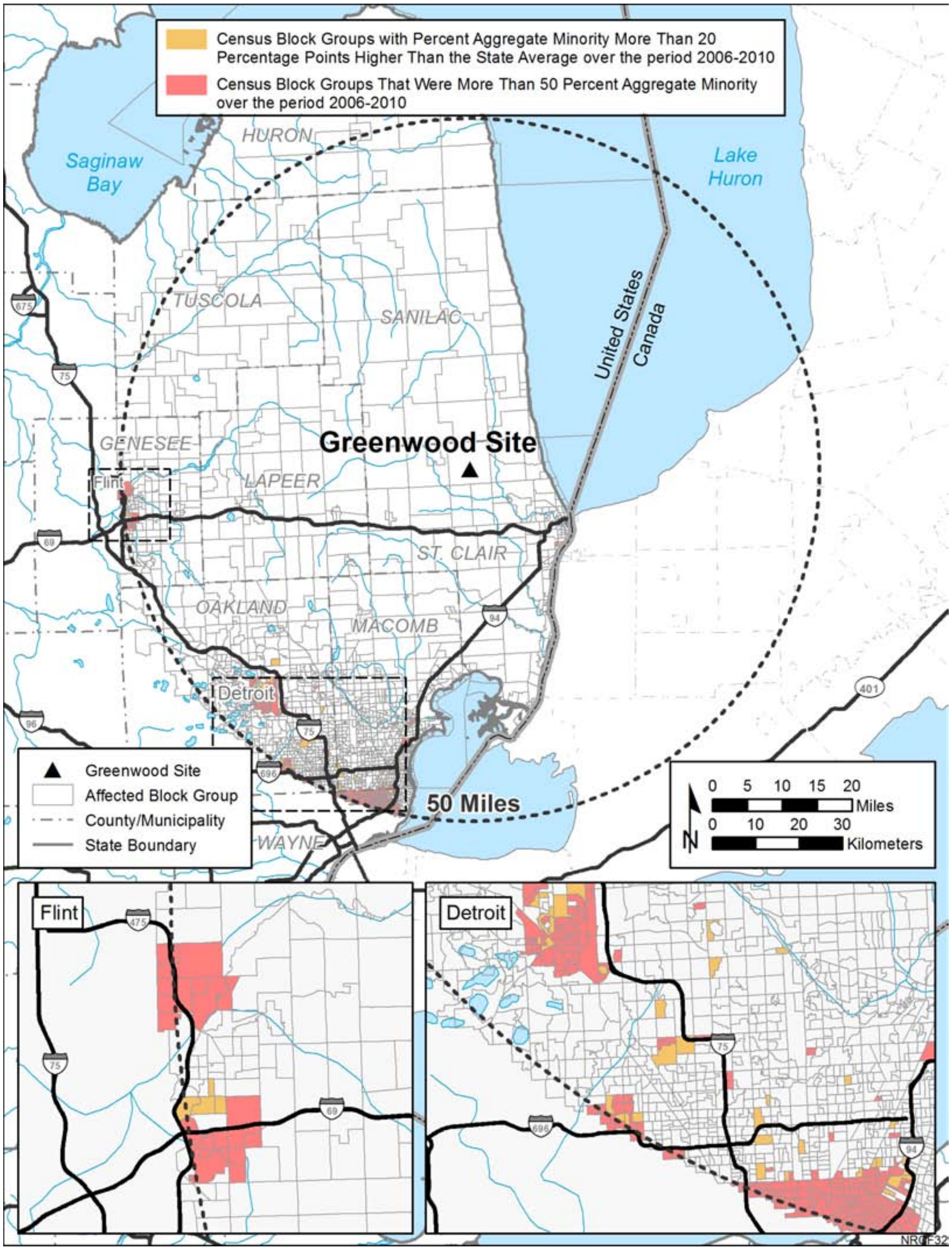

Figure 9-10. Aggregate Minority Census Block Group Populations of Interest within a 50-mi Radius of the Greenwood Alternative Site (USCB 2010d)

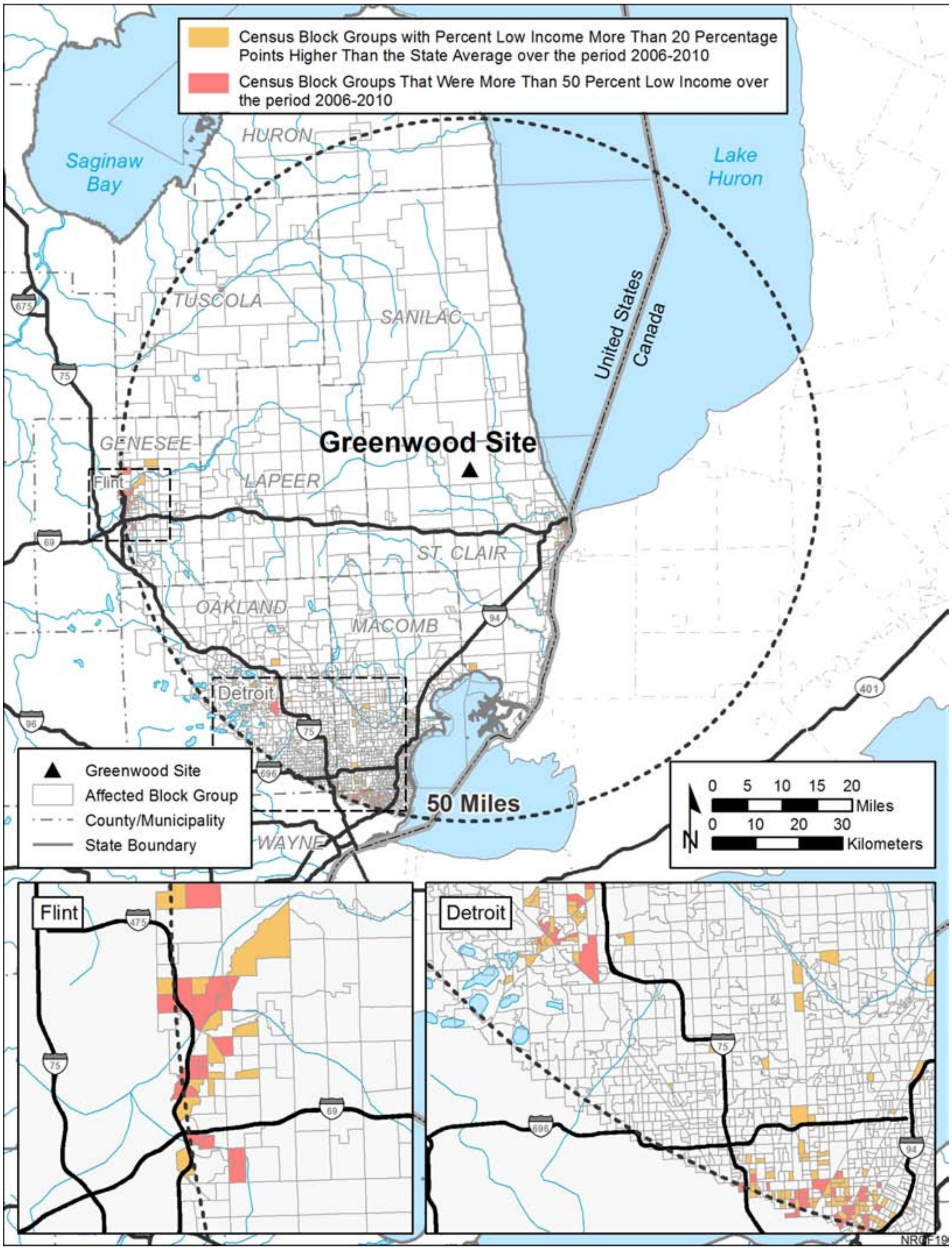

Figure 9-11. Low-Income Census Block Group Populations of Interest within a 50-mi Radius of the Greenwood Alternative Site (USCB 2010e)

socioeconomic effects as a result of construction or operation of a plant at the Greenwood alternative site. The review team did not identify any subsistence activities in St. Clair. For the other physical and environmental pathways described in Section 2.6.1, the review team determined that impacts at the Greenwood site would be similar to those at the Fermi 3 site. Therefore, the review team determined the environmental justice impacts of building and operating a nuclear reactor at the Greenwood site would be SMALL.

9.3.4.7 Historic and Cultural Resources

This section presents the review team's evaluation of the potential impacts of siting a new ESBWR at the Greenwood site on historic and cultural resources. For the analysis of impacts on historic and cultural resources, the geographic area of interest is considered to be the APE that would be defined for a new nuclear power facility at the site. This includes the physical APE, defined as the area directly affected by building and operating a new nuclear power plant and transmission lines, and the visual APE (i.e., the area from which the structures can be seen). The visual APE includes the area within 1 mi of the physical APE.

In developing the EIS, the review team relied upon reconnaissance-level information to perform its alternative site evaluation. Reconnaissance-level activities in a cultural resources review have particular meaning. For example, these activities may include site file searches, background research for environmental and cultural contexts, and preliminary field investigations to confirm the presence or absence of cultural resources in an APE or the sensitivity of an APE for cultural resources. For this alternatives analysis, reconnaissance-level information is considered data readily available from Federal and State agencies and other public sources. The following sources were used to identify reconnaissance-level information on historic and cultural resources in the APE at the Greenwood site:

- NPS's National Historic Landmarks Program database for designated National Historic Landmarks (NPS 2010a).
- NPS's NRHP database for properties listed in the NRHP (NPS 2010b).
- NationalRegisterofHistoricPlaces.com database for properties listed in the NRHP (NRHP 2010).
- Michigan's Historic Sites Online database for cultural resources significant to the State of Michigan (MSHDA 2010a).
- Detroit Edison's ER (Detroit Edison 2011a).
- *Cultural Resources Site File Review of Seven Alternative Sites in Monroe, Lenawee, St. Clair, and Huron Counties, Michigan, Fermi Nuclear Power Plant Unit 3 (Fermi 3) Project, Frenchtown and Berlin Townships, Monroe County, Michigan* (Lillis-Warwick et al. 2009).

No National Historic Landmarks, historic properties listed in the NRHP, or other cultural resources were identified within the APE (NPS 2010a, b; NRHP 2010; MSHDA 2010a; Lillis-Warwick et al. 2009). The closest cultural resources and/or historic properties identified within the general vicinity of the APE consist of two architectural resources (Detroit Edison 2011a). The first is the James McColl Residence (Site ID#P26144, also known as the James Godo Residence), a late-nineteenth century house, which is approximately 4 mi northwest of the APE in the town of Yale, St. Clair County. It was listed in the NRHP in 1985 (MSHDA 2010c) and is considered a historic property, pursuant to Section 106 of the NHPA. The second is the Ruby United Methodist Church, a late-nineteenth century church that was originally a store and was converted into a church in 1864. It was moved from its original location to its current location in 1928; the current location is approximately 7 mi south of the APE in Clyde Township, St. Clair County. It was listed in the Michigan SRHP in 1990 (MSHDA 2010d). It has not been included in, or determined to be eligible for inclusion in, the NRHP. Therefore, it is not considered a historic property pursuant to Section 106 of the NHPA. No archaeological and/or architectural surveys have been conducted at the alternative site to identify additional previously unrecorded cultural resources in the APE.

Consultation with the Michigan SHPO would be necessary to determine the need for cultural resources investigations (including archaeological and architectural surveys) to identify cultural resources within the APE prior to any onsite ground-disturbing activities; to determine whether any identified cultural resources are eligible for inclusion in the NRHP; to evaluate the potential impacts on cultural resources and/or historic properties; and to determine the effect of a new nuclear power facility at the Greenwood site pursuant to Section 106 of the NHPA. As part of this consultation, Detroit Edison would be expected to put measures in place to protect discoveries in the event that cultural resources are found during building or operation of a new plant. If an unanticipated discovery was made during building activities, site personnel would have to notify the Michigan SHPO and consult with them in conducting an assessment of the discovery to determine if additional work is needed.

The incremental impacts from installation and operation of offsite transmission lines and potential water intake and discharge pipelines to Lake Erie would be minimal, if there were no significant alterations (either physical alteration or visual intrusion) to the cultural environment. If these activities resulted in significant alterations to the cultural environment, then the impact could be greater. Although building and operating potential water intake and discharge pipelines would be the responsibility of Detroit Edison, building and operating the offsite transmission lines would be the responsibility of a transmission company. For impacts greater than small, mitigation may be developed in consultation with the appropriate Federal and State regulatory authorities. Only Federal undertakings would require a Section 106 review.

The APE does not contain any Indian Reservation land, and no Federally recognized Indian Tribes have indicated an interest in St. Clair County (BIA undated; NPS 2010c). However, consultation with Federally recognized Indian Tribes in the State of Michigan would be necessary in accordance with Section 106 of the NHPA. As part of this consultation, the NRC would consult with all 12 Federally recognized Indian Tribes that are located within the State of Michigan, as identified for the Fermi site (Michigan Department of Human Services 2001–2009). In addition, because of the APE's proximity to Canada, it is possible that prior to Euro-American settlement, the APE may have been settled and/or used by groups (First Nations) that are now located within Canada, as described in Section 9.3.3.7. One First Nation reserve is located outside, but in the general vicinity, of the APE in Ontario, Canada: Sarnia Reserve 45 (INAC 2010). Sarnia Reserve 45 is located approximately 15 mi southeast of the Greenwood site, on the eastern side of the St. Clair River south of Sarnia, Ontario. The Aamjiwnaang First Nation is associated with Sarnia Reserve 45. Additional First Nation reserves, which are more than 30 mi further to the south and east of the Greenwood site, in southern Ontario, would be the same as those identified for the Belle River-St. Clair site (see Table 9-18) (INAC 2010). The review team would consider the need to consult with INAC and First Nations to identify any concerns regarding physical (direct) or visual (indirect) impacts on cultural resources within the APE.

The following cumulative impact analysis for historic and cultural resources includes building and operating a new nuclear power facility at the Greenwood site. This analysis also considers other past, present, and reasonably foreseeable future actions that could affect historic and cultural resources, as identified in Table 9-19. The APE for the cumulative impact analysis for historic and cultural resources at the Greenwood site consists of the alternative site area and any new transmission line corridors, and a 1-mi buffer area around the site and the corridors.

The Greenwood site includes areas of agricultural land, woodland, wetland, and previous development (e.g., power plant, aboveground transmission lines, pipelines, roads, and railroads). Agricultural activities such as plowing, disking, and harvesting (whether historic or modern [mid-nineteenth to mid-twentieth century]) and logging or clearing of original forests (prior to the reestablishment of the existing woodland areas) are likely to have resulted in minimal subsurface disturbance, suggesting that at least some areas at the Greenwood site, which are currently used for agricultural purposes or as woodland, may have sustained minimal prior ground disturbance. However, historic aerial photography indicates that nearly the entire Greenwood site was cleared and graded in the past (Detroit Edison 2011a), suggesting that the site is likely to have undergone significant prior disturbance during previous development. Past actions at the Greenwood site that may have destroyed, disturbed, or otherwise affected onsite historic and cultural resources in the APE may have included construction and operation of the existing Greenwood Energy Center, Wilkes and Kilgore roads, a spur track of the CSX Transportation mainline rail line, and an existing 345-kV transmission line.

Construction and operation of the existing Greenwood Energy Center may have also indirectly (visually) affected cultural resources within the visual APE. Additional past actions, as identified from Table 9-19, such as construction and operation of the Belle River Power Plant, and the St. Clair Power Plant, approximately 24–25 mi southeast on the St. Clair River, would likely be too far away to incur cumulative indirect (visual) impacts on historic or cultural resources within the APE at the Greenwood site. Because a new nuclear power facility at the Greenwood site would be located on property that already contains the existing Greenwood Energy Center, it is likely that the proposed project would not result in new significant indirect (visual impacts) on cultural resources within the visual APE.

Based on reconnaissance-level information provided by Detroit Edison and identified by the review team and the review team's independent evaluation of this information, the review team concludes that the cumulative impacts on historic and cultural resources from building and operating a new nuclear power facility at the Greenwood site would be SMALL. This impact determination is based on available information, which indicates that nearly the entire Greenwood site was cleared and graded in the past, suggesting that the site has undergone prior subsurface ground disturbance; that no known historic properties are located within the APE; and that the existing and operating Greenwood Energy Center is already a landscape element within the existing visual setting for the site. However, cultural resources investigations within undisturbed portions of the APE and for any proposed transmission lines and water pipelines might reveal important historic properties that could result in greater cumulative impacts.

9.3.4.8 Air Quality

Criteria Pollutants

For a plant with the same capacity as the proposed Fermi 3 plant, the emissions from building and operating a nuclear power plant at the Greenwood site are assumed to be comparable to those from Fermi 3, as described in Chapters 4 and 5. The alternative site would be located in St. Clair County, about 10 mi west of Lake Huron. St. Clair County is in the Metropolitan Detroit-Port Huron Intrastate AQCR (40 CFR 81.37). Currently, St. Clair County is designated as a nonattainment area for $PM_{2.5}$ NAAQS and as a maintenance area for 8-hr ozone NAAQS (EPA 2010b). In July 2011, MDEQ submitted a request asking the EPA to redesignate Southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011). In July 2012, the EPA issued a proposed rule designating southeastern Michigan as having attained both the 1997 annual $PM_{2.5}$ NAAQS and the 2006 24-hour $PM_{2.5}$ NAAQS, based on 2009–2011 ambient air monitoring data (77 FR 39659, dated July 5, 2012), but the final determination has yet to be made.

In Sections 4.7 and 5.7, the review team concludes that air quality impacts of building and operating a plant at Fermi 3, including those associated with transmission lines and cooling towers, would be SMALL, as long as appropriate measures are taken to mitigate dust during building activities. During operation, cooling towers would be the primary source of $PM_{2.5}$, which accounts for most of total $PM_{2.5}$ emissions of 9.51 tons/yr at Fermi 3. However, these emissions would be relatively small and thus are not anticipated to elevate $PM_{2.5}$ concentrations in a designated nonattainment area. With dust mitigation, the impacts of building and operating a plant at the Greenwood site would also be SMALL. Any new industrial projects would either be small or subject to permitting by MDEQ. State permits are issued under regulations approved by the EPA and deemed sufficient to attain and maintain the NAAQS and comply with other Federal requirements under the CAA. Thus, the cumulative air quality impacts of building and operating a plant at the Greenwood site would be SMALL.

Greenhouse Gases

The extent and nature of climate change is not sensitive to where GHGs are emitted, because the long atmospheric lifetimes of GHGs result in extensive transport and mixing of these gases. Because the emissions of a plant at the Greenwood site would be comparable to those of a similar plant at the Fermi site, the discussions of Sections 4.7 and 5.7 for Fermi 3 also apply to building and operating a similar plant at the Greenwood site. Thus, the impacts of the plant's GHG emissions on climate change would be SMALL, but the cumulative impacts considering global emissions could be MODERATE. Building and operating a new nuclear unit at the Greenwood site would not be a significant contributor to these impacts.

9.3.4.9 Nonradiological Health

The following impact analysis considers nonradiological health impacts from building activities and operations on the public and workers from a new nuclear facility at the Greenwood Energy Center. The analysis also considers other past, present, and reasonably foreseeable future actions that affect nonradiological health, including other Federal and non-Federal projects and those projects listed in Table 9-19 within the geographic area of interest. The building-related activities that have the potential to affect the health of members of the public and workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the transport of construction materials and personnel to and from the site. The operation-related activities that have the potential to affect the health of members of the public and workers include exposure to etiological agents, noise, EMFs, and transport of workers to and from the site.

Most of the nonradiological impacts of building and operation (e.g., noise, etiological agents, occupational injuries) would be localized and would not have significant impact at offsite locations. However, activities such as vehicle emissions from transport of personnel to and from the site would encompass a larger area. Therefore, for nonradiological health impacts, the geographic area of interest for cumulative impacts analysis includes projects within a 50-mi radius of the Greenwood site based on the influence of vehicle and other air emissions sources, because the site is in a nonattainment area (Section 9.3.4.8). For cumulative impacts associated with transmission lines, the geographical area of interest is the transmission line corridor. These geographical areas are expected to encompass areas where public and worker health could be influenced by the proposed project and associated transmission lines, in combination with any past, present, or reasonably foreseeable future actions.

Building Impacts

Nonradiological health impacts on the construction workers from building a new nuclear unit at the Greenwood site would be similar to those from building Fermi 3 at the Fermi site, as evaluated in Section 4.8. They include occupational injuries, noise, odor, vehicle exhaust, and dust. Applicable Federal, State, and local regulations on air quality and noise would be complied with during the plant construction phase. The Greenwood site does not have any characteristics that would be expected to lead to fewer or more construction accidents than would be expected for the Fermi site. The site is in a predominantly rural area, and construction impacts would likely be minimal on the surrounding populations that are classified as medium- and low-population areas. Access routes to the site for construction workers would include State Route 136, approximately 1 mi south of the site, and Duce Road. Mitigation may be necessary to ease congestion, thereby improving traffic flow and reducing nonradiological health impacts (i.e., traffic accidents, injuries, and fatalities) during the building period.

Operational Impacts

Nonradiological health impacts on occupational health of workers and members of the public from operation of a new nuclear unit at the Greenwood site would be similar to those evaluated in Section 5.8 for the Fermi site. Occupational health impacts on workers (e.g., falls, electric shock, or exposure to other hazards) at the Greenwood Energy Center site would likely be the same as those evaluated for workers at the new Fermi site unit. Discharges to Lake Huron would be controlled by NPDES permits issued by MDEQ (Section 9.3.4.2). The growth of etiological agents would not be significantly encouraged at the Greenwood site because of the temperature attenuation in the length of the pipe required for a discharge system. Noise and EMF exposure would be monitored and controlled in accordance with applicable OSHA regulations. Effects of EMFs on human health would be controlled and minimized by conformance with NESC criteria. Nonradiological impacts of traffic during operations would be less than the impacts during building. Mitigation measures employed during building to improve traffic flow would also minimize impacts during operation of a new unit.

Cumulative Impacts

Past and present actions within the geographic area of interest that could contribute to cumulative nonradiological health impacts include the energy and mining projects in Table 9-19, as well as vehicle emissions and existing urbanization. Reasonably foreseeable future projects in the geographical area of interest that could contribute to cumulative nonradiological health impacts include construction of the Dawn Gateway Pipeline, and the I-94 Black River Bridge replacement in Port Huron, future transmission line development, and future urbanization.

The review team is also aware of the potential climate changes that could affect human health. A recent compilation of the state of the knowledge in this area (USGCRP 2009) has been considered in the preparation of this EIS. Projected changes in climate for the region include an increase in average temperature, increased likelihood of drought in summer, more heavy downpours, and an increase in precipitation, especially in the winter and spring, which may alter the presence of microorganisms and parasites. In view of the water source characteristics, the review team did not identify anything that would alter its conclusion regarding the presence of etiological agents or change in the incidence of waterborne diseases.

Summary of Nonradiological Health Impacts at the Greenwood Site

Based on the information provided by Detroit Edison and the review team's independent evaluation, the review team expects that the impacts on nonradiological health from building and operating a new nuclear unit at the Greenwood site would be similar to the impacts evaluated for the Fermi site. Although there are past, present, and future activities in the geographical area of interest that could affect nonradiological health in ways similar to the building and operation of a new unit at the Greenwood Energy Center site, those impacts would be localized and managed through adherence to existing regulatory requirements. Similarly, impacts on public health of a new nuclear unit operating at the Greenwood Energy Center site would be expected to be minimal. The review team concludes, therefore, that the cumulative impacts of building and operation of a nuclear unit at Greenwood site on nonradiological health would be SMALL.

9.3.4.10 Radiological Health

The following impact analysis considers radiological impacts on the public and workers from building activities and operations for one nuclear unit at the Greenwood Energy Center alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health, including other Federal and non-Federal projects and those projects listed in Table 9-19 within the geographic area of interest. The geographic area of interest is the area within a 50-mi radius of the Greenwood site. As described in Section 9.3.4, the Greenwood site contains one 800-MW oil-fired unit and three gas CTs. There are currently no nuclear facilities on the site or within a 50-mi radius. There are likely to be medical, industrial, and research facilities within 50 mi of the Greenwood site that use radioactive materials.

The radiological impacts of building and operating the proposed ESBWR unit at the Greenwood site include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways would result in low doses to people and biota offsite that would be well below regulatory limits. These impacts are expected to be similar to those at the proposed Fermi site.

The NRC staff concludes that the dose from direct radiation and effluents from medical, industrial, and research facilities that use radioactive materials would be an insignificant contribution to the cumulative impacts around the Greenwood site. This conclusion is based on data from radiological environmental monitoring programs conducted around currently operating nuclear power plants. Based on the information provided by Detroit Edison and the NRC staff's independent analysis, the NRC staff concludes that the cumulative radiological impacts from building and operating the proposed ESBWR and other existing projects and actions in the geographic area of interest around the Greenwood site would be SMALL.

9.3.4.11 Postulated Accidents

The following impact analysis considers radiological impacts from postulated operations accidents for one nuclear unit at the Greenwood Energy Center alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health from postulated accidents, including other Federal and non-Federal projects and those projects listed in Table 9-19 within the geographic area of interest. As described in Section 9.3.4, the Greenwood site is an active power generation site; however, there are currently no nuclear facilities on the site. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Greenwood site. The only existing facility potentially affecting radiological accident risk within this geographic area of interest is Fermi 2, because the 50-mi radius for Fermi 2 overlaps part of the 50-mi radius for the Greenwood site. No other reactors have been proposed within the geographic area of interest.

As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of DBAs at the proposed Fermi site would be minimal for an ESBWR. DBAs are addressed specifically to demonstrate that a reactor design is sufficiently robust to meet NRC safety criteria. The ESBWR design is independent of site conditions, and the meteorologies of the alternative and the proposed Fermi sites are similar; therefore, the NRC staff concludes that the environmental consequences of DBAs at the site would be SMALL.

Because the meteorology, population distribution, and land use for the Greenwood site are expected to be similar to those for the proposed Fermi site, risks from a severe accident for an ESBWR located at the Greenwood site would be expected to be similar to those analyzed for the proposed Fermi site. These risks for the proposed Fermi site are presented in Tables 5-34 and 5-35 of this EIS and are well below the mean and median values for current-generation reactors. In addition, as discussed in Section 5.11.2, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028). For the existing plant within the geographic area of interest (i.e., Fermi 2), the Commission has determined the probability-weighted consequences of severe accidents are small (10 CFR Part 51, Appendix B, Table B-1). Because of the NRC's safety review criteria, it is expected that risks for any new reactors at any other locations within the geographic area of interest for the Greenwood site would be well below risks for current-generation reactors and would meet the Commission's safety goals. The severe accident risk due to any particular nuclear power plant becomes smaller as the distance from that plant increases. However, the combined risk at any location within 50 mi of the Greenwood site would be bounded by the sum of risks for all these operating nuclear power plants and would still be low.

On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Greenwood site would be SMALL.

9.3.5 Petersburg Site

This section presents the review team's evaluation of the potential environmental impacts of building and operating a nuclear reactor at the Petersburg site. The following sections describe a cumulative impact assessment conducted for each major resource area. The specific resources and components that could be affected by the incremental effects of the proposed action if it were implemented at the Petersburg site and other actions in the same geographic area were considered. This assessment includes the impacts of NRC-authorized construction, operations, and preconstruction activities. Also included in the assessment were other past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could have meaningful cumulative impacts when considered together with the proposed action if implemented at the Petersburg site. Other actions and projects considered in this cumulative analysis are described in Table 9-28. The location and vicinity of the Petersburg alternative site are shown in Figure 9-12.

Referred to by Detroit Edison in its site selection process as Site A, the Petersburg site is approximately 7 mi north of the Michigan–Ohio border in Monroe County. This greenfield site occupies approximately 1900 ac in Sections 28, 29, 32, and 33 of Township 7 South, Range 6 East in Summerfield Township. The site is currently in agricultural use. Approximately 25 individuals currently reside on the site. Other than onsite residents, the next closest receptors are in the town of Deerfield, approximately 4 mi northwest.

Access to the site is provided by local roads, via U.S. Route 223. Rail access is provided via the CN North American line that runs along the northern border of the site.

Both 345-kV and 120-kV transmission lines are present approximately 1 mi north of the site, both with uncommitted capacity.

The closest surface water resource is the River Raisin, approximately 4 mi north of the site. However, water quality is poor. Lake Erie, the more likely source of water for operations of a nuclear plant at this site, is about 17 mi east of the site. Drainage from the site is provided by engineered ditches. No portion of the site is believed to be in the River Raisin floodplain;

Table 9-28. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Petersburg Alternative Site Cumulative Analysis

Project Name	Summary of Project	Location	Status
Energy Projects			
J.R. Whiting Power Plant	328-MW coal-fired plant	13 mi east-southeast of Petersburg site	Operational
Bay Shore Power Plant	499-MW coal-fired plant	16 mi southeast of Petersburg site in Maumee Bay, Ohio	Operational
Detroit Edison Monroe Power Plant	3280-MW coal-fired plant	19 mi east-northeast of Petersburg site	Operational
Fermi Unit 2	1098-MW nuclear power plant, including recently completed ISFSI and decommissioned Fermi 1 collocated on site	25 mi east-northeast of Petersburg site	Operational
Davis Besse Nuclear Plant Unit 1	925-MW nuclear power plant	36 mi southeast of Petersburg site on Lake Erie	Operational
Mining Projects			
STONECO-Ottawa Lake Site	Limestone and landscape material (i.e., boulders, gravel, topsoil, and sand)	6 mi south-southeast of Petersburg site	Operational
STONECO-Meanwell Road Site	Commercial fill sand and topsoil.	7 mi northeast of Petersburg site	Operational
Transportation Projects			
Cleveland-Toledo-Detroit Passenger Rail Line	Addition to regional transportation hub with rail lines connecting Cleveland, Buffalo, Toronto, Pittsburgh, Cincinnati, and Detroit	Rail line would pass through Monroe County on its way to Detroit	Proposed; schedule undetermined
Other Actions/Projects			
Petersburg WWTP	WWTP that discharges to River Raisin	4 mi north of Petersburg site on River Raisin	Operational
Deerfield WWTP	WWTP that discharges to River Raisin	4 mi north-northwest of Petersburg site on River Raisin	Operational
Midwest Grain Processing – Blissfield	Manufactures industrial organic chemicals with discharge to River Raisin.	5 mi west of Petersburg site	Operational
Global Ethanol Services	Manufactures industrial organic chemicals with discharge to Golf County Drain.	5 mi west of Petersburg site	Operational

Table 9-28. (contd)

Project Name	Summary of Project	Location	Status
Blissfield WWTP	WWTP that discharges to River Raisin	6 mi west of Petersburg site on River Raisin	Operational
Blissfield Manufacturing Company	Fabricated metal products	6 mi west of Petersburg site on River Raisin	Operational
Holcim (US) Inc. – Dundee	Portland cement plant	9 mi north-northeast of Petersburg site	Operational
Dundee WWTP	WWTP that discharges to River Raisin	9 mi north-northeast of Petersburg site on River Raisin	Operational
Central Lenawee WWTP and landfill	WWTP and landfill that discharges to River Raisin	13 mi west-northwest of Petersburg site	Operational
Adrian WWTP	WWTP that discharges to South Branch of River Raisin	15 mi west-northwest of Petersburg site	Operational
Dairy Farmers of America	Milk processing facility with discharge to South Branch of River Raisin	15 mi west-northwest of Petersburg site	Operational
Tecumseh WWTP	WWTP that discharges to River Raisin	15 mi northwest of Petersburg site	Operational
Fairfield Township Wastewater Stabilization Lagoon	Wastewater stabilization lagoon that discharges to River Raisin.	15 mi northwest of Petersburg site	Operational
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and rail; construction of water and/or wastewater treatment and distribution facilities and associated pipelines, as described in local land use planning documents. No specific data found concerning development/ expansion of the towns within 20 mi of site.	Throughout region	Construction would occur in the future, as described in State and local land use planning documents.
Global Climate Change/Natural Environmental Stressors	Short- or long-term changes in precipitation or temperature	Throughout region	Impacts would occur in the future

Source: Modified from NRC 2010a, d

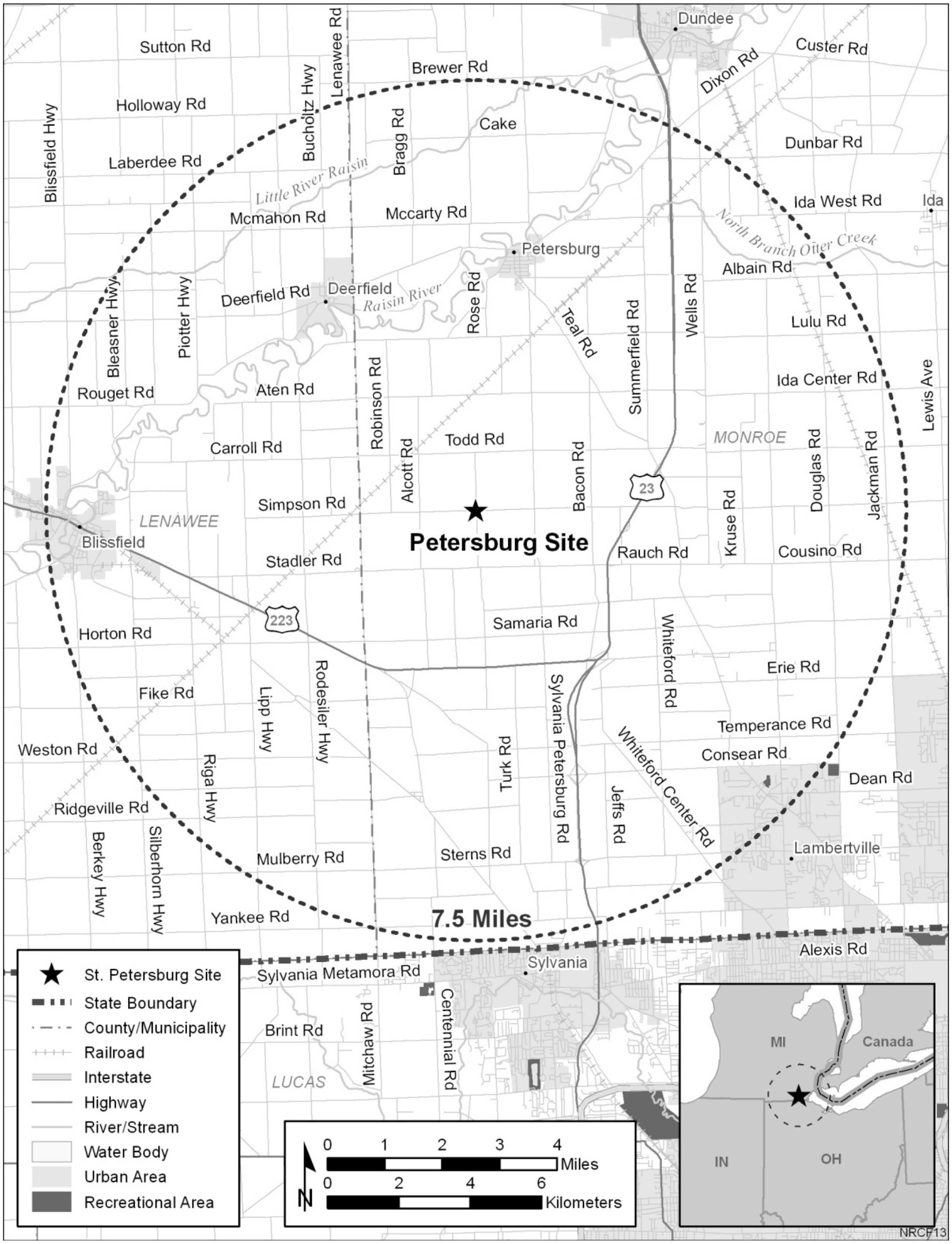

Figure 9-12. The Petersburg Alternative Site and Vicinity

however, a small portion of Section 30 in the forested portion of the site appears on the FWS Wetland Inventory Map for the area. Groundwater resources in the area are present in the Silurian and Devonian bedrock aquifer, which is approximately 100 to 200 ft thick.

Ecology on the site is composed primarily of cropland (i.e., wheat, corn, soybeans). A 50-ac forest parcel contains second-growth ash, oak (*Quercus* spp.), cottonwood, and maple (*Acer* spp.), with some portion of the forested area permanently wet.

The closest population center is Toledo, Ohio, 8 mi southeast of the site, with a 2000 population of approximately 305,000. The nearest towns, Petersburg, Deerfield, and Dundee, have 2000 populations of 1157, 1005, and 3522, respectively.

9.3.5.1 Land Use

The following impact analysis considers impacts on land use from building activities and operations at the Petersburg site and within the geographic area of interest, which is the 15-mi region surrounding the Petersburg site. The analysis also considers past, present, and reasonably foreseeable future actions that affect land use, including other Federal and non-Federal projects and those projects listed in Table 9-28 within the geographic area of interest.

The Petersburg site is owned by a number of private individuals and is zoned as agricultural (Detroit Edison 2011a). The proposed location for the new facility is in the southern part of the approximately 1900-ac site. There are approximately 25 buildings on the site, including existing residences, new dwellings, and abandoned barns (Detroit Edison 2011a). Site topography is generally flat with very little variation and is mainly prime agricultural land with some young mixed deciduous woodland. At least one forested wetland occurs on the site (see Section 9.3.5.3), and the site is outside of mapped floodplains (Detroit Edison 2011a). If the facilities associated with this alternative would extend into the Coastal Zone defined by the State of Michigan under the Coastal Zone Management Act, Detroit Edison would have to obtain a coastal zone consistency determination from MDEQ.

If a new nuclear power plant were located on the Petersburg site, portions of the 1900-ac tract would be disturbed, and some of the farmland and woodland areas on the tract would likely be lost possibly including some prime farmland). Based on Detroit Edison's conceptual plant layout (Detroit Edison 2009b), the review team estimates that the project would permanently occupy as much as 80 ac and temporarily disturb as much as 200 ac. Intake and discharge pipelines built to transfer water to and from Lake Erie could result in some offsite land use impacts, and the pipelines would likely cross railroad tracks and local roads. No new offsite roadways are expected to be needed during development or operation of the proposed facility (Detroit Edison 2011a).

The recreational area nearest to the site is the Petersburg State Game Management Area, approximately 1.5 mi northeast. There are several small local parks in Lambertville, about 6 mi southeast of the site (Detroit Edison 2011a). Recreational resources in Monroe County may be affected by development and operation of a plant at the Petersburg site, including increased user demand associated with the projected increase in population with the in-migrating workforce and their families; an impaired recreational experience associated with the views of the proposed 600-ft cooling tower and condensate plume; or access delays associated with increased traffic from the construction and operations workforce on local roadways.

An existing 120-kV and a 345-kV transmission line runs approximately 1.2 mi north of the site (Detroit Edison 2011a). Environmental conditions along the likely transmission line corridor are similar to those of the site, with a mixture of cropland, wooded areas, and some wetlands (Detroit Edison 2011a). Because of the short distance from the proposed site to the transmission interconnections, the review team concludes that the land use impacts of building and operating transmission lines for a new nuclear plant at the Petersburg site would be minor.

For cumulative land use analysis, the geographic area of interest is the 15-mi region surrounding the Petersburg site. This geographic area of interest includes the primary community (Summerfield Township) that would be affected by the proposed project if it were located at the Petersburg site.

There are a number of projects identified in Table 9-28 likely to affect land use in the geographic area of interest around the Petersburg site. The proposed Cleveland-Toledo-Detroit rail line project, which would be within 10 mi of the proposed site, would require slight changes in land use around the Petersburg site. Other projects identified in Table 9-28 have contributed or would contribute to some decreases in open lands, wetlands, and forested areas and generally result in increased urbanization and industrialization. However, the continued presence of existing parks, reserves, and managed areas would help preserve a substantial area of open lands, wetlands, and forested areas. The projects within the geographic area of interest identified in Table 9-28 would generally be consistent with applicable land use plans. The distance to transmission interconnections would be approximately 1.2 mi (Detroit Edison 2011a). Even with the new reactor facilities and other reasonably foreseeable development projects anticipated for the geographic area of interest, the currently rural character of the area would not likely be noticeably altered.

As described for the Fermi site in Section 7.1, climate change could increase precipitation and flooding in the area around the Petersburg site, while increased lake evaporation and reduced lake ice accumulation could reduce lake levels, thus changing land use through an increase in low-lying lakeshore areas (USGCRP 2009). Forest growth may increase as a result of more CO_2 in the atmosphere, while existing parks, reserves, and managed areas would help preserve wetlands and forested areas to the extent that they are not affected by the same factors

(USGCRP 2009). In addition, climate change could reduce crop yields and livestock productivity (USGCRP 2009), which might affect land use in some agricultural areas.

Based on the information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that the cumulative land use impacts associated with siting a reactor at the Petersburg site would be SMALL, and no mitigation would be warranted.

9.3.5.2 Water Use and Quality

Surface water features in the vicinity of the Petersburg site include engineered ditches and a small wetland area in the forested portion of the property. Because the surface water resources near the site are poor, water for a reactor at the Petersburg site was originally proposed to come from the River Raisin, which is about 4 mi north of the site. During the review team's visit in January 2009, the River Raisin was observed to be of moderate size with modest flow, and concern was expressed by the review team regarding the adequacy of the river as a source of cooling water for the proposed power plant and the river's ability to accept discharges of heated and chemically treated cooling tower blowdown discharges. Detroit Edison (Detroit Edison 2009c) has since indicated that a pipeline to Lake Erie would be a possible method of providing a dependable water source for power plant operations. A representative route along State highways and county roads was provided by Detroit Edison, with a total pipeline length of more than 15 mi. A new intake structure would be necessary at the lake (constructed under the USACE and MDEQ permits). Discharge would include cooling tower blowdown, treated process wastewater, and liquid radwaste. The receiving body of water for these discharges is not described by Detroit Edison (2011a), but it is assumed that a second pipeline would convey discharges back to Lake Erie. Such discharges would be controlled by an NPDES permit issued by MDEQ. Given the length of pipeline that would be required for a discharge system, at least partial temperature attenuation may take place prior to discharge in the lake.

Groundwater in the site vicinity is used for irrigation and domestic purposes. Well yields are in the 100- to 280-gpm range; however, groundwater static levels have been dropping throughout Monroe County. Groundwater quality is moderate to poor, and in combination with dropping water levels, Detroit Edison considers groundwater to have moderate to low feasibility as a water source for supporting building or operating a new nuclear facility at the Petersburg site.

Building activities, including site grading and dewatering and building of new intake and discharge pipelines, would have the potential to affect water quality through increased erosion by stormwater, increased turbidity of surface water, and possible spills or leaks of fuel and other liquids. Pipeline construction would create the potential for impacts of erosion and turbidity, especially at stream crossings. These changes would be expected to be limited by following appropriate BMPs. Surface water quality may be affected by discharges, but the discharges should be controlled by NPDES permits for cooling water discharge to Lake Erie or for local stormwater management.

For the cumulative analysis of impacts on surface water, the geographic area of interest for the Petersburg site is the local ditches and creeks and Lake Erie, because these are the areas potentially affected by the proposed project. Key actions that have current and reasonably foreseeable potential impacts on water supply and water quality in this area of interest include active fossil fuel and nuclear power plants, several sand and/or rock quarries, wastewater treatment plants (WWTPs), and industries (i.e., metal fabrication, organic chemicals, cement). For the cumulative analysis of impacts on groundwater, the geographic area of interest is the bedrock aquifer in the vicinity of the site.

Water Use

Operational cooling water requirements would be the major demand of a new nuclear power plant on surface water resources. As discussed in Section 5.2, water available from Lake Erie would be sufficient to support the makeup water needs of a new reactor, in addition to the cooling water needed by existing regional power plants and other projects listed in Table 9-28. The cumulative consumptive use of surface water is anticipated to have a small effect on the resource.

As described in Section 7.2.1, the greatest potential future impact on the Great Lakes water availability is predicted to be from climate change. The impact predicted for the lowest-emissions scenario discussed in the USGCRP report (2009) and by Hayhoe et al. (2010) would not be detectable or would be so minor that it would not noticeably alter the availability of water from the Great Lakes. However, if CO_2 emissions follow the trend evaluated in the highest-emissions scenario, the effect of climate change could noticeably increase air and water temperatures and decrease the availability of water in surface water resources in the Great Lakes region. As a result, the review team concludes that the potential impacts of use and climate change on surface water quantity would be SMALL to MODERATE. Based on its evaluation, the review team concludes that building and operating a nuclear plant at the Petersburg site would not be a significant contributor to the cumulative impact on surface water use.

Groundwater withdrawals associated with site dewatering during construction or preconstruction of a new nuclear power plant would be temporary and localized. As described above, though well yields are reasonably high in the Petersburg vicinity, the feasibility of using groundwater as a cooling water source is low. The review team concludes that cumulative groundwater impacts associated with withdrawals during the construction of a new nuclear power plant at the Petersburg site and with projects identified in Table 9-28 would be SMALL.

Water Quality

An NPDES permit from MDEQ would be required for discharges from a new nuclear power plant at the Petersburg site, as well as for discharges from the other projects identified in

Table 9-28 Such permits would limit both chemical and thermal discharges. Construction activities associated with the proposed facilities in Table 9-28, urbanization in the vicinity, and pipeline crossings have the potential to degrade surface water quality; adhering to BMPs would limit this impact.

The EPA's Great Lakes National Program Office has initiated the Great Lakes Restoration Initiative, a consortium of 11 Federal agencies that developed an action plan to address environmental issues. These issues fall into five areas: cleaning up toxics and areas of concern, combating invasive species, promoting nearshore health by protecting watersheds from polluted runoff, restoring wetlands and other habitats, and tracking progress and working with strategic partners. The results of this long-term initiative would presumably address water quality concerns of Lake Erie.

Climate change, as described in Section 7.2.1, has the potential to affect water quality within Lake Erie, leading to a MODERATE cumulative impact on surface water quality. Reduced lake levels could increase the impacts of discharges. The review team concludes that cumulative surface water quality impacts associated with a new nuclear power plant at the Petersburg site and other past, present, and reasonably foreseeable actions in the region would be MODERATE, however, building and operating a nuclear plant at the Petersburg Site would not be a significant contributor to the MODERATE cumulative impact on surface water.

Groundwater quality in the region, which is generally moderate to poor, could be affected by a new nuclear power plant at the Petersburg site and the other past, present, and reasonably foreseeable actions in the region identified in Table 9-28. These impacts would be expected to be localized in extent and may be avoided or minimized through adherence to BMPs. The review team concludes that cumulative groundwater quality impacts would be SMALL.

9.3.5.3 Terrestrial and Wetland Resources

The site is composed primarily of cropland planted with crops such as wheat, corn, and soybeans. A few areas of second-growth forest are scattered about the site. Ash, oak, cottonwood, and maple appear to be the prevalent species in these woodlands. Other non-cropland areas are limited to disturbed roadside ROWs dominated by tall fescue or ditches (drains) where cattail or orchard grass dominate, depending on the amount of moisture available.

The small forested areas provide daytime shelter for large mammals such as whitetail deer, nesting areas for birds, and other habitat needs for smaller mammals. Small mammals present in the area likely include opossum, raccoon, striped skunk, and a variety of rodents. Waterfowl (geese and ducks) and game birds likely feed in the fields after crops are harvested, taking advantage of the grain and other seeds that remain. Small amphibians and reptiles can be found in the local ditches (Detroit Edison 2011a).

The NWI identifies an area of forested wetland in a portion of the site. It is possible, but uncertain at this time, that one or more additional areas contain wetlands because most soils on the site are mapped as hydric soils (USDA 2010).

Three terrestrial species listed as threatened or endangered under the ESA are known to occur or could occur in Monroe County. The eastern prairie fringed orchid is Federally listed as threatened and is known mostly from lakeplain prairies around Saginaw Bay and western Lake Erie (MNFI 2007a). The Indiana bat is Federally listed as endangered. It occurs in southern Michigan when not hibernating (wintering) in hibernacula (caves and other wintering locations) located in southern Michigan and other States (MNFI 2007b). The bats generally require large trees (greater than 9 in. in diameter) with exfoliating bark for summer roosting. According to the FWS (2009), however, trees with diameters as small as 5 in. should be considered as potential habitat. The emerald ash borer is active in the project area (MDA 2009). It is likely that ash trees onsite have been killed by the borer, creating dead trees with loose bark and resulting in potential roosting habitat for the Indiana bat. The Karner blue butterfly (*Lycaeides melissa samuelis*) is Federally listed as endangered. The species was recorded in Monroe County in 1986 but is otherwise known from the west-central portion of lower Michigan. Suitable habitat does not appear to exist at the project site or in the immediate vicinity. According to the MDNR Endangered Species Coordinator, Karner blue butterflies were introduced to Monroe County in the Petersburg State Game Area within the last decade (Hoving 2010). Because the maximum movement of the butterflies from their point of introduction is about 0.6 mi and the Game Area is approximately 8 mi southeast, there is no likelihood that any butterflies introduced in the Game Area would occur on the site. Furthermore, suitable habitat does not appear to exist at the site or in the immediate vicinity. The bald eagle is no longer on the Federal endangered species list, although it is protected under the BGEPA and MBTA (MNFI 2007c). The bald eagle was also recently removed from the State list of threatened and endangered species but is still considered a species of concern. Although bald eagles are known to occur in the region, the species usually nests and roosts closer to fish-bearing waters. The potential for any impacts on protected species appears to be minimal because of the type of habitat present.

Nearly 50 State-listed species occur in Monroe County (see Table 9-29). Among the State-listed species is the eastern fox snake. Three other species formerly present in the county are presumed extirpated. Detroit Edison has not consulted with MDNR on potential impacts on State-listed species that could result from construction of the power plant at the Petersburg site.

Building Impacts

Agricultural land, possibly along with some forest and residential land, would have to be cleared and converted to industrial use in order to build a new reactor and associated facilities at the Petersburg site. According to Detroit Edison, the total area of the Petersburg site is approximately 1900 ac (Detroit Edison 2011a). Detroit Edison's conceptual plan layout shows the new reactor facilities would occupy as much as 80 ac in the central part of the Petersburg

Table 9-29. Federally and State-Listed Terrestrial Species That Occur in Monroe County and That May Occur on the Petersburg Site or in the Immediate Vicinity

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Amphibians			
Blanchard's cricket frog	*Acris crepitans blanchardi*	NL	T
Smallmouth salamander	*Ambystoma texanum*	NL	E
Birds			
Barn owl	*Tyto alba*	NL	E
Common moorhen	*Gallinula chloropus*	NL	T
Common tern	*Sterna hirundo*	NL	T
Cup plant	*Silphium perfoliatum*	NL	T
King rail	*Rallus elegans*	NL	E
Least bittern	*Ixobrychus exilis*	NL	T
Peregrine falcon	*Falco peregrinus*	NL	E
Invertebrates			
Dukes' skipper	*Euphyes dukesi*	NL	T
Frosted elfin	*Incisalia irus*	NL	T
Karner blue butterfly	*Lycaeides melissa samuelis*	E	T
Proud globe	*Mesodon elevatus*	NL	T
Silphium borer moth	*Papaipema silphii*	NL	T
Mammals			
Indiana bat	*Myotis sodalis*	E	E
Plants			
American chestnut	*Castanea dentata*	NL	E
American lotus	*Nelumbo lutea*	NL	T
Arrowhead	*Sagittaria montevidensis*	NL	T
Beak grass	*Diarrhena obovata*	NL	T
Corn salad	*Valerianella umbilicata*	NL	T
Downy sunflower	*Helianthus mollis*	NL	T
Gattinger's gerardia	*Agalinis gattingeri*	NL	E
Ginseng	*Panax quinquefolius*	NL	T
Goldenseal	*Hydrastis canadensis*	NL	T
Hairy mountain mint	*Pycnanthemum pilosum*	NL	T
Least pinweed	*Lechea minor*	NL	Presumed extirpated
Leggett's pinweed	*Lechea pulchella*	NL	T
Leiberg's panic grass	*Dichanthelium leibergii*	NL	T
Orange- or yellow-fringed orchid	*Platanthera ciliaris*	NL	E
Eastern prairie fringed orchid	*Platanthera leucophaea*	NL	E

Table 9-29. (contd)

Common Name	Scientific Name	Federal Status[a]	State Status[a]
Purple milkweed	*Asclepias purpurascens*	NL	T
Raven's-foot sedge	*Carex crus-corvi*	NL	E
Red mulberry	*Morus rubra*	NL	T
Round-fruited St. John's-wort	*Hypericum sphaerocarpum*	NL	E
Sand cinquefoil	*Potentilla paradoxa*	NL	T
Short-fruited rush	*Juncus brachycarpus*	NL	T
Smooth rose-mallow	*Hibiscus laevis*	NL	Presumed extirpated
Stiff gentian	*Gentianella quinquefolia*	NL	T
Sullivant's milkweed	*Asclepias sullivantii*	NL	T
Tall green milkweed	*Asclepias hirtella*	NL	T
Three-awned grass	*Aristida longespica*	NL	T
Violet wood sorrel	*Oxalis violacea*	NL	Presumed extirpated
Water willow	*Justicia americana*	NL	T
Wild hyacinth	*Camassia scilloides*	NL	T
Wild rice	*Zizania aquatica* var. *aquatica*	NL	T
Woodland lettuce	*Lactuca floridana*	NL	T
Reptiles			
Eastern fox snake	*Pantherophis gloydi*	NL	T

Source: MNFI 2010a
(a) E = listed as endangered, NL = not listed, T = listed as threatened.

site (Detroit Edison 2011a). Although Detroit Edison's conceptual plan layout (Detroit Edison 2009b) does not differentiate temporarily disturbed areas from the facility footprint, the review team estimates that temporary disturbance could be as much as 200 ac. Conversion of agricultural land would have minimal impact on wildlife and habitat. Conversion of forested areas would have some impact on most of the common species present onsite by removing habitat used for shelter or other functions. With the possible exception of the Indiana bat, adverse impacts on Federally listed species are not anticipated. The forested areas of the site have the potential to provide habitat for the Indiana bat in the form of dead ash trees. If the bat uses the areas that would be disturbed, impacts could be kept to minimal levels by limiting tree clearing to the times of year when the bats are not in the region.

The agricultural land and the small areas of forest on this site are not likely to provide habitat for State-listed species, but additional study would be called for to adequately assess potential impacts on terrestrial ecological resources, including the eastern fox snake, on the site and its vicinity if this alternative location for the power plant were to be selected. However, considering the prevalence of hydric soils on the site, the layout likely affects unmapped wetlands.

Information about the Petersburg alternative provided by Detroit Edison indicated that there are wetlands on the Petersburg site, but no wetland areas would be affected by building the new reactor facilities (Detroit Edison 2009b, 2011a). The conceptual plan layout appears to site the facilities entirely on agricultural land.

Detroit Edison's ER states that 345-kV and 120-kV transmission lines pass about 1.2 mi north of the Petersburg site. The ER also states that capacity and reliability in the area are good and that there is an open circuit on the 345-kV line. Nonetheless, it is possible that a new transmission line would be necessary for a number of reasons. A reactor built on the Petersburg site rather than at the proposed Fermi site would still be expected to serve the same load centers as if it were at the Fermi site. Detroit Edison did not state whether there is sufficient uncommitted current transmission capacity left on the existing lines. No information was provided on where a possible transmission line would be built, how long it would be, or what terrestrial ecological resources might be affected by such a transmission line. It may be possible, however, that a new transmission line could share or adjoin an existing transmission line corridor for some of its length and use existing substations, thereby resulting in less ecological impact than would occur with completely new corridors and substations. The vicinity of the Petersburg site is largely agricultural, with some forested areas. Although it appears possible to avoid most, if not all, important habitat with a new transmission line, a complete assessment would require a corridor location and site-specific information about the wildlife and habitat within the corridor.

Operational Impacts

During plant operation, wildlife, including the eastern fox snake, would be subjected to increased mortality from traffic, but it is not expected that such effects would destabilize the local or regional populations of the common species of the site (Forman and Alexander 1998). Information about the local occurrence of important species and habitats would be needed to conduct a more complete assessment of potential project effects on those resources at the Petersburg site. Potential impacts associated with transmission line operation would consist of bird collisions with transmission lines, habitat loss due to corridor maintenance, noise, and EMF effects on flora and fauna.

Direct mortality resulting from birds colliding with tall structures has been observed (Erickson et al. 2005). Factors that appear to influence the rate of bird collisions with structures are diverse and related to bird behavior, structure attributes, and weather. Migratory flight during darkness by flocking birds has contributed to the largest mortality events. Tower height, location, configuration, and lighting also appear to play a role in bird mortality. Weather, such as low cloud ceilings, advancing fronts, and fog, also contribute to this phenomenon.

There would be a potential for bird mortality from colliding with the nuclear power plant structures at this site. Typically, the cooling tower and the meteorological tower are the structures likely to pose the greatest risk. The potential for bird collisions increases as structure heights and widths increase. MDCTs are of little concern, because of their relatively low height compared with existing and proposed structures onsite. An NDCT, however, would be on the order of 600 ft high. Nonetheless, the NRC concluded that effects of bird collisions with existing cooling towers "involve sufficiently small numbers for any species that it is unlikely that the losses would threaten the stability of local populations or would result in a noticeable impairment of the function of a species within local ecosystems" (NRC 1996). Thus, the impacts on bird populations from collisions with the cooling tower are expected to be minimal.

Operational impacts of the transmission system on wildlife (e.g., bird collisions and habitat loss) resulting from the addition of new lines and towers cannot be fully evaluated without additional information on the length and location of any new transmission facilities. Nonetheless, Section 4.5.6.2 of the GEIS for license renewal (NRC 1996) provided a thorough discussion of the topic and concluded that bird collisions associated with the operation of transmission lines would not cause long-term reductions in bird populations. The same document also concluded that once a transmission corridor has been established, the impacts on wildlife populations would be from continued maintenance of transmission line corridors and are not significant (NRC 1996).

ITC*Transmission* would build and operate any new transmission line needed for a new reactor at the Petersburg site. ITC*Transmission* operates in accordance with industry standards for vegetation management (NERC 2010), including seasonal restriction on activities that could adversely affect important wildlife (Detroit Edison 2010a). According to ITC*Transmission*'s vegetation management policy, wetland areas within the corridor that have the potential to regenerate in forest vegetation would be manually cleared of woody vegetation periodically for line safety, thereby keeping them in a scrub-shrub or emergent wetland state (ITC*Transmission* 2010). Other forested areas would be managed similarly to prevent tree regrowth that could present safety or transmission reliability problems. Access to these areas for maintenance would likely be on foot or by using matting for vehicles so as not to disturb the soil. Pesticides or herbicides would be used only occasionally in specific areas where needed in the corridor. It is expected that the use of such chemicals in the transmission line corridor would be minimized to the greatest extent possible in wetlands areas to protect these important resources (Detroit Edison 2010a). The impact associated with corridor maintenance activities is loss of habitat, especially forested habitat, from cutting and herbicide application. The maintenance of transmission line corridors could be beneficial for some species, including those that inhabit early successional habitat or use edge environments. Impacts of transmission line corridor maintenance would depend on the types and extents of habitat crossed. Detroit Edison has not provided sufficient details to make a complete assessment of transmission line corridor maintenance impacts. In general, however, if a new transmission line is needed, the impacts would likely be minimal.

Detroit Edison provided no data on noise for the possible new reactor on the Petersburg site, but it is likely that impacts would be minimal and similar to those associated with the Fermi 3 project.

EMFs are unlike other agents that have an adverse impact (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NIEHS 2002). A careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures (NIEHS 2002). At a distance of 300 ft, the magnetic fields from many lines are similar to typical background levels in most homes (NIEHS 2002). Thus, impacts of EMFs from transmission systems with variable numbers of power lines on terrestrial flora and fauna are of small significance at operating nuclear power plants (NRC 1996). Since 1997, more than a dozen studies have been published that looked at cancer in animals that were exposed to EMFs for all or most of their lives (Moulder 2007). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2007). A review of the literature on health effects of electric and magnetic fields conducted for the Oregon Department of Energy looked at the effects of strong electric and magnetic fields on various bird species. While some studies concluded that some species of birds exhibited changes in activity levels and some physiological metrics, no studies demonstrated adverse effects on health or breeding success (Golder Associates, Inc. 2009).

Cumulative Impacts

Several past, present, and reasonably foreseeable projects could affect terrestrial resources in ways similar to siting a new reactor exist at the Petersburg site (see Table 9-28). The geographic area of interest for the following analysis is defined by a 25-mi radius extending out from the site

Past projects include three coal-fired generation facilities: the Detroit Edison Monroe power plant in Monroe, Michigan; the Bay Shore power plant in Oregon, Ohio; and the J.R. Whiting power plant in Luna Pier, Michigan. The Fermi 2 power plant is just inside the geographic area of interest, at a distance of approximately 25 mi. The three coal-fired plants are between 12 and 19 mi from the Petersburg site. All four power plants were constructed at least two decades ago. Any short-term impacts of plant construction ended years ago. The long-term effects on terrestrial ecological resources from operating a new reactor at the Petersburg site combined with the other power plants in the geographic area of interest would be minimal because of the low level of impacts of a new power plant and the distances to the other existing power plants.

Reasonably foreseeable projects within the geographic area of interest that could affect terrestrial resources include continued regional commercial and residential development and construction of a proposed Cleveland-Toledo-Detroit passenger rail line.

Urbanization would likely result in conversion of agricultural land, forest land, wetlands, and other habitat to urban uses. Urbanization would involve some of the same activities as building a new reactor, including land clearing and grading (temporary and permanent), increased human presence, heavy equipment operation, traffic (with resulting wildlife mortality), noise from construction equipment, and fugitive dust. Some of the effects of these activities, such as noise and dust, are short term and localized. The impacts of noise and dust from building a new reactor would be negligible. Other effects, such as clearing wildlife habitat that would not be restored, would be permanent. The effects of urbanization, land clearing and grading, filling of wetlands, increased human presence, and increased traffic would occur over a period of several years and in several locations away from the Petersburg site.

The current status of the proposed passenger rail line from Cleveland through Toledo to Detroit is not known. As part of this project, a railway station could be built in the City of Monroe. The project would have some potential to encourage local economic development, including urbanization.

Development of the site could result in increased employment and population within the geographic area of interest, and this, in turn, could result in additional urbanization. Given the current population of Monroe County, Michigan, of 146,000, the additional urbanization would be minor.

Considering the presence of known wetlands and hydric soils on the site, building a new reactor at the Petersburg site would likely result in unavoidable wetland impacts. Impacts from potential transmission line development cannot be assessed without more specific routing information. Because of the largely agricultural landscape of the Petersburg vicinity, it is likely that a transmission line corridor could be routed to minimize impacts on wildlife and habitat.

Summary of Impacts on Terrestrial and Wetland Resources at the Petersburg Site

Impacts on terrestrial ecological resources and wetland resources were estimated based on information provided by Detroit Edison and the review team's independent review. Based on the conceptual layout (Detroit Edison 2009b), the permanently disturbed area could be as much as 80 ac, and the temporarily disturbed area could be as much as 200 ac. Much of the project area is currently used for row crops and hay and provides relatively low wildlife habitat value. After construction and preconstruction, habitat resources in temporarily disturbed areas would be expected to naturally regenerate. Wildlife would also recover but might not use the regenerated habitat to the same degree. Permanently disturbed areas would be converted to industrial use for the indefinite future. However, because of the likelihood of wetland impacts at the site, impacts are expected to be noticeable. Because the review team has no definitive information on the routing and length of a new transmission corridor, it cannot estimate the extent of affected habitats.

The review team concludes that the cumulative impacts on terrestrial wildlife and habitat would be MODERATE for a new reactor at the Petersburg site. Building and operating a new nuclear plant at the Petersburg site would be a significant contributor to this MODERATE impact.

9.3.5.4 Aquatic Resources

Aquatic habitats in the vicinity of the Petersburg site include engineered agricultural drains that drain the site and a small wetland area in the forested portion of the property (Section 9.3.5.2). Land use around agricultural drains is primarily cropland. No information exists regarding the aquatic organisms in the onsite wetlands and drains, and surveys would be needed to characterize the aquatic communities present. However, a variety of aquatic macroinvertebrates, such as mayflies, stoneflies, caddisflies, isopods, and chironomids, are likely to be present, along with fish common to Great Lakes coastal habitats, such as sunfishes, shiners, suckers, and catfish (Bolsenga and Herdendorf 1993). The River Raisin is approximately 4 mi north of the proposed location for a new reactor and should not be affected by preconstruction, construction, and operations of a new reactor.

The western basin of Lake Erie would likely serve as the source of plant cooling water for a new reactor at the Petersburg site. Lake Erie supports an important commercial and recreational fishery. Common nearshore forage species include the emerald shiner (*Notropis atherinoides*), gizzard shad, rainbow smelt, and alewife. Salmonids (Family Salmonidae), sunfish, catfish, yellow perch, walleye, pike, and freshwater drum are commercially or recreationally important species found near the shoreline (USGS 2010). Some of the primary aquatic nuisance species are invasive waterfleas, dreissenid mussels, sea lamprey, common carp, round goby, and tubenose goby. The ecology of Lake Erie has been dramatically altered by the introduction of dreissenid mussels, with quagga mussels dominating the eastern basin and zebra mussels dominating the western basin of Lake Erie (Benson et al. 2011). Dreissenid mussels have increased benthic productivity, reduced plankton and planktivorous fish abundance, and altered the substrate available to demersal organisms. For additional information regarding the ecology of Lake Erie, including plankton, benthic invertebrates, and fish, refer to Section 2.4.2.1.

Federally and State-Listed Threatened and Endangered Species

Three native freshwater mussel species listed by the FWS as endangered could be present in Monroe County: the northern riffleshell (*Epioblasma torulosa rangiana*) the rayed bean (*Villosa fabalis*) and the snuffbox mussel (*Epioblasma triquetra*) (FWS 2010; 77 FR 8632). The white catspaw (*Epioblasma obliquata perobliqua*), which is Federally listed as endangered, historically occurred in Monroe County but is now considered to be extirpated from Michigan (FWS 2010). The northern riffleshell was historically present in the River Raisin drainages, but the most recent record from Monroe County is from 1977 (Carman and Goforth 2000c; FWS 2008). There are no designated critical habitats for any listed species in the vicinity of the Petersburg site. Within Monroe County, there are seven State-listed fishes and ten State-listed mussels potentially present on the Petersburg site, the River Raisin drainage, and in Lake Erie (Table 9-30). Suitable habitat for threatened and endangered mussels is not likely to be present near the Petersburg site. No recent records exist for the State-listed hickorynut (*Obovaria olivaria*), wavyrayed lampmussel, or white catspaw in Monroe County, although these species were historically present (Carman 2001c; Stagliano 2001a; Badra 2004a). The slippershell, round hickorynut (*Obovaria subrotunda*), threehorn wartyback (*Obliquaria reflexa*), lilliput (*Toxolasma parvus*), and the rayed bean, and snuffbox mussel are potentially present in streams within Monroe County as well as Lake Erie, although the rayed bean and threehorn wartyback are not likely to be present (Carman and Goforth 2000b; Carman 2001b, d; Carman 2002b; 75 FR 67552). Of the State-listed threatened and endangered fish, there are no recent records for the river darter (*Percina shumardi*) or eastern sand darter in Monroe County (Carman 2001e; Derosier 2004c). Lake sturgeon and sauger inhabit Lake Erie, although the sauger is uncommon (Goforth 2000; Derosier 2004b). The pugnose minnow (*Opsopoeodus emiliae*) and the channel darter have been recorded in nearshore areas of Lake Erie (Carman and Goforth 2000a; Carman 2001f).

Building Impacts

Impacts on aquatic habitats and biota could result from building the primary facilities, associated transmission lines, and the cooling water intake and discharge pipelines for a new reactor at the Petersburg site. As identified in Section 9.3.5.1, the area of the site that would be developed if the site were chosen for a new reactor facility consists primarily of agricultural land, and no streams are likely to be located directly within the construction footprint (Detroit Edison 2009b). Building new 15-mi intake and discharge pipelines between Lake Erie and the reactor site could affect aquatic habitat if present along the pipeline corridor and could require dredging, pile driving, and other alterations to the shoreline and benthic habitat of Lake Erie, potentially resulting in sedimentation, noise, turbidity, sediment removal, and accidental releases of contaminants (see Section 4.3.2 for a detailed description of potential impacts of building activities on aquatic habitat and biota). The impacts on aquatic organisms would likely be temporary and could be largely mitigated through the use of BMPs. Building activities within Lake Erie would require Section 10 and/or 404 permits from USACE and a regulatory permit from MDEQ, and these permits would contain stipulations that would further reduce impacts. Overall, the impact of the construction of cooling water intake and discharge structures on aquatic resources would be minor.

As described in Section 4.3.2, building activities at the location of the new reactor, including an increase in impervious land surface, vegetation removal, site grading, and dewatering, would have the potential to affect water quality and hydrology and therefore aquatic biota in wetlands located in the vicinity. Stormwater runoff could carry soil as well as contaminants (e.g., spilled

Table 9-30. Federally and State-Listed Threatened and Endangered Aquatic Species That Have Been Reported from Monroe County, Michigan

Common Name	Scientific Name	Federal Status[(a)]	State Status[(b)]
Fish			
Channel darter	*Percina copelandi*	NL	E
Eastern sand darter	*Ammocrypta pellucida*	NL	T
Lake sturgeon	*Acipenser fulvescens*	NL	T
Pugnose minnow	*Opsopoeodus emiliae*	NL	E
River darter	*Percina shumardi*	NL	E
Sauger	*Sander canadensis*	NL	T
Silver chub	*Macrhybopsis storeriana*	NL	SC
Invertebrates			
Hickorynut	*Obovaria olivaria*	NL	E
Lilliput	*Toxolasma parvus*	NL	E
Northern riffleshell	*Epioblasma torulosa rangiana*	E	E
Rayed bean	*Villosa fabalis*	E	E
Round hickorynut	*Obovaria subrotunda*	NL	E
Slippershell	*Alasmidonta viridis*	NL	T
Snuffbox mussel	*Epioblasma triquetra*	E	E
Threehorn wartyback	*Obliquaria reflexa*	NL	E
Wavyrayed lampmussel	*Lampsilis fasciola*	NL	T
White catspaw	*Epioblasma obliquata perobliqua*	E[(c)]	E

(a) Federal status rankings determined by the FWS under the Endangered Species Act: NL = not listed, E = endangered. Source: FWS 2010
(b) State species information provided by MNFI (2010b): E = endangered, T = threatened, SC = species of concern.
(c) The white catspaw is considered extirpated in Michigan.

fuel and oil) from construction equipment into wetlands located onsite. There is little high-quality aquatic habitat present at the Petersburg site, and impacts are expected to be minor. Information about the Petersburg site provided by Detroit Edison indicated that no wetland areas would be affected by building the new reactor facilities (Section 9.3.5.3). Based on the assumptions that required construction permits are obtained from MDEQ and/or USACE and that appropriate BMPs are implemented during building activities, the impacts on aquatic resources from onsite development activities would be temporary, easily mitigated, and minor.

It is possible that the transmission line for a new reactor at the Petersburg site could use existing substations and share or adjoin an existing transmission line corridor for some of its length. If so, building-related impacts on aquatic resources would be minimal. If the new transmission line is needed to service a new reactor, there is the potential for the construction-related impacts described above to affect aquatic habitat and aquatic biota if a new transmission line passes near or crosses a surface water feature. Expansion of existing corridors would be expected to result in minor environmental impacts, while establishing new corridors could result in greater impacts. However, based on the assumption that required construction permits would be obtained from MDEQ and appropriate BMPs implemented during building activities, the impacts on aquatic resources from development of additional transmission facilities would likely be temporary, easily mitigated, and minor.

The impacts of building a new reactor at the Petersburg Site on threatened and endangered aquatic species potentially present in the River Raisin are expected to be minimal, because the land area that would be affected by reactor construction is located approximately 4 mi away and no water would be withdrawn from or discharged into the River Raisin. New reactor construction is also not expected to result in impacts on threatened and endangered aquatic species, given the lack of suitable habitat at the reactor location and the use of BMPs to minimize potential construction impacts. However, threatened and endangered and mussels found in Lake Erie or in aquatic habitat located along the route of the transmission line or cooling water intake and discharge pipelines could be affected by disturbance from building activities. Threatened or endangered mussels potentially present in Lake Erie include the slippershell, round hickorynut, threehorn wartyback, lilliput, and snuffbox mussel. As discussed above, the rayed bean and threehorn wartyback are not likely to be present in Lake Erie. Additional information would need to be collected and surveys may need to be conducted to evaluate the potential for threatened and endangered mussel species to be present in aquatic habitat that would be disturbed by construction of cooling water intake and discharge facilities. If threatened and endangered mussels were found, it is likely that mitigation measures would need to be developed to limit potential impacts. Habitat for State-listed fish species could be temporarily disturbed by shoreline and in-water preconstruction activities. However, fish are highly mobile and would likely avoid the affected areas during construction. On the basis of this information and because construction and preconstruction activities would be temporary and mitigable, the review team concluded that impacts on threatened and endangered aquatic species would be minor.

Operational Impacts

Operational impacts on aquatic habitat and biota could result from cooling water consumption, transmission line maintenance, cooling water system maintenance, cooling water discharge, and impingement and entrainment of aquatic biota by the cooling water system.

Operational cooling water requirements would be the major water demand of a new nuclear power reactor at the Petersburg site. Detroit Edison has proposed a closed cycle recirculating cooling system, which could reduce water use by 96 to 98 percent compared to a once-through cooling system (66 FR 65256). Based on the assumption that cooling water needs would be similar to those identified for Fermi 3, approximately 34,000 gpm, or 49 MGD, would be needed (Detroit Edison 2011a). The withdrawal of water would not disrupt natural thermal stratification or turnover pattern for Lake Erie and would comply with EPA's CWA Section 316(b) Phase I regulations for new facilities. Water available from Lake Erie would be sufficient to support the makeup water needs of a new reactor; therefore, the incremental impact from operating a new power plant at the Petersburg site would be minor (see Section 9.3.5.2). Consequently, the hydrologic impacts on aquatic resources in Lake Erie should be minimal.

Periodic maintenance dredging in the vicinity of the water intake would be necessary to maintain appropriate operating conditions for cooling water intake. Such dredging would result in a temporary localized increase in turbidity in Lake Erie in the vicinity of the intake bay and would be managed under a permit from the USACE. Dredged material is expected to be disposed of in a spoil disposal pond, where sedimentation would occur prior to discharge of the water back into Lake Erie. The periodic dredging of the intake bay would result in minimal impacts on aquatic biota and habitats in Lake Erie.

The effect of impingement and entrainment of aquatic organisms from Lake Erie was evaluated by the review team. Entrainment may result in mortality to zooplankton and phytoplankton. In addition, data from the Fermi 2 cooling water intake system (Section 5.3.2) suggest both demersal and pelagic fishes in Lake Erie would be vulnerable to entrainment and impingement. Particularly vulnerable are early life stages of fish (eggs and larvae), which lack the swimming ability to overcome intake suction and which are small enough to pass through the mesh of the intake screens. The use of fish screens and a closed cycle recirculating cooling system as proposed by Detroit Edison would reduce water use and physical damage to aquatic organisms and would decrease impingement and entrainment (Section 5.3.2). Based on the assumption of a closed cycle cooling system that meets the EPA's CWA Section 316(b) Phase I regulations for new facilities, the anticipated impacts on populations of aquatic biota from entrainment and impingement are expected to be minor.

Discharge would include cooling tower blowdown, treated process wastewater, and processed radwaste wastewater, all of which could affect aquatic biota through mortality or sublethal physiological, behavioral, and reproductive impairment (see Section 5.3.2). In addition, aquatic organisms may be affected by cold shock and the scouring of benthic habitat near the discharge pipeline (see Section 5.3.2). Proposed design features, such as the presence of riprap around the submerged discharge port and orientation of the discharge ports in an upward direction, are intended to reduce scouring (Detroit Edison 2011a). As identified in Section 9.3.5.2, a NPDES permit from MDEQ would be required for discharges from a new nuclear power plant at the Petersburg site. Such a permit would likely specify limits for chemical and thermal discharges in order to protect water quality, thereby limiting the potential for impacts on aquatic organisms. Given the 15-mi length of pipeline that would be required for a discharge system, at least partial temperature attenuation may take place prior to discharge into Lake Erie. Assuming that NPDES permitting requirements are met, the impacts of discharges on aquatic habitats and biota would be minor.

Impacts on aquatic resources from operation of a new reactor at the Petersburg site may include those associated with maintenance of transmission line corridors. The review team assumed that ITC*Transmission* would construct and operate any new transmission line needed and that it would follow current maintenance practices designed to minimize impacts on aquatic habitats and wetlands, such as minimizing disturbance to riparian habitat and minimizing the application of pesticides and herbicides, which can enter aquatic habitat and adversely affect aquatic biota (Detroit Edison 2011a). Although impacts of transmission line corridor maintenance would depend, in part, on the types and extent of aquatic habitat located near the transmission line, impacts on aquatic habitats and biota from maintenance of transmission lines would likely be minor as long as maintenance practices currently followed by ITC*Transmission* are implemented.

There is no suitable habitat for threatened and endangered mussels near the proposed location of the reactor, but species potentially found in surface waters located along the transmission line and cooling water intake and discharge pipelines could be adversely affected by maintenance activities. The potential for impacts on threatened and endangered species could be minimized by following BMPs. Mussels, including the round hickorynut, threehorn wartyback, lilliput, snuffbox mussel, and the rayed bean, are potentially present in Lake Erie, and these species may be vulnerable to cooling water intake and discharge operational impacts if present in the immediately affected areas. As eggs, mussels are not likely to be affected by system operation because the eggs are not free-floating but, rather, develop into larvae within the female. Mussels in the glochidial stage during which juveniles attach to a suitable fish host are vulnerable indirectly through host impingement and entrainment. Hosts for the snuffbox mussel (logperch), lilliput (several species of Centrachids), and rayed bean (largemouth bass) are present in Lake Erie and could be impinged during reactor operations. Fish hosts for the threehorn wartyback and round hickorynut are not known. Post-glochidial and adult-stage mussels are not likely to be susceptible to entrainment, because they bury themselves in sediment.

The State-listed sauger is not common in Lake Erie, but the lake sturgeon historically spawned along the shoreline of Lake Erie in Monroe County, and early life stages may be vulnerable to entrainment and impingement. However, spawning activity in this area appears to have diminished or ceased since the 1970s (Goforth 2000). The State-listed channel darter could occur in Lake Erie but may be less likely to be entrained, because it resides near the bottom. None of these species were observed during impingement and entrainment studies conducted during 2008 and 2009 (AECOM 2009) at the Fermi 2 intake in Lake Erie. Consequently, it is considered unlikely that significant numbers would be affected by cooling water intake for a new reactor at the Petersburg site. Overall, impacts on threatened and endangered species from reactor operations are expected to be minor.

Cumulative Impacts

Past, present, and reasonably foreseeable projects, facilities, and other environmental changes that contribute to cumulative impacts on aquatic resources along with the construction and operation of a new reactor at the Petersburg site include the activities and projects shown in Table 9-28 and current and future ecosystem changes from climate change, introduced dreissenid mussels, and recreational and commercial fishing.

As discussed above, potential building-related impacts on aquatic habitat and biota could result from altered hydrology, erosion, stormwater runoff of soil and contaminants, and disturbance or loss of benthic habitat from construction of the reactor, associated transmission lines, and the water intake and discharge system. Urbanization can affect aquatic resources by increasing impervious surface, non-point-source pollution and water use, as well as by altering riparian and in-stream habitat and existing hydrology patterns. Development of a new reactor on the Petersburg site could result in increased human populations and additional urbanization with subsequent impacts on aquatic resources.

Operational cooling water requirements would be the major water demand from a new nuclear power plant on surface water resources. Lake Erie would be sufficient to support the makeup water needs of a new reactor in addition to the cooling water needed by existing U.S. and Canadian power plants and other projects listed in Table 9-28 (Section 9.3.5.2). However, as described in Section 7.2.1, the effect of climate change could noticeably decrease the availability of surface water resources in the Great Lakes. If such a reduction in surface water were to occur, aquatic habitat on the reactor site and in Lake Erie may be altered or eliminated, with potentially adverse consequences for aquatic habitat and biota.

Impingement and entrainment of aquatic biota from Lake Erie due to a new reactor must be considered along with mortality resulting from existing power plants that already withdraw water from Lake Erie, commercial and recreational fishing, and introduced zebra mussels and quagga mussels, which have dramatically reduced plankton abundance in the region. Commercially important species that have been the target of restoration efforts in Lake Erie, such as yellow perch and walleye, occupy nearshore areas and could be vulnerable to cooling water intake.

Discharges into Lake Erie from a new nuclear power plant at the Petersburg site must be considered along with discharges into Lake Erie from the other projects identified in Table 9-28. Contaminant loads in Lake Erie may be reduced in the future by the Great Lakes Restoration Initiative, which attempts to (1) clean up toxics and areas of concern, (2) protect watersheds from polluted runoff, and (3) restore wetlands (see http://greatlakesrestoration.us/). If climate change results in reduced water levels and increased water temperatures, the impacts associated with contaminant concentrations and thermal stress from cooling water discharge into Lake Erie could also increase. As identified in Section 9.3.5.2, the incremental contribution to overall cumulative surface water quality impacts associated with a new nuclear power plant at the Petersburg site is expected to be minor because of the expected localized extent of the impacts from projects and the adherence to BMPs and permitting requirements designed to avoid or minimize impacts. NPDES permits would also limit chemical and thermal discharges into Lake Erie. Similarly, the incremental contribution of a new reactor at the Petersburg site to cumulative impacts on aquatic biota from water quality changes due to operational discharges would also be minor.

Based on its evaluation, the review team concludes that the cumulative impacts on aquatic resources, including threatened or endangered species, could be substantial due to the continued inadvertent introduction of invasive species, overfishing, and increased urbanization resulting in further degradation of water quality and global climate change. However, the incremental impact from building and operating a new power plant at the Petersburg site would not contribute measurably to the overall cumulative impacts in the geographic area of interest.

Summary of Impacts on Aquatic Resources at the Petersburg Site

Impacts on wetlands, streams, Lake Erie, and associated aquatic biota could result from the construction of the reactor, transmission line, and cooling water intake and discharge pipelines at the Petersburg site. However, the impacts on aquatic organisms would be temporary and could be largely mitigated by avoiding aquatic habitats during siting of facilities and activity areas and by using BMPs during preconstruction and construction activities.

Operational impacts on aquatic resources could result from cooling water consumption, transmission line and cooling water system maintenance, alteration of water quality by cooling water discharge, and impingement and entrainment of aquatic biota by the cooling water system. If the reactor is constructed, impingement and entrainment would add to existing mortality sources for aquatic biota such as invasive species, commercial and recreational fishing, and the operation of other power plants using water from or discharging into Lake Erie.

Impingement and entrainment of aquatic organisms would be minimized by complying with EPA's CWA Section 316(b) Phase I regulations. Lake Erie could support the makeup water needs of a new reactor. However, climate change could noticeably decrease the availability of surface water resources in the Great Lakes region. Similarly, while a NPDES permit would limit both chemical and thermal discharges, climate change has the potential to increase impacts of the discharges on aquatic communities. Transmission line and cooling water pipeline maintenance impacts on aquatic habitat and biota could be minimized by implementing BMPs.

Although suitable habitat is not likely to be present on the reactor site, State-listed fish and mussels could occur in Lake Erie or in aquatic habitat located along the transmission line or cooling water intake corridors and could be vulnerable to benthic disturbance associated with the construction, operation, and maintenance of the cooling water intake and discharge system. If required, surveys for threatened and endangered mussels could be conducted in aquatic habitats that would be disturbed by construction, and observed individuals could be relocated before building activities as a mitigation action. The potential for entrainment and impingement of threatened and endangered aquatic species in Lake Erie is possible but not likely to be significant. Overall, minor impacts on listed aquatic species are expected from reactor construction and operations.

The review team's conclusion, based on the information provided by Detroit Edison and the review team's independent evaluation, is that the impacts on aquatic resources, including threatened or endangered species, from the Petersburg reactor considered together with cumulative impacts on aquatic resources from other activities and climate change would be MODERATE. Building and operating a new nuclear unit at the Petersburg site would not be a significant contributor to the overall cumulative impact.

9.3.5.5 Socioeconomics

The economic impact area for the Petersburg alternative site is a three-county area, including Monroe and Lenawee Counties, Michigan, and Lucas County, Ohio. The site is located in Monroe County and is 1 mi east of Lenawee County and 7 mi north of Lucas County. Because the plant would be located in Monroe County and near Lenawee and Lucas Counties, those jurisdictions are where the majority of the socioeconomic impacts are expected to occur from the in-migrating construction and operations workforces.

However, within a 50-mi radius are portions of several large metropolitan areas, including Toledo, Ohio, which is included in the economic impact area, and Detroit and Ann Arbor, Michigan, which are outside of the economic impact area. Detroit Edison may draw some of the construction and operations workers who currently reside in these large metropolitan areas, depending on the skills and availability of the workforce, even though the commute for the workers would be longer. Detroit, Michigan, is 45 mi northeast of the Petersburg site; Ann Arbor, Michigan, is 30 mi north of the site; and Toledo, Ohio, is 8 mi south of the site. Toledo, Ohio, is included in the economic impact area, because it is located in Lucas County; however, impacts on the Detroit and Ann Arbor metropolitan areas are not considered, because they are outside of the economic impact area.

Members of the in-migrating construction and operations workforces who choose to live within the Detroit–Warren–Livonia MSA, portions of the Toledo MSA outside of the economic impact area, or Ann Arbor MSA are not likely to cause significant impacts in any single jurisdiction, and workers who currently reside in these large metropolitan areas would not affect housing, schools, or other public services, because they are members of the baseline population. The number of workers who would relocate within any single jurisdiction outside of Monroe, Lenawee, or Lucas County is expected to be small, because the number of possible jurisdictions in which members of the workforce could reside is large. Therefore, this analysis focuses on Monroe, Lenawee, and Lucas Counties, which encompass the plant location and where the majority of the in-migrating workers are expected to reside.

Physical Impacts

Physical impacts include impacts on workers and the general public, noise, air quality, buildings, roads, and aesthetics. Because the physical impacts of building and operating a nuclear power plant are very similar between the proposed site and the alternative sites, the review team determined that, as assessed for the Fermi 3 site, all physical impacts related to the Petersburg site would be minor. See Sections 4.4.1 and 5.4.1 for a detailed discussion of physical impacts for Fermi 3.

Demography

The Petersburg site is located in Summerfield Township, Monroe County, 4 mi south of the town of Petersburg and approximately 1 mi east of the Lenawee County border. The western portion of Monroe County, where the site is located, is rural. The highest concentration of population in Monroe County is east along Lake Erie, including the City of Monroe and adjoining townships of Frenchtown Charter and Bedford. Lenawee County is rural; the largest population center is the City of Adrian. Toledo, Ohio, is the largest population center in Lucas County and is near the Michigan–Ohio border, approximately 7 mi south of the Petersburg site. Table 9-31 provides the 2000 and 2010 Census population and the projected 2020 population for these areas.[(a)]

Detroit Edison estimates that the size of the construction workforce needed for a new nuclear power plant over a 10-year construction period would range from a minimum of 35 workers to a peak construction workforce of 2900 workers, and that the average size of the onsite workforce during the 10-year construction period would be approximately 1000 workers (Detroit Edison 2011a).

The review team's assumptions for in-migrating and local workers are similar to those for the Fermi 3 plant site. Although the site is located in a rural area, it is also within commuting distance of highly urbanized areas. The site is within 50 mi of the Detroit–Warren–Livonia MSA, and the City of Toledo is approximately 7 mi south. Therefore, for comparison between analyses of the site alternatives, the review team based the analysis of this site upon the assumptions presented in Section 4.4.2 of this EIS, with approximately 15 percent of the construction workforce (approximately 435 workers during the peak construction and

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(a) This section has been updated for the Final EIS to include the results of the mandated U.S. decadal census for 2010 for the data sets that have been released by the U.S. Census Bureau as of May 2012. For the data sets that have not yet been released, the review team has presented the results of the five-year estimates from the American Community Survey (i.e., 2006–2010).

Table 9-31. Demographics for Monroe, Lenawee, and Lucas Counties and Local Jurisdictions

County/City/Township	Population 2000	Population 2010	Population 2020 Projected
Monroe County	145,945	152,021	159,461
City of Monroe	22,076	20,733	22,475
Frenchtown Charter Township	20,777	20,428	21,868
Bedford Township	28,606	31,085	31,669
Lenawee County	98,890	99,892	109,086[(a)]
City of Adrian	21,574	21,133	NA[(b)]
Lucas County	455,054	441,815	434,650
City of Toledo	313,619	287,208	NA[(b)]

Sources: The 2020 projections for Monroe County and townships within Monroe County are provided by SEMCOG (2008). For Lucas County, 2020 projections are provided by the Ohio Department of Development, Office of Policy Research and Strategic Planning (2003). The 2020 projection for Lenawee County is provided by the Lenawee County Planning Commission (2002). The 2000 and 2010 data for all areas are from the USCB (2000a, b, 2010a).

(a) Lenawee County used three different methods to project its population in 2020 (Lenawee County Planning Commission 2002). The projection presented is an average of the three methods.

(b) NA = Population projections are not available for these jurisdictions.

150 workers on an average annual basis) expected to relocate within a 50-mi radius of the project site. Approximately 85 percent of the construction workforce would be drawn from the existing workforce in the regional area.

If the facility were to be built at the Petersburg site and operations commenced, Detroit Edison expects an operations workforce of 900 workers in 2020 (Detroit Edison 2011a). For similar reasons, the review team determined that based on the analysis of impacts presented in Section 5.4.2 of this EIS, approximately 30 percent of the operations workforce (approximately 270 workers) would be expected to relocate within a 50-mi radius of the project site. Approximately 70 percent of the operations workforce would be drawn from the existing workforce in the regional area.

Using an average household size of 2.6, based on the national average household size in the USCB's 2010 population data, the total in-migrating population is estimated to be approximately 1131 persons during the peak construction period and less during periods of non-peak construction. The projected population increase associated with the in-migrating operations workers is estimated to be 702 persons.

If all the in-migrating construction workers and their families settled in the three-county economic impact area for the 2-year peak construction period, the projected increase would be less than 1 percent of the projected 2020 population for these three counties. Demographic impacts during periods of non-peak construction would be less. The in-migrating construction workers and their families would likely settle in various cities and townships throughout the three-county area, and the population effects are expected to be minimal. The projected population increase for the operations workforce would be less than that projected for the peak construction period and would also be less than 1 percent of the projected 2020 population for the three-county area.

Given the small number of in-migrating workers compared to the projected 2020 population for Monroe, Lenawee, and Lucas Counties, the review team concludes that the demographic impact during peak building employment and during operations would be minor. Demographic impacts in the rest of the 50-mi region also would be minor.

Economic Impacts on the Community

Economy

The following paragraphs provide an analysis of each of the three counties within the economic impact area.

Monroe County. There were nearly 62,000 workers employed in Monroe County in 2010 (USBLS 2012) (see Table 9-32). Approximately 42 percent of the jobs in Monroe County are in manufacturing, educational services, health care, and social assistance sectors (USCB 2010b). The four largest employers in Monroe County in 2007 were Detroit Edison, with approximately 1500 employees; Mercy Memorial Hospital, with approximately 1300 employees; the supermarket chain Meijer, Inc., with approximately 1025 employees; and the Monroe Public Schools school district, with approximately 1000 employees (Monroe County Finance Department 2008). Manufacturing businesses in Monroe County include Johnson Controls (720 employees), La-Z-Boy Incorporated (522 employees), Tenneco Automotive (500 employees), Gerdeau Macsteel (450 employees), Holcim US Inc. (cement; 350 employees), TWB Company (automotive body parts; 303 employees), and MTS Seating (300 employees) (Monroe County Chamber of Commerce 2010).

The U.S. Bureau of Labor Statistics (USBLS) reported a rise in unemployment from 3.2 percent in 2000 to 12.4 percent in 2010. The job outlook has improved over the past year, with the USBLS reporting an annual unemployment rate of 9.7 percent for Monroe County in 2011 (USBLS 2012).

Table 9-32. Labor Force Statistics for Monroe, Lenawee, and Lucas Counties in 2000 and 2010

	Monroe County		Lenawee County		Lucas County	
	2000	**2010**	**2000**	**2010**	**2000**	**2010**
Total labor force	77,194	70,724	51,699	46,103	227,304	214,733
Employed workers	74,756	61,921	49,769	39,627	217,049	190,514
Unemployed workers	2438	8803	1930	6476	10,255	24,219
Unemployment rate	3.2%	12.4%	3.7%	14.0&	4.5%	11.3%

Source: USBLS 2012

Lenawee County. There were 39,627 employed workers in Lenawee County in 2010 (USBLS 2012) (see Table 9-32). Approximately 24 percent of the jobs are in educational services, health care, and social assistance. Manufacturing and retail trade employ approximately 22 percent and 12 percent, respectively (USCB 2010b). The four largest employers in Lenawee County are Promedica Health Systems, with approximately 1062 employees; Lenawee County, with approximately 657 employees; Michigan Department of Corrections, with approximately 587 employees; and Adrian Mall (stores and management), with approximately 500 employees (Lenawee Economic Development Corporation 2010). Lenawee County has a number of manufacturing companies, many of which specialize in plastics, and a strong agricultural base, with the largest number of farms of any county in Michigan and the highest revenue in the State for corn, soy, and wheat (Lenawee Economic Development Corporation 2010).

Between 2000 and 2010, the unemployment rate for the county increased from 3.7 percent to 14.0 percent. The job outlook has improved over the past year, with the USBLS reporting an unemployment rate of 10.9 percent for Lenawee County in 2011 (USBLS 2012).

Lucas County. There were 190,514 employed workers in Lucas County in 2010 (USBLS 2012). Approximately 26 percent of the workforce is employed in educational services, health care, and social assistance. Manufacturing and retail trade employ approximately 15 percent and 12 percent, respectively (USCB 2010b). The four largest employers in Lucas County in 2007 were Promedica Health Systems, with approximately 11,265 employees; Mercy Health Partners, with approximately 6723 employees; the University of Toledo, with approximately 4987 employees; and the Toledo School District, with approximately 4554 employees (Lucas County Auditor's Office 2008). Large manufacturing businesses in the Toledo area as of 2009 included General Motors Corporation (2924 employees), Chrysler LLC (2261 employees), The Andersons (grain storage, process, and retail [1793 employees]), Libbey, Inc. (glass manufacturing, 1047 employees), Owens-Corning (glass manufacturing, 950 employees), and Dana Corporation (automotive parts manufacturing, 850 employees) (Regional Growth Partnership 2010).

Between 2000 and 2010, the unemployment rate for the county increased from 4.5 percent to 11.3 percent. The job outlook has improved over the past year, with the USBLS reporting an unemployment rate of 9.7 percent for Lucas County in 2011 (USBLS 2012).

The economies of Monroe, Lenawee, and Lucas Counties would benefit over the estimated 10-year construction period through direct purchase of materials and supplies and direct employment of the construction workforce. Detroit Edison estimates the size of the construction workforce would range from a minimum of 35 workers to a peak construction workforce of 2900 workers, averaging to an annual onsite construction workforce of 1000 workers. The review team estimates that based on an average salary estimate of $50,500, approximately $50.5 million would be expended directly in payroll annually during the construction period.

Detroit Edison expects direct employment for an operating new nuclear plant to be 900 full-time and contract employees. In addition, Detroit Edison estimates 1200 to 1500 workers would be employed during scheduled maintenance outages, which would occur every 24 months and require workers for a period of about 30 days. Based on an average salary estimate of $63,625, approximately $57.3 million would be expended directly in payroll annually during the 40-year operating license of the plant. In addition, every 24 months, an additional $6.3 to $7.9 million in payroll would be expended for the outage workforce for the plant.

New workers (i.e., in-migrating workers and those previously unemployed) would have an additional indirect effect on the local economy, because these new workers would stimulate the regional economy through their spending on goods and services in other industries.

Additional expenditures would be necessary for construction of the transmission lines from the nuclear power plant at the Petersburg site to the existing transmission and distribution network. The local economy would benefit from the direct purchase of materials and supplies for the transmission line construction and the employment of workers to support the construction and operation of these lines.

Based on the information provided by Detroit Edison, review of existing documentation, and the review team's evaluation, the review team concludes that the impact of building and operations on the economy would be noticeable and beneficial in Monroe County and minor and beneficial elsewhere.

Taxes

Construction and operation of a new nuclear facility at the Petersburg site would result in increased tax revenues to State and local governments. State income tax revenue would accrue through income taxes on salaries of the new workers (i.e., in-migrating workers and those previously unemployed). Based on an estimated annual average of 362 new construction workers (i.e., 150 in-migrating and 212 previously unemployed) residing equally in Monroe, Lenawee, and Lucas Counties (i.e., one-third of the number of workers in each county) during the 10-year construction period and an average salary of $50,500, the State of Michigan would receive an estimated $0.5 million in income tax revenue and the State of Ohio would receive an estimated $0.2 million annually during the construction period. Estimated income tax revenues reflect the respective State income tax rate as described in Sections 2.5, 4.4, and 5.4. The State of Michigan would also receive tax revenue through increased sales expenditures by workers and for the plant construction, operation and maintenance, and business taxes during operation

The review team assumed an annual average of 327 new operations workers (i.e., 270 in-migrating and 57 previously unemployed) for operation of the plant would reside equally in Monroe, Lenawee, and Lucas Counties (e.g., one-third of the number of workers in each county), with an average salary of $63,625. Based on this assumption, the State of Michigan would receive an estimated $0.5 million in income tax revenue and the State of Ohio would receive an estimated $0.1 million in income tax revenue annually during the period of the 40-year operating license.

Property tax revenue would be the primary tax benefit to the local jurisdictions. The plant would be assessed during the construction period and be at its highest assessed value when it becomes operational. For analysis, the review team recognizes that the full estimated construction cost of $6.4 billion for a nuclear power plant of 1605 MW(e), as discussed in Section 4.4.3.1, may not be the actual assessed value for property tax purposes. However, for comparison in the alternative sites analysis, the review team based its conclusions upon this construction cost estimate.

In 2009, the assessed value of Detroit Edison's properties in Monroe County was $821 million, approximately 13.3 percent of the $6.9 billion total assessed property value in the county (Monroe County Finance Department 2009). Consequently, with completion of the construction of a new nuclear power plant at the Petersburg site, the total assessed property value in the county would be increased by about 100 percent. The review team recognizes that this would be an upper bound to the assessed value of the property and that a fee in lieu of agreement or other considerations may significantly reduce that assessed value. However, the review team believes that the property tax impact on Monroe County would be substantial and beneficial.

<u>Summary of Economic Impacts and Taxes</u>

Based on the information provided by Detroit Edison, review of reconnaissance-level existing documentation, and the review team's evaluation, the review team concludes that the impact of building and operations on the economy would be noticeable and beneficial in Monroe County and minor and beneficial elsewhere. The impact of tax revenues would be substantial and beneficial in Monroe County and minimal and beneficial elsewhere. An annual average of 150 new construction workers would relocate into the three-county area, and 212 workers who are currently unemployed would be employed for building activities over the 10-year construction period. A portion of the estimated $6.4-billion construction cost of the nuclear power plant would be spent on materials and supplies in the three-county area. Tax revenue to the State and local jurisdictions would accrue through personal income, sales, and property taxes and would have the largest benefit on the local jurisdictions within Monroe County.

During operations at the Petersburg site, an estimated 270 new operations workers would relocate into the area, and 57 workers who are currently unemployed would be employed in operating the plant. Based on the information provided by Detroit Edison and the review team's evaluation, the review team concludes that the economic impact of operating a nuclear power plant at the Petersburg site, including tax revenues, would be substantial and beneficial in Monroe County and minimal and beneficial elsewhere.

Infrastructure and Community Services

Traffic

Primary transportation routes servicing the Petersburg site are U.S. Routes 23 and 223. U.S. Route 23 is a north–south route. North of the site is an interchange on U.S. Route 23 with State Route 50, which proceeds east to the City of Monroe. U.S. Route 23 also provides access to the Ann Arbor MSA further north and to the Toledo MSA to the south. U.S. 223 provides access west to Adrian, in Lenawee County. There is no direct access to Detroit. The site is also served by numerous local roadways. Direct access to the site would be from Lake Road, approximately 2 mi from an interchange at U.S. Routes 23 and 223. Two local roadways cross the site: Morocco Road (east–west) and Payne Road (north–south).

Three major railway systems provide service within Monroe County: CN, CSX, and Norfolk Southern Railway (NS) (Monroe County Planning Department and Commission 2010). A CN rail line runs along the northern border of the site.

Local roadways may need to be upgraded to support the level of traffic generated by the plant construction and operation. In addition, unlike the Fermi site, the Petersburg site would require two roads that cross the site to be abandoned and rerouted to accommodate the building footprint and exclusion boundary. New road construction would require further analysis to determine whether local terrestrial, aquatic, and wetland resources would also be affected, depending on the reroutes identified and selected. Based on review of area maps, the review team believes such rerouting could affect local streams or rivers. Detroit Edison, in coordination with the MDOT and the Monroe County Road Commission, would need to conduct a transportation study that evaluates the roadway and traffic impacts and identifies the need for any road and/or bridge upgrades, the effects of roadway abandonments for site development, and mitigating strategies, such as road upgrades and/or road reroutes that would (1) mitigate impacts on transportation routes and (2) mitigate the traffic impacts to an acceptable level. For the above stated reasons, the review team expects that traffic impacts from building activities and operations, including construction workers, operations workers, and deliveries, could be substantial and potentially destabilizing and would warrant mitigation in coordination with MDOT and the Monroe County Road Commission, as well as USACE and MDEQ if impacts on waters of the United States and State-regulated waters would be affected.

Recreation

Recreational resources in Monroe, Lenawee, and Lucas Counties may be affected by construction and operation of a plant at the Petersburg site. Impacts may include increased user demand associated with the projected increase in population with the in-migrating workforce and their families, an impaired recreational experience associated with the views of the proposed 600-ft cooling tower and condensate plume, or access delays associated with increased traffic from the construction and operations workforce on local roadways.

State recreational areas in Monroe County total 7413 ac and include Sterling State Park and three game areas – Point Mouille State, Petersburg State, and Erie State – as well as several boat access sites and road rest areas. In addition, numerous county, township, village, and city recreational areas are located throughout the county.

Lucas County contains many Federal, State, and local park and conservation lands. Along Lake Erie is the Ottawa National Wildlife Refuge (NWR) Complex, which consists of three NWRs and a waterfowl production area. The Cedar Point NWR, West Sister Island NWR, and a portion of the Ottawa NWR are located in Lucas County. State lands include the 2202-ac Magee Marsh Wildlife Refuge, the 3101-ac Maumee State Forest, and the 1336-ac Maumee Bay State Park (Ohio Department of Natural Resources 2009).

The Metroparks of the Toledo Area encompass 11 parks in and around the Toledo area, totaling 10,500 ac. These parks provide a variety of passive and active recreational opportunities and preserve the natural and cultural features of the area.

Three State parks (W.J. Hayes State Park, 654 ac; Lake Hudson State Park, 2700 ac; and Cambridge Historic State Park, 181 ac) and six county parks are located in Lenawee County. In addition, numerous city, village, and township parks are located throughout the county (Lenawee County Parks and Recreation Commission 2010). Water resources in the county used for recreation include the Raisin River, which flows into Monroe County and is designated by the MDNR as "readily canoeable," and numerous lakes, ponds, streams, and rivers. The Irish Hills is a scenic recreational area in the northeastern part of Lenawee County and contains rolling hills and more than 50 lakes.

The recreational areas nearest to the Petersburg site are the Petersburg State Game Management Area in Monroe County, approximately 1.5 mi northeast of the site, and the Raisin River, approximately 4 mi north of the site.

The review team determines that the impacts associated with the increased use of the recreational resources in the vicinity and region would be minimal. The projected increase in population in the three-county area associated with in-migrating workers and their families for construction and operation is less than 1 percent of the projected 2020 population and would not affect the availability and use of recreational resources in the area.

People using recreational facilities near the site may experience roadway traffic congestion during the construction period, during morning and afternoon commutes of the operations workforce, and during the scheduled maintenance and forced outage periods. Measures to mitigate traffic impacts would be needed; these would alleviate impacts on users of recreational facilities as well as members of the general public.

The visual experience of users of recreational resources in the vicinity of the Petersburg site might be affected by the views of the 600-ft cooling tower and condensate plume that would occur during operation of the plant under certain meteorological conditions. The nuclear power plant and 600-ft cooling tower and condensate plume would be visible in a wide area, because the topography in the vicinity of the site is flat. Since the Petersburg site is a greenfield site, the visual intrusion of the cooling tower and other structures would offer a unique visual experience that the review team considers to be noticeable and adverse.

Housing

As shown in Table 9-33, an estimated 308,920 housing units are located within the three-county area, based on the USCB 2010 housing data. Of these, 33,791 housing units are vacant within the three-county area, primarily in Lucas County. Demand for short-term housing is expected to be highest during the peak construction period, and demand for long-term housing is expected to be highest when operations commence. Based on the analysis of impacts presented in Section 4.4.2, most of the construction and operations workforces would already reside in the area, so they would be accommodated in existing housing. Approximately 15 percent of the peak construction workforce (approximately 435 workers) and approximately 30 percent of the operations workforce (approximately 270 workers) would be expected to relocate within a 50-mi radius of the project site. Considering that the construction workforce may choose short-term accommodations such as campsites or hotels, the review team expects that the existing housing supply is sufficient to accommodate the construction workforce of 435 workers during the peak construction period and the operations workforce of 270 workers in-migrating to the area without affecting the housing supply or prices in the local area or stimulating new housing construction. Therefore, the review team determines the housing impact from a Petersburg site would be minimal.

Table 9-33. Housing Units in Monroe, Lenawee, and Lucas Counties (USCB 2010 Estimate)

Type of Housing Unit	Monroe County	Lenawee County	Lucas County
Total Housing Units	62,930	43,331	202,659
Occupied	58,298	37,831	179,000
Owner-occupied (units)	47,048	30,198	116,420
Owner-occupied (percent)	81	80	65
Renter-occupied (units)	11,250	7633	62,580
Renter-occupied (percent)	19	20	35
Vacant	4632	5500	23,659
Vacancy Rate			
Homeowner (percent)	2.4	2.4	3.8
Rental (percent)	9.1	5.8	10.6

Source: USCB 2010c

Public Services

In-migrating construction and operations workers and their families would increase the demand for water supply and wastewater treatment services within the communities where they choose to reside; the size of the total construction and operations workforce also would increase the demand for water supply and wastewater treatment services at the Petersburg site. The site is not currently served by water supply or sewer lines, pump stations, or other public utility infrastructure.

Monroe County. Several municipal water suppliers provide water to residents of Monroe County, including the City of Monroe; Frenchtown Charter Township; the City of Toledo, Ohio; and the Detroit Water and Sewerage Department (DWSD). Residents outside of these municipal suppliers obtain water through private wells (Monroe County Planning Department and Commission 2010). Residents of Summerfield Township obtain water through private wells. The City of Monroe provides bulk water to the City of Petersburg, but water lines do not extend out into Summerfield Township.

Wastewater treatment services are provided by a number of municipalities in Monroe County, including the City of Monroe; Frenchtown Charter, Monroe Charter, Berlin, Ash, and Ida Townships; Cities of Milan, Petersburg, and Luna Pier; and Villages of Dundee, Estral Beach, Carleton, South Rockwood, and Maybee. Other residents within the county are served by private onsite wastewater disposal systems (Monroe County Planning Department and Commission 2010). Residents of Summerfield Township have private sanitary waste disposal systems. The City of Petersburg serves the city and the Summerfield High School complex, which is located in Summerfield Township, just outside the city limits. Capacity of the wastewater treatment plant in the City of Petersburg is 0.5 MGD, and it treats an average daily flow of 0.08 MGD (Monroe County Planning Department and Commission 2010).

Lenawee County. The rural areas of Lenawee County receive potable water through private wells and use private waste disposal systems for treatment of sanitary wastewater (Lenawee County Planning Commission 2002). The four cities in Lenawee County (Adrian, Hudson, Morenci, and Tecumseh) and seven of the eight villages (Addison, Blissfield, Britton, Cement City, Clinton, Deerfield, and Onsted) are served by both municipal water supplies and wastewater treatment services. The Village of Clayton does not have a municipal water supply system, but does have wastewater treatment (Lenawee County Planning Commission 2002).

Lucas County. Residents in Lucas County are served by two municipal water suppliers. Toledo's water treatment and distribution system serves the city residents and portions of Lucas County, including the Cities of Maumee, Sylvania, and Perrysburg and portions of Monroe County, Michigan, and Wood County, Ohio. The City of Oregon's water treatment and distribution system serves city residents and portions of eastern Lucas County.

Lucas County residents are served by various wastewater treatment systems. The City of Toledo's Bayview Wastewater Treatment Plant is one of the largest wastewater treatment facilities in northwest Ohio. It provides treatment services to an area of approximately 100 mi^2 with a population of approximately 398,000 residents within the City of Toledo, the City of Rossford, the Villages of Walbridge and Ottawa Hills, and portions of Wood County, Lucas County, and the Village of Northwood.

The water supply and wastewater treatment systems within the three-county area should be able to accommodate the in-migrating construction and operations workforces and their families, which would represent less than 1 percent of the projected populations in 2020. Increased demand for police, fire response, and health care services from the in-migrating construction and operations workforces and their families are also expected to be accommodated within the existing systems. Given the number of jurisdictions within the three-county area, the new workers in-migrating into the area from building and operating a nuclear plant at the Petersburg site would have a negligible impact on capacity of any of the public services within the three-county area.

However, currently no service is available to support the workforce at the plant site. Detroit Edison would need to develop private water supply and waste disposal systems or develop water supply and sewer lines from the City of Petersburg. In either case, the review team believes that the potable water supply and waste disposal service needed for operations of a Petersburg nuclear power plant would be minimal.

Education

Numerous public school districts are located throughout the three-county area, including 9 public school districts in Monroe County (Airport Community, Bedford, Dundee, Ida, Jefferson, Mason Consolidated (Monroe), Monroe, Summerfield, and Whiteford Agricultural) with a combined enrollment of 23,913 students; 13 public school districts in Lenawee County (Addison, Adrian, Blissfield, Britton-Macon, Clinton, Deerfield, Hudson, Lenawee, Madison (Lenawee), Morenci, Onsted, Sand Creek, and Tecumseh) with a combined enrollment of 18,107 students; and 8 public school districts in Lucas County (Anthony Wayne, Maumee, Oregon, Ottawa Hills, Springfield, Sylvania, Toledo, and Washington Local) with a combined enrollment of 58,843 students (U.S. Department of Education 2010). As stated in Section 4.4.4.5, approximately 202 school-age children are expected to in-migrate into the 50-mi region during building activities, and 124 school-age children are expected to in-migrate for operations. Given the number of schools and the total student enrollment, the new students in-migrating into the area from building and operating a nuclear plant at the Petersburg site would have a negligible impact on the capacity of school systems within the three-county area.

Summary of Impacts on Infrastructure and Community Services

The review team has concluded from the information provided by Detroit Edison, review of existing reconnaissance level documentation, and its own independent evaluation that the impact of building and operations activities on regional infrastructure and community services – including housing, water and wastewater facilities, police, fire, and medical facilities, and education – would be minor. The visual impacts under recreation would be noticeable and adverse. The estimated peak workforce of 2900 would have a substantial and adverse impact on traffic on local roadways near the Petersburg site. These traffic-related impacts could be reduced but not eliminated with proper planning and mitigation measures.

Cumulative Impacts

The geographic area of interest for analysis of cumulative socioeconomic impacts of the Petersburg site includes Monroe, Lenawee, and Lucas Counties, where most of the socioeconomic impacts of construction and operation of the Petersburg site are expected to occur.

The impact analyses presented for the Petersburg site are cumulative. Past and current economic impacts associated with activities listed in Table 9-28 already have been considered as part of the socioeconomic baseline or in the analyses discussed above for the Petersburg site. Construction and operation of a new nuclear facility at the Petersburg site could result in cumulative impacts on the demographics, economy, and community infrastructure of Monroe, Lenawee, and Lucas Counties in conjunction with those reasonably foreseeable future actions shown in Table 9-28, and generally result in increased urbanization and industrialization.

However, many impacts, such as those on housing or public services, are able to adjust over time, particularly with increased tax revenues. Furthermore, State and county plans, along with modeled demographic projections, include forecasts of future development and population increases. Because the projects within the geographic area of interest would be consistent with applicable land use plans and control policies, the review team considers the cumulative socioeconomic impacts from the projects to be manageable. Physical impacts include impacts on workers and the general public, noise, air quality, buildings, roads, and aesthetics.

Based on the above considerations, Detroit Edison's ER, and the review team's independent evaluation, the review team concludes that under some circumstances building the nuclear power plant at the Petersburg site could make a temporary small adverse contribution to the cumulative effects associated with some socioeconomic issues. Those impacts would include physical impacts (workers and the local public, buildings, transportation, and visual aesthetics), demography, local infrastructures and community services (traffic; recreation; housing; water and wastewater facilities; and police, fire, and medical services; and schools), and would depend on the particular jurisdictions affected.

The cumulative effects on regional economies and tax revenues would be beneficial and SMALL with the exception of Monroe County, which would experience a MODERATE and beneficial cumulative effect on the economy and a LARGE and beneficial cumulative effect from property taxes. The cumulative effects on physical impacts, demography, infrastructure, and community services would be SMALL within the 50-mi region, except for a MODERATE and adverse cumulative impact on recreation (visual), and a LARGE and adverse cumulative effect on local traffic near the Petersburg site during construction and operation. Building and operating a new nuclear unit at the Petersburg site would be a significant contributor to the MODERATE and LARGE impacts.

9.3.5.6 Environmental Justice

The economic impact area for the Petersburg alternative site is a three-county area, including Monroe and Lenawee Counties, Michigan, and Lucas County, Ohio. To evaluate the distribution of minority and low-income populations near the Petersburg site, the review team conducted a demographic analysis of populations within the 50-mi region surrounding the proposed site in accordance with the methodology discussed in Section 2.6.1 of this EIS. The results of this analysis are displayed below in Tables 9-34 and 9-35 and Figures 9-13, 9-14, 9-15, and 9-16.

Table 9-34. Results of the Census Block Group Analysis for Minority Populations of Interest within the Region Surrounding the Petersburg Alternative Site (50-mi radius)[(a)]

State/County	Total Number of Census Block Groups in the 50-mi Region	Number of Census Block Groups with Minority Populations of Interest					
		Black	American Indian	Asian	Pacific Islander	Hispanic	Aggregate
Michigan							
Hillsdale	35	0	0	0	0	0	0
Ingham	5	0	0	0	0	0	0
Jackson	121	11	0	0	0	2	11
Lenawee	82	1	0	0	0	6	1
Livingston	66	0	0	0	0	0	0
Monroe	123	1	0	0	0	1	1
Oakland	157	34	0	16	0	0	42
Washtenaw	251	28	0	22	0	0	51
Wayne	1380	546	0	18	0	72	597
Ohio							
Defiance	17	0	0	0	0	1	0
Erie	1	0	0	0	0	0	0
Fulton	31	0	0	0	0	0	0
Hancock	7	0	0	0	0	0	0
Henry	27	0	0	0	0	0	0
Lucas	398	94	0	2	0	175	106
Ottawa	37	0	0	0	0	2	0
Putnam	2	0	0	0	0	0	0
Sandusky	46	0	0	0	0	11	3
Seneca	15	0	0	0	0	3	0
Williams	31	0	0	0	0	1	0
Wood	90	0	0	0	0	5	0
Total	**2922**	**715**	**0**	**58**	**0**	**279**	**812**

Source: USCB 2010d
(a) Shaded rows indicate the economic impact area.

Table 9-35. Results of the Census Block Group Analysis for Low-Income Populations of Interest within the 50-mi Region of the Petersburg Alternative Site[(a)]

State/County	Total Number of Census Block Groups in the 50-mi Region	Census Block Groups with Low-Income Populations of Interest	
		Number	Percentage
Michigan			
Hillsdale	35	3	8.6
Ingham	5	0	0
Jackson	121	17	14.0
Lenawee	82	4	4.9
Livingston	66	0	0
Monroe	123	1	0.8
Oakland	157	4	2.5
Washtenaw	251	34	13.5
Wayne	1380	291	21.1
Ohio			
Defiance	17	10	5.9
Erie	1	0	0
Fulton	31	0	0
Hancock	7	0	0
Henry	27	1	3.7
Lucas	398	81	20.4
Ottawa	37	0	0
Putnam	2	0	0
Sandusky	46	1	2.2
Seneca	15	0	0
Williams	31	2	6.5
Wood	90	9	10.0
Total	**2922**	**449**	**15.4**

Source: USCB 2010e

(a) Shaded rows indicate the economic impact area.

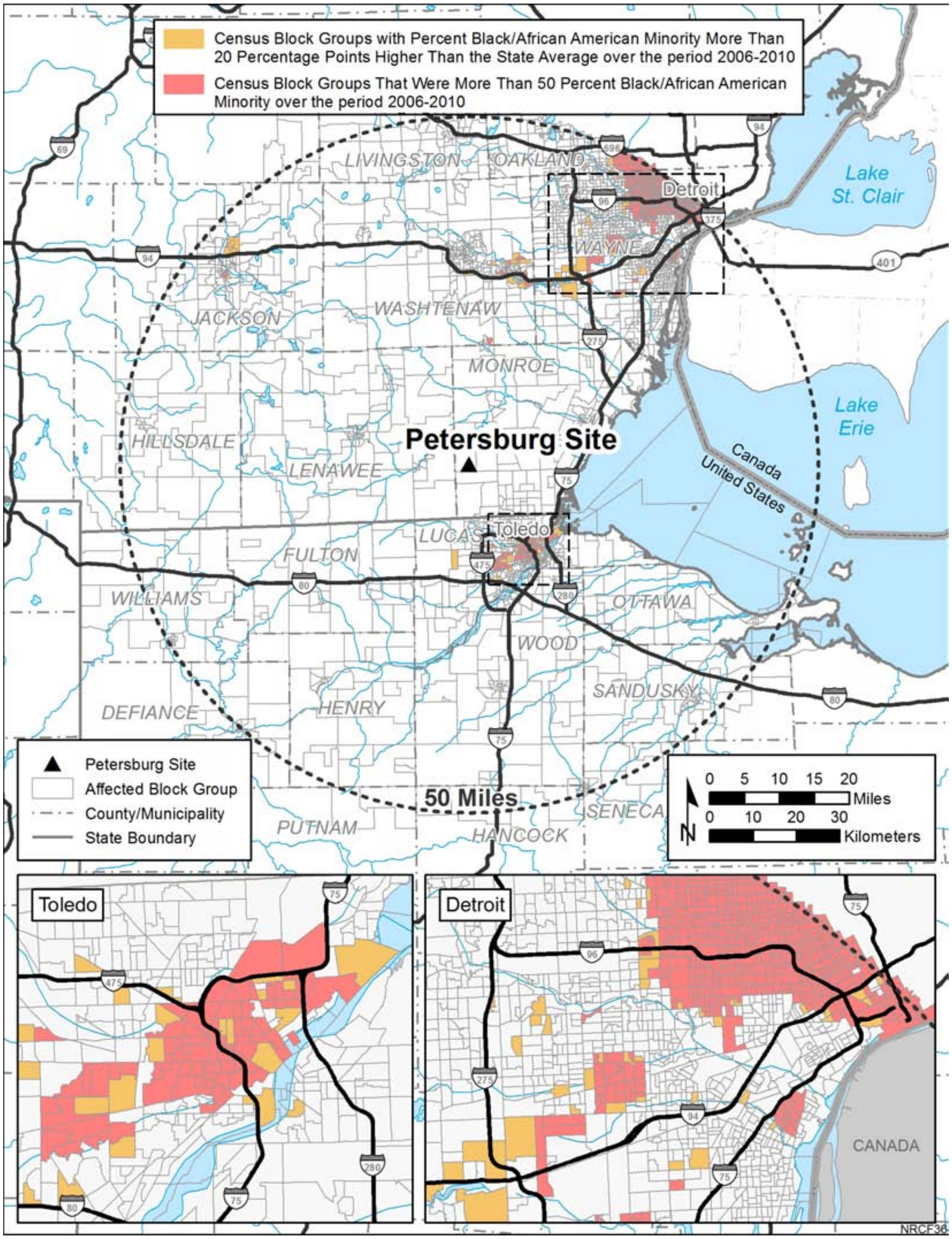

Figure 9-13. Black and African-American Minority Census Block Group Populations of Interest within a 50-mi Radius of the Petersburg Site (USCB 2010d)

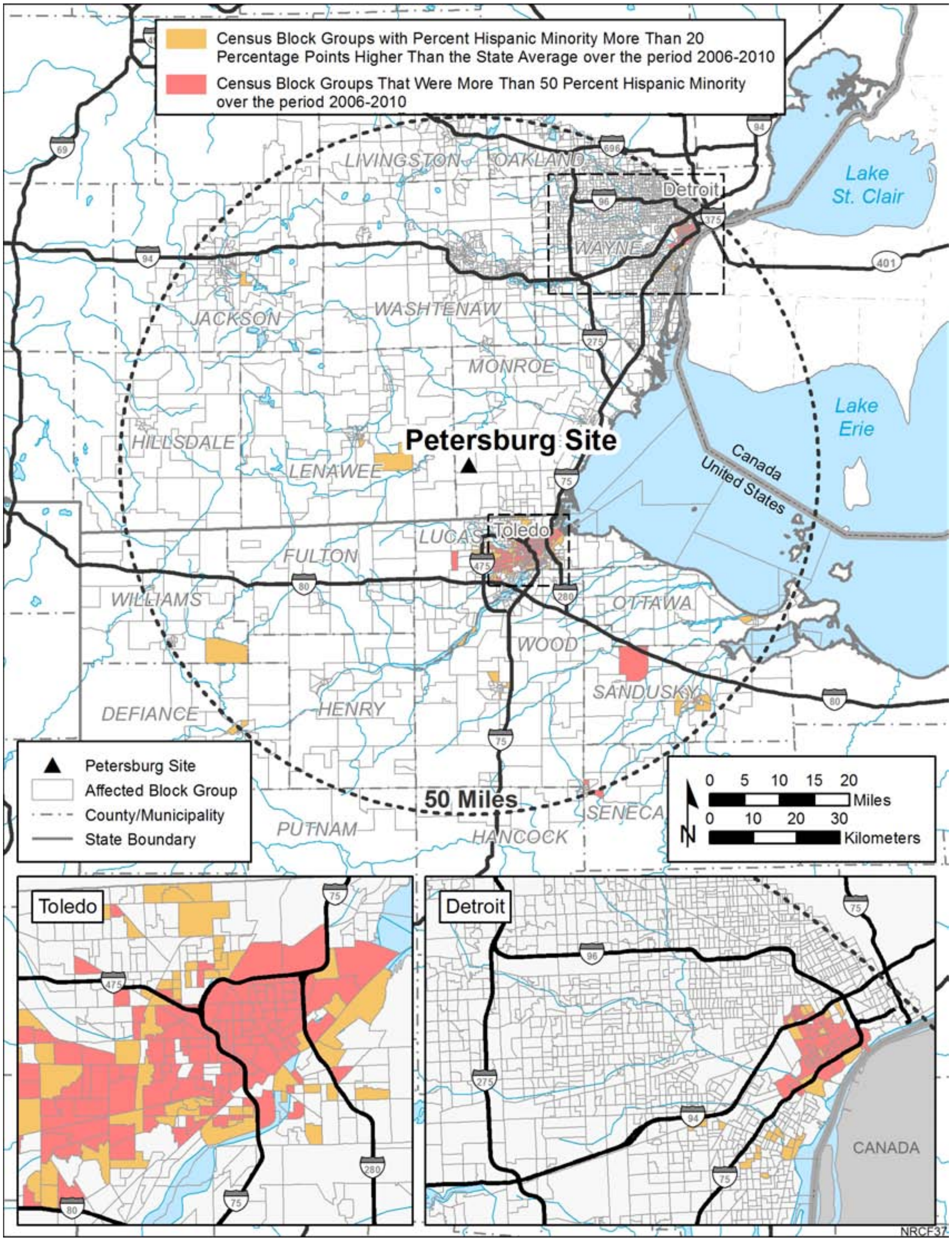

Figure 9-14. Hispanic Minority Census Block Group Populations of Interest within a 50-mi Radius of the Petersburg Site (USCB 2010d)

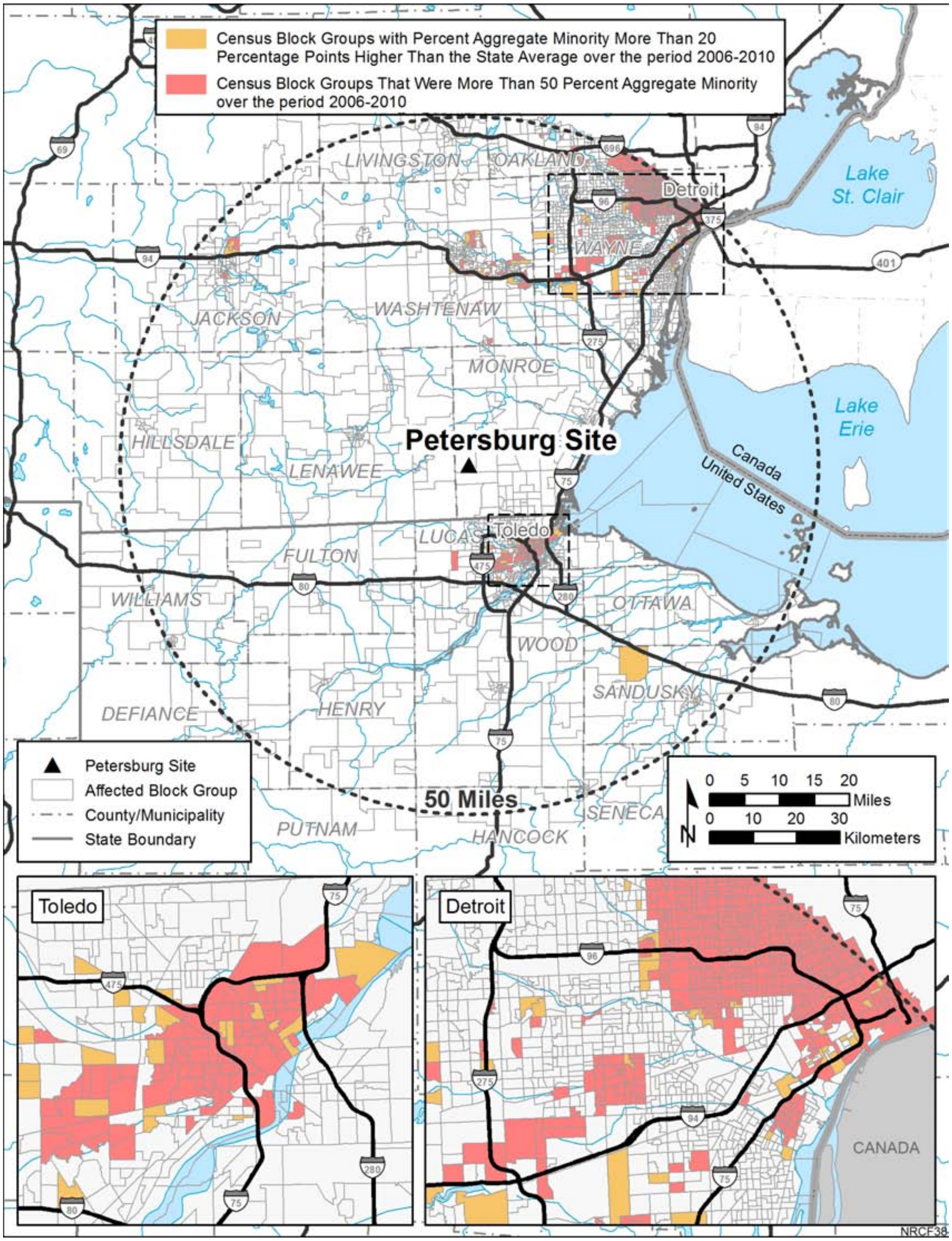

Figure 9-15. Aggregate Minority Census Block Group Populations of Interest within a 50-mi Radius of the Petersburg Site (USCB 2010d)

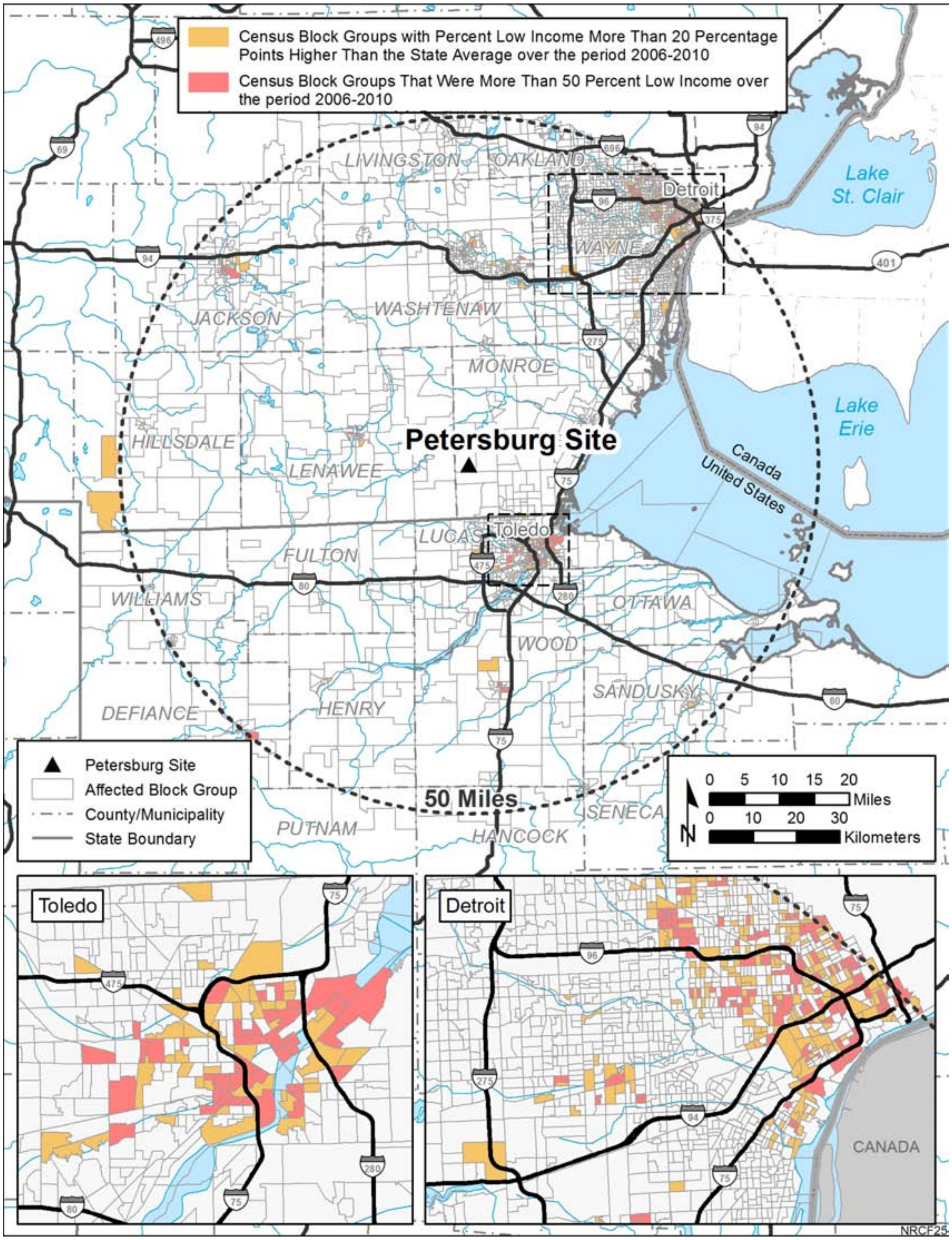

Figure 9-16. Low-Income Census Block Group Populations of Interest within a 50-mi Radius of the Petersburg Site (USCB 2010e)

Because of the proximity of the 50-mi region surrounding the Petersburg plant to the Fermi 3 site, the review team found the population to be similar in demographic distribution to the 50-mi region surrounding the proposed Fermi 3 site: rural, with few representative minority or low-income populations of interest outside the urban areas (for the Petersburg site, these urban areas are the same as those for Fermi 3, with Toledo about 10 mi to the south and Detroit near the boundary of the 50-mi region to the north). The review team identified Lenawee County as part of the economic impact area because of the proximity of the proposed site to the border between Lenawee and Monroe Counties. The review team also identified Monroe County in Michigan and Lucas County in Ohio, which were also the economic impact area for Fermi 3, as part of the economic impact area for the Petersburg alternative site. The review team focused its analysis upon the minority and low-income populations within these three counties. The review team found no low-income or minority populations of interest within 15 mi of the Petersburg site.

Based on this analysis, the review team determined that there do not appear to be any identified minority or low-income populations of interest in Monroe, Lenawee, or Lucas Counties that would be likely to experience disproportionate and adverse human health, environmental, physical, or socioeconomic effects as a result of construction or operation of a plant at the Petersburg site. The review team did not identify any subsistence activities in the economic impact area or elsewhere in the 50-mi region. For the other physical and environmental pathways described in Section 2.6.1, the review team determines that impacts at the Petersburg site would be similar to those at the Fermi site. Therefore, the review team determines the environmental justice impacts of building and operating a nuclear reactor at the Petersburg would be SMALL.

9.3.5.7 Historic and Cultural Resources

This section presents the review team's evaluation of the potential impacts on historic and cultural resources of siting a new ESBWR at the Petersburg site. For the analysis of impacts on historic and cultural resources, the geographic area of interest is considered to be the APE that would be defined for a new nuclear power facility at the Petersburg site. This includes the physical APE, defined as the area directly affected by building and operating a new nuclear power plant and transmission lines, and the visual APE (i.e., the area from which the structures can be seen). The visual APE includes the area within a 1-mi radius of the physical APE.

The review team relied upon reconnaissance-level information to perform the alternative site evaluation. Reconnaissance-level activities in a cultural resources review have particular meaning. For example, these activities may include site file searches, background research for environmental and cultural contexts, and preliminary field investigations to confirm the presence or absence of cultural resources in an APE, or the sensitivity of an APE for cultural resources. For this alternatives analysis, reconnaissance-level information is considered data that are readily available from Federal and State agencies and other public sources. The following sources were used to identify reconnaissance-level information on historic and cultural resources in the APE at the Petersburg site:

- NPS's National Historic Landmarks Program database for designated National Historic Landmarks (NPS 2010a).
- NPS's NRHP database for properties listed in the NRHP (NPS 2010b).
- NationalRegisterofHistoricPlaces.com database for properties listed in the NRHP (NRHP 2010).
- Michigan's Historic Sites Online database for cultural resources significant to the State of Michigan (MSHDA 2010a).
- Detroit Edison's ER (Detroit Edison 2011a).
- *Cultural Resources Site File Review of Seven Alternative Sites in Monroe, Lenawee*, St. C*lair, and Huron Counties, Michigan, Fermi Nuclear Power Plant Unit 3 (Fermi 3) Project, Frenchtown and Berlin Townships, Monroe County, Michigan* (Lillis-Warwick et al. 2009).

No National Historic Landmarks or other historic properties listed in the NRHP were identified (NPS 2010a, b; NRHP 2010). Three previously recorded cultural resources have been identified within the APE for the Petersburg site. All three are archaeological resources (Sites 20MR576, 20MR574, and 20MR304); no architectural or aboveground cultural resources have been identified within the APE at the Petersburg site. None of these three previously recorded cultural resources have been included in or determined eligible for inclusion in the NRHP (Lillis-Warwick et al. 2009). Therefore, none of these three previously recorded cultural resources are considered a historic property pursuant to Section 106 of the NHPA.

Archaeological Site 20MR576 is a Late Archaic/Early Woodland Period (prehistoric) archaeological site of unknown function. Archaeological Site 20MR574 is a prehistoric isolated find (isolated artifact) of unknown cultural affiliation and unknown function. Archaeological Site 20MR304 is a prehistoric archaeological site of unknown function, with occupation and/or use dating from the Paleo-Indian, Archaic, and Late Woodland Periods. All three archaeological resources are located outside of physical APE, but within the indirect (visual) APE. None of the three archaeological resources have been evaluated for NRHP eligibility or Michigan SRHP eligibility (Lillis-Warwick et al. 2009).

One historic property is in the general vicinity of the APE at the Petersburg site, the Dundee Historic District (Site ID#P24264), a mid-nineteenth to mid-twentieth century historic district, which is 8 mi northeast of the APE (Detroit Edison 2011a). The Dundee Historic District straddles the River Raisin and includes the historic downtown commercial and industrial areas of Dundee. The district also includes a ca. 1850s mill, which was purchased by Henry Ford as part of his "Village Industries" experiment to determine whether factory work could be done in small town environments using water power. The Dundee Historic District was listed in the NRHP in 1990 (MSHDA 2010e) and is considered a historic property pursuant to Section 106 of the NHPA. This NRHP-listed property is outside of the indirect (visual) APE for the Petersburg site.

No archaeological and/or architectural surveys have been conducted at the alternative site to identify additional cultural resources in the APE and/or to determine or confirm the significance (NRHP eligibility) of the previously identified cultural resources in the APE at the Petersburg site. As currently designed, the proposed layout for a new nuclear power facility at the Petersburg site and potential water intake and discharge pipeline from Lake Erie would not affect any of the previously identified cultural resources within the APE. However, the proposed layout for a new nuclear power facility at the Petersburg site includes structures (buildings and cooling towers) and operational activities (condensation plumes) that would be new landscape elements within the APE at the Petersburg site.

Consultation with the Michigan SHPO would be necessary to determine the need for cultural resources investigations (including archaeological and architectural surveys) to (1) identify cultural resources within the APE prior to any onsite ground-disturbing activities; (2) determine whether any identified cultural resources are eligible for inclusion in the NRHP; (3) evaluate the potential impacts on cultural resources and/or historic properties; and (4) determine the effect of a new nuclear power facility at the Petersburg site pursuant to Section 106 of NHPA. As part of this consultation, Detroit Edison would be expected to put measures in place to protect discoveries in the event that cultural resources are found during building or operation of a new plant. If an unanticipated discovery was made during building activities, site personnel would have to notify the Michigan SHPO and consult with them in conducting an assessment of the discovery to determine whether additional work is needed.

The incremental impacts from installation and operation of offsite transmission lines and potential water intake and discharge pipelines to Lake Erie would be minimal if there are no significant alterations (either physical alteration or visual intrusion) to the cultural environment. If these activities result in significant alterations to the cultural environment, then the impact could be greater. Although building and operating potential water intake and discharge pipelines would be the responsibility of Detroit Edison, building and operating offsite transmission lines would be the responsibility of a transmission company. For impacts greater than small, mitigation may be developed in consultation with the appropriate Federal and State regulatory authorities. Only Federal undertakings would require a Section 106 review.

The APE at the Petersburg site does not contain any Indian Reservation land (BIA undated). However, consultation with Federally recognized Indian Tribes in the State of Michigan would be necessary in accordance with Section 106 of NHPA. In addition, two Federally recognized Indian Tribes located outside the State of Michigan – the Forest County Potawatomi Community of Wisconsin and the Ottawa Tribe of Oklahoma – have indicated an interest in Monroe County (NPS 2010d). As part of this consultation, the NRC would consult with all 12 Federally recognized Indian Tribes located within the State of Michigan (Michigan Department of Human Services 2001–2009), as identified for the Fermi site, and with the Forest County Potawatomi Community of Wisconsin and the Ottawa Tribe of Oklahoma.

The following cumulative impact analysis for historic and cultural resources includes building and operating a new nuclear power facility at the Petersburg site. This analysis also considers other past, present, and reasonably foreseeable future actions that could affect historic and cultural resources, as identified in Table 9-28. The APE for the cumulative impact analysis for historic and cultural resources for the Petersburg site consists of the alternative site area and any new transmission line corridors, and a 1-mi buffer area around the site and the corridors.

The Petersburg site is predominantly agricultural land, with one small area of second-growth woodland and two local roadways (Morocco Road [east–west] and Payne Road [north–south]). Although numerous farms are located within the APE, no previous industrial development (e.g., power plants, aboveground transmission lines, pipelines, and railroads) has occurred onsite. Agricultural activities such as plowing, disking, and harvesting (whether historic or modern [mid-nineteenth to mid-twentieth century]) and logging or clearing of original forests (prior to the reestablishment of the existing second-growth woodland area) are likely to have resulted in minimal subsurface disturbance, suggesting that areas at the Petersburg site that are currently used for agricultural purposes may have sustained minimal prior ground disturbance.

Additional past actions in the general vicinity of the Petersburg site, as identified from Table 9-28, may have also indirectly (visually) affected cultural resources within the visual APE. These past actions would have included construction and operation of the Holcim (US) Inc. Portland cement plant, approximately 7 mi north-northeast in Dundee, Michigan; the Stansley Mineral Resources, STONECO-Meanwell Road Site (Ida Road); and STONECO Inc.-Maybee sand, gravel, topsoil, and/or limestone mines or quarries, approximately 5 to 10 mi from the Petersburg site. However, the locations of these projects would likely be too far to result in cumulative indirect (visual) impacts on historic or cultural resources within the APE at the Petersburg site. Because a new nuclear power facility at the Petersburg site would be located on minimally developed agricultural property, it is likely that the proposed project would result in new significant indirect (visual) impacts on cultural resources that might be identified within the visual APE.

Based on reconnaissance-level information provided by Detroit Edison and identified by the review team and the review team's independent evaluation of this information, the review team concludes that the cumulative impacts on historic and cultural resources from building and operating a new nuclear power facility at the Petersburg site would be SMALL. This impact determination is based on available information, which indicates that no known historic properties would be affected (none of the cultural resources identified within the APE at the

Petersburg site have been evaluated for NRHP eligibility), resulting in a SMALL impact determination. However, if a new nuclear power facility were to be developed at the Petersburg site, then cultural resources investigations within the APE and for any proposed transmission lines and water pipelines might reveal important historic or cultural resources that could be directly or indirectly affected, resulting in greater cumulative impacts.

9.3.5.8 Air Quality

Criteria Pollutants

For a plant with the same capacity as the proposed Fermi 3 plant, the emissions from building and operating a nuclear power plant at the Petersburg site are assumed to be comparable to those from Fermi 3. The alternative site is located in Monroe County, about 7 mi north of the Michigan–Ohio boundary and 1 mi east of Lenawee County. Monroe County is in the Metropolitan Toledo Interstate AQCR (40 CFR 81.43), while Lenawee County is in the South Central Michigan Intrastate AQCR (40 CFR 81.196). Monroe County is designated as a nonattainment area for $PM_{2.5}$ NAAQS and as a maintenance area for 8-hr ozone NAAQS, while Lenawee County is in unclassifiable/attainment for all criteria pollutants, except in a maintenance area for 8-hr ozone NAAQS (EPA 2010b). In July 2011, MDEQ submitted a request asking the EPA to redesignate southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011). In July 2012, the EPA issued a proposed rule designating southeastern Michigan as having attained both the 1997 annual $PM_{2.5}$ NAAQS and the 2006 24-hour $PM_{2.5}$ NAAQS, based on 2009–2011 ambient air monitoring data (77 FR 39659, dated July 5, 2012), but the final determination has yet to be made.

In Sections 4.7 and 5.7, the review team concludes that air quality impacts of building and operating a plant at Fermi 3, including those associated with transmission lines and cooling towers, would be SMALL, as long as appropriate measures are taken to mitigate dust during building activities. During operation, cooling towers would be the primary source of $PM_{2.5}$, which accounts for most of total $PM_{2.5}$ emissions of 9.51 tons per year at Fermi 3. However, these emissions would be relatively small and thus are not anticipated to elevate $PM_{2.5}$ concentrations in a designated nonattainment area. With dust mitigation, the impacts of building and operating a plant at the Petersburg site would also be SMALL. Any new industrial projects would either be small or subject to permitting by MDEQ. State permits are issued under regulations approved by the EPA and deemed sufficient to attain and maintain the NAAQS and comply with other Federal requirements under the CAA. Thus, the cumulative air quality impacts of building and operating a plant at the Petersburg site would be SMALL.

Greenhouse Gases

The extent and nature of climate change is not sensitive to where GHGs are emitted, because the long atmospheric lifetimes of GHGs result in extensive transport and mixing of these gases.

Since the emissions of a plant at the Petersburg site would be comparable to those of a similar plant at the Fermi site, the discussions of Sections 4.7 and 5.7 for Fermi 3 also apply to building and operating a similar plant at Petersburg. Thus, the impacts of the plant's GHG emissions on climate change would be SMALL, but the cumulative impacts considering global emissions would be MODERATE. Building and operating a new nuclear unit at the Petersburg site would not be a significant contributor to these impacts.

9.3.5.9 Nonradiological Health

The following impact analysis considers nonradiological health impacts from building activities and operations on the public and workers from a new nuclear facility at the Petersburg alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect nonradiological health, including other Federal and non-Federal projects and those projects listed in Table 9-28 within the geographic area of interest. The building-related activities that have the potential to affect the health of members of the public and workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the transport of construction materials and personnel to and from the site. The operation-related activities that have the potential to affect the health of members of the public and workers include exposure to etiological agents, noise, EMFs, and the transport of workers to and from the site.

Most of the nonradiological impacts of building and operation (e.g., noise, etiological agents, occupational injuries) would be localized and would not have significant impact at offsite locations. However, activities such as vehicle emissions from transport of personnel to and from the site would encompass a larger area. Therefore, for nonradiological health impacts, the geographic area of interest for cumulative impacts analysis includes projects within a 50-mi radius of the Petersburg site based on the influence of vehicle and other air emissions sources, because the site is in a nonattainment area (Section 9.3.5.8). For cumulative impacts associated with transmission lines, the geographical area of interest is the transmission line corridor. These geographical areas are expected to encompass areas where public and worker health could be influenced by the proposed project and associated transmission lines, in combination with any past, present, or reasonably foreseeable future actions.

Building Impacts

Nonradiological health impacts on construction workers from building a new nuclear facility at the Petersburg site would be similar to those from building Fermi 3 at the Fermi site, as evaluated in Section 4.8. They include occupational injuries, noise, odor, vehicle exhaust, and dust. Applicable Federal, State, and local regulations on air quality and noise would be complied with during the plant construction phase. The Petersburg site does not have any characteristics that would be expected to lead to fewer or more construction accidents than would be expected for the Fermi site. The site is in a predominantly rural area, and construction impacts on the surrounding population areas that are classified as medium- and low-population areas would likely be minimal. Access routes to the site for construction workers would include U.S. Route 23 and Lake Road. Mitigation may be necessary to ease congestion, thereby improving traffic flow and reducing nonradiological health impacts (i.e., traffic accidents, injuries, and fatalities) during the building period.

Operational Impacts

Nonradiological health impacts on occupational health of workers and members of the public from operation of a new nuclear unit at the Petersburg site would be similar to those evaluated in Section 5.8 for the Fermi site. Occupational health impacts on workers (e.g., falls, electric shock, or exposure to other hazards) at the Petersburg site would likely be the same as those evaluated for workers at the new unit at the Fermi site. Discharges to the Lake Erie would be controlled by NPDES permits issued by MDEQ (Section 9.3.5.2). The growth of etiological agents would not be significantly encouraged at the Petersburg site because of the temperature attenuation in the length of the pipe required for a discharge system. Noise and EMF exposure would be monitored and controlled in accordance with applicable OSHA regulations. Effects of EMFs on human health would be controlled and minimized by conformance with NESC criteria. Nonradiological impacts of traffic during operations would be less than the impacts during building. Mitigation measures taken during building to improve traffic flow would also minimize impacts during operation of a new unit.

Cumulative Impacts

Past and present actions within the geographic area of interest that could contribute to cumulative nonradiological health impacts include the energy and mining projects in Table 9-28, as well as vehicle emissions and existing urbanization. Reasonably foreseeable future projects in the geographical area of interest that could contribute to cumulative nonradiological health impacts include construction of the proposed Cleveland-Toledo-Detroit Passenger Rail line, future transmission line development, and future urbanization.

The review team is also aware of the potential climate changes that could affect human health. A recent compilation of the state of the knowledge in this area (USGCRP 2009) has been considered in the preparation of this EIS. Projected changes in the climate for the region include an increase in average temperature, increased likelihood of drought in summer, more heavy downpours, and an increase in precipitation, especially in the winter and spring, which may alter the presence of microorganisms and parasites. In view of the water source characteristics, the review team did not identify anything that would alter its conclusion regarding the presence of etiological agents or change in the incidence of waterborne diseases.

Summary Nonradiological Health Impacts at the Petersburg Site

Based on the information provided by Detroit Edison and the review team's independent evaluation, the review team expects that the impacts on nonradiological health from building and operation of a new nuclear unit at the Petersburg site would be similar to the impacts evaluated for the Fermi site. Although there are past, present, and future activities in the geographical area of interest that could affect nonradiological health in ways similar to the building and operation of a new unit at the Petersburg site, those impacts would be localized and managed through adherence to existing regulatory requirements. Similarly, impacts on public health of a new nuclear unit operating at the Petersburg site would be expected to be minimal. The review team concludes, therefore, that the cumulative impacts of building and operating a nuclear unit at Petersburg on nonradiological health would be SMALL.

9.3.5.10 Radiological Health

The following impact analysis considers radiological impacts on the public and workers from building activities and operations for one nuclear unit at the Petersburg alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health, including other Federal and non-Federal projects, and those projects listed in Table 9-28 within the geographic area of interest. As described in Section 9.3.5, the Petersburg site is a greenfield site; there are no nuclear facilities currently on the site. The geographic area of interest is the area within a 50-mi radius of the Petersburg site. Existing facilities potentially affecting radiological health within this area are Fermi 2 and Davis-Besse. In addition, there are likely to be medical, industrial, and research facilities within 50 mi of the Petersburg site that use radioactive materials.

The radiological impacts of building and operating the proposed ESBWR unit at the Petersburg site include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways would result in low doses to people and biota offsite that would be well below regulatory limits. These impacts are expected to be similar to those at the proposed Fermi site.

The radiological impacts of Fermi 2 and Davis-Besse also include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways result in low doses to people and biota offsite that are well below regulatory limits as demonstrated by the ongoing radiological environmental monitoring programs (REMPs) conducted around these plants. In addition, the NRC staff concludes that the dose from direct radiation and effluents from medical, industrial, and research facilities that use radioactive materials would be an insignificant contribution to the cumulative impact around the Petersburg site. This conclusion is based on data from REMPs conducted around currently operating nuclear power plants. Based on the information provided by Detroit Edison and the NRC staff's independent analysis, the NRC staff concludes that the cumulative radiological impacts from building and operating the proposed ESBWR and other existing projects and actions in the geographic area of interest around the Petersburg site would be SMALL.

9.3.5.11 Postulated Accidents

The following impact analysis considers radiological impacts from postulated accidents from operations for one nuclear unit at the Petersburg alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health from postulated accidents, including other Federal and non-Federal projects and those projects listed in Table 9-22 within the geographic area of interest. As described in Section 9.3.5, the Petersburg site is a greenfield site and there are no nuclear facilities currently on the site. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Petersburg site. Existing facilities potentially affecting radiological accident risk within this geographic area of interest are Fermi 2 and Davis-Besse, because the 50-mi radii for Fermi 2 and Davis-Besse overlap part of the 50-mi radius for the Petersburg site. No other reactors have been proposed within the geographic area of interest.

As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of DBAs at the proposed Fermi site would be minimal for an ESBWR. DBAs are addressed specifically to demonstrate that a reactor design is sufficiently robust to meet NRC safety criteria. The ESBWR design is independent of site conditions, and the meteorologies of the alternative and the proposed Fermi sites are similar; therefore, the NRC staff concludes that the environmental consequences of DBAs at the site would be SMALL.

Because the meteorology, population distribution, and land use for the Petersburg site are expected to be similar to those for the proposed Fermi site, risks from a severe accident for an ESBWR located at the Petersburg site are expected to be similar to those analyzed for the proposed Fermi site. These risks for the proposed Fermi site are presented in Tables 5-34 and 5-35 of this EIS and are well below the mean and median values for current-generation reactors. In addition, as discussed in Section 5.11.2, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028). For existing plants within the geographic area of interest (i.e., Fermi 2, and Davis-Besse), the Commission determined the probability-weighted consequences of severe accidents are small (10 CFR Part 51, Appendix B, Table B-1). Because of the NRC's safety review criteria, it is expected that risks for any new reactors at any other locations within the geographic area of interest for the Petersburg site would be well below risks for current-generation reactors and would meet the Commission's safety goals. The severe accident risk due to any particular nuclear power plant becomes smaller as the distance from that plant increases. However, the combined risk at any location within 50 mi of the Petersburg site would be bounded by the sum of risks for all these operating nuclear power plants and would still be low.

On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Petersburg site would be SMALL.

9.3.6 South Britton Site

This section presents the review team's evaluation of the potential environmental impacts of siting a nuclear reactor at the South Britton site. The following sections describe a cumulative impact assessment conducted for each major resource area. The specific resources and components that could be affected by the incremental effects of the proposed action if it were implemented at the South Britton site and other actions in the same geographic area were considered. This assessment includes the impacts of NRC-authorized construction, operations, and preconstruction activities. Also included in the assessment are other past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could have meaningful cumulative impacts when considered together with the proposed action if implemented at the South Britton site. Other actions and projects considered in this cumulative analysis are described in Table 9-36. The location and vicinity of the South Britton alternative site are shown in Figure 9-17.

Referred to by Detroit Edison in its site selection process as Site C, the South Britton site is located approximately 1 mi southeast of the town of Britton and 6.5 mi west of Dundee. This greenfield site occupies approximately 1140 ac in Sections 1, 2, 11, and 12 of Township 6 South, Range 5 East.

Road access to the site is provided by U.S. Route 50, which borders the site on the northeast. Rail access is via a spur track of the NS mainline, approximately 1 mi northwest of the site. A 345-kV transmission line approximately 1 mi north of the site is believed to have uncommitted current-carrying capacity.

Surface water on the site includes a tributary to the River Raisin, which crosses the site. The River Raisin is located about 5 mi south and 6 mi west of the site.

The site is currently in agricultural use. Approximately 15 to 25 residents are estimated to currently live on the site. Other than onsite residents, the nearest sensitive receptors are in the town of Britton. The site topography is flat with little variability. Aside from wheat, corn, and soybean cropland, the site supports several small patches of second-growth forest.

The nearest population centers are the towns of Toledo, Ohio, approximately 17.5 mi south, with a population of approximately 305,000 (2000 data), and the towns of Britton and Dundee,

Table 9-36. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the South Britton Alternative Site Cumulative Analysis

Project Name	Summary of Project	Location	Status
Energy Projects			
J.R. Whiting Power Plant	328-MW coal-fired plant	20 mi southeast of South Britton site	Operational
Detroit Edison Monroe Power Plant	3280-MW coal-fired plant	23 mi east–southeast of South Britton site	Operational
Bay Shore Power Plant	499-MW coal-fired plant	25 mi southeast of South Britton site in Maumee Bay, Ohio	Operational
Fermi Unit 2	1098-MW nuclear power plant, including recently completed ISFSI and decommissioned Fermi 1 collocated on site	26 mi east of South Britton site	Operational
Davis Besse Nuclear Plant Unit 1	925-MW nuclear power plant	46 mi southeast of South Britton site on Lake Erie	Operational
Mining Projects			
Stansley Mineral Resources	Construction sand and gravel mine	12 mi northwest of South Britton site	Operational
STONECO-Meanwell Road Site	Commercial fill sand and topsoil	10 mi east-southeast of South Britton site	Operational
STONECO-Maybee Site	Limestone quarry	15 mi east-northeast of South Britton site	Operational
Transportation Projects			
Cleveland-Toledo-Detroit Passenger Rail Line	Addition to regional transportation hub with rail lines connecting Cleveland, Buffalo, Toronto, Pittsburgh, Cincinnati, and Detroit	Rail line would pass through Monroe County on its way to Detroit	Proposed; schedule undetermined
Other Actions/Projects			
Britton/Ridgeway Wastewater Stabilization Lagoon (WWSL)	WWSL that discharges to Schreeder Brook	1 mi north of South Britton site	Operational
Deerfield WWTP	WWTP that discharges to River Raisin	5 mi south-southeast of South Britton site on River Raisin	Operational
The Farms WWTP	WWTP that discharges to North Branch of Macon Creek	5 mi northeast of South Britton site	Operational

Table 9-36. (contd)

Project Name	Summary of Project	Location	Status
Petersburg WWTP	WWTP that discharges to River Raisin	6 mi southeast of South Britton site on River Raisin	Operational
Tecumseh WWTP	WWTP that discharges to River Raisin	6 mi west–northwest of South Britton site	Operational
Holcim (US) Inc. – Dundee	Portland cement plant	7 mi north–northeast of South Britton site	Operational
Dundee WWTP	WWTP that discharges to River Raisin	7 mi east of South Britton site on River Raisin	Operational
Blissfield WWTP	WWTP that discharges to River Raisin	9 mi south–southwest of South Britton site on River Raisin	Operational
Blissfield Manufacturing Company	Fabricated metal products	9 mi south–southwest of South Britton site on River Raisin	Operational
Milan WWTP	WWTP that discharges to Saline River	9 mi northeast of South Britton site	Operational
Midwest Grain Processing – Blissfield	Manufactures industrial organic chemicals with discharge to River Raisin	10 mi south–southwest of South Britton site	Operational
Global Ethanol Services	Manufactures industrial organic chemicals with discharge to Golf County Drain	10 mi south–southwest of South Britton site	Operational
Saline Valley Farms WWTP	WWTP that discharges to Saline River	11 mi north of South Britton site	Operational
Dairy Farmers of America	Milk processing facility with discharge to South Branch of River Raisin	11 mi west–southwest of South Britton site	Operational
Clinton WWTP	WWTP that discharges to River Raisin	11 mi northwest of South Britton site	Operational
Central Lenawee WWTP and landfill	WWTP and landfill that discharge to River Raisin	11 mi west–southwest of South Britton site	Operational
Adrian WWTP	WWTP that discharges to South Branch of River Raisin	11 mi west–southwest of South Britton site	Operational
Adrian WTP	WTP that discharges to Wolf Creek	12 mi west–southwest of South Britton site	Operational
Saline WWTP	WWTP that discharges to Saline River	13 mi north of South Britton site	Operational

Table 9-36. (contd)

Project Name	Summary of Project	Location	Status
Saline WTP	WTP that discharges to Saline River	13 mi north of South Britton site	Operational
Five additional minor dischargers	Dischargers to Saline River	13 mi north of South Britton site	Operational
Fairfield Township WWSL	WWSL that discharges to River Raisin	16 mi southwest of South Britton site	Operational
Manchester WWTP	WWTP that discharges to River Raisin	17 mi northwest of South Britton site	Operational
Onsted WWTP	WWTP that discharges to Wolf Creek	17 mi west of South Britton site	Operational
Monroe Metro WWTP	WWTP that discharges to Lake Erie–Plum Creek Channel	23 mi east-southeast of South Britton site	Operational
Future Urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and rail; construction of water and/or wastewater treatment and distribution facilities and associated pipelines, as described in local land use planning documents. No specific data found concerning development/expansion of the towns within 20 mi of site.	Throughout region	Construction would occur in the future, as described in State and local land use planning documents.
Global Climate Change/ Natural Environmental Stressors	Short- or long-term changes in precipitation or temperature	Throughout region	Impacts would occur in the future.

Source: Modified from NRC 2010a, e

with populations of 700 and 3522 (all 2000 data), respectively. Ann Arbor, Michigan, lies approximately 20 mi north of the site.

9.3.6.1 Land Use

The following impact analysis considers impacts on land use from building activities and operations at the South Britton site and within the geographic area of interest, which is the 15-mi region surrounding the South Britton site. The analysis also considers past, present, and reasonably foreseeable future actions that affect land use, including other Federal and non-Federal projects and those projects listed in Table 9-36 within the geographic area of interest.

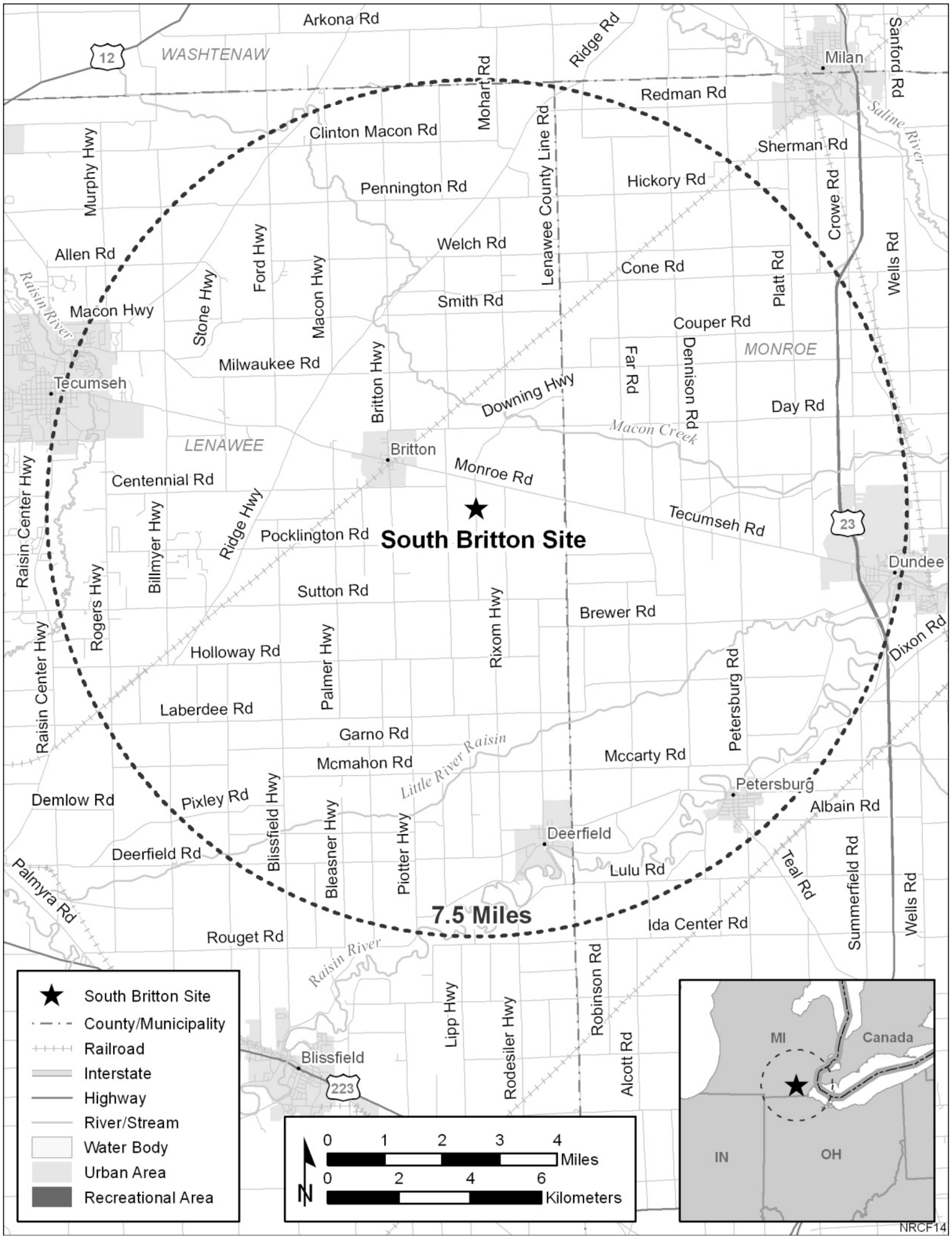

Figure 9-17. The South Britton Alternative Site and Vicinity

The South Britton site is owned by a number of private individuals and is zoned as agricultural (Detroit Edison 2011a). The proposed location for the new facility is in the southern part of the 1140-ac site. There are approximately 15 to 25 residential buildings on the site (Detroit Edison 2011a). Site topography is flat with very little variation and is primarily agricultural land, with some small areas of young mixed deciduous woodland. There are no mapped wetlands on the site (see Section 9.3.6.3). Although a tributary to the River Raisin runs through the site, it is outside the floodplain of the river (Detroit Edison 2011a). If the facilities associated with this alternative would extend into the Coastal Zone defined by the State of Michigan under the Coastal Zone Management Act, Detroit Edison would have to obtain a coastal zone consistency determination from MDEQ.

If a new nuclear power plant were sited on the South Britton site, a large portion of the 1140-ac tract would be disturbed, and some of the agricultural land (possibly including some prime farmland) and woodland areas on the tract would be lost. Based on Detroit Edison's conceptual plan layout (Detroit Edison 2009b), the review team estimates that the new facilities would permanently occupy as much as 100 ac and temporarily disturb as much as 200 ac. Although their lengths are unknown, intake and discharge pipelines constructed to transfer water to and from Lake Erie could result in some offsite land use impacts, and the pipelines would likely cross railroad tracks and local roads. No new offsite roadways are expected to be needed.

The recreational area nearest to the site is the River Raisin, located 5 mi south and 6 mi west of the site. There are also three small parks in Adrian, about 8 mi southwest of the site. The Hidden Lake Gardens, a nature preserve and conservatory, is located about 15 mi west-northwest (Detroit Edison 2011a). Although it is not known whether pipeline or transmission lines would cross recreational areas, these resources in Monroe County may be affected by construction and operation of a plant at the South Britton site, including increased user demand associated with the projected increase in population from the in-migrating workforce and their families; an impaired recreational experience associated with the views of the proposed 600-ft cooling tower and condensate plume; or access delays associated with increased traffic from the construction and operations workforces on local roadways.

Existing 120-kV and a 345-kV transmission lines run approximately 1 mi north of the site (Detroit Edison 2011a). Environmental conditions along the anticipated transmission line route are generally similar to those of the site, with a mixture of cropland, wooded areas, and some inland wetlands. Because of the short distances to the transmission interconnections, the review team believes that the land use impacts of building and operating transmission lines for a new nuclear plant at the South Britton site would be minor.

For cumulative land use analysis, the geographic area of interest is the 15-mi region surrounding the South Britton site. This geographic area of interest includes the primary communities (Britton Township and Dundee Township) that would be affected by the proposed project if it were located at the South Britton site.

There are a number of projects identified in Table 9-36 likely to affect land use in the geographic area of interest around the South Britton site. All would require slight changes in land use around the South Britton site. The proposed Cleveland-Toledo-Detroit rail line project, which would be within 10 mi of the proposed site, would require slight changes in land use around the South Britton site. Other projects identified in Table 9-36 have contributed or would contribute to some decreases in open lands, wetlands, and forested areas and generally result in increased urbanization and industrialization. However, existing parks, reserves, and managed areas would help preserve open lands, wetlands, and forested areas. The review team concludes that the land use impacts of building and operating a new nuclear generating unit and associated transmission lines at the South Britton site would be minimal, because the projects within the geographic area of interest identified in Table 9-36 would be consistent with applicable land use plans and because the distance to the transmission interconnections is short.

As described for the Fermi site in Section 7.1, climate change could increase precipitation and flooding in the area of interest, while increased lake evaporation and reduced lake ice accumulation could reduce lake levels, thus changing land use through an increase in low-lying lakeshore areas (USGCRP 2009). Forest growth may increase as a result of more CO_2 in the atmosphere, while existing parks, reserves, and managed areas would help preserve wetlands and forested areas to the extent that they are not affected by the same factors (USGCRP 2009). In addition, climate change could reduce crop yields and livestock productivity (USGCRP 2009), which might change portions of agricultural land uses in the area of interest.

Based on the information provided by Detroit Edison and the review team's independent evaluation, the review team concludes that the cumulative land use impacts associated with siting a reactor at the South Britton site would be SMALL, and no mitigation would be warranted.

9.3.6.2 Water Use and Quality

Surface water features in the vicinity of the South Britton site include small creeks and ditches. Because the surface water resources near the site are poor, water for a reactor at the South Britton site was originally proposed to come from the River Raisin (Detroit Edison 2011a), which is about 5 to 6 mi southeast of the site. During the review team's visit in January 2009, the River Raisin was observed to be of moderate size with modest flow, and concern was expressed by the review team regarding the adequacy of the river as a source of cooling water for a power plant and the river's ability to accept heated and chemically treated cooling tower blowdown discharges. Detroit Edison (2009c) has since indicated that a pipeline to Lake Erie would be a possible method of providing a dependable water source for power plant operations. A representative route along State highways and county roads was provided by Detroit Edison, with a total pipeline length of more than 25 mi. A new intake structure would be necessary at the lake (constructed under USACE and MDEQ permits). Discharge would include cooling tower blowdown, treated process wastewater, and liquid radwaste. The receiving body of water for these discharges is not described by Detroit Edison (2011a), but it is assumed that a second pipeline would convey discharges back to Lake Erie, with such discharges controlled by an NPDES permit issued by MDEQ. Given the length of pipeline that would be required for a discharge system, at least partial temperature attenuation may take place prior to discharge in the lake.

Groundwater in the site vicinity is used for domestic and municipal purposes. The maximum groundwater-producing well is in the City of Britton and is located about 1 mi northwest of the proposed site (Detroit Edison 2011a). Groundwater resources exist within both a surficial aquifer and a Silurian and Devonian bedrock aquifer. The thickness of the surficial aquifer is 50 to 200 ft, and the thickness of the bedrock aquifer is about 100–200 ft, with well yields of 10 to 80 gpm and 15 to 30 gpm, respectively. Although groundwater quality is good, Detroit Edison notes that the feasibility of groundwater as a water source for supporting building or operating a new nuclear facility at the South Britton site is moderate to poor due to dropping water levels.

Building activities, including site grading and dewatering and building of new intake and discharge pipelines, would have the potential to affect water quality through increased erosion by stormwater, increased turbidity in surface water, and possible spills or leaks of fuel and other liquids. Pipeline construction would create the potential for impacts from erosion and turbidity, especially at stream crossings. These changes would be expected to be limited by following appropriate BMPs. Surface water quality may be affected by discharges, but the discharges should be controlled by NPDES permits for cooling water discharge to Lake Erie or for local stormwater management.

For the cumulative analysis of impacts on surface water, the geographic areas of interest for the South Britton site are the local ditches and creeks and Lake Erie, because these are the areas potentially affected by the proposed project. Key actions that have current and reasonably foreseeable potential impacts on water supply and water quality in this area of interest include active coal-fired and nuclear power plants, a sand pit, a bedrock quarry, wastewater treatment plants, and industries (e.g., metal fabrication, organic chemicals, cement plant). For the cumulative analysis of impacts on groundwater, the geographic area of interest is the surficial and bedrock aquifers in the vicinity of the site.

Water Use

Operational cooling water requirements would be the major demand of a new nuclear power plant on surface water resources. As described in Section 5.2, there would be sufficient Lake Erie water available to support the makeup water needs of a new reactor, in addition to the cooling water needed by existing power plants and other projects listed in Table 9-36. The cumulative consumptive use of surface water is anticipated to have a small effect on the resource.

As described in Section 7.2.1, the greatest potential future impact on the Great Lakes water availability is predicted to be from climate change. The impact predicted for the lowest-emissions scenario discussed in the USGCRP report (2009) and by Hayhoe et al. (2010) would not be detectable or would be so minor that it would not noticeably alter the availability of water from the Great Lakes. However, if CO_2 emissions follow the trend evaluated in the highest-emissions scenario, the effect of climate change could noticeably increase air and water temperatures and decrease the availability of water in surface water resources in the Great Lakes region. As a result, the review team concludes that the potential impacts of use and climate change on surface water quantity would be SMALL to MODERATE. Based on its evaluation, the review team concludes that building and operating a nuclear plant at the South Britton site would not be a significant contributor to the cumulative impact on surface water use.

Groundwater withdrawals associated with site dewatering during construction or preconstruction of a new nuclear power plant would be temporary and localized. As discussed above, the feasibility of using groundwater as a cooling water source is low. The review team concludes that cumulative groundwater impacts associated with withdrawals while building a new nuclear power plant at the South Britton site and with projects identified in Table 9-36 would be SMALL.

Water Quality

An NPDES permit from MDEQ would be required for discharges from a new nuclear power plant at the South Britton site as well as for discharges from the other projects identified in Table 9-36. Such permits would limit both chemical and thermal discharges. Construction activities associated with the proposed facilities in Table 9-36, urbanization in the vicinity, and pipeline crossings have the potential to degrade surface water quality; adhering to BMPs would limit this impact.

The EPA's Great Lakes National Program Office has initiated the Great Lakes Restoration Initiative, a consortium of 11 Federal agencies that developed an action plan to address environmental issues. These issues fall into five areas: cleaning up toxics and areas of concern, combating invasive species, promoting nearshore health by protecting watersheds from polluted runoff, restoring wetlands and other habitats, and tracking progress and working with strategic partners. The results of this long-term initiative would presumably address water quality concerns of Lake Erie.

Climate change, as described in Section 7.2.1, has the potential to affect water quality within Lake Erie, leading to a MODERATE cumulative impact on surface water quality. Reduced lake levels could increase the impact of discharges. The review team concludes that cumulative surface water quality impacts associated a new nuclear power plant at the South Britton site and other past, present, and reasonably foreseeable actions in the region could result in a MODERATE impact; however, building and operating a nuclear power plant at the South Britton site would not be a significant contributor to the MODERATE cumulative impact on surface water.

Groundwater in the region could be affected by a new nuclear power plant at the South Britton site and other past, present, and reasonably foreseeable actions in the region identified in Table 9-36. These impacts would be expected to be localized and may be avoided or minimized through adherence to BMPs. The review team concludes that cumulative groundwater quality impacts would be SMALL.

9.3.6.3 Terrestrial and Wetland Resources

The site is composed primarily of cropland planted with crops such as wheat, corn, and soybeans. A few areas (one of less than 20 ac and others of less than 5 ac each) of second-growth forest are scattered about the site. Ash, oak, cottonwood, and maple appear to be the prevalent species in these woodlands. Other non-cropland areas are limited to disturbed roadside ROWs dominated by tall fescue or ditches (drains) where cattail or orchard grass dominate, depending on the amount of moisture available (Detroit Edison 2011a).

The site and surrounding vicinity is mostly cropland, with a few scattered and small islands of second-growth forest. The small forested areas provide daytime shelter for large mammals such as whitetail deer, nesting areas for birds, and other habitat needs for smaller mammals. Small mammals present in the area likely include opossum, raccoon, striped skunk, and a variety of rodents. Waterfowl (geese and ducks) and game birds presumably feed in the fields after crops are harvested, taking advantage of the grain and other seeds that remain. It is unlikely that fish are present in the vicinity, but small amphibians and reptiles can be found in the local ditches (Detroit Edison 2011a).

The NWI does not identify wetlands on the site. It is likely, however, that portions of the site contain wetlands, as evidenced by the presence of drainage ditches (Detroit Edison 2009b) and by the fact that most soils on the site are mapped as hydric soils (USDA 2010).

Four terrestrial species listed as threatened or endangered under the ESA are known to occur or could occur in Lenawee County. The eastern prairie fringed orchid is Federally listed as threatened and is known mostly from lakeplain prairies around Saginaw Bay and western Lake Erie (MNFI 2007a). The Indiana bat is Federally listed as endangered. It occurs in southern Michigan when it is not hibernating (wintering) in hibernacula (caves or other wintering locations) in southern Michigan and other States (MNFI 2007b). The bats generally require large trees (greater than 9 in. in diameter) with exfoliating bark for summer roosting. According to the FWS (2009), however, trees with a diameter as small as 5 in. should be considered as potential habitat. The emerald ash borer is active in the project area (MDA 2009). It is likely that ash trees onsite have been killed by the borer, creating dead trees with loose bark and resulting in potential roosting habitat for the Indiana bat. The Karner blue butterfly is Federally listed as endangered. The species was recorded from neighboring Monroe County in 1986, but is otherwise known from the west-central portion of lower Michigan. Suitable habitat does not appear to exist at the project site or in the immediate vicinity. According to the MDNR Endangered Species Coordinator, Karner blue butterflies were introduced to Monroe County in the Petersburg State Game Area within the last decade (Hoving 2010). Because the maximum movement of the butterflies from their point of introduction is about 0.6 mi and the Game Area is approximately 8 mi to the southeast of the South Britton site, there is no likelihood that any butterflies introduced in the Game Area would occur on the site. Furthermore, suitable habitat does not appear to exist at the project site or in the immediate vicinity. Mitchell's satyr butterfly (*Neonympha mitchellii mitchellii*) also is Federally listed as endangered. The species has been recorded in Lenawee County. However, suitable habitat does not appear to exist at the project site or in the immediate vicinity. The bald eagle is no longer on the Federal endangered species list, although it is protected under the BGEPA and MBTA (MNFI 2007c). The bald eagle was also recently removed from the State list of threatened and endangered species and is now considered a species of concern. Although bald eagles are known to occur in the region, the species usually nests and roosts closer to fish-bearing waters. The potential for any impacts on protected species appears to be minimal, because of the type of habitat present.

More than 40 State-listed species occur in Lenawee County (see Table 9-37). Detroit Edison has not consulted with MDNR about potential impacts on State-listed species that could result from construction of the power plant at the South Britton site. Unlike the counties containing the Fermi site and the other alternative sites considered, the eastern fox snake is not recognized by MDNR as potentially occurring in Lenawee County.

Building Impacts

Agricultural land, possibly along with some forest and residential land, would have to be cleared and converted to industrial use in order to build a new reactor and associated facilities at the South Britton site. According to Detroit Edison, the total area of the South Britton site is approximately 1140 ac (Detroit Edison 2011a). Detroit Edison's conceptual plan layout shows that the new reactor facilities would occupy as much as 100 ac of the east-central part of the South Britton site (Detroit Edison 2011a). Although Detroit Edison's proposed conceptual plan layout (Detroit Edison 2009b) does not differentiate temporarily disturbed areas from the facility footprint, information about the proposed Fermi site location indicates that temporary disturbance could be as much as 200 ac.

Conversion of agricultural land would have minimal impact on wildlife and habitat. Conversion of forested areas would have some impact on most of the common species present onsite, by removing habitat used for shelter or other functions. With the possible exception of the Indiana bat, adverse impacts on Federally listed species are not anticipated. The forested areas of the site have the potential to provide habitat for the Indiana bat in the form of dead ash trees. If the

Table 9-37. Federally and State-Listed Terrestrial Species That Occur in Lenawee County and That May Occur on the South Britton Site or in the Immediate Vicinity

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Amphibians			
Blanchard's cricket frog	*Acris crepitans blanchardi*	NL	T
Birds			
Henslow's sparrow	*Ammodramus henslowii*	NL	E
Invertebrates			
Dukes' skipper	*Euphyes dukesi*	NL	T
Karner blue butterfly	*Lycaeides melissa samuelis*	E	T
Mitchell's satyr butterfly	*Neonympha mitchellii mitchellii*	E	E
Poweshiek skipperling	*Oarisma poweshiek*	NL	T
Regal fritillary	*Speyeria idalia*	NL	E
Mammals			
Indiana bat	*Myotis sodalis*	E	E
Plants			
American chestnut	*Castanea dentata*	NL	E
Beak grass	*Diarrhena obovata*	NL	T
Beaked agrimony	*Agrimonia rostellata*	NL	T
Canadian milk vetch	*Astragalus canadensis*	NL	T
Cup plant	*Silphium perfoliatum*	NL	T
Edible valerian	*Valeriana edulis* var. *ciliata*	NL	T
False pennyroyal	*Trichostema brachiatum*	NL	T
Forest skullcap	*Scutellaria ovata*	NL	T
Goldenseal	*Hydrastis canadensis*	NL	T
Hollow-stemmed Joe-pye weed	*Eupatorium fistulosum*	NL	T
Jacob's ladder	*Polemonium reptans*	NL	T
Eastern prairie fringed orchid	*Platanthera leucophaea*	T	E
Purple milkweed	*Asclepias purpurascens*	NL	T
Red mulberry	*Morus rubra*	NL	T
Round-seed panic-grass	*Dichanthelium polyanthes*	NL	E
Sedge	*Carex albolutescens*	NL	T
Sedge	*Carex conjuncta*	NL	T
Showy orchis	*Galearis spectabilis*	NL	T
Smooth ruellia	*Ruellia strepens*	NL	E
Southeastern adder's-tongue	*Ophioglossum vulgatum*	NL	E
Sullivant's milkweed	*Asclepias sullivantii*	NL	T
Swamp or black cottonwood	*Populus heterophylla*	NL	E
Toadshade	*Trillium sessile*	NL	T

Table 9-37. (contd)

Common Name	Scientific Name	Federal Status[(a)]	State Status[(a)]
Virginia bluebells	*Mertensia virginica*	NL	E
Virginia snakeroot	*Aristolochia serpentaria*	NL	T
Virginia water-horehound	*Lycopus virginicus*	NL	T
Western mugwort	*Artemisia ludoviciana*	NL	T
White lady slipper	*Cypripedium candidum*	NL	T
Wideflower phlox	*Phlox ovata*	NL	E
Wild hyacinth	*Camassia scilloides*	NL	T
Woodland lettuce	*Lactuca floridana*	NL	T
Reptiles			
Kirtland's snake	*Clonophis kirtlandii*	NL	E
Spotted turtle	*Clemmys guttata*	NL	T

Source: MNFI 2010a
(a) E = listed as endangered, NL = not listed, T = listed as threatened.

bat uses the areas that would be disturbed, impacts could be kept to minimal levels by limiting tree clearing to the times of year when the bats are not in the region.

The agricultural land and the small areas of forest on this site are not likely to provide habitat for State-listed species, but additional study would be needed to more precisely assess potential impacts on terrestrial ecological resources on the site and its vicinity.

Information about the South Britton site provided by Detroit Edison did not indicate whether wetlands would be affected by building the new reactor facilities (Detroit Edison 2009b, 2011a). The conceptual plan layout appears to locate the facilities on agricultural land away from wetlands mapped by NWI. However, with the prevalence of hydric soils on the site, the layout likely affects unmapped wetlands not identified on NWI maps.

Detroit Edison's ER states that there appears to be an open circuit on a 345-kV transmission line that passes 1 mi north of the site and that capacity and reliability in the area are good. Nonetheless, it is possible that a new transmission line would be necessary for a number of reasons. A reactor built on the South Britton site rather than at the proposed Fermi site would still be expected to serve the same load centers as if it were at the Fermi site, and it is unclear whether there is sufficient uncommitted current carrying capacity left on the existing lines. No information was provided on where a possible transmission line would be constructed, how long it would be, or what terrestrial ecological resources might be affected by such a transmission line. It may be possible, however, that a new transmission line could share or adjoin an existing transmission line corridor for some of its length and use existing substations, thereby resulting in less ecological impact than completely new corridors and substations. The vicinity of the South Britton site is largely agricultural, with some forested areas. Although it appears possible to avoid most, if not all, important habitat with a new transmission line, a complete assessment would require a corridor location and site-specific information about the wildlife and habitat within the corridor.

Operational Impacts

During plant operation, wildlife would be subjected to increased mortality from traffic, but it is not expected that such effects would destabilize the local or regional populations of the common species of the site (Forman and Alexander 1998). Information about the local occurrence of important species and habitats would be needed to conduct a more complete assessment of potential project effects on those resources at the South Britton site. Potential impacts associated with transmission line operation would consist of bird collisions with transmission lines, habitat loss due to corridor maintenance, noise, and EMF effects on flora and fauna.

Direct mortality resulting from birds colliding with tall structures has been observed (Erickson et al. 2005). Factors that appear to influence the rate of bird collisions with structures are diverse and related to bird behavior, structure attributes, and weather. Migratory flight during darkness by flocking birds has contributed to the largest mortality events. Tower height, location, configuration, and lighting also appear to play a role in bird mortality. Weather, such as low cloud ceilings, advancing fronts, and fog, also contributes to this phenomenon.

There would be a potential for bird mortality from collisions with the nuclear power plant structures at this site. Typically, the cooling tower and the meteorological tower are the structures likely to pose the greatest risk. The potential for bird collisions increases as structure heights and widths increase. MDCTs are of little concern because of their relatively low height compared to existing and proposed structures onsite. An NDCT, however, would be on the order of 600 ft high. Nonetheless, the NRC concluded that effects of bird collisions with existing cooling towers “involve sufficiently small numbers for any species that it is unlikely that the losses would threaten the stability of local populations or would result in a noticeable impairment of the function of a species within local ecosystems” (NRC 1996). Thus, the impacts on bird populations from collisions with the cooling tower are expected to be minimal.

Operational impacts of the transmission system on wildlife (e.g., bird collisions and habitat loss) resulting from the addition of new lines and towers cannot be fully evaluated without additional information on the length and location of any new transmission facilities. Nonetheless, Section 4.5.6.2 of the GEIS for license renewal (NRC 1996) provides a thorough discussion of the topic and concludes that bird collisions associated with the operation of transmission lines would not cause long-term reductions in bird populations. The same document also concludes that once a transmission corridor has been established, the impacts on wildlife populations would be from continued maintenance of transmission line corridors and are not significant (NRC 1996).

The review team assumed that ITC*Transmission* would construct and operate any new transmission lines needed for a new reactor at the South Britton site. ITC*Transmission* operates in accordance with industry standards for vegetation management (NERC 2010), including seasonal restriction on activities that could adversely affect important wildlife (Detroit Edison 2010a). According to ITC*Transmission*'s vegetation management policy, wetland areas within the corridor that have the potential to regenerate in forest vegetation would be periodically manually cleared of woody vegetation for line safety, thereby keeping them in a scrub-shrub or emergent wetland state (ITC*Transmission* 2010). Other forested areas would be managed similarly to prevent tree regrowth that could present safety or transmission reliability problems. Access to these areas for maintenance would likely be on foot or by using matting for vehicles so as not to disturb the soil. Pesticides or herbicides would be used only occasionally in specific areas where needed in the corridor. It is expected that the use of such chemicals in the transmission line corridor would be minimized to the greatest extent possible in wetland areas to protect these important resources (Detroit Edison 2010a). The impact associated with corridor maintenance activities is loss of habitat, especially forested habitat, from cutting and herbicide application. The maintenance of transmission line corridors could be beneficial for some species, including those that inhabit early successional habitat or use edge environments. Impacts of transmission line corridor maintenance would depend on the types and extents of habitat crossed. In general, however, if a new transmission line is needed, the impacts would likely be minimal.

Detroit Edison provided no data on noise for the possible new reactor on the South Britton site, but it is likely that impacts would be minimal and similar to those of the Fermi 3 project.

EMFs are unlike other agents that have an adverse biological impact (e.g., toxic chemicals and ionizing radiation) in that dramatic acute effects cannot be demonstrated and long-term effects, if they exist, are subtle (NIEHS 2002). A careful review of biological and physical studies of EMFs did not reveal consistent evidence linking harmful effects with field exposures (NIEHS 2002). At a distance of 300 ft, the magnetic fields from many lines are similar to typical background levels in most homes (NIEHS 2002). Thus, impacts on terrestrial flora and fauna of EMFs from transmission systems with variable numbers of power lines are of minor significance at operating nuclear power plants (NRC 1996). Since 1997, more than a dozen studies have been published that looked at cancer in animals that were exposed to EMFs for all or most of their lives (Moulder 2007). These studies have found no evidence that EMFs cause any specific types of cancer in rats or mice (Moulder 2007). A review of the literature on health effects of electric and magnetic fields conducted for the Oregon Department of Energy looked at the effects of strong electric and magnetic fields on various bird species. While some studies concluded that some species of birds exhibited changes in activity levels and some physiological metrics, no studies demonstrated adverse effects on health or breeding success (Golder Associates, Inc. 2009).

Cumulative Impacts

Several past, present, and reasonably foreseeable projects could affect terrestrial resources in ways similar to siting a new reactor at the South Britton site (see Table 9-36). The geographic area of interest for the following analysis is defined by a 25-mi radius extending out from the site.

Past projects include three coal-fired generation facilities: the Detroit Edison Monroe power plant in Monroe, Michigan; the Bay Shore power plant in Oregon, Ohio; and the J.R. Whiting power plant in Luna Pier, Michigan. All three coal plants are at least 20 mi from the South Britton site. The Fermi 2 power plant is just outside the geographic area of interest, at a distance of approximately 26.4 mi. All four power plants were constructed at least two decades ago, and any short-term impacts of plant construction ended years ago. The long-term effects on terrestrial ecological resources from operating a new reactor at the South Britton site would be minimal, as evidenced by the low level of operational impacts described in the GEIS (NRC 1996) and the distances to the other existing power plants.

A future activity in the region that could noticeably affect wildlife and habitat in or near the geographic area of interest is future urbanization. Development of the South Britton site could result in increased employment and population within the geographic area of interest, which in turn could result in additional urbanization. Given the current populations of Lenawee, Washtenaw, and Monroe Counties, Michigan (approximately 99,000, 347,000, and 146,000, respectively), the additional impact on ecological resources from indirect urbanization if the South Britton site were developed would be minor.

Urbanization would likely result in conversion of agricultural land, forest land, wetlands, and other habitat to urban uses. Urbanization would involve some of the same activities as building a new reactor, including land clearing and grading (temporary and permanent), increased human presence, heavy equipment operation, traffic (including the resulting wildlife mortality), noise from construction equipment, and fugitive dust. Some of the effects of these activities, such as noise and dust, are short term and localized. The impacts of noise and dust from building a new reactor would be negligible. Other effects, such as clearing wildlife habitat that will not be restored, would be permanent. The effects of urbanization, including land clearing and grading, filling of wetlands, increased human presence, and increased traffic, would occur over a period of several years and in several locations away from the South Britton site.

Another project that has been proposed for the geographic area of interest is a passenger rail line that would run from Cleveland through Toledo to Detroit. As part of this project, a railway station could be built in the City of Monroe. The current status of this project is not known, but it would have some potential to encourage local economic development, including urbanization.

With the presence of hydric soils and drainage ditches on the site, it is likely that wetland habitat not identified on NWI maps would be unavoidably disturbed by building a new reactor at the South Britton site. The review team cannot assess impacts from potential transmission line development without more specific routing information. Because of the largely agricultural landscape surrounding the South Britton site, however, it is likely a transmission line corridor could be routed to minimize impacts on wildlife and habitat.

Summary of Impacts on Terrestrial and Wetland Resources at the South Britton Site

Impacts on terrestrial ecological resources and wetland resources were estimated based on information provided by Detroit Edison and the review team's independent review. Based on the conceptual layout (Detroit Edison 2009b), the permanently disturbed area could be as much as 100 ac, and the temporarily disturbed area could be as much as 200 ac. Much of the project area is currently used for row crops and provides relatively low wildlife habitat value. After construction and preconstruction, habitat resources in temporarily disturbed areas would be expected to naturally regenerate. Wildlife would also recover but might not use the regenerated habitat to the same degree. Permanently disturbed areas would be converted to industrial use for the indefinite future. However, because of the likelihood of wetland impacts at the site, impacts are expected to be noticeable. Because the review team has no definitive information on the routing and length of a new transmission corridor, it cannot estimate the extent of affected habitats.

The review team concludes that the cumulative impacts on terrestrial wildlife and habitat would be MODERATE for a new reactor at the South Britton site. Building and operating a new nuclear plant at the South Britton site would be a significant contributor to this MODERATE impact.

9.3.6.4 Aquatic Resources

The primary surface water features that could be affected by the construction and operation of a new reactor at the South Britton site include onsite ditches and small tributaries of the River Raisin, as well as Lake Erie to the east. There are no NWI-designated wetlands on the site (Section 9.3.6.3). No information exists regarding the aquatic organisms in the ditches and tributaries located onsite, and surveys would be needed to characterize the aquatic communities present. However, a variety of aquatic macroinvertebrates, such as mayflies, stoneflies, caddisflies, isopods, and chironomids, are likely to be present, along with fish common to Great Lakes coastal habitats, such as sunfishes, shiners, suckers, and catfish (Bolsenga and Herdendorf 1993).

The western basin of Lake Erie would likely serve as the source of plant cooling water for a new reactor at the South Britton site. Lake Erie supports an important commercial and recreational fishery. Common nearshore forage species include the emerald shiner, gizzard shad, rainbow smelt, and alewife. Salmonids, catfish, yellow perch, walleye, pike, gizzard shad, and freshwater drum are commercially or recreationally important species found near the shoreline (USGS 2010). Some of the primary aquatic nuisance species are invasive waterfleas, dreissenid mussels, sea lamprey, common carp, and round goby. The ecology of Lake Erie has been dramatically altered by the introduction of dreissenid mussels, with quagga mussels dominating the Eastern Basin and zebra mussels dominating the western basin of Lake Erie (Benson et al. 2011). Dreissenid mussels have increased benthic productivity, reduced plankton and planktivorous fish abundance, and altered the substrate available to demersal organisms.

Federally and State-Listed Threatened and Endangered Species

Three native freshwater mussel species that are Federally listed as endangered could occur in Lenawee and Monroe Counties: the northern riffleshell (*Epioblasma torulosa rangiana*); the rayed bean (*Villosa fabalis*); and the snuffbox mussel (FWS 2010; 77 FR 8632). The northern riffleshell was historically present in the River Raisin drainage, which passes through Lenawee and Monroe County; however, the most recent record from Monroe County is from 1977, and the most recent record from Lenawee County is from 1930 (Carman and Goforth 2000c; FWS 2008). Although the Federally listed white catspaw was historically reported from Monroe County, it is now considered to be extirpated from Michigan. There are no designated critical habitats for any listed species in the vicinity of the South Britton site. Within Lenawee and Monroe Counties in the River Raisin drainage and in Lake Erie, there are 11 State-listed fish species and 15 listed mussels potentially present (Table 9-38). Of the State-listed threatened or endangered species, the hickorynut and white catspaw, were historically present, but no recent records exist for these species in Monroe County or Lenawee County (Carman 2001c; Badra 2004a). The purple lilliput, slippershell (*Alasmidonta viridis*), purple wartyback (*Cyclonaias tuberculata*), rainbow (*Villosa iris*), round pigtoe (*Pleurobema sintoxia*), and wavyrayed lampmussel are present in small to medium-size streams in Monroe County in the River Raisin drainage, and therefore could be present in tributaries on the South Britton site (Stagliano 2001a; Carman 2002a, b; Badra 2004b, 2007a, b). The threehorn wartyback, round hickorynut (*Obovaria subrotunda*), lilliput, rayed bean, and the snuffbox mussel may occur in streams within Monroe County as well as in Lake Erie (Carman 2001b, d; Carman and Goforth 2000b; 75 FR 67552). Of the State-listed threatened and endangered fish, the creek chubsucker (*Erimyzon claviformis*), river darter, pugnose shiner, southern redbelly dace (*Phoxinus erythrogaster*), and eastern sand darter historically occurred in Monroe County or Lenawee County in the River Raisin drainage or in Lake Erie, but these species have not been found in recent surveys (Carman and Goforth 2000a; Stagliano 2001b; Carman 2001e; Derosier 2004c, d). The pugnose minnow and the channel darter have been recorded in nearshore areas of Lake Erie (Carman and Goforth 2000a; Carman 2001f). Lake sturgeon and sauger are

Table 9-38. Federally and State-Listed Threatened and Endangered Aquatic Species That Are Known to Occur in Lenawee and Monroe Counties and That May Occur on the South Britton Site, in the River Raisin Drainage, and in Lake Erie

Scientific Name	Common Name	Federal Status[a]	State Status[b]
Fish			
Brindled madtom	*Noturus miurus*	NL	SC
Channel darter	*Percina copelandi*	NL	E
Creek chubsucker	*Erimyzon claviformis*	NL	E
Eastern sand darter	*Ammocrypta pellucida*	NL	T
Lake sturgeon	*Acipenser fulvescens*	NL	T
Pugnose minnow	*Opsopoeodus emiliae*	NL	E
Pugnose shiner	*Notropis anogenus*	NL	E
River darter	*Percina shumardi*	NL	E
Sauger	*Sander canadensis*	NL	T
Silver chub	*Macrhybopsis storeriana*	NL	SC
Southern redbelly dace	*Phoxinus erythrogaster*	NL	E
Invertebrates			
Elktoe	*Alasmidonta marginata*	NL	SC
Hickorynut	*Obovaria olivaria*	NL	E
Lilliput	*Toxolasma parvus*	NL	E
Northern riffleshell	*Epioblasma torulosa rangiana*	E	E
Purple lilliput	*Toxolasma lividus*	NL	E
Purple wartyback	*Cyclonaias tuberculata*	NL	T
Rainbow	*Villosa iris*	NL	SC
Rayed bean	*Villosa fabalis*	E	E
Round hickorynut	*Obovaria subrotunda*	NL	E
Round pigtoe	*Pleurobema sintoxia*	NL	SC
Slippershell	*Alasmidonta viridis*	NL	E
Snuffbox mussel	*Epioblasma triquetra*	E	E
Threehorn wartyback	*Obliquaria reflexa*	NL	E
Wavyrayed lampmussel	*Lampsilis fasciola*	NL	T
White catspaw	*Epioblasma obliquata perobliqua*	E[c]	E

(a) Federal status rankings determined by the FWS under the Endangered Species Act: NL = not listed, E = endangered. Source: FWS 2010.
(b) State species information provided by MNFI (2010a): E = endangered, T = threatened, SC = species of concern.
(c) The white catspaw is considered extirpated from Michigan.

potentially found in Lake Erie, although the sauger is uncommon (Goforth 2000; Derosier 2004b).

Building Impacts

Impacts on aquatic habitat and biota on the South Britton site and in Lake Erie could result from building the primary facilities, associated transmission lines, and the cooling water intake and discharge system for a new reactor at the South Britton site. As identified in Section 9.3.6.1, the area of the site that would be developed if the South Britton site were chosen for a new reactor facility consists primarily of agricultural land. There are not likely to be any aquatic habitats located directly within the construction footprint (Detroit Edison 2009b). Building a new cooling water intake and discharge pipeline between Lake Erie and the reactor site could affect aquatic habitat if present along the pipeline corridor and could require dredging, pile driving, and other alterations to the shoreline and benthic habitat of Lake Erie, potentially resulting in sedimentation, noise, turbidity, sediment removal, and accidental releases of contaminants (see Section 4.3.2 for a detailed description of potential impacts of construction activities on aquatic habitats and biota). The potential for impacts could be limited by avoiding surface water features, and any impacts on aquatic organisms would likely be temporary and could be largely mitigated through the use of BMPs. Preconstruction and construction activities within Lake Erie would require Section 10 and/or 404 permits from USACE, as well as a regulatory permit from MDEQ, and these permits would likely contain stipulations that would further reduce impacts. Overall, the impact of the building of cooling water intake and discharge structures on aquatic resources would be minor.

As described in Section 4.3.2, building activities at the location of the new reactor, including an increase in impervious land surface, vegetation removal, site grading, and dewatering, would have the potential to affect water quality and hydrology, and therefore aquatic biota in ditches and streams located within the South Britton site and in downstream areas outside of the site. Stormwater runoff could carry soil as well as contaminants (e.g., spilled fuel and oil) from construction equipment into onsite streams and ditches. There does not appear to be high-quality aquatic habitat present at the South Britton site, and impacts are expected to be minor. Impacts on aquatic resources from construction site discharges could be controlled by NPDES and stormwater permits. Implementation of appropriate BMPs would further reduce the potential for sediments to enter surface water.

It is possible that a new transmission line for a new reactor at the South Britton site could share or adjoin the existing 345-kV transmission line corridor located 1 mi from the site, where environmental conditions are similar to those of the site, with a mixture of cropland, wooded areas, and some wetlands. If so, building-related impacts on aquatic resources would be minimal. If a new transmission line is needed to service a new reactor, there is the potential for the building-related impacts described above to affect aquatic habitat and aquatic biota, if the new transmission line passes near or crosses a surface water feature. Expansion of existing corridors would be expected to result in minor environmental impacts, while establishing new corridors could result in greater impacts. However, based on the assumptions that required construction permits were obtained from MDEQ and/or USACE and appropriate BMPs were implemented during building activities, the impacts on aquatic resources from development of additional transmission facilities would likely be temporary, easily mitigated, and minor.

Building a new reactor is not expected to result in impacts on threatened and endangered aquatic species, given the lack of suitable habitat at the location of the South Britton site. However, several threatened and endangered species of fish and freshwater mussels were historically present in the River Raisin drainage, and a tributary of the River Raisin is present at the South Britton site. The potential for construction-related impacts on threatened and endangered species can be minimized by avoiding construction near streams, surveying streams for species, and implementing BMPs. Threatened and endangered fish and mussels found in Lake Erie or in aquatic habitat located along the route of the transmission line or cooling water pipelines may be affected by disturbance from building activities. Based on recent records, the threatened or endangered mussels potentially present in Lake Erie include the round hickorynut, threehorn wartyback, lilliput, snuffbox mussel, and rayed bean. Additional information would need to be collected and surveys may need to be conducted to evaluate the potential for Federally and State-listed mussel species to be present in aquatic habitat that would be disturbed by building activities. If threatened or endangered mussels were found, it is likely that mitigation measures would need to be developed to limit potential impacts. Habitat for State-listed fish species could be temporarily disturbed by shoreline and in-water preconstruction activities. However, fish are highly mobile and would likely avoid the affected areas during these activities. On the basis of this information and because construction and preconstruction activities would be temporary and mitigable, the review team concludes that impacts on threatened and endangered aquatic species would be minor.

Operational Impacts

Operational impacts on aquatic resources could result from cooling water consumption, transmission line maintenance, cooling water system maintenance, cooling water discharge, and impingement and entrainment of aquatic biota in Lake Erie by the cooling water system.

Operational cooling water requirements would be the major water demand of a new nuclear power reactor at the South Britton site. Detroit Edison has indicated a closed cycle recirculating cooling system would be used, which could reduce water use by 96 to 98 percent compared to a once-through cooling system (66 FR 65256). Based on the assumption that cooling water needs would be similar to those identified for the proposed Fermi 3, approximately 34,000 gpm, or 49 MGD, would be needed (Detroit Edison 2011a). The withdrawal of water would not disrupt natural thermal stratification or turnover pattern for Lake Erie and would comply with EPA's CWA Section 316(b) Phase 1 regulations for new facilities. Water available from Lake Erie would be sufficient to support the makeup water needs of a new reactor (Section 9.3.6.2), and therefore the incremental impact from operating a new power plant at the South Britton site would be minor (see Section 9.3.6.2). Consequently, the hydrologic impacts on aquatic habitat in Lake Erie from water withdrawal should be minimal.

Periodic maintenance dredging of the water intake area would likely be necessary to maintain appropriate operating conditions for cooling water intake. Such dredging would be managed under permits from USACE and MDEQ and could result in temporary localized increases in turbidity in the vicinity of the intake bay. Dredged material is expected to be disposed of in a spoil disposal pond, where sediment would settle out prior to discharge of the water back into Lake Erie as allowed and managed under existing NPDES permit regulations. The periodic dredging of the intake bay would result in minor impacts on aquatic biota and habitats in Lake Erie.

The effect of impingement and entrainment of aquatic organisms from Lake Erie was evaluated by the review team. Entrainment may result in mortality to zooplankton and phytoplankton. In addition, data from the Fermi 2 cooling water intake system (Section 5.3.2) suggests that demersal and pelagic fish species in Lake Erie would be vulnerable to entrainment and impingement. Particularly vulnerable are early life stages of fish (eggs and larvae), which lack the ability to overcome intake suction and which are small enough to pass through the mesh of the intake screens. The use of fish screens and a closed cycle recirculating cooling system as proposed by Detroit Edison would reduce water use and physical damage to aquatic organisms and decrease the impingement and entrainment of organisms (Section 5.3.2). Based on the assumption of a closed cycle cooling system that meets the EPA's CWA Section 316(b) Phase I regulations for new facilities, anticipated impacts on aquatic populations from entrainment and impingement are expected to be minor.

Discharge would include cooling tower blowdown, treated process wastewater, and processed radwaste wastewater, all of which could affect aquatic biota through mortality or sublethal physiological, behavioral, and reproductive impairment. In addition, aquatic organisms may be affected by cold shock and the scouring of benthic habitat near the discharge pipeline (see Section 5.3.2). However, proposed design features such as the presence of riprap around the submerged discharge ports and orientation of the discharge ports in an upward direction are intended to reduce scouring (Detroit Edison 2011a). As identified in Section 9.3.6.2, an NPDES permit from MDEQ would be required for discharges from a new nuclear power plant at the South Britton site. Such a permit would likely specify limits for chemical and thermal discharges in order to protect water quality, thereby limiting the potential for impacts on aquatic organisms. Given the length of pipeline that would be required for a discharge system, at least partial temperature attenuation may take place prior to discharge into Lake Erie (see Section 9.3.6.2). Based on the assumption that NPDES permitting requirements are met, the impacts of discharges on aquatic habitats and biota would be minor.

Impacts on aquatic resources from operation of a new reactor at the South Britton site may include those associated with maintenance of transmission line corridors. The review team assumed that ITC*Transmission* would construct and operate any new transmission line needed to service a new reactor at the South Britton site, and that it would follow current maintenance practices designed to minimize impacts on ditches, creeks, rivers, and wetlands, such as minimizing disturbance to riparian habitat and minimizing the application of pesticides and herbicides, which can enter aquatic habitat and adversely affect aquatic biota (Detroit Edison 2011a). Although impacts of transmission line corridor maintenance would depend, in part, on the types and extent of aquatic habitat located near the transmission line, impacts on aquatic habitats and biota from maintenance of transmission lines would likely be minor as long as maintenance practices currently followed by ITC*Transmission* are implemented.

Threatened and endangered aquatic species potentially found in surface waters located along the transmission line and cooling water intake and discharge pipelines could be adversely affected by maintenance activities. The potential for impacts on threatened and endangered aquatic species could be minimized by avoiding streams and following BMPs. Threatened or endangered mussels, including the round hickorynut, threehorn wartyback, lilliput, snuffbox mussel, and rayed bean, could be present in Lake Erie, and these species could be vulnerable to cooling water intake and discharge impacts. As eggs, mussels are not likely to be affected by operations because they are not free-floating, but rather develop into larvae within the female. Mussels in the glochidial stage, during which juveniles attach to a suitable fish host, are vulnerable indirectly through host impingement and entrainment. Hosts for the snuffbox mussel (logperch), lilliput (several species of Centrachids), and rayed bean (largemouth bass [*Micropterus salmoides*]) are present in Lake Erie and could be impinged during reactor operations. Fish hosts for the round hickorynut and threehorn wartyback are not known. Post-glochidial and adult stages of mussels are not likely to be susceptible to entrainment, because they bury themselves in sediment.

The State-listed channel darter and eastern sand darter may be less likely to be entrained, because they bury themselves in sediment and remain near the bottom. The State-listed sauger is not common in Lake Erie, but lake sturgeon were historically observed to spawn along the shoreline of Lake Erie in Monroe County, and early life stages may be vulnerable to entrainment and impingement. However, spawning activity in this area appears to have diminished or ceased since the 1970s (Goforth 2000). None of these species were observed during impingement and entrainment studies conducted during 2008 and 2009 (AECOM 2009) at the Fermi 2 intake in Lake Erie. Consequently, it is unlikely that significant numbers would be affected by the cooling water intake of a new reactor at the South Britton site. Overall, impacts on threatened and endangered species from reactor operations are expected to be minor.

Cumulative Impacts

Past, present, and reasonably foreseeable projects, facilities, and other environmental changes that may contribute to cumulative impacts on aquatic resources in the area include the activities and projects shown in Table 9-36 and current and future ecosystem changes resulting from climate change, introduced dreissenid mussels, and recreational and commercial fishing.

As discussed above, potential building-related impacts on aquatic habitat and biota could result from altered hydrology, erosion, stormwater runoff of soil and contaminants, and disturbance or loss of benthic habitat from construction of the reactor, associated transmission lines, and water intake and discharge system. Urbanization can affect aquatic resources by increasing impervious surfaces, non-point-source pollution, and water use, as well as altering riparian and in-stream habitat and existing hydrology patterns. Development of a new reactor on the South Britton site and the other projects in the region could result in an increased human population and additional urbanization with subsequent impacts on aquatic resources.

The primary operational impacts on aquatic habitat and biota could result from makeup water needs, transmission line maintenance, alteration in water quality from cooling water discharge, and impingement and entrainment of aquatic biota during cooling water intake. Impingement and entrainment of aquatic biota from Lake Erie resulting from operations of a new reactor must be considered along with mortality resulting from existing power plants that already withdraw water from Lake Erie, from commercial and recreational fishing, and from introduced zebra mussels and quagga mussels, which have dramatically reduced plankton abundance in the region. Commercially important species that have been the target of restoration efforts in Lake Erie such as yellow perch and walleye occupy nearshore areas and could be vulnerable to cooling water intake.

Operational cooling water requirements would be the major water demand from a new nuclear power plant on surface water resources. As described above, the water available from Lake Erie would be sufficient to support the makeup water needs of a new reactor in addition to the cooling water needed by existing power plants and other projects listed in Table 9-36 (Section 9.3.6.2). However, as described in Section 7.2.1, climate change could noticeably decrease the availability of surface water resources in the Great Lakes region. If such a reduction in surface water were to occur, aquatic habitats on the South Britton site and in Lake Erie may be altered or eliminated with potentially adverse consequences for aquatic habitats and biota.

Discharges into Lake Erie from a new nuclear power plant at the South Britton site must be considered together with discharges into Lake Erie from the other projects identified in Table 9-36. Contaminant loads in Lake Erie may be reduced in the future by the Great Lakes Restoration Initiative, which attempts to (1) clean up toxics and areas of concern, (2) protect watersheds from polluted runoff, and (3) restore wetlands (see http://greatlakesrestoration.us/).

However, if climate change results in reduced water levels and increased water temperatures, the impacts associated with contaminant concentrations and thermal stress from cooling water discharge into Lake Erie could also increase. As identified in Section 9.3.6.2, the overall cumulative surface water quality impacts associated with a new nuclear power plant at the South Britton site together with other past, present, and reasonably foreseeable actions in the region are expected to be minor because of the expected localized extent of the impacts from projects and the adherence to BMPs and permitting requirements designed to avoid or minimize impacts. NPDES permits would also limit chemical and thermal discharges into Lake Erie. Similarly, the incremental contribution of a new reactor at the South Britton site to cumulative impacts on aquatic biota from water quality changes due to operational discharges would also be minor.

Based on its evaluation, the review team concludes that the cumulative impacts on aquatic resources, including threatened or endangered species, could be substantial due to continued inadvertent introduction of invasive species, overfishing, and increased urbanization resulting in further degradation of water quality and global climate change. However, the incremental impact from building and operating a new power plant at the South Britton site would not contribute measurably to the overall cumulative impacts in the geographic area of interest.

Summary of Impacts on Aquatic Resources at the South Britton Site

Impacts on aquatic habitats and associated biota at the South Britton site could result from reactor, transmission line, and cooling water intake pipeline preconstruction and construction activities. However, the impacts on aquatic organisms would be temporary and could be largely mitigated by avoiding aquatic habitats during siting of facilities and activity areas and through the use of BMPs during preconstruction and construction activities.

Operational impacts on aquatic resources could result from cooling water consumption, transmission line and cooling water system maintenance, alteration of water quality by cooling water discharge, and impingement and entrainment of aquatic biota by the cooling water system. Impingement and entrainment from the nearshore environment of Lake Erie would add to existing mortality sources for aquatic biota, such as invasive species, commercial and recreational fishing, and the operation of other power plants using water from or discharging into Lake Erie.

Impingement and entrainment of aquatic organisms would be minimized by complying with EPA's CWA Section 316(b) Phase I regulations. Water availability in Lake Erie is adequate to support the makeup water needs of a new reactor. However, climate change could noticeably decrease the availability of surface water resources in the Great Lakes region. Similarly, while a NPDES permit would limit chemical and thermal discharges, climate change has the potential to increase impacts of the discharges on aquatic communities. Transmission line and cooling water pipeline maintenance impacts on aquatic habitat and biota could be minimized by implementing BMPs.

State-listed fish and mussels may be found in the River Raisin drainage (tributaries of which flow through the site), in Lake Erie, or in aquatic habitat located along the transmission line or cooling water system corridors. Avoiding streams and implementing BMPs would reduce the probability of impacts associated with construction activities. As a mitigation action, surveys should be conducted for threatened and endangered mussels in aquatic habitats that would be affected by preconstruction and construction activities, and any individuals found should be relocated before initiating building activities. The potential for entrainment and impingement of listed aquatic species in Lake Erie is possible but not likely to be significant. Overall, minor impacts on listed aquatic species are expected from operations.

The review team's conclusion, based on the information provided by Detroit Edison and the review team's independent evaluation, is that the impacts on aquatic resources, including threatened or endangered species, from a new reactor at the South Britton site, considered together with cumulative impacts on aquatic resources from other activities and climate change, would be MODERATE. Building and operating a new nuclear unit at the South Britton alternative site would not be a significant contributor to the overall cumulative impact.

9.3.6.5 Socioeconomics

The economic impact area for the South Britton alternative site is a two-county area, including Lenawee and Monroe Counties, Michigan. The site is located in the rural county of Lenawee. The nearest residential concentrations are the Cities of Tecumseh and Adrian, 5 and 13 mi west of the South Britton site, respectively, although several smaller towns and villages are located in both Lenawee County and western Monroe County. The majority of the socioeconomic impacts are expected to occur in these two counties.

The site is also centrally located between larger urban areas, including the City of Monroe, approximately 20 mi east in Monroe County; the City of Ann Arbor, approximately 20 mi north of the South Britton site in Washtenaw County; the City of Toledo, approximately 25 mi south in Lucas County, Ohio; and the City of Detroit, approximately 45 mi northeast in Wayne County. Detroit Edison may also draw some of the construction and operations workers who currently reside in these larger metropolitan areas, depending on the skills and availability of the workforce, even though the commute for the workers would be longer.

Physical Impacts

Physical impacts include impacts on workers and the general public, noise, air quality, buildings, roads, and aesthetics. Because the physical impacts of building and operating a nuclear power plant are very similar between the proposed site and the alternative sites, the review team determined that as assessed for the Fermi 3 site, all physical impacts related to the South Britton site would be minor. See Sections 4.4.1 and 5.4.1 for a detailed discussion of physical impacts for Fermi 3.

Demography

The South Britton site is located in Ridgeway Township, Lenawee County, 4 mi east of Tecumseh and approximately 1 mi west of the Monroe County border. The eastern portion of Lenawee County, where the South Britton site is located, is rural. Most of Lenawee County's population (i.e., 57 percent) is located along the State Route 52 corridor between Adrian and Clinton, including the Cities of Adrian and Tecumseh (Lenawee County Planning Commission 2002). The highest concentration of population in Monroe County is east along Lake Erie, including the City of Monroe and adjoining township of Frenchtown Charter, and in Bedford Township, near the southern border of Monroe County and Lucas County, Ohio. Table 9-39 provides the 2000 and 2010 Census population and the projected 2020 population for these areas.[(a)]

Table 9-39. Demographics for Lenawee and Monroe Counties and Local Jurisdictions

	Population		
County/City/Township	**2000**	**2010**	**2020 Projected**
Lenawee County	98,890	99,892	109,086[(a)]
City of Adrian	21,574	21,133	NA[(b)]
City of Tecumseh	8574	8521	NA
Monroe County	145,945	152,021	159,461
City of Monroe	22,076	20,733	22,475
Frenchtown Charter Township	20,777	20,428	21,868
Bedford Township	28,606	31,085	31,669

Source: The 2020 projections for Monroe County and townships within Monroe County are provided by SEMCOG (2008). The projection for Lenawee County is provided by the Lenawee County Planning Commission (2002). The 2000 and 2010 data are from the USCB (2000a, 2010a).

(a) Lenawee County used three different methods to project its population in 2020 (Lenawee County Planning Commission 2002). The projection presented is an average of the three methods.

(b) NA = Population projections are not available for these jurisdictions.

Detroit Edison estimates that the size of the construction workforce needed for the nuclear power plant over a 10-year construction period would range from a minimum of 35 workers to a peak construction workforce of 2900 workers, and that the average size of the onsite workforce

(a) This section has been updated for the Final EIS to include the results of the mandated U.S. decadal census for 2010 for the data sets that have been released by the U.S. Census Bureau as of May 2012. For the data sets that have not yet been released, the review team has presented the results of the five-year estimates from the American Community Survey (i.e., 2006–2010).

during the 10-year construction period would be approximately 1000 workers (Detroit Edison 2011a).

The review team's assumptions for in-migrating and local workers are similar to those for the Fermi 3 plant site. Although the plant is located in a rural area, it is also within commuting distance of highly urbanized areas, including Toledo, Detroit and Ann Arbor, as discussed above. Therefore, for comparison between analyses of the site alternatives, the review team based the analysis of this site upon the assumptions presented in Section 4.4.2 of this EIS, with approximately 15 percent of the construction workforce (approximately 435 workers during the peak construction and 150 workers on an average annual basis) expected to relocate within a 50-mi radius of the project site.

If the facility were to be built at the South Britton site and operations commenced, Detroit Edison expects an operations workforce of 900 workers in 2020 (Detroit Edison 2011a). For similar reasons, the review team determined that based on the analysis of impacts presented in Section 5.4.2, approximately 30 percent of the operations workforce (approximately 270 workers) would relocate within a 50-mi radius of the project site.

Based on an average household size of 2.6, which is the national average household size in the USCB's 2010 population data, the total in-migrating population during the peak construction period is estimated to be approximately 1131 persons and less during periods of non-peak construction. The projected population increase associated with the in-migrating operations workers is estimated to be 702 persons.

If all the in-migrating construction workers and their families settled in either Lenawee or Monroe County for the 2-year peak construction period, the projected increase would be less than 1 percent of the projected 2020 population for these counties. Demographic impacts during periods of non-peak construction would be less. The in-migrating construction workers and their families would likely settle in various cities and townships throughout the two-county area, and the population effects are expected to be minimal. The projected population increase for the operations workforce would be less than that projected for the peak construction period, and would also be less than 1 percent of the projected 2020 population for the two-county area.

Given the small number of in-migrating workers compared to the projected 2020 population for Lenawee and Monroe Counties, the review team concludes that the demographic impact during peak construction and operation would be minor.

Economic Impacts on the Community

<u>Economy</u>

The following provides an analysis of each of the two counties within the economic impact area.

Lenawee County. There were 39,627 employed workers in Lenawee County in 2010 (USBLS 2012) (see Table 9-40). Approximately 24 percent of the jobs were in educational services, health care, and social assistance. Manufacturing and retail trade employed approximately 22 percent and 12 percent, respectively (USCB 2010b). The four largest employers in Lenawee County are Promedica Health Systems, with approximately 1062 employees; Lenawee County, with approximately 657 employees; Michigan Department of Corrections, with approximately 587 employees; and Adrian Mall (stores and management) with approximately 500 employees (Lenawee Economic Development Corporation 2010). Lenawee County has a number of manufacturing companies, many of which specialize in plastics and a strong agricultural base, having the largest number of farms of any county in Michigan with the highest revenue in the State for corn, soybeans, and wheat (Lenawee Economic Development Corporation 2010).

Table 9-40. Labor Force Statistics for Monroe and Lenawee Counties (2000 and 2010)

	Monroe County		Lenawee County	
	2000	**2010**	**2000**	**2010**
Total labor force	77,194	70,724	51,699	46,103
Employed workers	74,756	61,921	49,769	39,627
Unemployed workers	2438	8803	1930	6476
Unemployment rate	3.2	12.4	3.7	14.0

Source: USBLS 2012

Between 2000 and 2010, the unemployment rate for the county increased from 3.7 percent to 14.0 percent. The job outlook has improved over the past year, with the USBLS reporting an annual unemployment rate of 10.9 percent for Lenawee County in 2011 (USBLS 2012).

Monroe County. There were nearly 62,000 workers in Monroe County in 2010 (USBLS 2012) (see Table 9-40). Approximately 42 percent of the jobs in Monroe County are in manufacturing, educational services, health care, and social assistance sectors (USCB 2010b). The four largest employers in Monroe County in 2007 were Detroit Edison, with approximately 1500 employees; Mercy Memorial Hospital, with approximately 1300 employees; the supermarket chain Meijer Inc., with approximately 1025 employees; and the Monroe Public Schools school district, with approximately 1000 employees (Monroe County Finance Department 2008). Manufacturing businesses in Monroe County include Johnson Controls (720 employees), La-Z-Boy Incorporated (522 employees), Tenneco Automotive (500 employees), Gerdeau Macsteel (450 employees), Holcim (US) Inc. (cement, 350 employees), TWB Company (automotive body parts, 303 employees), and MTS Seating (300 employees) (Monroe County Chamber of Commerce 2010).

The USBLS reported a rise in unemployment from 3.2 percent in 2000 to 12.4 percent in 2010. The job outlook has improved over the past year, with the USBLS reporting an annual unemployment rate of 9.7 percent for Monroe County in 2011 (USBLS 2012).

The economies of Lenawee and Monroe Counties would benefit over the estimated 10-year construction period through direct purchase of materials and supplies and direct employment of the construction workforce. Detroit Edison expects the size of the construction workforce would range from a minimum of 35 workers to a peak construction workforce of 2900 workers, averaging to an annual onsite construction workforce of 1000 workers. Based on an average salary estimate of $50,500, approximately $50.5 million would be directly expended in payroll annually during the construction period.

Detroit Edison expects direct employment when the plant becomes operational to be 900 full-time and contract employees. In addition, Detroit Edison estimates 1200 to 1500 workers would be employed during scheduled outages, which would occur every 24 months and require workers for a period of about 30 days. Based on an average salary estimate of $63,625, approximately $57.3 million would be expended directly in payroll annually during the plant's 40-year operating license. In addition, every 24 months, an additional $6.3 to $7.9 million in payroll would be expended for the plant's outage workforce.

New workers (i.e., in-migrating workers and those previously unemployed) would have an additional indirect effect on the local economy, because these new workers would stimulate the regional economy through their spending on goods and services in other industries.

Additional expenditures would be needed for construction of the transmission lines from the nuclear power plant at the South Britton site to the existing transmission and distribution network. The local economy would benefit from the direct purchase of materials and supplies for the transmission line construction and the employment of workers to support the construction and operation of these lines.

Taxes

Construction and operation of a plant at the South Britton site would result in increased tax revenues to State and local governments. State income tax revenue would accrue primarily through income taxes on salaries of the new workers (i.e., in-migrating workers and those previously unemployed). Based on an estimated annual average of 362 new workers (i.e., 150 in-migrating and 212 previously unemployed) residing in the two-county area during the 10-year construction period and an average salary of $50,500, the State of Michigan would receive an estimated $0.7 million in income tax revenue annually during the construction period. Estimated income tax revenue reflects the State income tax rate as described in Sections 2.5, 4.4, and 5.4. Based on an estimated annual average of 327 new workers (i.e., 270 in-migrating and 57 previously unemployed) for operation of the plant and an average salary of $63,625, the

State of Michigan would receive an estimated $0.8 million in income tax revenue annually during the period of the 40-year operating license. The State of Michigan would also receive tax revenue through increased sales expenditures by workers and for the plant construction, operation and maintenance, and business taxes during operation.

Property tax revenue would be the primary tax benefit to the local jurisdictions. The plant would be assessed during the construction period and be at its highest assessed value when it becomes operational. For analysis, the review team recognizes that the full estimated construction cost of $6.4 billion for a nuclear power plant of 1605 MW(e), as discussed in Section 4.4.3.1, may not be the actual assessed value for property tax purposes. However, for comparative purposes in this alternative sites analysis, the review team based its conclusions upon this construction cost estimate. In 2009, the assessed value of all taxable property in Lenawee County was $4.2 billion (Michigan Department of Treasury 2009). Consequently, with completion of the construction of a nuclear power plant at the South Britton site, the total assessed property value in Lenawee County would be increased by about 150 percent. The review recognizes that this would be an upper bound to the assessed value of the property and that a fee in lieu of agreement or other considerations may significantly reduce that assessed value. However, the review team believes that the property tax impact on Lenawee County would be substantial and beneficial.

Summary of Economic Impacts and Taxes

Based on the information provided by Detroit Edison and the review team's evaluation, the review team concludes that the impact of building activities on the economy would be substantial and beneficial in Lenawee County and minor and beneficial elsewhere. The impact of tax revenue would be substantial and beneficial in Lenawee County and minimal and beneficial elsewhere. An annual average of 150 new construction workers would relocate into Lenawee and Monroe Counties, and 212 workers who are currently unemployed would be employed for construction and preconstruction over the 10-year construction period. A portion of the estimated $6.4 billion construction cost of the nuclear power plant would be spent on materials and supplies in Lenawee and Monroe Counties. Tax revenue to the State and local jurisdictions would accrue through personal income, sales, and property taxes and would have the largest benefit on the local jurisdictions within Lenawee County.

During operations at the South Britton site, an estimated 270 new operations workers would relocate into the area, and 57 workers who are currently unemployed would be employed in operating the plant. Based on the information provided by Detroit Edison and the review team's evaluation, the review team concludes that the economic impact of operating a nuclear power plant at the South Britton site, including tax revenues, would be substantial and beneficial in Lenawee County and minimal and beneficial elsewhere.

Infrastructure and Community Services

Traffic

The primary transportation route servicing the South Britton site is M-50. M-50 is an east–west route that would border the site on the northeast side. M-50 extends east to the City of Monroe, in Monroe County, and west to the City of Tecumseh, before heading north toward Jackson, Michigan. M-50 also connects with U.S. Route 23, which provides access to the Ann Arbor MSA further north and to the Toledo MSA to the south. In the City of Monroe, M-50 connects to Interstate 75 (I-75), which leads north to Detroit and south to Toledo. The site is also served by numerous local roadways. Two local roadways cross the site: Pocklington Road (east–west) and Downing Highway (north–south). A spur from the mainline of the NS railroad would provide railway access to the site.

Local roadways may need to be upgraded to support the level of traffic generated by the plant construction and operation. In addition, unlike the Fermi site, the South Britton site would require two roads that cross the site to be abandoned and rerouted to accommodate the building footprint and exclusion boundary. New road construction would require further analysis to determine whether local, terrestrial, aquatic, and wetland resources would also be affected depending on the reroutes identified and selected. Based on review of area maps, the review team believes such rerouting could affect local streams or rivers. Detroit Edison, in coordination with MDOT and the Lenawee County Road Commission, would need to conduct a transportation study that evaluates the roadway impacts and traffic impacts and identifies the need for any road and/or bridge upgrades, the effects of roadway abandonments for site development, and mitigating strategies, such as road upgrades and/or road reroutes that would (1) mitigate impacts on transportation routes and (2) mitigate traffic impacts to an acceptable level. For the above stated reasons, the review team expects that traffic impacts from building activities and operations, including construction workers, operations workers, and deliveries, could be substantial and potentially destabilizing, and would warrant mitigation in coordination with MDOT, the Lenawee County Road Commission, and USACE and MDEQ if waters of the United States and/or State-regulated waters would be affected.

Recreation

Recreational resources in Lenawee and Monroe Counties may be affected by construction and operation of a plant at the South Britton site. Impacts may include increased user demand associated with the projected increase in population from the in-migrating workforce and their families; an impaired recreational experience associated with the views of the proposed 600-ft cooling tower and condensate plume; or access delays associated with increased traffic from commuting of the construction and operations workforces and deliveries of goods and materials during construction on local roadways.

Three State parks (W.J. Hayes State Park, 654 ac; Lake Hudson State Park, 2700 ac; and Cambridge Historic State Park, 181 ac) and six county parks are located in Lenawee County. In addition, numerous city, village, and township parks are located throughout the county (Lenawee County Park and Recreation Commission 2010). Water resources in the county used for recreation include the River Raisin, which flows into Monroe County and is designated by MDNR as "readily canoeable," and numerous lakes, ponds, streams, and rivers. The Irish Hills is a scenic recreational area in the northeastern part of Lenawee County and contains rolling hills and more than 50 lakes.

State recreational areas in Monroe County total 7413 ac and include Sterling State Park and three game areas – Point Mouille State, Petersburg State, and Erie State – as well as several boat access sites and road rest areas. In addition, numerous county, township, village, and city recreational areas are located throughout the county.

The recreational area nearest to the South Britton site is the River Raisin, the main parts of which are 5 mi south and 6 mi west of the site.

Local residences, traffic on M-50, and users of recreational resources in the vicinity of the South Britton site may be affected by the views of the 600-ft cooling tower and condensate plume that would occur during operation of the plant under certain meteorological conditions. The nuclear power plant and 600-ft cooling tower and condensate plume would be visible in a wide area, because the topography in the vicinity of the site is flat. Because the South Britton site is a greenfield site, the visual intrusion of the cooling tower and other structures would offer a unique visual experience that the review team considers to be noticeable and adverse.

The review team determined the impacts associated with the increased use of the recreational resources in the vicinity and region would be minimal. The projected increase in population in the three-county area associated with in-migrating workers and their families for construction and operation is less than 1 percent of the projected 2020 population and would not affect the availability and use of recreational resources in the area.

People using recreational facilities near the site might experience traffic congestion on the roads during the construction period, during morning and afternoon commutes of the operations workforce, and during the scheduled maintenance and forced outage periods. Measures to mitigate traffic impacts would be needed and would alleviate impacts on users of recreational facilities as well as members of the general public.

Housing

As shown in Table 9-41, an estimated 106,261 housing units are located within Lenawee and Monroe Counties, based on 2010 housing data. Of these, 10,132 housing units are vacant.

Table 9-41. Housing Units in Lenawee and Monroe Counties (2010)

Housing Units	Lenawee County	Monroe County
Total Housing Units	43,331	62,930
Occupied	37,831	58,298
Owner-occupied (units)	30,198	47,048
Owner-occupied (percent)	80	81
Renter-occupied (units)	7633	1,250
Renter-occupied (percent)	20	19
Vacant	5500	4632
Vacancy Rate		
Homeowner (percent)	2.4	2.4
Rental (percent)	5.8	9.1

Source: USCB 2010c

The number of vacant units in Lenawee County increased from 3839 to 5500 between 2000 and 2010; and in Monroe County, from 2699 to 4632.

Demand for housing is expected to be highest during the peak construction period. Based on the analysis of impacts presented in Section 4.4.2, most of the construction and operations workforces would already reside in the area and so would be accommodated in existing housing. Approximately 15 percent of the peak building-related workforce (approximately 435 workers during the peak construction) and approximately 30 percent of the operations workforce (approximately 270 workers) would be expected to relocate within a 50-mi radius of the project site. Considering that the construction workforce may choose short-term accommodations, such as campsites or hotels, the review team expects that the existing housing supply would be sufficient to accommodate the construction workforce of 435 workers during the peak construction period and the operations workforce of 270 workers in-migrating to the area without affecting the housing supply or prices in the local area or stimulating new housing construction. Therefore, the impacts on housing would be minor.

Public Services

In-migrating construction and operations workers and their families would increase the demand for water supply and wastewater treatment services within the communities where they choose to reside; the size of the total construction and operations workforce also would increase the demand for water supply and wastewater treatment services at the South Britton site.

The rural areas of Lenawee County receive potable water through private wells and use private waste disposal systems for treatment of sanitary wastewater (Lenawee County Planning Commission 2002). The four cities in Lenawee County (Adrian, Hudson, Morenci, and Tecumseh) and seven of the eight villages (Addison, Blissfield, Britton, Cement City, Clinton, Deerfield, and Onsted) are served by both municipal water supplies and wastewater treatment services. The Village of Clayton does not have a municipal water supply system but does have wastewater treatment (Lenawee County Planning Commission 2002).

Several municipal water suppliers provide water to residents of Monroe County, including the City of Monroe; Frenchtown Charter Township; the City of Toledo, Ohio; and the DWSD. Residents outside of these municipal suppliers obtain water through private wells (Monroe County Planning Department and Commission 2010).

Wastewater treatment services are provided by a number of municipalities in Monroe County, including the City of Monroe; Frenchtown Charter, Monroe Charter, Berlin, Ash, and Ida Townships; Cities of Milan, Petersburg, and Luna Pier; and Villages of Dundee, Estral Beach, Carleton, South Rockwood, and Maybee. Other residents within the county are served by private onsite wastewater disposal systems (Monroe County Planning Department and Commission 2010). The City of Petersburg serves the city and the Summerfield High School complex, which is located in Summerfield Township, just outside the city limits.

The water supply and wastewater treatment systems within the two-county area should be able to accommodate the in-migrating construction and operations workforces and their families, which would represent less than 1 percent of the projected populations in 2020.

Increased demand for police, fire response, and health care services from the in-migrating construction and operations workforces and their families is also expected to be accommodated within the existing systems. Given the number of jurisdictions within the three-county area, the new workers in-migrating into the area from building and operating a nuclear plant at the South Britton site would have a negligible impact on capacity of any of the public services within the three-county area.

However, currently no service is available to support the workforce at the plant site. Detroit Edison would need to develop private water supply and waste disposal systems or develop water supply and sewer lines to the South Britton site. In either case, the review team believes that the potable water supply and waste disposal service needed for operations of a nuclear power plant at the South Britton site would be minimal.

For the reasons discussed above, the review team determines the impact on public services from a South Britton power plant would be minimal.

Education

Numerous public school districts are located throughout Lenawee and Monroe Counties, including 13 public school districts in Lenawee County (Addison, Adrian, Blissfield, Britton-Macon, Clinton, Deerfield, Hudson, Lenawee, Madison [Lenawee], Morenci, Onsted, Sand Creek, and Tecumseh) with a combined enrollment of 18,107 students; and 9 public school districts in Monroe County (Airport Community, Bedford, Dundee, Ida, Jefferson, Mason Consolidated [Monroe], Monroe, Summerfield, and Whiteford Agricultural) with a combined enrollment of 23,913 students (U.S. Department of Education 2010). As stated in Section 4.4.4.5, approximately 202 school-age children are expected to in-migrate into the 50-mi region during construction activities, and 124 school-age children are expected to in-migrate for operations. Given the number of schools and the total student enrollment, the new students in-migrating into the area as a result of constructing and operating a nuclear plant at the South Britton site would have a negligible impact on the capacity of school systems within the two-county area.

Summary of Impacts on Infrastructure and Community Services at the South Britton Site

From the information provided by Detroit Edison, review of existing reconnaissance level documentation, and its own independent evaluation, the review team concludes that the impact of building and operations activities on regional infrastructure and community services – including housing, water and wastewater facilities, police, fire, and health care services, and education – would be minor. The visual impacts under recreation would be noticeable and adverse. The estimated peak workforce of 2900 would have a substantial and adverse impact on traffic on local roadways near the South Britton site. These traffic-related impacts could be reduced but not eliminated with proper planning and mitigation measures.

Cumulative Impacts

The geographic area of interest for analysis of cumulative socioeconomic impacts of the South Britton site includes Lenawee and Monroe Counties, where most of the socioeconomic impacts of construction and operation of the South Britton site are expected to occur.

The impact analyses presented for the South Britton site are cumulative. Past and current economic impacts associated with activities listed in Table 9-36 already have been considered as part of the socioeconomic baseline or in the analyses discussed above for the South Britton site. Construction and operation of the South Britton plant could result in cumulative impacts on the demographics, economy, and community infrastructure of Lenawee and Monroe Counties, in conjunction with those reasonably foreseeable future actions shown in Table 9-36, and generally result in increased urbanization and industrialization.

However, many impacts, such as those on housing or public services, are able to adjust over time, particularly with increased tax revenues. Furthermore, State and county plans, along with modeled demographic projections, include forecasts of future development and population increases. Because the projects within the geographic area of interest identified in Table 9-36 would be consistent with applicable land use plans and control policies, the review team considered the cumulative socioeconomic impacts from the projects to be manageable. Physical impacts include effects on workers and the general public, noise, air quality, buildings, roads, and aesthetics.

Based on the above considerations, Detroit Edison's ER, and the review team's independent evaluation, the review team concludes that under some circumstances, building the nuclear power plant at the South Britton site could make a temporary detectable adverse contribution to the cumulative effects associated with some socioeconomic issues. Those impacts would include physical effects (workers and the local public, noise, air quality, buildings, roads, and aesthetics), demography, and local infrastructure and community services (transportation; recreation; housing; water and wastewater facilities; police, fire, and medical services; and schools), and would be dependent on the particular jurisdictions affected.

The cumulative effects on regional economies and tax revenues would be beneficial and SMALL, with the exception of Lenawee County, which would experience a MODERATE and beneficial cumulative effect on the economy and a LARGE and beneficial cumulative effect from property taxes. The cumulative effects on physical impacts, demography, infrastructure, and community services would be SMALL within the 50-mi region, except for a LARGE and adverse cumulative effect on local traffic near the South Britton site during construction and operations and a MODERATE impact on the aesthetic aspect of recreation. Building and operating a new nuclear unit at the South Britton alternative site would be a significant contributor to the cumulative impacts.

9.3.6.6 Environmental Justice

The economic impact area for the South Britton alternative site is a two-county area, including Lenawee and Monroe Counties, Michigan. To evaluate the distribution of minority and low-income populations near the South Britton site, the review team conducted a demographic analysis of populations within the 50-mi region surrounding the proposed site in accordance with the methodology discussed in Section 2.6.1 of this EIS. The results of this analysis are displayed below in Tables 9-42 and 9-43 and Figures 9-18, 9-19, 9-20, and 9-21.

In general, the review team found the population within the 50-mi region surrounding the South Britton site to be similar in demographic distribution to the 50-mi region surrounding the proposed Fermi 3 site: rural, with few representative minority or low-income populations of interest outside the urban areas (for the South Britton site, these urban areas are the same as for the Fermi 3 site, with Detroit to the north and east near the border of the 50-mi region and

Table 9-42. Results of the Census Block Group Analysis for Minority Populations of Interest within the Region Surrounding the South Britton Alternative Site (50-mi radius)[(a)]

State/County	Total Census Block Groups	Number of Census Block Groups with Minority Populations of Interest					
		Black	American Indian	Asian	Pacific Islander	Hispanic	Aggregate
Michigan							
Calhoun	4	0	0	0	0	0	0
Hillsdale	41	0	0	0	0	0	0
Ingham	19	0	0	0	0	0	0
Jackson	130	11	0	0	0	2	11
Lenawee	82	1	0	0	0	6	1
Livingston	108	0	0	0	0	0	0
Macomb	6	1	0	2	0	1	2
Monroe	123	1	0	0	0	1	1
Oakland	527	64	0	3	0	1	106
Washtenaw	251	28	0	22	0	0	51
Wayne	1593	736	0	29	0	72	797
Ohio							
Defiance	4	0	0	0	0	0	0
Fulton	31	0	0	0	0	0	0
Henry	22	0	0	0	0	0	0
Lucas	398	94	0	2	0	175	106
Ottawa	24	0	0	0	0	0	0
Sandusky	14	0	0	0	0	1	1
Williams	20	0	0	0	0	1	0
Wood	82	0	0	0	0	5	0
Total	**3479**	**967**	**0**	**77**	**0**	**265**	**1076**

Source: USCB 2010d
(a) Shaded rows indicate the economic impact area.

Toledo about 20 mi to the south of the site). Because the review team identified Monroe and Lenawee Counties in Michigan as the economic impact area for the South Britton alternative site, the review team focused its analysis upon the minority and low-income populations within those counties. The review team identified several minority populations of interest surrounding the South Britton site at a distance of about 10 mi. These are the closest populations of interest to the alternative site. The review team identified a single population of interest about 15 mi to the east of the South Britton site.

Based on this analysis, the review team determined that there do not appear to be any identified minority or low-income populations of interest in Monroe or Lenawee Counties that would be

Table 9-43. Results of the Census Block Group Analysis for Low-Income Populations of Interest within the 50-mi Region of the South Britton Alternative Site

State/County	Total Number of Census Block Groups	Census Block Groups with Low-Income Populations of Interest	
		Number	Percentage
Michigan			
Calhoun	4	1	25.0
Hillsdale	41	3	7.3
Ingham	19	0	0
Jackson	130	17	13.0
Lenawee[(a)]	82	4	4.9
Livingston	108	0	0
Macomb	6	2	33.3
Monroe	123	1	0.8
Oakland	527	14	2.7
Washtenaw	251	34	13.5
Wayne	1593	396	24.9
Ohio			
Defiance	4	0	0
Fulton	31	0	0
Henry	22	1	4.5
Lucas	398	81	20.4
Ottawa	24	0	0
Sandusky	14	0	0
Williams	20	1	5.0
Wood	82	9	11.0
Total	**3479**	**564**	**16.2**

Source: USCB 2010e
(a) Shaded row indicates the economic impact area.

likely to experience disproportionate and adverse human health, environmental, physical, or socioeconomic effects as a result of construction or operation of a plant at the South Britton site. The review team did not identify any subsistence activities in the economic impact area or elsewhere in the 50-mi region. For the other physical and environmental pathways described in Section 2.6.1, the review team has determined that impacts at the South Britton site would be similar to those at the Fermi 3 site. Therefore, the review team has determined the environmental justice impacts of building and operating a nuclear reactor at the South Britton site would be SMALL.

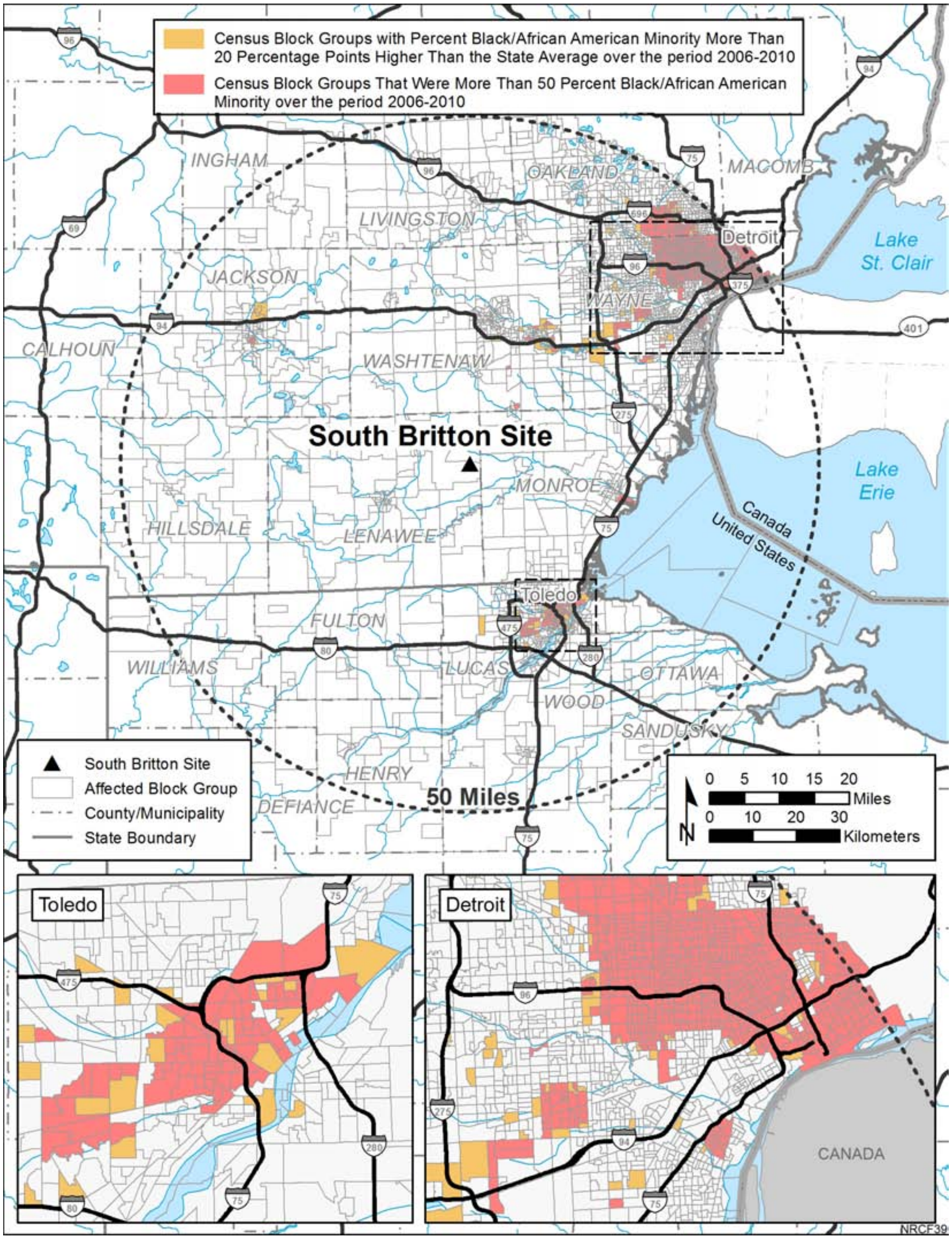

Figure 9-18. Black and African-American Minority Census Block Group Populations of Interest within a 50-mi Radius of the South Britton Site (USCB 2010d)

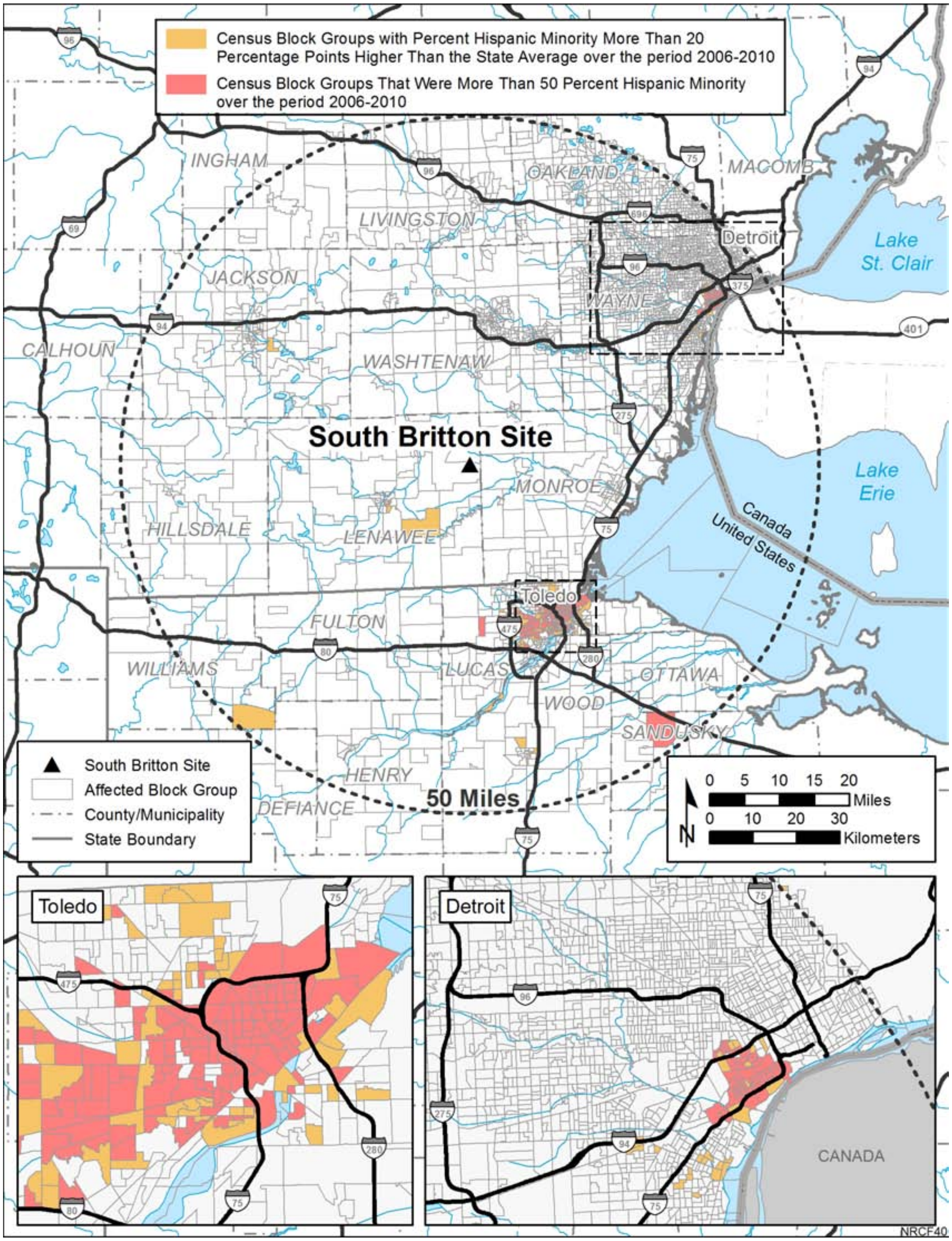

Figure 9-19. Hispanic Minority Census Block Group Populations of Interest within a 50-mi Radius of the South Britton Site (USCB 2010d)

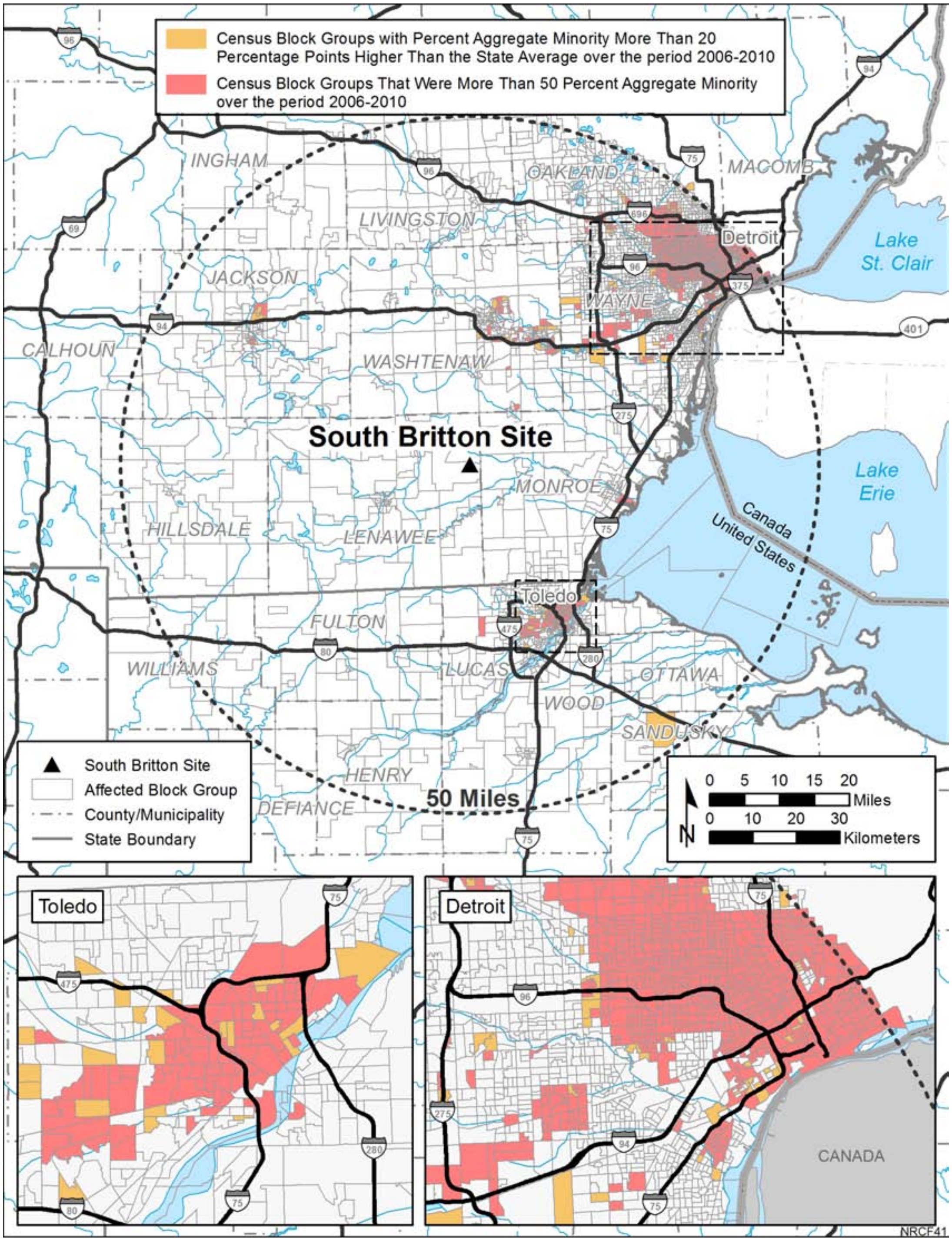

Figure 9-20. Aggregate Minority Census Block Group Populations of Interest within a 50-mi Radius of the South Britton Site (USCB 2010d)

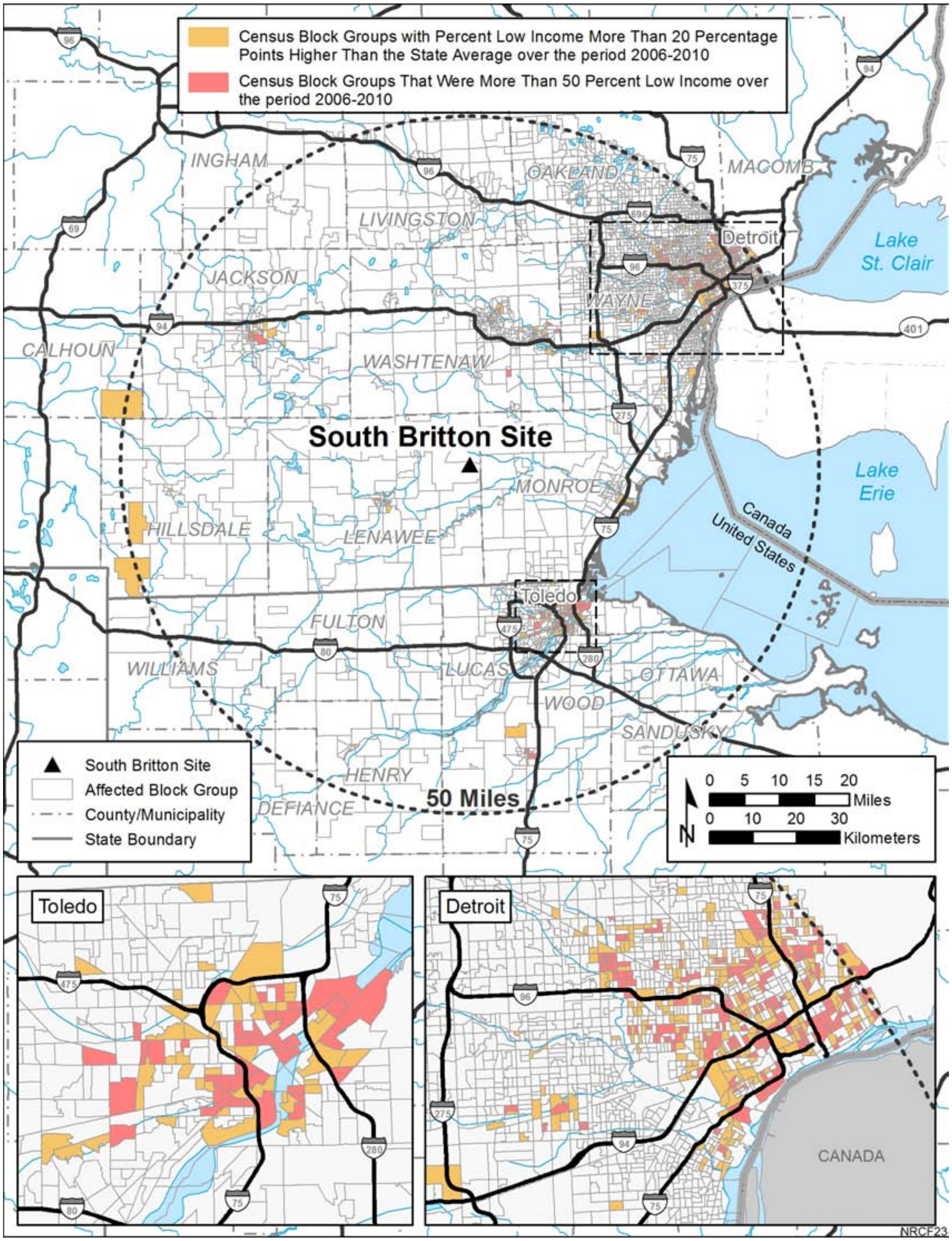

Figure 9-21. Low-Income Census Block Group Populations of Interest within a 50-mi Radius of the South Britton Site (USCB 2010e)

9.3.6.7 Historic and Cultural Resources

This section presents the review team's evaluation of the potential impacts of siting a new ESBWR at the South Britton site on historic and cultural resources. For the analysis of impacts on historic and cultural resources, the geographic area of interest is considered to be the APE that would be defined for a new nuclear power facility at the South Britton site. This includes the physical APE, defined as the area directly affected by building and operating a new nuclear power plant and transmission lines, and the visual APE (i.e., the area from which the structures can be seen). The visual APE includes the area within a 1-mi radius of the physical APE.

The review team relied upon reconnaissance-level information to perform its alternative site evaluation. Reconnaissance-level activities in a cultural resources review have particular meaning. For example, these activities may include site file searches, background research for environmental and cultural contexts, and preliminary field investigations to confirm the presence or absence of cultural resources in an APE or the sensitivity of an APE for cultural resources. For this alternatives analysis, reconnaissance-level information is considered data that are readily available from Federal and State agencies and other public sources. The following sources were used to identify reconnaissance-level information on historic and cultural resources in the APE at the South Britton site:

- NPS's National Historic Landmarks Program database for designated National Historic Landmarks (NPS 2010a).
- NPS's NRHP database for properties listed in the NRHP (NPS 2010b).
- NationalRegisterofHistoricPlaces.com database for properties listed in the NRHP (NRHP 2010).
- Michigan's Historic Sites Online database for cultural resources significant to the State of Michigan (MSHDA 2010a).
- Detroit Edison's ER (Detroit Edison 2011a).
- *Cultural Resources Site File Review of Seven Alternative Sites in Monroe, Lenawee, St. Clair, and Huron Counties, Michigan, Fermi Nuclear Power Plant Unit 3 (Fermi 3) Project, Frenchtown and Berlin Townships, Monroe County, Michigan* (Lillis-Warwick et al. 2009).

No National Historic Landmarks or other historic properties listed in the NRHP were identified (NPS 2010a, b; NRHP 2010). Three previously recorded cultural resources have been identified within the APE for the South Britton site. Two are archaeological resources (Sites 20LE202 and 20LE203); one is an aboveground resource (La Plaisance Bay Pike). None of these previously recorded cultural resources have been included in, or determined eligible for inclusion in, the NRHP (Lillis-Warwick et al. 2009; MSHDA 2010f). Therefore, none of these three previously recorded cultural resources are considered a historic property, pursuant to Section 106 of the NHPA of 1966, as amended.

Archaeological Site 20LE202 is a prehistoric archaeological site of unknown function and unknown cultural period. Archaeological Site 20Le203 is also a prehistoric archaeological site of unknown function, with occupation and/or use dating from the Paleo-Indian, Archaic, and Late Woodland Periods. Both archaeological resources are located outside of the physical APE, but within the indirect (visual) APE. Neither of the two archaeological resources has been evaluated for NRHP eligibility (Lillis-Warwick et al. 2009).

La Plaisance Bay Pike (Site ID#P23945), is an early-nineteenth century road, begun in 1832 and completed in 1835, and extending from La Plaisance Bay along the Lake Erie shoreline near Monroe, in Monroe County, west to the Chicago Road at Cambridge Junction, Lenawee County. The alignment of La Plaisance Bay Pike appears to follow what is now State Route 50; a portion of this alignment extends roughly east to west across the indirect (visual) APE for the South Britton site. La Plaisance Bay Pike was used by early settlers moving into western Michigan. Its NRHP eligibility status is not known; it was listed on the Michigan SRHP in 1965, and the State of Michigan erected a historical marker for La Plaisance Bay Pike at the Tecumseh Community Center on State Route 50 near the Monroe County line in 1966 (MSHDA 2010f).

One historic property is in the general vicinity of the APE for the South Britton site, the Lenawee County Courthouse (Site ID#P23895), a late-nineteenth century courthouse building, which is 12 mi southwest of the APE at the South Britton site, in the town of Adrian, Lenawee County (Detroit Edison 2011a). The Lenawee County Courthouse was constructed in 1885 and represents an example of county courthouses and an important work by its architect, E.O. Fallis of Toledo, Ohio, who designed eight massive courthouses in the Midwest during the 1880s. The Lenawee County Courthouse was listed on the Michigan SRHP in 1974, and the State of Michigan erected a historical marker in front of it in 1981. It was subsequently listed in the NRHP in 1991 (MSHDA 2010g) and is considered a historic property, pursuant to Section 106 of the NHPA. This NRHP-listed property is outside of the indirect (visual) APE for the South Britton site.

No archaeological and/or architectural surveys have been conducted at the alternative site to identify additional cultural resources in the APE and/or to determine or confirm the significance (NRHP eligibility) of the previously identified cultural resources in the APE at the South Britton site. As currently designed, the proposed layout for a new nuclear facility at the South Britton site would not affect any of the previously identified cultural resources within the APE. However, potential water intake and discharge pipelines from Lake Erie have the potential to affect one of the previously identified cultural resources (i.e., La Plaisance Pike along State Route 50) and may result in disturbance or destruction of intact archaeological deposits associated with La Plaisance Pike during preconstruction activities. This portion of State

Route 50 would have to be investigated to determine whether it aligns with the early to mid-nineteenth century La Plaisance Pike, determine the NRHP eligibility of any archaeological or aboveground resources associated with La Plaisance Pike, and determine the effect of potential pipelines on this resource pursuant to 36 CFR Part 800.

In addition, the proposed layout for a new nuclear power facility at the South Britton site includes structures (buildings and cooling towers) and operational activities (condensation plumes) that would be new landscape elements within the APE at the South Britton site, including within viewsheds from the apparent alignment of La Plaisance Pike. The indirect (visual) effect of a new nuclear power facility at the South Britton site on historic and cultural resources in the indirect (visual) APE would have to be evaluated pursuant to 36 CFR Part 800.

Consultation with the Michigan SHPO would be necessary to determine the need for cultural resources investigations (including archaeological and architectural surveys) to identify cultural resources within the APE prior to any onsite ground-disturbing activities, to determine whether any identified cultural resources are eligible for inclusion in the NRHP, to evaluate the potential impacts on cultural resources and/or historic properties, and to determine the effect of a new nuclear power facility at the South Britton site pursuant to Section 106 of the NHPA. As part of this consultation, Detroit Edison would be expected to put measures in place to protect discoveries in the event that cultural resources are found during building or operation of a new plant. If an unanticipated discovery were made during building activities, site personnel would have to notify the Michigan SHPO and consult with them in conducting an assessment of the discovery to determine whether additional work is needed.

The incremental impacts from installation and operation of offsite transmission lines and potential water intake and discharge pipelines to Lake Erie would be minimal if there are no significant alterations (either physical alteration or visual intrusion) of the cultural environment. If these activities result in significant alterations of the cultural environment, then the impacts could be greater. Although building and operating potential water intake and discharge pipelines would be the responsibility of Detroit Edison, building and operation offsite transmission lines would be the responsibility of a transmission company. For impacts greater than small, mitigation may be developed in consultation with the appropriate Federal and State regulatory authorities. Only Federal undertakings would require a Section 106 review.

The APE at the South Britton site does not contain any Indian Reservation land (BIA undated). However, consultation with Federally recognized Indian Tribes in the State of Michigan would be necessary in accordance with Section 106 of the NHPA. In addition, one Federally recognized Indian Tribe located outside the State of Michigan, the Forest County Potawatomi Community of Wisconsin, has indicated an interest in Lenawee County (NPS 2010c). As part of this consultation, the NRC would consult with all 12 Federally recognized Indian Tribes located within the State of Michigan (Michigan Department of Human Services 2001–2009), as identified for the Fermi site, and with the Forest County Potawatomi Community of Wisconsin.

The following cumulative impact analysis for historic and cultural resources considers building and operating a new nuclear power facility at the South Britton site. This analysis also considers other past, present, and reasonably foreseeable future actions that could affect historic and cultural resources, as identified in Table 9-36. The APE for the cumulative impact analysis for historic and cultural resources for the South Britton site consists of the alternative site area and any new transmission line corridors, and a 1-mi buffer area around the site and the corridors.

The South Britton site is predominantly agricultural land, with some small areas of second-growth woodland and two roads (Pocklington Road, east-west, and Downing Highway, north-south). No previous development (e.g., power plants, aboveground transmission lines, pipelines, railroads) has occurred onsite. Agricultural activities such as plowing, disking, and harvesting (whether historic or modern [mid-nineteenth to mid-twentieth century]) and logging or clearing of original forests (prior to the reestablishment of the existing second-growth woodland areas) are likely to have resulted in minimal subsurface disturbance, suggesting that at least some areas at the South Britton site, currently used for agricultural purposes, may have sustained minimal prior ground disturbance.

Additional past actions in the general vicinity of the South Britton site, as identified from Table 9-36, may have also indirectly (visually) affected cultural resources within the visual APE. These past actions would have included construction and operation of the Holcim (US) Inc.-Dundee Portland cement plant, approximately 7 mi east–northeast in Dundee, Michigan, and the Stansley Mineral Resources, STONECO-Meanwell Road Site (Ida Road), and STONECO Inc.-Maybee sand, gravel, topsoil, and/or limestone mines and quarries, located 9 to 15 mi from the South Britton site. However, the locations of these projects would likely be too far to incur cumulative indirect (visual) impacts on historic or cultural resources within the APE at the South Britton site. Because a new nuclear power facility at the South Britton site would be located on undeveloped property, it is likely that the proposed project would result in new significant indirect (visual impacts) on cultural resources that might be identified within the visual APE.

Based on reconnaissance-level information provided by Detroit Edison and identified by the review team and the review team's independent evaluation of this information, the review team concludes that the cumulative impacts on historic and cultural resources from building and operating a new nuclear power facility at the South Britton site would be SMALL. This impact determination is based on available information, which indicates that no known historic properties would be affected (none of the cultural resources identified within the APE at the South Britton site have been evaluated for NRHP eligibility), resulting in an impact determination of SMALL. However, if a new nuclear power facility was to be developed at the South Britton site, then cultural resources investigations within the APE and for any proposed transmission lines and water pipelines might reveal important historic or cultural resources that could be directly or indirectly affected, resulting in greater cumulative impacts.

9.3.6.8 Air Quality

Criteria Pollutants

For a plant with the same capacity as the proposed Fermi 3 plant, the emissions from building and operating a nuclear power plant at the South Britton site are assumed to be comparable to those from Fermi 3, as described in Chapters 4 and 5. The alternative site is located in Lenawee County, 1 mi west of Monroe County. Lenawee County is in the South Central Michigan Intrastate AQCR (40 CFR 81.196), while Monroe County is in Metropolitan Toledo Interstate AQCR (40 CFR 81.43). Lenawee County is in unclassifiable/attainment for all criteria pollutants, except in a maintenance area for 8-hr ozone NAAQS, while Monroe County is designated as a nonattainment area for $PM_{2.5}$ NAAQS and as a maintenance area for 8-hr ozone NAAQS (EPA 2010b). In July 2011, MDEQ submitted a request asking the EPA to redesignate southeast Michigan as being in attainment with the $PM_{2.5}$ NAAQS (MDEQ 2011). In July 2012, the EPA issued a proposed rule designating southeastern Michigan as having attained both the 1997 annual $PM_{2.5}$ NAAQS and the 2006 24-hour $PM_{2.5}$ NAAQS, based on 2009–2011 ambient air monitoring data (77 FR 39659, dated July 5, 2012), but the final determination has yet to be made.

In Sections 4.7 and 5.7, the review team concludes that air quality impacts of building and operating a plant at Fermi 3, including those associated with transmission lines and cooling towers, would be SMALL, as long as appropriate measures are taken to mitigate dust during building activities. During operation, cooling towers would be the primary source of $PM_{2.5}$, which accounts for most of total $PM_{2.5}$ emissions of 9.51 tons/yr at Fermi 3. However, these emissions would be relatively small and thus are not anticipated to elevate $PM_{2.5}$ concentrations in a designated nonattainment area. With dust mitigation, the impacts of building and operating a plant at the South Britton site would also be SMALL. Any new industrial projects would either be small or subject to permitting by MDEQ. State permits are issued under regulations approved by the EPA and deemed sufficient to attain and maintain the NAAQS and comply with other Federal requirements under the CAA. Thus, the cumulative air quality impacts of building and operating a plant at the South Britton site would be SMALL.

Greenhouse Gases

The extent and nature of climate change is not sensitive to where GHGs are emitted because the long atmospheric lifetimes of GHGs result in extensive transport and mixing of these gases. Because the emissions of a plant at the South Britton site would be comparable to those of a similar plant at the Fermi site, the discussions of Sections 4.7 and 5.7 for Fermi 3 also apply to building and operating a similar plant at the South Britton site. Thus, the impacts of the plant's GHG emissions on climate change would be SMALL, but the cumulative impacts considering global emissions would be MODERATE. Building and operating a new nuclear unit at the South Britton site would not be a significant contributor to these impacts.

9.3.6.9 Nonradiological Health

The following impact analysis considers nonradiological health impacts from building activities and operations on the public and workers from a new nuclear facility at the South Britton alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that impact nonradiological health, including other Federal and non-Federal projects and those projects listed in Table 9-36 within the geographic area of interest. The building-related activities that have the potential to affect the health of members of the public and workers include exposure to dust and vehicle exhaust, occupational injuries, noise, and the transport of construction materials and personnel to and from the site. The operations-related activities that have the potential to affect the health of members of the public and workers include exposure to etiological agents, noise, EMFs, and impacts from the transport of workers to and from the site.

Most of the nonradiological impacts of building and operation (e.g., noise, etiological agents, occupational injuries) would be localized and would not have significant impact at offsite locations. However, activities such as vehicle emissions from transport of personnel to and from the site would encompass a larger area. Therefore, for nonradiological health impacts, the geographic area of interest for cumulative impacts analysis includes projects within a 50-mi radius of the South Britton site based on the influence of vehicle and other air emissions sources because neighboring Monroe County is in nonattainment (Section 9.3.6.8). For cumulative impacts associated with transmission lines, the geographical area of interest is the transmission line corridor. These geographical areas are expected to encompass areas where public and worker health could be influenced by the proposed project and associated transmission lines, in combination with any past, present, or reasonably foreseeable future actions.

Building Impacts

Nonradiological health impacts on the construction workers from building a new nuclear facility at the South Britton site would be similar to those from building Fermi 3 at the Fermi site, as evaluated in Section 4.8. They include occupational injuries, noise, odor, vehicle exhaust, and dust. Applicable Federal. State, and local regulations on air quality and noise would be complied with during the plant construction phase. The South Britton site does not have any characteristics that would be expected to lead to fewer or more construction accidents than would be expected for the Fermi site. The site is in a predominantly rural area, and construction impacts on the surrounding populations classified as medium- and low-population areas would likely be minimal. Access routes to the site for construction workers would include State Route 50 and minor local roads. Mitigation may be necessary to ease congestion, thereby improving traffic flow and reducing nonradiological health impacts (i.e., traffic accidents, injuries, and fatalities) during the building period.

Operational Impacts

Nonradiological health impacts on occupational health of workers and members of the public from operation of a new nuclear unit at the South Britton site would be similar to those evaluated in Section 5.8 for the Fermi site. Occupational health impacts on workers (e.g., falls, electric shock, or exposure to other hazards) at the South Britton site would likely be the same as those evaluated for workers at the new unit at the Fermi site. Discharges to the Lake Erie would be controlled by NPDES permits issued by MDEQ (Section 9.3.6.2). The growth of etiological agents would not be significantly encouraged at the South Britton site due to the temperature attenuation in the length of the pipe required for a discharge system. Noise and EMF exposure would be monitored and controlled in accordance with applicable OSHA regulations. Effects of EMFs on human health would be controlled and minimized by conformance with NESC criteria. Nonradiological impacts of traffic during operations would be smaller than the impacts during building. Mitigation measures undertaken during construction to improve traffic flow would also minimize impacts during operation of a new unit.

Cumulative Impacts

Past and present actions within the geographic area of interest that could contribute to cumulative nonradiological health impacts include the energy and mining projects in Table 9-36, as well as vehicle emissions and existing urbanization. Reasonably foreseeable future projects in the geographical area of interest that could contribute to cumulative nonradiological health impacts include construction of the proposed Cleveland-Toledo-Detroit Passenger Rail Line, future transmission line development, and future urbanization.

The review team is also aware of the potential climate changes that could affect human health. A recent compilation of the state of the knowledge in this area (USGCRP 2009) has been considered in the preparation of this EIS. Projected changes in the climate for the region include an increase in average temperatures, increased likelihood of drought in summer, more heavy downpours, and an increase in precipitation, especially in the winter and spring, which may alter the presence of microorganisms and parasites. In view of the water source characteristics, the review team did not identify anything that would alter its conclusion regarding the presence of etiological agents or change in the incidence of waterborne diseases.

Summary of Nonradiological Health Impacts at the South Britton Site

Based on the information provided by Detroit Edison and the review team's independent evaluation, the review team expects that the impacts on nonradiological health from building and operating a new nuclear unit at the South Britton site would be similar to the impacts evaluated for the Fermi site. While there are past, present, and future activities in the geographical area of interest that could affect nonradiological health in ways similar to the construction and operation of a new unit at the South Britton site, those impacts would be localized and managed through adherence to existing regulatory requirements. Similarly, impacts on public health of a new nuclear unit operating at the South Britton site would be expected to be minimal. The review team concludes, therefore, that the cumulative impacts of building and operating a nuclear unit at South Britton on nonradiological health would be SMALL.

9.3.6.10 Radiological Health

The following impact analysis considers radiological impacts on the public and workers from building activities and operations for one nuclear unit at the South Britton alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health, including other Federal and non-Federal projects and those projects listed in Table 9-36 within the geographic area of interest. As described in Section 9.3.6, the South Britton site is a greenfield site; there are currently no nuclear facilities. The geographic area of interest is the area within 50-mi radius of the South Britton site. Existing facilities potentially affecting radiological health within this area are Fermi 2 and Davis-Besse. In addition, there are also likely to be medical, industrial, and research facilities within 50 mi of the South Britton site that use radioactive materials.

The radiological impacts of building and operating the proposed ESBWR unit at the South Britton site include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways would result in low doses to people and biota offsite that would be well below regulatory limits. These impacts are expected to be similar to those at the proposed Fermi site.

The radiological impacts of Fermi 2 and Davis-Besse also include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways result in low doses to people and biota offsite that are well below regulatory limits, as demonstrated by the ongoing REMPs conducted around these plants. In addition, the NRC staff concludes that the dose from direct radiation and effluents from medical, industrial, and research facilities that use radioactive materials would be an insignificant contribution to the cumulative impact around the South Britton site. This conclusion is based on data from radiological environmental monitoring programs conducted around currently operating nuclear power plants. Based on the information provided by Detroit Edison and the NRC staff's independent analysis, the NRC staff concludes that the cumulative radiological impacts from building and operating the proposed ESBWR and other existing projects and actions in the geographic area of interest around the South Britton site would be SMALL.

9.3.6.11 Postulated Accidents

The following impact analysis considers radiological impacts from postulated accidents from operations for one nuclear unit at the South Britton alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health from postulated accidents, including other Federal and non-Federal projects and those projects listed in Table 9-36 within the geographic area of interest. As described in Section 9.3.6, the South Britton site is a greenfield site, and there are currently no nuclear facilities on the site. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the South Britton site. Existing facilities potentially affecting radiological accident risk within this geographic area of interest are Fermi 2 and Davis-Besse 1, because the 50-mi radii for Fermi 2 and Davis-Besse overlap part of the 50-mi radius for the South Britton site. No other reactors have been proposed within the geographic area of interest.

As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of DBAs at the proposed Fermi site would be minimal for an ESBWR. DBAs are addressed specifically to demonstrate that a reactor design is sufficiently robust to meet NRC safety criteria. The ESBWR design is independent of site conditions, and the meteorology of the alternative and the proposed Fermi sites are similar; therefore, the NRC staff concludes that the environmental consequences of DBAs at the site would be SMALL.

Because the meteorology, population distribution, and land use for the South Britton site are expected to be similar to those for the proposed Fermi site, risks from a severe accident for an ESBWR located at the South Britton site would be expected to be similar to those analyzed for the proposed Fermi site. These risks for the proposed Fermi site are presented in Tables 5-34 and 5-35 of this EIS and are well below the mean and median values for current-generation reactors. In addition, as discussed in Section 5.11.2, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028). For the existing plants within the geographic area of interest (i.e., Fermi 2 and Davis-Besse), the Commission has determined the probability-weighted consequences of severe accidents are small (10 CFR Part 51, Appendix B, Table B-1). Because of the NRC's safety review criteria, it is expected that risks for any new reactors at any other locations within the geographic area of interest for the South Britton site would be well below risks for current-generation reactors and would meet the Commission's safety goals. The severe accident risk due to any particular nuclear power plant gets smaller as the distance from that plant increases. However, the combined risk at any location within 50 mi of the South Britton site would be bounded by the sum of risks for all these operating nuclear power plants and would still be low. On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the South Britton site would be SMALL.

9.3.7 Comparison of the Impacts of the Proposed Action and Alternative Sites

This section summarizes the review team's impact characterizations for cumulative impacts related to locating one new nuclear unit (an ESBWR) at the proposed site or at each alternative site. The four Michigan sites selected for detailed review as part of the alternative sites environmental analysis included two existing Detroit Edison power plant facilities – the Belle River-St. Clair Energy Facility and the Greenwood Energy Center, both located in St. Clair County – and two greenfield sites in Monroe and Lenawee Counties – the Petersburg and South Britton sites. Comparisons were made between the proposed site and each of the alternatives to determine whether one of the alternative sites is environmentally preferable to the proposed site. The NRC's determination as to whether an alternative site is environmentally preferable to the proposed site for Fermi 3 is independent of the USACE's determination of the LEDPA pursuant to the CWA Section 404(b)(1) Guidelines at 40 CFR Part 230. USACE will conclude its Section 404(b)(1) evaluation of alternatives in its permit decision document.

The need to compare the proposed site with alternative sites arises from the requirement in Section 102(2)(C)(iii) (42 USC 4332) of NEPA that EISs include an analysis of alternatives to the proposed action. The NRC criteria to be employed in assessing whether a proposed site is to be rejected in favor of an alternative site are based on whether the alternative site is "obviously superior" to the site proposed by the applicant (Public Service Co. of New Hampshire 1977). An alternative site is "obviously superior" to the proposed site if it is "clearly and substantially" superior to the proposed site (Rochester Gas and Electric Corp. 1978). The standard of obviously superior "is designed to guarantee that a proposed site will not be rejected in favor of an alternate unless, on the basis of appropriate study, the Commission can be confident that such action is call for" (New England Coalition on Nuclear Pollution 1978).

The "obviously superior" test is appropriate for two reasons. First, the analysis performed by the NRC staff in evaluating alternative sites is necessarily imprecise. Key factors considered in the alternative site analysis, such as population distribution and density, hydrology, air quality, aquatic and terrestrial ecological resources, aesthetics, land use, and socioeconomics, are difficult to quantify in common metrics. Given this difficulty, any evaluation of a particular site must have a wide range of uncertainty. Second, Detroit Edison's proposed site has been analyzed in detail, with the expectation that most adverse environmental impacts associated with the site have been identified. The alternative sites have not undergone a comparable level of detailed study. For these reasons, a proposed site may not be rejected in favor of an alternative site when the alternative site is marginally better than the proposed site, but only when it is obviously superior (Rochester Gas and Electric Corp. 1978). NEPA does not require that a nuclear plant be constructed on the single best site for environmental purposes. Rather, "all that NEPA requires is that alternative sites be considered and that the effects on the environment of building the plant at the alternative sites be carefully studied and factored into the ultimate decision" (New England Coalition on Nuclear Pollution 1978).

The NRC staff's review of alternative sites consists of a two-part sequential test (NRC 2000). The first part of the test determines whether any of the alternative sites are environmentally preferable to the applicant's proposed site. The NRC staff considers whether the applicant has (1) reasonably identified candidate sites, (2) evaluated the likely environmental impacts of building and operation at these sites, and (3) used a logical means of comparing sites that led to the applicant's selection of the proposed site. Based on NRC's own independent review, the NRC staff then determines whether any of the alternative sites are environmentally preferable to the applicant's proposed site. If the NRC staff determines that one or more alternative sites are environmentally preferable, then it would compare the estimated costs (i.e., environmental, economic, and time) of constructing the proposed plant at the proposed site and at the environmentally preferable site or sites (NRC 2000). The second part of the test determines whether an environmentally preferable alternative site is obviously superior to the proposed site. The NRC staff must determine that (1) one or more important aspects, either singly or in combination, of an environmentally preferable alternative site are obviously superior to the corresponding aspects of the applicant's proposed site and (2) the alternative site does not have offsetting deficiencies in other important areas. An NRC staff conclusion that an alternative site is obviously superior to the applicant's proposed site would normally lead to a recommendation that the application for the license be denied.

Section 9.3.7.1 discusses the process the NRC staff used to compare the alternative sites to the proposed Fermi 3 site. Sections 9.3.7.2 and 9.3.7.3 discuss the environmental impacts of the proposed site in relation to the alternative sites as they relate to "environmentally preferable" and "obviously superior" evaluations, respectively.

9.3.7.1 Comparison of the Proposed Site and Alternative Site Cumulative Impacts

The review team's characterizations of the cumulative environmental impacts of building and operating a new nuclear generating unit at the proposed site (impact levels from Chapter 7) and four alternative sites (from Sections 9.3.3 through 9.3.6) are listed in Table 9-44.

The review team performed reconnaissance-level reviews of each of the four alternative sites and reviewed information provided in Detroit Edison's ER and RAI responses, information from other Federal and State agencies, and information gathered during visits to each alternative site. The review team found that Detroit Edison implemented a reasonable process to select alternative sites and used a logical process to compare the impacts of the proposed site to those at the alternative sites. The following discussion summarizes the staff's independent assessment of the proposed and alternative sites.

The review team's characterizations of the expected cumulative environmental impacts of building and operating a new unit at the Fermi site and alternative sites are summarized by impact category level in Table 9-44. Full explanations for the particular characterizations are provided in Chapter 7 for the proposed Fermi 3 site and in Sections 9.3.3 through 9.3.6 for the four alternative sites. The staff's impact category levels are based on professional judgment, experience, and consideration of controls likely to be imposed under required Federal, State, or local permits that would not be acquired until an application for a COL is under way. These

Table 9-44. Comparison of Cumulative Impacts at the Proposed and Alternative Sites

Resource Category	Fermi	Belle River-St. Clair	Greenwood	Petersburg	South Britton
Land Use	SMALL	SMALL	SMALL	SMALL	SMALL
Water Resources					
Surface Water Use	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Groundwater Use	SMALL	SMALL	SMALL	SMALL	SMALL
Surface Water Quality	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Groundwater Quality	SMALL	SMALL	SMALL	SMALL	SMALL
Ecology					
Terrestrial and Wetland Resources	SMALL to MODERATE (potential for MODERATE limited to eastern fox snake)	MODERATE	MODERATE	MODERATE	MODERATE
Aquatic Resources	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Socioeconomics					
Physical Impacts	SMALL	SMALL	SMALL	SMALL	SMALL
Demography	SMALL (beneficial)	SMALL	SMALL	SMALL	SMALL
Taxes and Economy	SMALL (region) to LARGE (Monroe County) (beneficial)	SMALL (region) to LARGE (St. Clair County) (beneficial)	SMALL (region) to LARGE (St. Clair County) (beneficial)	SMALL (region) to LARGE (Monroe County) (beneficial)	SMALL (region) to LARGE (Lenawee County) (beneficial)
Traffic	SMALL (region); MODERATE (Monroe County)	SMALL (region) to MODERATE (St. Clair County)	SMALL (region) to MODERATE (St. Clair County)	SMALL (region) to LARGE (Monroe County)	SMALL (region) to LARGE (Lenawee County)
Recreation	SMALL	SMALL	SMALL	SMALL (region) to MODERATE (Monroe County)	SMALL (region) to MODERATE (Monroe and Lenawee Counties)
Housing	SMALL	SMALL	SMALL	SMALL	SMALL

Table 9-44. (contd)

Resource Category	Fermi	Belle River-St. Clair	Greenwood	Petersburg	South Britton
Public Services	SMALL	SMALL	SMALL	SMALL	SMALL
Education	SMALL	SMALL	SMALL	SMALL	SMALL
Environmental Justice	SMALL	SMALL	SMALL	SMALL	SMALL
Historic and Cultural Resources	MODERATE	SMALL	SMALL	SMALL	SMALL
Air Quality	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Nonradiological Health	SMALL	SMALL	SMALL	SMALL	SMALL
Radiological Health	SMALL	SMALL	SMALL	SMALL	SMALL
Nonradioactive Waste	SMALL	SMALL	SMALL	SMALL	SMALL
Postulated Accidents	SMALL	SMALL	SMALL	SMALL	SMALL

considerations and assumptions were similarly applied at each of the alternative sites to provide comparisons of impact levels between the proposed site and each alternative site.

9.3.7.2 Environmentally Preferable Sites

Neither the proposed site nor any of the four alternative sites appear to have inherent characteristics that would completely preempt building a nuclear plant at that location. However, as shown in Table 9-44, there are some differences in the review team's projections of impacts among the sites. Comparisons among the proposed site and the four alternatives to identify an environmentally preferable site, or subsequently an obviously superior site, are typically made across all the impact categories. However, in this particular instance, impacts on land use, groundwater use, groundwater quality, physical socioeconomic parameters, environmental justice, radiological health, nonradiological health, nonradioactive waste, and postulated accidents are projected by the review team to be SMALL for all the sites. Consequently, these categories are not discriminators in the exercise of selecting an environmentally preferable or obviously superior site and were not considered further in site comparisons. While impacts on demography are all identified in Table 9-44 as SMALL, the review team has concluded that the impacts at the Fermi site are beneficial, which is not the case for the four alternative sites.

For some impact categories, different levels of impact are simultaneously possible in different portions of each site's ROI, for example, from SMALL to LARGE for traffic. Such variability of impact levels within the affected regions of each site is especially prominent for the two greenfield sites, Petersburg and South Britton. Finally, for those impact categories in which the projected impact is anything greater than SMALL, sites are differentiated on the basis of the expected contribution of a new reactor to cumulative impacts in those categories.

In evaluating the three sites with existing power plants, the review team assumed that current power production activities would continue unchanged and that the necessary expansions of cooling system and transmission infrastructures to increase their capacities are technically feasible. The review team assumed that the existing infrastructure, with modifications, would be used to the greatest extent possible as a way to minimize environmental impacts; however, the review team also concluded that the building of some new infrastructure may also be necessary.

In the comparison of the Fermi and Belle River-St. Clair sites, the impacts are the same except for terrestrial ecology, demography, and historic and cultural resources. Building and operating the new unit would have a SMALL to MODERATE impact on terrestrial ecology at the Fermi site (with the potential for MODERATE impacts limited to the eastern fox snake), but an overall MODERATE terrestrial ecology impact at the Belle River-St. Clair site. Building the new unit at the Fermi site would have a SMALL beneficial impact on demography, as discussed in Chapters 4 and 5, but a SMALL adverse impact at the Belle River-St. Clair site. Regarding cultural resources, building a new unit at the Fermi site would require dismantling Fermi 1, and the review team concluded that this was a MODERATE impact. The review team noted that the dismantlement would be performed following the stipulations in an agreement that would be set between the Michigan SHPO and Detroit Edison to mitigate the impacts. At the Belle River-St. Clair site, the review team did not identify any cultural resources known to be eligible for listing on the NRHP that would be affected by a new plant. Overall, the review team concludes that the two sites rank closely and therefore concludes that the Belle River-St. Clair site is not environmentally preferable to the Fermi site.

Comparing the Fermi and Greenwood sites, the review team noted that the impacts at the Greenwood site are essentially the same as those at the Belle River-St. Clair site. The comparison to the Fermi site would follow the same lines, and the review team therefore concludes that the Greenwood site is not environmentally preferable to the Fermi site.

In the comparison of the Fermi and Petersburg sites, the impacts are the same except for terrestrial ecology, traffic, recreation, and historic and cultural resources. Building and operating the new unit would have a SMALL to MODERATE impact on terrestrial ecology at the Fermi site (with the potential for MODERATE impacts limited to the eastern fox snake), but an overall MODERATE terrestrial ecology impact at the Petersburg site. Building the new unit at the Fermi site would have a MODERATE impact on traffic and a SMALL impact on recreation, while it would have a LARGE impact on traffic and a MODERATE impact on recreation at the Petersburg site because of the site’s rural nature. Regarding cultural resources, building a new unit at the Fermi site would require dismantling Fermi 1, and the review team concluded that this was a MODERATE impact. The review team noted that the dismantlement would be performed following the stipulations in an agreement that would be set between the Michigan SHPO and Detroit Edison to mitigate the impacts. At the Petersburg site, the review team did not identify any cultural resources known to be eligible for listing on the NRHP that would be affected by a new plant. Overall, the review team concludes that the impacts of building and operating a new nuclear plant at the Petersburg site would be greater than the impacts of the same project at the Fermi site. The review team therefore concludes that the Petersburg site is not environmentally preferable to the Fermi site.

In the comparison of the Fermi and South Britton sites, the impacts are the same except for terrestrial ecology, traffic, recreation, and historic and cultural resources. Building and operating the new unit would have a SMALL to MODERATE impact on terrestrial ecology at the Fermi site (with the potential for MODERATE impacts limited to the eastern fox snake), but an overall MODERATE terrestrial ecology impact at the South Britton site. Building the new unit at the Fermi site would have a MODERATE impact on traffic, while the traffic impacts at the South Britton site would be LARGE. Building the new unit at the Fermi site would have a SMALL impact on recreation, but a MODERATE impact at the South Britton site because of its rural nature. Regarding cultural resources, building a new unit at the Fermi site would require dismantling Fermi 1 and the review team concluded that this was a MODERATE impact. The review team noted that the dismantlement would be performed following the stipulations in an agreement that would be set between the Michigan SHPO and Detroit Edison to mitigate the impacts. At the South Britton site, the review team did not identify any cultural resources known to be eligible for listing on the NRHP that would be affected by a new plant. Overall, the review team concludes that the impacts of building and operating a new nuclear plant at the South Britton site would be greater than the impacts of the same project at the Fermi site. The review team therefore concludes that the South Britton site is not environmentally preferable to the Fermi site.

The review team concludes that despite the observed differences in projected impacts among the sites, none of the alternative sites are environmentally preferable to the Fermi site.

9.3.7.3 Obviously Superior Sites

Because none of the alternative sites are environmentally preferable to the proposed site, none could be obviously superior, and no additional evaluations in that regard are required.

9.4 System Design Alternatives

The review team considered a variety of heat dissipation systems and circulating water system (CIRC) alternatives for Fermi 3. While other heat-dissipation systems and water systems exist, by far the largest and the most likely to dominate the environmental consequences of operation is the CIRC that cools and condenses the steam for the turbine generator. Other water systems, such as the station water system (SWS), are much smaller than the CIRC. As a result, the review team considered only alternative heat dissipation and water treatment systems for the CIRC. The proposed CIRC is a closed cycle system that uses an NDCT for heat dissipation (Detroit Edison 2011a). The proposed system is discussed in detail in Chapter 3.

9.4.1 Heat Dissipation Systems

About two-thirds of the heat from a commercial nuclear reactor is rejected as heat to the environment. The remaining one-third of the reactor-generated heat is converted into electricity. Normal heat-sink cooling systems transfer the rejected heat load into the atmosphere and/or nearby water bodies, primarily as latent heat exchange (evaporating water) or sensible heat exchange (warmer air or water). Different heat dissipation systems rely on different exchange processes. The following sections describe alternative heat dissipation systems considered by the staff for the proposed Fermi 3 reactor.

A closed cycle cooling system using an NDCT was selected by Detroit Edison to provide heat dissipation for Fermi 3. The NDCT induces the flow of ambient air by convection up through the large (600-ft tall and 400-ft diameter) tower and allows an exchange of heat from the cooling water to the air by a counter-flowing cascade of warm cooling water downward in the lower portion of the cooling tower. As heat transfers from the water to the air in the tower, the air becomes more buoyant and rises. This buoyant circulation induces more air to enter the tower through its open base. A portion of the water evaporates, resulting in the cooling of the remaining portion of the water. To control scale and biological organisms in the recirculating water, a portion of the water in the closed cooling system is periodically discharged as blowdown and replaced with an equal volume of treated water. Likewise, the volume of water lost to evaporation is also replaced to maintain the design volume of water in the system. Lake Erie would be the source of cooling water, including water to replace blowdown and evaporative losses. After treatment, blowdown water would be discharged to Lake Erie under the auspices of an NPDES permit issued by MDEQ. Other impacts of the selected system include the potential for drift, visual impacts from both the NDCT and a condensate plume (during certain weather conditions), and small amounts of wastes resulting from required water treatment.

In its ER, Detroit Edison considered a range of heat dissipation systems, including a once-through cooling system, several alternative closed cycle cooling system configurations, dry cooling systems, and wet/dry hybrid systems (Detroit Edison 2011a). The review team's evaluation of each of these alternative systems appears in the following paragraphs. Each is evaluated on its own merits and, as well, compared to the proposed closed cycle wet natural draft system, when such comparisons are relevant, on matters such as water requirements, water consumption, impacts on water quality and aquatic ecosystems, parasitic loads, noise, atmospheric effects, and visual impacts.

9.4.1.1 Once-Through Cooling

A once-through cooling system would withdraw water from Lake Erie and return virtually the same volume of water to the lake at an elevated temperature. The water intake and discharge structures would be separated to limit recirculation. Lake Erie would be capable of supplying the substantial volumes of water continuously required for a once-through system. The discharge of cooling water back to Lake Erie would require an NPDES permit that would establish thermal limits for the discharging water to prevent or mitigate adverse impacts on aquatic ecosystems. Because there is no evaporative loss associated with exchange of heat with the steam water, there is no consumptive use of water in a once-through system as the water passes through the plant heat exchangers. However, the elevated temperature of the receiving water body would result in induced evaporative loss that decreases the net water supply. A once-through system would withdraw substantially more water from Lake Erie than the proposed system (Detroit Edison estimates 720,000 gpm for a once-through system versus 34,000 gpm for the proposed closed cycle system [Detroit Edison 2011a]). The large intake and discharge flows associated with once-through cooling systems require large intake and discharge structures, result in higher levels of impingement and entrainment, and may result in hydrologic alterations in the source/receiving water bodies. Based on recent changes to implementation plans to meet Section 316(b) of the CWA, the review team has determined that once-through cooling systems for new nuclear reactors are unlikely to be permitted in the future, except in rare and unique situations. Because once-through systems do not use any sort of cooling tower, have an otherwise low profile, and do not produce a condensate plume, visual impacts are greatly reduced and land requirements are minimized. Noise impacts from pump operation are also expected to be minimal.

The likely locations for both intake and discharge structures for a once-through system would be in a relatively shallow portion of Lake Erie, potentially further exacerbating any adverse impacts of impingement, entrainment, or thermal plumes. For these reasons, in addition to the CWA considerations, the review team concludes that a once-through cooling system is not an environmentally preferable alternative cooling system for Fermi 3.

9.4.1.2 Once-Through System with Helper Tower

A variant of the once-through system involves adding a helper tower between the condenser and the discharge. The helper tower is typically a conventional MDCT. Operators have the ability to divert a portion of the water leaving the condenser to the helper tower, where it can undergo further cooling before being recombined with the rest of the cooling water and discharged to Lake Erie. Such systems are used at some nuclear power plants that are located on bodies of water for which thermal effects are a concern. The advantage of such a system is the enhanced ability to lower the temperature of the discharging water by transferring some of the heat in the water diverted to the helper tower to the atmosphere instead. Such a system may be essential in ensuring that the facility meets the thermal limits of its NPDES discharge permit. However, this option would require slightly more water than the once-through system alone to account for evaporative losses in the helper tower. It also adds complexity to the simple once-through system, adds land requirements, and does nothing to ameliorate the adverse impacts of impingement or entrainment that may be associated with the once-through system. Introduction of the MDCT increases the parasitic load of the plant (due to operation of extra water pumps and air fans) and introduces noise, drift, and visual impacts. Because this system would not result in diminution of impingement or entrainment impacts typically associated with once-through systems, it offers only the incremental advantage of enhanced control of thermal impacts on Lake Erie. For the same reasons that apply to once-through systems, the review team has concluded that a once-through system with a helper tower is not an environmentally preferable alternative cooling system for Fermi 3.

9.4.1.3 Combination Dry and Wet Cooling Tower System

Hybrid systems combine conventional closed cycle wet mechanical or natural draft cooling systems with dry cooling systems. The two cooling systems can be arranged either in parallel or in series. Operators can control the extent of cooling that occurs through adjustments of the operating parameters of each cooling system or, in the case of the parallel arrangement, by controlling the amount of cooling water diverted to each. During cold weather, heat rejection demands could be met exclusively by the dry system, thus greatly reducing water impacts typically associated with wet cooling, albeit with some performance penalties with respect to power production. Although the hybrid system offers some advantages, it also involves adverse impacts such as added complexity and maintenance requirements, parasitic loads, noise, and visual impacts that are additive between the two systems. Water from Lake Erie would still be required to support the wet system, although evaporative losses could be expected to be smaller than for the proposed system operating alone. Blowdown from the wet cooling system would still be discharged to the lake (albeit in slightly lesser quantities than from a wet cooling system operating alone), and makeup water to replace blowdown and evaporative losses would still be withdrawn from the lake and would need chemical treatment before use. Further, performance of the dry cooling system is dependent on atmospheric conditions with maximum performance occurring during periods of low relative humidity, an unlikely condition in southeastern Michigan during periods of peak summer loads when heat rejection capacity is most needed. Although a hybrid system is technically feasible and adverse impacts on Lake Erie may be incrementally smaller, other impacts such as increased visual impacts, noise, variable performance of the dry system, and parasitic loads counterbalance any advantages. Despite its technical feasibility, the review team does not believe that a hybrid cooling system would offer substantial benefits over the proposed natural draft wet cooling system. The review team concludes that this option is not environmentally preferable to the proposed system.

9.4.1.4 Mechanical Draft Wet Cooling System

The mechanical draft wet cooling system option is closely related to the proposed natural draft cooling system. Heat rejection mechanisms are identical, and water demands and impacts on Lake Erie would be virtually the same. Water requirements and water consumption would be virtually the same as the proposed natural draft cooling system. Blowdown discharges to the lake would still occur under an NPDES permit. Water pumping loads would be about the same, but the fans of the mechanical draft system would increase parasitic loads over the natural draft system. Condensate plumes and drift are still possible with the mechanical draft system, but because it has a much smaller profile, the mechanical draft system offers less visual impact from both the cooling tower and its condensate plume than its natural draft counterpart. However, because the NCDTs supporting Fermi 2 would still be operative, both the proposed natural draft system and the mechanical draft alternative would add only incrementally to the existing visual impacts of the Fermi site. Although their technical feasibility is virtually equivalent to the proposed natural draft wet cooling system, the review team has determined that a mechanical draft wet cooling system is not environmentally preferable to the proposed system.

9.4.1.5 Spray Ponds

Spray pond cooling systems use engineered ponds to cool water and enhance evaporative cooling by spraying water into the atmosphere. In addition to evaporation, heat transfer from the spray ponds to the atmosphere occurs through blackbody radiation and conduction. Spray pond systems comprise a number of spray nozzles installed on an extensive plumbing system, which may introduce significant maintenance requirements. Operational noise would be minimal and localized. Spray ponds would require a substantial initial charge of water to the system as well as replacement of evaporative losses would still be supplied from the lake. Blowdown from the spraypond to maintain water quality would likely be to Lake Erie. Some drift losses are possible, and in some weather conditions, a ground fog (rather than a condensate plume) may occur. Although system efficiency is somewhat dependent on ambient conditions, it is reasonable to assume that the pond would have sufficient capacity to easily overcome any weather-related deleterious impacts on performance. The parasitic load of a spray pond results primarily from water pumping and is expected to be slightly greater than that of a once-through system, but still smaller than any of the other options considered. It is reasonable to expect that a spray pond would represent the greatest land requirement among all the heat rejection options considered. Although Detroit Edison did not identify a required size, it concluded that the land required for a spray pond of sufficient capacity would likely not be available within the Fermi site's current footprint, especially since much of the fallow land is wetland. Primarily because of the impacts associated with the increased land requirements, the review team concludes that a spray pond cooling system is not environmentally preferable to the proposed natural draft system.

9.4.1.6 Dry Cooling Towers

Dry cooling towers would greatly reduce water-related impacts from cooling system operation, because no water would be consumed by evaporation. However, dry cooling systems require much larger cooling systems, and their efficiency is dependent on ambient conditions of temperature and humidity, with their lowest performance occurring during periods of high dry bulb temperature. Unfortunately, this is a condition that is likely to occur during periods of peak summer demand in southeastern Michigan, when the greatest heat dissipation capacity is required. Dry cooling systems result in the greatest power-producing performance penalties of all the heat dissipation systems evaluated. This loss in generation efficiency translates into increased impacts from the fuel cycle. In addition, a dry cooling system sized to cool the plant under all conditions would be very large, occupying a much larger area than the proposed cooling tower and potentially increasing both land use and terrestrial impacts.

Although the cumulative surface water use impacts identified by the review team in Section 7.2.2 are SMALL to MODERATE, these impacts result primarily from climate change, and the proposed Fermi 3 cooling system is not a significant contributor to those impacts. Using a dry cooling system would not lead to any noticeable reduction in the cumulative impacts on surface water use. The review team determined that construction and operation of dry cooling towers would not be environmentally preferable to the proposed cooling system.

9.4.2 Circulating Water Systems

The review team considered water supply alternatives for both the normal power heat sink (NPHS) cooling system (the proposed natural draft closed cycle cooling system), and the plant service water system (PSWS). The capacity requirements of the intake and discharge systems are defined primarily by the requirements of the proposed heat dissipation system. The maximum design basis for the cooling system is represented by maximum normal power operation during summer months and includes a total makeup water intake to the cooling system of 34,234 gpm, composed of 17,124 gpm to replace drift and evaporation losses and 17,110 gpm NPHS discharges (blowdown from the cooling tower). The total maximum flow of the PSWS is 40,000 gpm (Detroit Edison 2011a).

9.4.2.1 Intake Alternatives

Lake Erie would provide water for plant cooling and industrial applications. Water would be withdrawn from the lake through an intake bay adjacent to the existing intake bay for Fermi 2, between the two rock groins that extend into the lake (see Figure 3-5 of the ER [Detroit Edison 2011a]). The intake system is described in Section 3.2.2.2 of this EIS and in Section 3.4.2.1 of the ER (Detroit Edison 2011a). The intake would supply water to the SWS, which supports all non-safety-related cooling in the plant. The ultimate heat sink for Fermi 3 would be a separate system.

The intake would be equipped with a trash rack to screen out large objects and three dual-flow traveling screens with 3/8-in. mesh arranged side-by-side to further screen out litter from the water before it reaches the SWS pump. Trash collected on the rack and screens would be periodically removed and disposed of. Fish impinged on the intake screens will be returned alive to Lake Erie via a fish return system. After water enters the pump house, it would be treated by using sodium hypochlorite as a biocide/algaecide before it enters the pumps at the location of the biocide injection diffuser. There would be two groups of pumps in the intake bay: three pumps, each equipped to pump at 50 percent capacity for makeup water to the cooling tower basins, and two pumps, each designed to pump (at 100-percent capacity) makeup water to the auxiliary heat sink and fire protection system during shutdown.

In the ER, Detroit Edison considered two alternatives to the proposed intake structure: an offshore intake positioned just above the bottom of the lake and located some unspecified distance from the shore, and an alternative shoreline intake structure located some unspecified distance from the Fermi 2 intake. The review team focused its evaluation of alternative intake designs on these two alternatives.

The offshore alternative could result in adverse impacts during building of the structure, including increased water turbidity and significant disturbance to the lake bottom. Conversely, positive attributes associated with this option include (1) the ability to position the intake at a location with less abundant aquatic resources and (2) minimization of land use impacts. There would be no measurable differences regarding water use. Nevertheless, the potential for substantial adverse impacts during construction led the review team to conclude that the offshore alternative would not be environmentally preferable.

An alternative shoreline location would disrupt the shoreline to a greater degree than the disruptions anticipated from the necessary modifications to the existing intake. Because the Fermi 2 intake would remain in service, the second separate intake would increase operational impacts from such necessary activities as periodic dredging. Water use from the operation of two separate intakes for Fermi 2 and Fermi 3 would be indistinguishable from impacts expected from the use of a single intake structure. Finally, adequate separation between the intakes and discharges would be required to prevent recirculation of discharged cooling water. The review team concludes that a second separate shoreline intake would not be environmentally preferable to the proposed intake.

9.4.2.2 Discharge Alternatives

The discharge structure proposed for Fermi 3 would be located offshore, adjacent to the intake canal, and extend sufficiently into the lake to prevent recirculation of discharged cooling water. In its ER, Detroit Edison identified one alternative discharge system and one alternative discharge location; the alternative discharge system is a shoreline discharge, while the alternative discharge location is an inland discharge to any of the existing lagoons on the Fermi site. In evaluating these alternatives, the review team considered impacts on aquatic resources, land, and water and the feasibility of securing the necessary permits.

Alternative Discharge System

The proposed offshore discharge system would have a discharge port located on the bottom of the lake bed, sufficiently removed from the intake structure to prevent recirculation of discharged heated cooling water. Construction of such a system would result in temporary land impacts from installation of the discharge piping and staging of equipment to support installation of offshore system elements. However, construction would result in substantial disruption of the lake bed, with concomitant disruptions to the benthic communities in the affected area and a temporary decrease in water quality in the vicinity due to an increase in total suspended solids. Construction of the alternative shoreline discharge system would result in little disruption to the lake bed but greater land impacts, most of which would be permanent. Operational impacts on aquatic organisms from the two systems would depend on the communities existing at the locations selected for each system. It is reasonable to presume that a shoreline discharge point would be selected to avoid sensitive nearshore wetland areas. Even so, water discharged from a shoreline system would have a greater probability of migrating to environmentally sensitive shoreline areas than would the offshore discharge. A shoreline discharge system would be expected to have greater potential for impacts on shoreline wetland areas and on the littoral zone of the lake, and thus could be expected to have greater overall impact on the aquatic ecosystem than the offshore system. Depending on its location relative to the intake, either discharge system could affect both the temperature and turbidity of water drawn into the intake, which could subsequently affect the cooling efficiency of the heat dissipation system and introduce additional maintenance issues at the intake. The design basis for the offshore discharge system has already considered such impacts, and the location has been determined to be far enough away from the intake that no deleterious effects on intake water would be expected, even through seasonal variations of lake currents. Similar considerations could be made in the selection of a shoreline discharge system location, such that operational impacts on water quality would be essentially the same for either system. Either discharge system would require an NPDES permit. The feasibility of securing the necessary permits is considered to be the same for either system. The review team concludes that an offshore discharge system would result in fewer impacts than a shoreline discharge system.

Alternative Discharge Location

In its comparison of building impacts at alternative discharge locations, Detroit Edison noted that the proposed offshore location is in the same general area as the cooling water intake pipe for the now-decommissioned Fermi 1 reactor, and therefore has been previously disturbed. Conversely, construction impacts would be new if the discharge structure were built in any of the inland lagoons selected for the inland discharge alternative. Land impacts from construction are expected to be essentially the same for either discharge location alternative. Operational impacts, however, could be greater for an inland discharge system. The inland lagoons connect to the lake through a series of engineered culverts, but they are also in hydraulic communication with inland wetland areas. These inland wetland areas may play a significant role for animals that frequent the site. Discharges to the lagoons could result in adverse impacts on the inland wetlands and those terrestrial communities that rely on them. Both thermal and chemical impacts may be more significant on the lagoons than they would be on the lake, given the relatively smaller volumes of water expected to absorb those discharges. Discharge to the lagoons, because of the confined nature of the lagoons and isolation from the Fermi 2 discharge, would increase the probability of occasional heat and cold shock to aquatic organisms. The review team concludes that an offshore discharge location would result in fewer impacts than an inland discharge location.

9.4.2.3 Water Supplies

In Section 5.2.2.1 of this EIS, the review team considers the impacts of using Lake Erie as the proposed source of water to support the operation of Fermi 3 and concludes that the impacts would be SMALL and that no mitigation would be warranted. The review team identified alternative sources for the CIRC that included water reuse, groundwater, and surface water, and evaluated each for its environmental equivalency to Lake Erie as a source of water.

Water Reuse

Sources of water for reuse can come either from the plant itself or from other local water users. Sanitary wastewater treatment plants are the most ubiquitous sources of water for reuse in the vicinity of the Fermi site. Other activities in the vicinity of Fermi that could provide water include industrial activities and quarry dewatering. Although sanitary wastewaters are likely to be available in abundance within the Detroit metropolitan area, such water sources would require substantial additional treatment before becoming available for application in the CIRC or for any other Fermi application. In addition, a significant investment in infrastructure and associated disturbance of terrestrial and aquatic resources would be required to bring this water source to the Fermi site. Industrial wastewaters would also require extensive treatment and substantial investments in infrastructure. Quarry dewatering would produce water that is likely to require lesser amounts of treatment; however, pipeline or alternative transport infrastructure is also lacking, and the constancy of such a source is not guaranteed. The review team therefore concludes that no source of reused water would be environmentally preferable to Lake Erie.

Groundwater

Groundwater hydrology in the vicinity of the Fermi site is described in Section 2.3.1. Comparing the accessibility and availability of groundwater beneath the Fermi site and in the vicinity of the site with the expected demands of Fermi 3's CIRC, the review team concludes that the use of groundwater for cooling would result in greater impacts than using water from Lake Erie.

Surface Water

Surface water hydrology in the vicinity of the Fermi site is described in Section 2.3.1. No other suitable source of surface water exists to support the expected demands for Fermi 3 power plant operations.

9.4.2.4 Water Treatment

As proposed by Detroit Edison, both inflow and effluent water would receive chemical treatment to ensure that they meet plant water needs and effluent water standards. Detroit Edison has identified two alternatives to chemical treatment of cooling water: mechanical treatment and thermal shock. In the mechanical treatment option, periodic mechanical treatment of the cooling tower could be performed to control the accumulation of biological species such as zebra mussels or the accumulation of scale, both of which, in sufficient quantities, could compromise the efficiency of the cooling tower. However, while mechanical cleaning is environmentally preferable to the use of chemicals, the physical design of the cooling tower basin makes mechanical cleaning impractical. Furthermore, during such cleaning, the cooling tower and reactor must be shut down. By comparison, chemical cleaning and biological control can occur continuously while the cooling tower is in operation. (However, for large accumulations of zebra mussels, shock chlorination is best accomplished through the short-term isolation of the SWS.) Biological control, especially of zebra mussels, could also be accomplished through thermal shock by raising the temperature for a brief period of time. However, artificially raising the temperature of water in the cooling system is counterproductive to the cooling system's purpose, and such elevated temperatures would not be compatible with some cooling system components. Both mechanical cleaning and thermal shock treatment are environmentally preferable to the use of chemicals; however, both alternatives are impractical and would result in the interruption of the cooling tower's function for some period of time. The review team therefore concludes that no viable alternatives to the proposed chemical treatment of water in the cooling tower and the CIRC exist.

9.4.3 Summary

The review team considered alternative systems designs, including six alternative heat-dissipation systems and alternative intake, discharge, and water supply systems and locations. As discussed in previous sections, the staff identified no feasible alternative that would be environmentally preferable to those proposed by Detroit Edison.

9.5 References

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10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

10 CFR Part 54. Code of Federal Regulations, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

33 CFR Part 325. Code of Federal Regulations, Title 33, *Navigation and Navigable Waters*, Part 325, "Processing of Department of the Army Permits."

36 CFR Part 800. Code of Federal Regulations, Title 36, *Parks, Forests, and Public Property*, Part 800, "Protection of Historic Properties."

40 CFR Part 60. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 60, "Standards of Performance for New Stationary Sources."

40 CFR Part 63. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 63, "National Emission Standards for Hazardous Air Pollutants for Source Categories."

40 CFR Part 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81, "Designation of Areas for Air Quality Planning Purposes."

40 CFR Part 1502. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 1502, "Environmental Impact Statement."

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10.0 Conclusions and Recommendations

This chapter provides a discussion of the conclusions reached in earlier parts of this environmental impact statement (EIS), as well as the U.S. Nuclear Regulatory Commission (NRC) staff's recommendations. Section 10.1 summarizes the impacts of the proposed action. Section 10.2 summarizes the proposed project's unavoidable adverse impacts and is accompanied by a table, and Section 10.3 discusses the relationship between the short-term use of resources and long-term productivity of the human environment. Section 10.4 summarizes the irretrievable and irreversible use of resources, and Section 10.5 summarizes the alternatives to the proposed action. Section 10.6 discusses benefits and costs. Section 10.7 includes the NRC staff's recommendation.

On September 18, 2008, the NRC received an application from the Detroit Edison Company (Detroit Edison) for a combined license (COL) for the proposed Enrico Fermi Unit 3 (Fermi 3) to be located on the Enrico Fermi Atomic Power Plant (Fermi) site. The site is located approximately 30 mi southwest of Detroit, Michigan, and 7 mi from the United States–Canada international border. A COL, which is a combined construction permit and operating license, is a Commission approval to build and operate one or more nuclear power facilities. In its application, Detroit Edison specified the economic simplified boiling water reactor (ESBWR) as the proposed reactor design for Fermi 3.

The U.S. Army Corps of Engineers (USACE) is participating as a cooperating agency in preparing this EIS. Detroit Edison will be required to obtain a Department of the Army (DA) permit to discharge dredged material and/or fill and to perform any work and/or place structures in, over, under and/or affecting waters of the United States, including wetlands associated with the Fermi 3 project and, as appropriate, to the USACE scope of analysis. As an initial step in this permitting process, Detroit Edison submitted a permit application (Detroit Edison 2011d) to the USACE on September 9, 2011. The USACE issued a public notice under file number LRE-2008-00443-1-S11 on December 23, 2011 (USACE 2011) to solicit comments from the public; Federal, State, and local agencies and officials; Indian Tribes; and other interested parties in order to consider and evaluate the impacts of regulated activities associated with the Fermi 3 project. The proposed activities and the comments received during the public comment period are under review and are being considered by the USACE to determine whether to issue, modify, condition, or deny a permit.

Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA; 42 USC 4321 *et seq.*) directs that an EIS is required for major Federal actions that significantly affect the quality of the human environment. Section 102(2)(C) of NEPA requires that an EIS include information on:

- The environmental impact of the proposed action;

- Any adverse environmental effects that cannot be avoided, should the proposal be implemented;
- Alternatives to the proposed action;
- The relationship among local short-term uses of the environment and the maintenance and enhancement of long-term productivity; and
- Any irreversible and irretrievable commitments of resources that would be involved if the proposed action is implemented.

The NRC has set forth regulations for implementing NEPA in Title 10 of the Code of Federal Regulations (CFR) Part 51. In 10 CFR 51.20, the NRC requires preparation of an EIS for issuance of COLs. Subpart C of 10 CFR Part 52 contains the NRC regulations related to COLs.

The proposed actions in the COL and USACE joint permit applications are (1) NRC issuance of a COL for construction and operation of a power reactor at the Fermi site in Monroe County, Michigan, and (2) the USACE issuance of a permit pursuant to Section 404 of the Federal Water Pollution Control Act (also referred to as the Clean Water Act) (33 USC 1251 *et seq.*), and Section 10 of the Rivers and Harbors Appropriation Act (RHAA) of 1899 (33 USC 403 *et seq.*). If issued, the USACE permit would authorize the impact on waters of the United States, including wetlands, from various regulated integral project components associated with the Fermi 3 facility, including access roads, a barge slip, blowdown pipelines, a makeup water pipeline, and cooling water intake structure.

The environmental review described in this EIS was conducted by a review team consisting of NRC staff, its contractors' staff, and staff from the USACE. During the course of preparing this EIS, the staff reviewed the Environmental Report (ER) submitted by Detroit Edison (Detroit Edison 2011a) and supplemental documentation; consulted with Federal, State, Tribal, and local agencies; and followed the guidance set forth in NUREG-1555, *Environmental Standard Review Plans* (NRC 2000) and Staff Memorandum *Addressing Construction and Preconstruction, Greenhouse Gas Issues, General Conformity Determinations, Environmental Justice, Need for Power, Cumulative Impact Analysis, and Cultural/Historical Resources Analysis Issues in Environmental Impact Statements* (NRC 2011). In addition, the NRC considered the public comments related to the environmental report received during the scoping process. These comments are provided in Appendix D of this EIS. The review team also considered public comments on the draft EIS. Those comments and responses are provided in Appendix E of the final EIS.

Included in this EIS are (1) the results of the NRC staff's analyses, which consider and weigh the environmental effects of the proposed action, (2) mitigation measures for reducing or avoiding adverse impacts, (3) the environmental impacts of alternatives to the proposed action, and (4) the NRC staff's recommendation regarding the proposed action based on its environmental review.

The USACE's role as a cooperating agency in the preparation of this EIS is to ensure to the maximum extent practicable that the information presented is adequate to fulfill the requirements of USACE regulations. Section 404(b)(1) of the Clean Water Act, "Guidelines for Specification of Disposal Sites for Dredged or Fill Material" (40 CFR Part 230), contains the substantive environmental criteria used by USACE in evaluating discharges of dredged or fill material into waters of the United States. Although the USACE, as part of the review team, concurs with the designation of impact levels for terrestrial and aquatic resources, insofar as waters of the United States are concerned, the USACE must conduct a quantitative comparison of impacts on waters of the United States as part of the 404(b)(1) evaluation. In addition, USACE's regulations (33 CFR 320.4) direct the USACE to conduct a public interest review (PIR) that requires consideration of a number of factors as part of a balanced evaluation process. USACE's PIR and 404(b)(1) Evaluation will be part of its permit decision document and such factors may not be fully addressed in this EIS. The USACE's independent regulatory permit decision documentation will reference relevant analyses from the EIS and, as necessary, include a supplemental PIR, CWA 404(b)(1) evaluation, evaluation of cumulative impacts, compensatory mitigation plan that is in accordance with 33 CFR Part 332, "Compensatory Mitigation for Losses of Aquatic Resources," and other information and evaluations that may be outside the NRC's scope of analysis and not included in this EIS, but are required by the USACE to support its permit decision.

Mitigation measures were considered for each environmental issue and are discussed in the appropriate sections. During its environmental review, the review team considered planned activities and actions that Detroit Edison indicated it and others would likely take if Detroit Edison receives a COL. In addition, Detroit Edison provided estimates of the environmental impacts resulting from the building and operation of a new nuclear unit on the Fermi site.

10.1 Impacts of the Proposed Action

In a final rule dated October 9, 2007 (72 *Federal Register* [FR] 57416), the Commission limited the definition of "construction" to those activities that fall within its regulatory authority in 10 CFR 51.4. Many of the activities required to build a nuclear power plant are not part of the NRC action to license the plant. Activities associated with building the plant that are not within the purview of the NRC action are grouped under the term "preconstruction." Preconstruction activities include clearing and grading, excavating, erection of support buildings and transmission lines, and other associated activities. Because the preconstruction activities are not part of the NRC action, their impacts are not reviewed as a direct effect of the NRC action. Rather, the impacts of the preconstruction activities are considered in the context of cumulative impacts. Although the preconstruction activities are not part of the NRC action, they support or are requisite to the NRC action. In addition, certain preconstruction activities require permits from the USACE, as well as from other Federal, State, and local agencies.

Chapter 4 of this EIS describes the relative magnitudes of impacts related to preconstruction and construction activities, and a summary of impacts is given in Table 4-22. Impacts associated with operation of the proposed facilities are discussed in Chapter 5 of this EIS and summarized in Table 5-37. Chapter 7 describes the impacts associated with preconstruction and construction activities and operation of Fermi 3 when considered along with the cumulative impacts of other past, present, and reasonably foreseeable future projects in the geographical region around the Fermi site.

10.2 Unavoidable Adverse Environmental Impacts

Section 102(2)(C)(ii) of NEPA requires that an EIS include information on any adverse environmental effects that cannot be avoided if the proposal is implemented. Unavoidable adverse environmental impacts are those potential impacts of the NRC and USACE action that cannot be avoided and for which no practical means of mitigation are available.

10.2.1 Unavoidable Adverse Impacts during Preconstruction and Construction

Chapter 4 discusses in detail the potential impacts from preconstruction and construction of the proposed new Fermi 3 nuclear unit at the Fermi site and presents mitigation and controls intended to lessen the adverse impacts. Table 10-1 presents the unavoidable adverse impacts associated with construction and preconstruction activities to each of the resource areas evaluated in this EIS, as well as the mitigation measures that would reduce the impacts. Those impacts remaining after mitigation is applied (e.g., avoidance and minimization, but not including compensatory mitigation) are identified in Table 10-1 as unavoidable adverse impacts. Unavoidable adverse impacts are the result of both construction and preconstruction activities, unless otherwise noted. The impact determinations in Table 10-1 are for the combined impacts of construction and preconstruction.

The unavoidable adverse impacts are primarily attributable to preconstruction activities due to the initial land disturbance from clearing the land, excavation, filling wetlands and waterways, adding impervious surfaces, and dredging.

The primary unavoidable adverse environmental impacts during building activities would be related to land use and terrestrial habitat loss. Approximately 301 acres (ac) on the Fermi site would be disturbed by the Fermi 3 project. Of that, approximately 197 ac would consist of presently undisturbed habitat, including approximately 34.5 ac of wetlands and approximately 5.2 ac of open water. About 8.3 ac of wetland habitat would be permanently filled. Other wetland impacts would be temporary or involve conversion of one wetland type to another. Temporary wetland impacts related to fill for construction laydown areas would include the temporary loss of wetland functions from the time the wetland is filled until it is rehabilitated.

Table 10-1. Unavoidable Adverse Environmental Impacts from Preconstruction and Construction of Fermi 3

Resource Area	Adverse Impacts	Actions to Mitigate Impacts[a]	Unavoidable Adverse Impacts
Land Use	SMALL	Comply with requirements of applicable Federal, State, local permits, and zoning requirements. Implement erosion control measures described in the Fermi 3 SESC Plan.	Onsite: 301 ac Offsite (transmission lines): 1069 ac. Also needs approximately 19 ac to expand Milan Substation.
Water Use	SMALL	None.	Lake Erie water would be used for concrete batch plant operation, temporary fire protection, dust control, and sanitary needs, but needs would be small enough to not require a review under the Great Lakes Compact. Dewatering systems would depress the water table in the general vicinity, but the impacts would be localized and temporary.
Water Quality	SMALL	Implement the construction SESC Plan to limit sedimentation of drainage to Lake Erie. Implement dewatering plan to minimize the amount of water discharged. Develop and implement a PIPP. Comply with requirements of CWA Section 404 permit, Section 402(p) NPDES permit, Section 10 of the RHAA permit, and Michigan Compiled Law Act 451 Parts 303 and 325 permit. Clean Water Act Section 401 Water Quality Certification and CZMA Certification.	Hydrological alterations associated with building on and near the Fermi site would include dredging for the intake and discharge structures, altering the surface topography and hydrology (e.g., site grading, laydown areas, filling of onsite water bodies), and dewatering the excavation in order to construct the nuclear facilities. Offsite alterations would be associated with the proposed new or expanded transmission line corridors where they cross streams and wetlands.

Table 10-1. (contd)

Resource Area	Adverse Impacts	Actions to Mitigate Impacts[(a)]	Unavoidable Adverse Impacts
Terrestrial and Wetland Resources	SMALL to MODERATE (potential for MODERATE limited to eastern fox snake)	Observe BMPs and obtain appropriate Federal and State permits and certifications prior to preconstruction and construction activities. Comply with requirements of permits for RHAA Section 10, CWA Section 404, and Michigan Compiled Law Act 451 Parts 303 and 325 to minimize and mitigate impacts on aquatic resources, including jurisdictional wetlands. Wetland mitigation would be developed in coordination with MDEQ and USACE (Appendix K). Rehabilitate approximately 23.7 ac of temporarily affected onsite wetlands and restore and conduct offsite mitigation to compensate for wetland function loss. Follow MDNR construction limitation recommendations for bald eagle nests. Transplant American lotus from areas of disturbance. Implement Habitat and Species Conservation Plan to mitigate building impacts on the eastern fox snake. Develop NDCT lighting plan in coordination with FAA and FWS to minimize avian impacts.	Onsite: approximately 197 ac of habitat would be disturbed, including approximately 34.5 ac of wetlands and 5.2 ac of open water. About 8.3 ac of impacted wetlands and 5.2 ac of impacted open water would be permanently filled. For the temporarily filled wetlands, a temporary loss of function would occur from the time wetland is filled until the time the wetland is rehabilitated. Offsite (transmission lines): 1069 ac of habitat would be disturbed. Approximately 19 ac of additional habitat would be used to expand Milan Substation.

Table 10-1. (contd)

Resource Area	Adverse Impacts	Actions to Mitigate Impacts[(a)]	Unavoidable Adverse Impacts
Aquatic Ecology	SMALL	Implement measures in the SESC permit and NPDES permit. Implement measures in the PIPP. Implement measures outlined in the RHAA Section 10 permit, CWA Section 404 permit, and Michigan Compiled Law Act 451 Part 303 and 325 permit.	Minor impacts on aquatic resources on and near the Fermi site from dredging for the intake and discharge structures, loss of lake bottom habitat due to discharge and intake structures, alterations in onsite surface topography and hydrology, and filling of some onsite water bodies. Minor impacts to offsite aquatic resources from building activities where proposed new or expanded transmission line corridors cross streams and wetlands.
Socioeconomics			
Physical	SMALL	Implement standard noise control measures for construction equipment (silencers). Limit the types of construction activities during nighttime and weekend hours. Notify all affected neighbors of planned activities. Establish a construction noise monitoring program. Control fugitive dust through construction watering. Control vehicle emissions through regularly scheduled maintenance. Add surfacing on local roadways to prevent deterioration from construction vehicles.	None.

Table 10-1. (contd)

Resource Area	Adverse Impacts	Actions to Mitigate Impacts[(a)]	Unavoidable Adverse Impacts
Socioeconomics (contd)			
Demography	No adverse impact. Impact is beneficial.	None.	None.
Community economics	No adverse impacts. All impacts are beneficial.	None.	None.
Infrastructure and services	SMALL (most impacts) to MODERATE (traffic)	Traffic control and management measures would reduce traffic congestion impacts. These would be developed in conjunction with MDOT, MCRC, and other appropriate agencies.	Increase in local traffic during construction, resulting in increased congestion during the peak construction period.
Environmental Justice	SMALL	None.	None.
Historic and Cultural Resources	MODERATE	Mitigate adverse effects from demolition of recommended NRHP-eligible Fermi 1 according to stipulations in the MOA developed as a result of consultation among the NRC, SHPO, Detroit Edison, and Monroe County Community College. Inadvertent discovery procedures will be in place prior to ground-disturbing activities. ITC*Transmission* would be expected to conform to regulatory requirements pertaining to historic and cultural resources that could be affected by transmission line development.	Demolition of Fermi 1.

Table 10-1. (contd)

Resource Area	Adverse Impacts	Actions to Mitigate Impacts[(a)]	Unavoidable Adverse Impacts
Air Quality	SMALL	Implement BMPs to reduce vehicle and equipment exhaust emissions and fugitive dust in accordance with all applicable State and Federal permits and regulations.	Vehicle and equipment exhaust emissions and fugitive dust emissions from operation of earthmoving equipment would be sources of air pollution, but impacts would be temporary.
Nonradiological Health	SMALL	Comply with Federal, State, and local regulations governing construction activities and construction vehicle emissions; comply with Federal and local noise-control ordinances; comply with Federal and State occupational safety and health regulations; implement traffic management plan and noise monitoring program.	Temporary public health impacts from exposure to fugitive dust and vehicular emissions, noise, and increased occupational injuries and traffic accidents during the building phase.
Radiological Health	SMALL	Maintain doses to construction workers below NRC public dose limits.	Small dose to construction workers that would be less than NRC public dose limit.
Nonradioactive Wastes	SMALL	Manage hazardous and nonhazardous solid wastes according to county, State, and Federal handling and transportation regulations; implement recycling and BMPs to minimize waste generation.	Minor decrease in capacity of waste treatment and disposal facilities. Minor discharges to outfall and to atmosphere.

(a) BMPs = best management practices; CWA = Clean Water Act; CZMA = Coastal Zone Management Act; FAA = Federal Aviation Administration; FWS = U.S. Fish and Wildlife Service; MCRC = Monroe County Road Commission; MDEQ = Michigan Department of Environmental Quality; MDNR = Michigan Department of Natural Resources; MDOT = Michigan Department of Transportation; MOA = Memorandum of Agreement; NPDES = National Pollutant Discharge Elimination System; NRHP = *National Register of Historic Places*; PIPP = Pollution Incident Prevention Plan; NDCT = natural draft cooling tower; RHAA = Rivers and Harbors Appropriation Act; SESC = Soil Erosion and Sedimentation Control; SHPO = State Historic Preservation Office.

Permanent and temporary impacts resulting from building offsite facilities (transmission lines) could total 1069 ac, plus approximately 19 ac to expand the Milan Substation. Additional areas could be disturbed on a short-term basis as a result of temporary activities and facilities and laydown areas.

As part of USACE regulations, Detroit Edison must demonstrate to the USACE why the proposed project could not be reconfigured or reduced in scope to minimize or avoid adverse impacts on waters of the United States. In order to comply with the U.S. Environmental Protection Agency (EPA) 404(b)(1) Guidelines, proposed aquatic resource fill activities associated with building Fermi 3 would have to demonstrate that no practicable alternative with less damaging impacts is available. Detroit Edison has prepared and submitted to USACE a proposed alternative analysis that identifies the company's proposed Least Environmentally Damaging Practicable Alternative (LEDPA) to satisfy these requirements (Detroit Edison 2011b; see Appendix J of this EIS). In addition to avoiding impacts on wetlands by siting facilities in nonwetland areas to the extent practicable, and minimizing wetland impacts by avoiding wetland fragmentation and maintaining existing hydrology to the extent practicable, Detroit Edison has proposed mitigation that calls for the restoration of wetlands, off-site in the coastal zone of western Lake Erie, to compensate for all but 1.9 ac of the unavoidable wetland losses, including temporal losses due to temporary wetlands impacts at the Fermi site (Appendix K) (Detroit Edison 2012a). Detroit Edison will comply with State and Federal wetland permit conditions with respect to mitigating wetland impacts and restoring wetland habitat to offset the permanent loss of wetlands resulting from building Fermi 3 (Detroit Edison 2011a).

The eastern fox snake (*Pantherophis gloydi*) is State-listed as threatened and occurs on the site in the project area. Detroit Edison has developed a Habitat and Species Conservation Plan (Detroit Edison 2012b) that identifies mitigation of direct impacts from construction and preconstruction on the snake. This plan would mitigate the potential for building-related mortality and would limit the amount of fox snake habitat disturbed during construction and preconstruction.

The impacts from building the proposed Fermi 3 on onsite historic properties would be MODERATE if the Fermi 1 structure was present when Fermi 3 preconstruction activities would begin. The NRC, in consultation with the Michigan State Historic Preservation Office (SHPO), has determined that work associated with the proposed project would have an adverse effect on Fermi 1. The NRC staff consulted with the Michigan SHPO, Detroit Edison, and Monroe County Community College to develop a Memorandum of Agreement (MOA) to resolve the adverse effects on Fermi 1 pursuant to 36 CFR 800.6(c). Measures to mitigate adverse effects on Fermi 1 consist of (1) preparation of recordation documentation for the Fermi 1 structure consistent with the Michigan SHPO's *Documentation Guidelines* and (2) development of a public exhibit on the history of Fermi 1 (NRC 2012a). These mitigation measures are described in greater detail in Section 2.7.4.

10.2.2 Unavoidable Adverse Impacts during Operation

Chapter 5 provides a detailed discussion of the potential impacts from operation of the proposed Fermi 3 at the Fermi site. The unavoidable adverse impacts related to operation are listed and summarized in Table 10-2.

Unavoidable adverse impacts on land use from operation of Fermi 3 would be minimal and associated with the offsite development that is expected to occur to accommodate new workers at the plant. Land use changes would include the conversion of some land in nearby areas to housing and retail development to serve plant workers. Property tax revenue from Fermi 3 could lead to additional growth in Monroe County as a result of infrastructure improvements (e.g., new roads and utility services).

Fermi 3 operations would result in an average consumptive use of approximately 7.6 billion gallons (gal) of Lake Erie water per year. This represents approximately 4.1 percent of the current consumptive use in the Lake Erie basin. Surface water quality impacts could result from stormwater runoff and cooling tower blowdown discharge. These water-related impacts would be mitigated through compliance with the site's National Pollution Discharge Elimination System (NPDES) permit, Michigan Department of Environmental Quality (MDEQ) Large Quantity Water Withdrawal Permit, Clean Water Act (CWA) Section 404 permit, MDEQ Water Quality Standards Certification, and through Detroit Edison's adherence to best management practices (BMPs) and the Stormwater Pollution Prevention Plan (SWPPP). Remaining adverse impacts on water use and water quality during operation would be minimal and limited to increased use of surface water for cooling, potential increases in sedimentation in surface water bodies, and potential surface water and groundwater contamination from inadvertent spills.

Unavoidable adverse impacts on terrestrial ecology resources would include the increased risk of birds and bats colliding with structures; the avoidance of the site by wildlife as a result of noise; the potential vehicle-related mortality of wildlife, including the State-listed eastern fox snake; and the maintenance-related disturbance of habitats within transmission line corridors. The eastern fox snake (*Pantherophis gloydi*) is State-listed as threatened and occurs on the site in the project area. Detroit Edison has developed a Conservation and Monitoring Plan (Detroit Edison 2012c) that identifies mitigation measures to reduce direct impacts on the snake from traffic caused by operation of Fermi 3. Implementation of the plan could reduce impacts to minor levels.

Unavoidable adverse impacts on aquatic ecology resources would include a potential for entrainment, impingement, and thermal loading to Lake Erie. However, the operation of Fermi 3 would not noticeably alter the aquatic resources of the lake. Other impacts from operational

Table 10-2. Unavoidable Adverse Environmental Impacts from Operation of Fermi 3

Resource Area	Adverse Impacts	Actions to Mitigate Impacts[a]	Unavoidable Adverse Impacts
Land Use	SMALL	Adhere to applicable zoning regulations of Frenchtown Charter Township as well as Monroe County land use plans. Minimize potential impacts through use of BMPs and compliance with SWPPP requirements. Incorporate drift eliminators into the design of the cooling towers to minimize the potential for salt deposition, especially on nearby agricultural lands.	Permanent commitment of approximately 155 ac onsite, and 1069 ac within the offsite transmission corridor for the operational life of Fermi 3. Approximately 19 ac offsite would be converted for the expanded Milan Substation. Some offsite land use changes are expected to indirectly result from operational activities, including the conversion of some land in surrounding areas to housing and retail developments to serve plant workers.
Water Use	SMALL	Comply with MDEQ Large Quantity Water Withdrawal Permit requirements. Use Best Available Technology to reduce evaporative losses from cooling towers.	Average consumptive use of approximately 7.6 billion gal per year from Lake Erie. No groundwater use or dewatering during operations.
Water Quality	SMALL	Develop and implement the SWPPP to manage stormwater runoff and prevent erosion. Develop and implement a PIPP. Comply with requirements of CWA Section 404 permit, Section 402(p) NPDES permit, RHAA Section 10 permit, and MDEQ Act 451 Part 303 and 325 permit. CWA Section 401 water quality certification and CZMA certification.	Surface water impacts would include thermal, chemical, and radiological wastes and physical changes in Lake Erie resulting from stormwater runoff and effluents discharged by the proposed plant. No unavoidable adverse impacts on groundwater quality are anticipated during operations.

Table 10-2. (contd)

Resource Area	Adverse Impacts	Actions to Mitigate Impacts[(a)]	Unavoidable Adverse Impacts
Water Quality (contd)		Design cooling water discharge diffuser to minimize the size of the thermal mixing zone, in both lateral and vertical extent. Design the cooling water discharge diffuser to minimize bottom scour and associated turbidity. Riprap may be required to reduce bottom scour. Locate and orient the discharge structure to minimize siltation resulting from turbidity at the diffuser ports. Diffuser design would reduce concentrated silt buildup through discharge points spaced approximately 17 ft apart.	
Terrestrial and Wetland Resources	SMALL to MODERATE (potential for MODERATE limited to eastern fox snake)	Implement Conservation and Monitoring Plan to mitigate operational impacts on the eastern fox snake, including measures to reduce traffic-induced mortality. Implement measures in the SWPPP, PIPP, and permits for RHAA Section 10, CWA Section 404, and MDEQ Act 451 Parts 303 and 325 to minimize and mitigate impacts on aquatic resources, including jurisdictional wetlands. Wetland mitigation would be developed in coordination with MDEQ and USACE (Appendix K).	Onsite: long-term maintenance of approximately 155 ac of developed land. Offsite: maintenance of 1069 ac in the transmission line corridor. Approximately 19 ac would be converted for the expanded Milan Substation. Increased risk of birds and bats colliding with structures; the avoidance of the site by wildlife as a result of noise; the potential vehicle-related mortality of wildlife.

Table 10-2. (contd)

Resource Area	Adverse Impacts	Actions to Mitigate Impacts[(a)]	Unavoidable Adverse Impacts
Terrestrial and Wetland Resources (contd)		Develop and implement the SWPPP to manage stormwater runoff and prevent erosion. Develop and implement a PIPP. Use drift eliminators to keep solids deposition (assumed as salt) from cooling towers below NUREG-1555 significance level. Develop NDCT lighting plans in consultation with the FAA and FWS to minimize avian impacts. Although not under Detroit Edison's control, ITC*Transmission* would be expected to conform to industry-standard BMPs for transmission ROW maintenance to reduce impacts on terrestrial and wetland systems.	
Aquatic Ecology	SMALL	Implement measures in the SWPPP, PIPP, and permits for RHAA Section 10, CWA Section 404, and MDEQ Act 451 Parts 303 and 325. Use a closed cycle cooling system to reduce impingement and entrainment of aquatic organisms. Maintain a low intake velocity ($\leq$0.5 fps).	Minor effects to aquatic resources in Lake Erie from operation of the cooling system due to thermal discharges, impingement, and entrainment.

Table 10-2. (contd)

Resource Area	Adverse Impacts	Actions to Mitigate Impacts[(a)]	Unavoidable Adverse Impacts
Aquatic Ecology (contd)		Design intake screens with appropriate mesh size and include a trash rack. Regular washing of the intake screens will minimize impingement mortality. Use a backwash system that would remove impinged organisms from intake screens and return them to the lake alive using a fish return system to Lake Erie outside the intake bay area. If a shutdown of the proposed facility is planned during winter months, reduce the discharge of cooling water gradually in order to reduce the potential for cold shock to aquatic organisms. Design cooling water discharge diffuser to minimize the size of the thermal mixing zone in both lateral and vertical extent. Compliance with NPDES permit effluent limits and use of one Lake Erie outfall for Fermi 3 would minimize chemical impacts. Avoid the use of phosphorus-containing corrosion and scale inhibitors in order to reduce nutrient loading that could contribute to algal blooms. Minimize scouring through the use of riprap around the submerged discharge port, if necessary, and use an upward orientation of discharge ports.	

Table 10-2. (contd)

Resource Area	Adverse Impacts	Actions to Mitigate Impacts[(a)]	Unavoidable Adverse Impacts
Aquatic Ecology (contd)		Although not under Detroit Edison's control, ITC*Transmission* would be expected to conform to industry-standard BMPs that are protective of aquatic systems for transmission ROW maintenance. Design transmission lines to avoid wetlands or other water bodies to the maximum extent possible. Any unavoidable impacts would be subject to regulatory permit conditions.	
Socioeconomics			
Physical	SMALL	Sound attenuation measures as part of the standard mechanical draft cooling tower should be sufficient to limit the noise impact. Infrequent operation of the mechanical draft cooling towers would further reduce noise impacts. Although most operational noise is expected to be similar to ambient noise levels, employees would be trained and appropriately protected to reduce their risk of noise exposure. Comply with all relevant OSHA regulations during operations of Fermi 3 Implement traffic control and management measures to reduce the potential for traffic-related accident and health impacts.	Small increase in noise levels and traffic. Cooling tower and associated condensate plume would be visible offsite.

Table 10-2. (contd)

Resource Area	Adverse Impacts	Actions to Mitigate Impacts[a]	Unavoidable Adverse Impacts
Demography	No adverse impact. Impact is beneficial.	None.	None.
Community economics	No adverse impacts. All impacts are beneficial.	None.	None.
Infrastructure and services	SMALL (most impacts) to MODERATE (traffic during outages)	Implement roadway improvements either during the construction period or as recommended by MCRC or MDOT following review of the site development plan.	Minor impacts on transportation, recreation, housing, public services, and education associated with population increase offset by increase in tax revenue. Increase in local traffic during operations, resulting in increased congestion, especially during outages.
Environmental Justice	SMALL	None.	None.
Historic and Cultural Resources	SMALL	Inadvertent discovery procedures would be in place to minimize impacts on potential onsite historic resources.	Minor impacts on offsite historical properties associated with visible condensate plume from cooling towers.
Air Quality	SMALL	Comply with Federal, State, and local air permits. Use cooling-tower drift eliminators. Water, reseed, or pave areas used for construction. Treat cooling water prior to discharge to reduce salt released into the atmosphere.	Slight increase in certain criteria pollutants and carbon dioxide from plant auxiliary combustion equipment (e.g., diesel generators). Plumes and drift from cooling towers. Minimal impacts on vegetation, soils, electrical equipment, and transmission lines.

Table 10-2. (contd)

Resource Area	Adverse Impacts	Actions to Mitigate Impacts[(a)]	Unavoidable Adverse Impacts
Nonradiological Health	SMALL	Use of biocides in the cooling system. Comply with OSHA standards for Fermi 3 operational workers. Control vehicle emissions by regularly scheduled maintenance. Use standard sound attenuation measures for mechanical draft cooling towers. These should be sufficient to limit the noise impact. Infrequent operation of the mechanical draft cooling towers would further reduce noise impacts. Monitor the release of nonradiological waste emissions and effluents. Transmission line design would be compliant with Electric Safety Code standards.	Minor increase in noise levels at nearest sensitive receptor. Minor increases in the potential for occupational injuries and traffic accidents.
Radiological Health	SMALL	Maintain doses to members of the public below NRC and EPA standards; maintain worker doses below NRC limits and ALARA; keep doses to biota other than humans well below NCRP and IAEA guidelines.	Small radiation doses (below NRC and EPA standards) to members of the public; ALARA doses to workers; and biota doses well below NCRP and IAEA guidelines.

Table 10-2. (contd)

Resource Area	Adverse Impacts	Actions to Mitigate Impacts[(a)]	Unavoidable Adverse Impacts
Fuel Cycle (including radioactive waste), Transportation, and Decommissioning	SMALL[(b)]	Industry-wide changes in technology are reducing fuel cycle impacts. Implement waste-minimization program. Comply with NRC and DOT regulations.	Small impacts from fuel cycle as presented in Table S-3, 10 CFR Part 51. Small impacts from carbon dioxide, radon, and technetium-99. Small radiological doses that are within NRC and DOT regulations from transportation of fuel and radwaste. Small impacts from decommissioning as presented in NUREG-0586 (NRC 2002).
Nonradioactive Waste	SMALL	Manage hazardous and nonhazardous solid wastes according to county and State handling and transportation regulations. Treat sanitary wastewater and discharge it to Monroe Metropolitan Wastewater Treatment Facility for treatment under an existing permit. Implement stormwater management plan. Implement recycling and waste minimization program.	Minor decrease in the capacity of waste treatment and disposal facilities. Minor increases in stormwater runoff, liquid discharges, and air emissions maintained within permit limits.

(a) ALARA = as low as reasonably achievable; BMPs = best management practices; CWA = Clean Water Act; CZMA = Coastal Zone Management Act; DOT = U.S. Department of Transportation; EPA = U.S. Environmental Protection Agency; FAA = Federal Aviation Administration; fps = feet per second; FWS = U.S. Fish and Wildlife Service; IAEA = International Atomic Energy Agency; MCRC = Monroe County Road Commission; MDEQ = Michigan Department of Environmental Quality; MDNR = Michigan Department of Natural Resources; MDOT = Michigan Department of Transportation; MOA = Memorandum of Agreement; NCRP = National Council on Radiation Protection and Measurements; NPDES = National Pollutant Discharge Elimination System; NRHP = *National Register of Historic Places*; PIPP = Pollution Incident Prevention Plan; NDCT = natural draft cooling tower; NRC = U.S. Nuclear Regulatory Commission; OSHA = Occupational Safety and Health Administration; RHAA = Rivers and Harbors Appropriation Act; ROW = right-of-way; SESC = Soil Erosion and Sedimentation Control; SHPO = State Historic Preservation Office; SWPPP = Stormwater Pollution Prevention Plan; USACE = U.S. Army Corps of Engineers.

(b) This conclusion is conditional on the results of the ongoing rulemaking to update the Waste Confidence Decision and Rule (see Section 6.1.6).

activities, such as cooling tower drift, maintenance dredging, and transmission line corridor maintenance, would also be minor.

Although minor impacts on transportation, recreation, housing, public services, and education would be associated with an increase in population related to Fermi 3 operations, these adverse impacts would be offset by an increase in tax revenue. Because the site is located in a predominantly agricultural area, is light industrial site by its nature, and is well masked by vegetation in most directions, its impacts on aesthetics would be minor. Local traffic would increase during operations, resulting in increased congestion, especially during outages. Impacts on local roadways would be mitigated by implementation of roadway improvements either during the construction period or as recommended by the Monroe County Road Commission (MCRC) or Michigan Department of Transportation (MDOT) following review of the site development plan.

The review team found no evidence of unique characteristics or practices among current minority and low-income populations that would make them differentially affected by operational activities. No unusual resource dependencies were identified in the minority and low-income populations in the region.

The cooling tower condensate plume would be visible within the visual setting of 21 architectural resources that have been determined or recommended eligible for listing in the *National Register of Historic Places* (NRHP). The existing visual setting of these properties, which are all located offsite but within the indirect area of potential effect, currently includes existing condensate plumes from the active Fermi 2 power plant facilities on the Fermi property and from the active Monroe County coal-fired power plant to the south along the Lake Erie shoreline. The Fermi 3 cooling tower plume would be consistent with the existing visual settings and views from these 21 architectural resources, and there would be no new significant visual impacts that would affect their NRHP-eligibility determination or recommendations for their eligibility. Finally, Detroit Edison has agreed to follow its unanticipated discovery procedures if historic or cultural resources are discovered during operation activities. USACE would also include an unanticipated discovery procedure requirement as a condition of its permit, if issued, relative to regulated locations and activities associated with the Fermi project.

Unavoidable adverse air quality impacts would be negligible, and pollutants emitted during operations would not be significant. Unavoidable adverse nonradiological health impacts on members of the public from operations – including impacts related to etiological agents, noise, electromagnetic fields (EMFs), occupational health, and transportation of materials and personnel – would be minimal, because Detroit Edison would implement controls and measures in compliance with Federal and State regulations.

Unavoidable adverse nonradiological health impacts would be related to minor increases in noise levels at the nearest sensitive receptor, and minor increases in the potential for occupational injuries and traffic accidents.

Radiological doses to members of the public from operation of proposed Fermi 3 would be below the NRC and EPA standards. Doses to workers from operation of Fermi 3 would also be below NRC limits and maintained as low as reasonably achievable (ALARA). The radiation protection measures designed to maintain doses to members of the public below NRC and EPA standards would also ensure that doses to biota other than humans would be well below National Council on Radiation Protection and Measurements (NCRP) and International Atomic Energy Agency (IAEA) guidelines.

Impacts from the nuclear fuel cycle would be bounded by the impacts in presented in Table S-3 of 10 CFR Part 51, and are therefore small. Impacts from carbon dioxide, radon, and technetium-99 were not addressed in Table S-3; Section 6.1 of this EIS addresses those impacts and concludes that they are small. Radiological doses from transportation of fuel and radiological waste would be within NRC and U.S. Department of Transportation (DOT) regulations, and therefore small. Impacts from decommissioning are addressed in Section 6.3 of this EIS; they are also consistent with the impacts presented in NUREG-0586 (NRC 2002), and are therefore small.

10.3 Relationship between Short-Term Uses and Long-Term Productivity of the Human Environment

Section 102(2)(C)(iv) of NEPA requires that an EIS include information on the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity.

The local use of the human environment by the proposed project can be summarized in terms of the unavoidable adverse environmental impacts of preconstruction, construction, and operations and the irreversible and irretrievable commitments of resources. With the exception of the consumption of depletable resources as a result of building and operating Fermi 3, these uses may be classified as short-term. The principal short-term benefit of the plant is represented by the production of electrical energy; and the economic productivity of the site, when used for this purpose, would be extremely large when compared to the short-term productive use of that portion of the Fermi site that would be developed for Fermi 3. The portion of the Fermi site where Fermi 3 would be built is not currently available for agricultural or industrial uses until Fermi 1 and 2 are decommissioned.

The maximum long-term impact on productivity would result if the plant was not immediately dismantled at the end of its operations and the land occupied by the plant structures was thus not be available for any other use. However, it is expected that the enhancement of regional productivity that would result from the electrical energy produced by Fermi 3 would lead to a correspondingly large increase in regional long-term productivity that would not be equaled by any other long-term use of the site. In addition, most long-term impacts resulting from land use preemption by plant structures could be eliminated by removing these structures or by converting them to other productive uses. Once Fermi 3 was shut down, it would be decommissioned according to NRC regulations. Once decommissioning was complete and the NRC license was terminated, the site would be available for other uses.

10.4 Irreversible and Irretrievable Commitments of Resources

Section 102(2)(C)(v) of NEPA requires that an EIS include information on any irreversible and irretrievable commitments of resources that would occur if the proposed actions were implemented. The term "irreversible commitments of resources" refers to environmental resources that would be irreparably changed by building and operating Fermi 3 and that could not be restored at some later time to what their state was before the relevant activities occurred. "Irretrievable commitments of resources" refers to materials that would be used for or consumed by Fermi 3 in such a way that they could not, by practical means, be recycled or restored for other uses. The environmental resources and the anticipated impacts on them are discussed in Chapters 4, 5, and 6 of this EIS.

10.4.1 Irreversible Commitments of Resources

Irreversible commitments of environmental resources resulting from the construction, preconstruction, and operation of Fermi 3, in addition to the materials used for the nuclear fuel, are described below.

10.4.1.1 Land Use

Land committed to the disposal of radioactive and nonradioactive wastes is committed to that use and cannot be used for other purposes. The land used for Fermi 3, with the exception of any permanently filled wetlands, is not irreversibly committed because once Fermi 3 ceases operations and the plant is decommissioned in accordance with NRC requirements, the land supporting the facilities could be returned to other industrial or nonindustrial uses. Prime farmland contained within the roughly 64-ac agricultural field in the west-southwest corner of the Fermi site would either be irreversibly converted to developed land or experience surface soil damage during temporary use such that the soil properties responsible for the prime farmland designation would be irreversibly damaged. Most prime farmland within the proposed transmission line corridors would not be lost, as agricultural use remains possible for land traversed by transmission lines.

10.4.1.2 Water Use and Quality

Approximately 7.6 billion gal per year of water from Lake Erie would be lost through consumptive use as evaporative and drift losses from the natural draft cooling tower during operation. Some chemicals, including very low concentrations of radioisotopes, would be released from the facility into the surface water. Because these releases would conform to applicable Federal and State regulations, their impact on public health and the environment would be limited. The review team expects no irreversible commitment of water resources because Fermi 3 releases would be made in accordance with duly issued permits.

10.4.1.3 Terrestrial and Aquatic Resources

Preconstruction and construction activities would permanently convert some portions of terrestrial and aquatic habitats on the Fermi site, which would temporarily adversely affect the abundance and distribution of local terrestrial and aquatic species. Irretrievable commitments of resources include losses of approximately 5.2 ac of open water habitat and approximately 51 ac of currently undeveloped land, including 8.3 ac of wetlands. Approximately 146 ac of habitat (including 23.7 ac of wetlands) would be temporarily disturbed during preconstruction and construction, but these areas would not support new facilities once building was complete. Although considered “temporary impacts,” these impacts may persist for a long period of time before forested habitats that are ecologically similar to mature forest in the region could develop through natural successional processes, and temporarily filled wetland habitats could return to pre-project functional levels after site rehabilitation. In addition, vegetation cutting to maintain the new transmission corridor will permanently convert forested wetlands to other wetland types, resulting in a permanent alteration in wetland functions provided by the impacted wetlands.

Dredging and the laying of pipes would temporarily affect benthic habitats in Lake Erie. Most of these areas are expected to recover, although periodic maintenance dredging would interrupt complete recovery near the barge slip. The intake and discharge structures on the lake bottom will result in permanent loss of lake bottom habitat. No irretrievable losses of resources detectable at the population level are expected to result from operations, and any impacts that would result from operations would cease post operations. Building and maintaining transmission line rights-of-way (ROWs) would result in the conversion of about 1069 ac of upland and wetland habitat to maintained early successional habitats (grassland and shrubland). Approximately 19 ac of additional upland habitat would be developed permanently to support an expanded Milan Substation. The ability to recover these habitats once the transmission lines and expanded substation were no longer needed is possible, but could require several decades. The majority of terrestrial and aquatic habitat losses would be due to preconstruction activities.

10.4.1.4 Socioeconomic Resources

The review team expects that no irreversible commitments would be made to socioeconomic resources, since they would be reallocated for other purposes once the plant was decommissioned.

10.4.1.5 Historic and Cultural Resources

Historic and cultural resources could be permanently altered by the preconstruction and construction of Fermi 3 and associated transmission lines. Fermi 1 is considered eligible for listing in the NRHP. Detroit Edison has not determined whether or not to remove Fermi 1 after the facility is decommissioned and its NRC license is terminated. If the Fermi 1 external structure is present when Fermi 3 building activities begin, then demolition of Fermi 1 would be required to construct Fermi 3, and demolition would represent an irreversible commitment of resources. Visual impacts (alteration of the existing landscape) would occur during operations.

10.4.1.6 Air Quality

Dust and other emissions, such as vehicle exhaust, would be released to the air during preconstruction and construction activities. During operations, vehicle exhaust emissions would continue, and other air pollutants and chemicals, including very low concentrations of radioactive gases and particulates, would be released from the facility into the air. Because these releases would conform to applicable Federal and State regulations, their impact on public health and the environment would be limited. The review team expects no irreversible commitment of air resources because all Fermi 3 releases would be in accordance with duly issued permits.

10.4.2 Irretrievable Commitments of Resources

In ER Revision 2 (Detroit Edison 2011a), Detroit Edison estimated the irretrievable commitment of resources for the construction of Fermi 3 as follows:

- 460,000 yd^3 of concrete;
- 46,000 tons of rebar;
- 25,000 tons of structural steel;
- 690,000 ft of piping;
- 220,000 ft of cable tray;
- 1,200,000 ft of conduit;
- 1,400,000 ft of power cable;

- 5,400,000 ft of control wire; and
- 740,000 ft of process and instrument tubing.

The review team expects that the construction materials used and the energy consumed for Fermi 3, while irretrievable, would be of small consequence with respect to the quantities of such resources that are available.

Uranium would be irretrievably committed during operation of Fermi 3. The availability of uranium ore and existing stockpiles of highly enriched uranium in the United States and Russia that could be processed into fuel is sufficient (OECD, NEA, and IAEA 2008), and the irreversible and irretrievable commitment is expected to be negligible.

10.5 Alternatives to the Proposed Action

Alternatives to the proposed action are discussed in Chapter 9 of this EIS. Alternatives considered are the no action alternative, energy production alternatives, system design alternatives, and alternative sites. For the purposes of the USACE's 404(b)(1) alternative evaluation, Detroit Edison's proposed alternative analysis and proposed Least Environmentally Damaging Practicable Alternative (LEDPA), as presented for compliance with the 404(b)(1) Guidelines, are discussed in Appendix J. The no action alternative, described in Section 9.1, refers to a scenario in which the NRC would deny the request for the COL. If no other power plant was built or if no electrical power supply strategy was implemented to take its place, the electrical capacity to be provided by the project would not become available, and the benefits (electricity generation) associated with the proposed action would not occur, so the need for power would not be met.

Alternative energy sources are described in Section 9.2. Alternatives that would not require additional generating capacity are described in Section 9.2.1. Detailed analyses of coal- and natural-gas-fired alternatives are provided in Section 9.2.2. Other energy sources are discussed in Section 9.2.3. A combination of energy alternatives is discussed in Section 9.2.4.

The review team concluded that none of the alternative energy options were both (1) consistent with Detroit Edison's objective of building baseload generation units and (2) environmentally preferable to the proposed action.

Alternative sites are discussed in Section 9.3. The cumulative impacts of building and operating the proposed facilities at the alternative sites are compared to the impacts at the proposed Fermi site in Section 9.3.7. Table 9-44 contains the review team's characterization of cumulative impacts at the proposed and alternative sites. On the basis of this review, the NRC staff concludes that although there are differences in cumulative impacts at the proposed and alternative sites, none of the alternative sites would be environmentally preferable or obviously superior to the proposed Fermi site. The NRC's determination is independent of the USACE's determination of a Least Environmentally Damaging Practicable Alternative pursuant to Clean Water Act Section 404(b)(1) guidelines. The USACE will conclude this analysis of alternatives in its permit decision document.

Alternative heat dissipation and circulating water system designs are discussed in Section 9.4. The NRC staff concluded that none of the alternatives considered would be environmentally preferable to the proposed system designs.

10.6 Benefit-Cost Balance

NEPA (42 U.S.C. 4321 *et seq.*) requires that all agencies of the Federal Government prepare detailed EISs on proposed major Federal actions that can significantly affect the quality of the human environment. A principal objective of NEPA is to require each Federal agency to consider, in its decision-making process, the environmental impacts of each proposed major action and the available alternative actions. In particular, Section 102 of NEPA requires that all Federal agencies, to the fullest extent possible, identify and develop methods and procedures, in consultation with the Council on Environmental Quality (CEQ) established by Title II of this Act, which will ensure that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations. However, neither NEPA nor the CEQ requires the costs and benefits of a proposed action to be quantified in dollars or any other common metric.

This section focuses on the monetized values of only those activities closely related to the building and operation of the proposed Fermi 3. The section does not identify and provide monetary estimates of all potential societal benefits of the proposed project and compare these to a monetized estimate of the potential costs of the proposed project. The review team offers quantified assessments for other benefits and costs that are of sufficient magnitude or importance that their inclusion in this analysis can inform the NRC and USACE decision-making processes. This section compiles and compares the pertinent analytical conclusions reached in earlier chapters of this EIS. It gathers all of the expected impacts from building and operating Fermi 3 and aggregates them into two final categories: the expected environmental costs and the expected benefits to be derived from approval of the proposed action.

Although the analysis in this section is conceptually similar to a purely economic benefit-cost analysis, which determines the net present dollar value of a given project, the intent is to identify potential societal benefits of proposed activities and compare these to their potential internal (i.e., private) and external (i.e., societal) costs. The purpose is to generally inform the COL process by gathering and reviewing information that demonstrates the likelihood that the benefits of the proposed activities outweigh the aggregate costs.

General issues related to Detroit Edison's financial viability are outside the scope of NRC's EIS process and are thus not considered in this EIS. Issues related to Detroit Edison's financial qualifications will be addressed in the NRC's safety evaluation report. It is not possible to quantify and assign a value to all benefits and costs of the proposed action. This analysis, however, attempts to identify, quantify, and provide monetary values for benefits and costs when reasonable estimates are available.

Section 10.6.1 discusses the benefits associated with the proposed action. Section 10.6.2 discusses the costs associated with the proposed action. A summary of benefits is shown in Table 10-3. In accordance with NRC's guidance in NUREG-1555 (NRC 2000, pages 10.4.2–10.4.4), the internal costs of the proposed project are presented in monetary terms. Internal costs include all of the costs included in a total capital cost assessment: the direct and indirect costs of preconstruction and construction plus the annual costs of operation and maintenance. Section 10.6.3 provides a summary of the impact assessments, bringing previous sections together to establish a general impression of the relative magnitude of the proposed project's costs and benefits.

10.6.1 Benefits

The most obvious benefit from building and operating a power plant is that it would generate power and provide thousands of residential, commercial, and industrial consumers with electricity. The social and economic benefits of maintaining an adequate supply of electricity in any given region could be large, given that reliable electricity supplies are key to economic stability and growth in a region. In addition to nuclear power, however, there are a number of different power generation technology options that could meet the need for electric power, including natural-gas-powered plants, coal-fired generation, and hydroelectric plants. Because the focus of this EIS is the proposed expansion of generating capacity at the Fermi site, this section focuses primarily on the relative benefits of the Fermi option rather than the broader, more generic benefits of electricity supply.

10.6.1.1 Societal Benefits

For the production of electricity to be beneficial to a society, there must be a corresponding demand or "need for power" in the region. Chapter 8 of this EIS defines and discusses the need for power in more detail. From a societal perspective, the power itself is the primary benefit to society because it helps maintain the Nation's standard of living. However, price stability and longevity, energy security, and fuel diversity also are key benefits associated with nuclear power generation relative to the benefits from most other alternative generating technologies. These benefits are described in this section.

Table 10-3. Benefits of Building and Operating Fermi 3

Category of Benefit	Description of Benefit	Impact Assessment
Electricity generated	14 million MWh per year for the 40-year life of the plant.	–
Generating capacity	1605 MW(e).	–
Fuel diversity and energy security	Nuclear power generation provides diversity to Detroit Edison's and the Midwest Independent Transmission System Operator, Inc. (MISO) region's baseload generation inventory.	SMALL
Tax revenues	Sales taxes paid by Detroit Edison for local purchases of about $14 million (in 2008 U.S. dollars) annually over the 40-year life of the unit; and local sales taxes and other taxes paid by in-migrating workers that amount to about $0.25 million divided between Michigan and Ohio locales (see Section 5.4.3.2).	SMALL to MODERATE
	Property taxes paid by Detroit Edison to Monroe County and local governments during construction (about $96.1 million over 10 years) and over the 40-year life of the unit (about $302.9 million per year).	LARGE
Local economy	Increased jobs would benefit the area economically and increase the economic diversity of the region (see Sections 4.4.3.1 and 5.4.3.1).	SMALL to MODERATE
Traffic	Minor upgrades to roads around the Fermi site to mitigate anticipated traffic quality degradation from Fermi 3 worker commutes.	SMALL
Public services and education	Additional tax revenues and philanthropic dollars to the community expected from Detroit Edison corporate donations as well as donations of time and money from its employees (see Sections 4.4.4.4, 4.4.4.5, 5.4.4.4, and 5.4.4.5).	SMALL

Price Stability and Longevity

Because of nuclear power's relatively low and nonvolatile fuel costs (approximately one-half cent per kilowatt-hour [kWh]) and a projected capacity utilization rate of 85 to 93 percent, nuclear energy is a dependable source of electricity that can be provided at relatively stable prices. Because of its low costs, the fuel price elasticity of electricity demand (how the consumer's demand for electricity changes as the price of uranium changes the cost of producing that electricity) is the lowest of all baseload electricity-generating fuels. The price of uranium fuel is only 3 to 5 percent of the cost of a kWh of nuclear-generated electricity. Doubling the price of uranium increases the cost of electricity by about 7 percent. In contrast, doubling the price of natural gas adds about 70 percent to the price of electricity; and doubling the cost of coal adds about 36 percent to the price of electricity (WNA 2007).

Unlike some other energy sources, nuclear energy is generally not subject to unreliable weather or climate conditions, unpredictable cost fluctuations, or dependence on foreign suppliers. In addition to low fuel prices, the relative lack of volatility in fuel prices when compared to fuel prices for natural gas-fired and oil-fired power plants, along with projected power plant availability rates of 85 to 93 percent, mean that nuclear energy is a dependable source of electricity that can be provided to the consumer at relatively stable prices over a long period of time.

Energy Security and Fuel Diversity

Currently, more than 70 percent of the electricity generated in the United States is generated by using fossil-based technologies. Nuclear power adds diversity and flexibility to the U.S. energy mix, thereby hedging the risk of shortages and price fluctuations that would result from an overdependence on any one power generating system.

A diverse fuel mix helps protect consumers from contingencies, such as fuel shortages or disruptions, price fluctuations, and changes in regulatory practices. Within Detroit Edison's service area, coal provides 57 percent of the electricity generation, natural gas provides 23 percent, oil provides 11 percent, and nuclear power provides 9 percent (Detroit Edison 2011a). The proposed expansion of the Fermi site generating capacity could provide additional nuclear power generating capacity to the generation mix and thus, give the region a hedge against risks of future shortages and price fluctuations associated with alternative generating systems.

10.6.1.2 Regional Benefits

Regional benefits of building and operating Fermi 3 include enhanced tax revenues at the State, county, and local levels; opportunities for increased regional productivity in industry, manufacturing, and other business categories; and improvements in local infrastructure and services derived from the increased tax base provided by the proposed Fermi 3 plant.

Tax Revenue Benefits

Tax revenues would come from various sources during preconstruction, construction, and operation of Fermi 3, including (a) State taxes on worker incomes, (b) State sales taxes on materials and supplies, (c) State sales taxes on worker expenditures, and (d) local property taxes or payments in lieu of taxes based on the incremental increase in the value of Fermi 3 during construction. The tax structure of the region is discussed in Section 2.5.2.2 of this EIS.

State income tax revenue during the building of Fermi 3 would be approximately $1 million annually ($0.9 million annually for the State of Michigan and approximately $0.12 million annually for the State of Ohio – see Section 4.4.3.2). During operations, about $0.25 million in income taxes would be received: about $0.2 million would be received by the State of Michigan, and $0.03 million would be received by the State of Ohio (see Section 5.4.3.2). The States of Michigan and Ohio and some of the local jurisdictions in Ohio would also receive sales tax revenue on expenditures made by the new workers and on purchases of building materials and supplies in the local area. The review team estimated, on the basis of information provided by Detroit Edison, that the State of Michigan would receive new sales tax revenue of about $8.3 million over the 10-year building period for Fermi 3 and that the State of Ohio would receive about $5.1 million.

Assuming a State sales tax rate in Michigan of 6 percent, an estimated $0.5 million in sales tax revenue would be received by the State of Michigan annually over the 40-year life of the Fermi 3 COL. Assuming a State sales tax rate in Ohio of 5.5 percent, an estimated $0.3 million in sales tax revenue would be received by the State annually from the purchase of materials and supplies for the operation and maintenance of Fermi 3.

A number of local jurisdictions, including Monroe County and Frenchtown Charter Township, would benefit from increased property taxes associated with Fermi 3. In 2009, the assessed value of property owned by Detroit Edison in Monroe County was $821 million (Monroe County Finance Department 2009), which is approximately 13.3 percent of the total county taxable assessed value of slightly more than $6.1 billion. Given that the expected Fermi 3 overnight cost of construction is $6.4 billion, upon completion of the construction of Fermi 3, the total assessed property value in Monroe County would increase by about 100 percent.

In 2009, Detroit Edison paid a millage rate of approximately 47.33 mills, which was dispersed to Frenchtown Charter Township (6.8 mills), Monroe County (including Monroe Intermediate School District, Monroe Community College, and the Monroe Library) (13.23 mills), Jefferson Resort School District (18.5 mills), and the Resort Authority (2.8 mills) (Detroit Edison 2011a). As the assessed value of property would increase each year during the project, so would the taxes paid to Monroe County, Frenchtown Charter Township, and other local jurisdictions. These incremental increases in taxes would have a significant impact on annual property tax revenues in these jurisdictions.

Regional Productivity and Community Impacts

Building of Fermi 3 would require an average workforce of about 1000 workers per year over the 10-year construction period, with a peak building employment of about 2900 workers. The

Fermi 3 workforce would produce, on average, about $50.5 million in income each year over the entire preconstruction and construction period (see Section 4.4.3.1). Stimulus from these new jobs and income would induce a multiplier effect that would create additional indirect jobs in the economic impact area – Monroe, Wayne, and Lucas Counties – producing about 253 new jobs during the building of Fermi 3. Operations would create 900 direct jobs and $57.3 million in income annually and would be maintained throughout the life of the plant (see Section 5.4.3.1). Additional annual indirect jobs and indirect income would be created in the three-county area by the new operational jobs, for a total of 458 indirect jobs during operations. An estimated 1200 to 1500 workers would also be employed at Fermi 3 during scheduled refueling outages, which would occur every 24 months and require outage workers for a period of 30 days, producing an additional $7.9 million in income every 2 years (Detroit Edison 2011a).

10.6.2 Costs

Internal costs to Detroit Edison as well as external costs to the surrounding region and environment would be incurred during the preconstruction, construction, and operation of Fermi 3. Internal costs include the costs to build the power plant (capital costs), as well as operating and maintenance costs and the costs of fuel, waste disposal, and decommissioning. External costs include all costs imposed on the environment and region surrounding the plant and may include the loss of regional productivity, environmental degradation, and loss of wildlife habitat. Internal and external costs of building and operating Fermi 3 are presented in Table 10-4.

10.6.2.1 Internal Costs

The most substantial monetary cost associated with nuclear energy is the cost of capital. Nuclear power plants typically have relatively high capital costs but low fuel costs relative to alternative power generation systems. Because of the high capital costs for nuclear power and because of the relatively long construction period before revenue is returned, servicing the capital costs of a nuclear power plant is the most important factor in determining the economic competitiveness of nuclear energy. Because a power plant does not yield profits during construction, longer construction times can add significantly to the cost of a plant through higher interest expenses on borrowed construction funds.

Preconstruction and Construction Costs

In evaluating monetary costs related to constructing Fermi 3, Detroit Edison reviewed recent published literature, vendor information, internally generated financial information, and internally generated, site-specific information (Detroit Edison 2011a). The cost estimates reviewed were not based on nuclear plant construction experience in the United States, which is more than 20 years old, but rather on construction costs overseas, which are more recent. A phrase commonly used to describe the monetary cost of constructing a nuclear plant is “overnight

Table 10-4. Internal and External Costs of Building and Operating Fermi 3

Benefit-Cost Category	Description (except where noted, costs are in 2008 U.S. dollars)	Impact Assessment[(a)]
Internal Costs[(b)]		
Construction cost	$6.4 billion (overnight capital cost).	–
Operating cost	6.7–7.0 cents per kWh (levelized cost of electricity) (MIT 2010).	–
Spent fuel management	0.1 cent/kWh (WNA 2007).[(c)]	–
Decommissioning	0.1–0.2 cent/kWh (WNA 2007).[(d)]	–
Material and resources	460,000 yd^3 of concrete 46,000 tons of rebar 25,000 tons of structural steel 690,000 ft of piping 220,000 ft of cable tray 1,200,000 ft of conduit 1,400,000 ft of power cable 5,400,000 ft of control wire 740,000 ft of process and instrument tubing.	–
Tax payments	State income taxes of $0.7 million annually during construction and operation (see Section 5.4.3.2).	SMALL
	Annual sales taxes of $0.3 million during construction and of $0.2 million during operations.	SMALL
	Approximately $14 million per year in local property taxes paid by Detroit Edison over the 40-year life of the COL.	SMALL
Land use	Approximately 155 ac occupied on a long-term basis by the new nuclear reactor and associated infrastructure. An estimated 1069 ac of land for ROWs would need to be acquired and developed for electricity transmission (see Sections 4.1 and 5.1). An additional 19 ac would be developed to expand the Milan Substation.	SMALL
External Costs		
Land use	The onsite and offsite land devoted to the proposed Fermi 3 facilities would not be available for other land uses over the operational life of Fermi 3 (see Sections 4.1 and 5.1).	SMALL

Table 10-4. (contd)

Benefit-Cost Category	Description (except where noted, costs in 2008 U.S. dollars)	Impact Assessment[(a)]
Air quality impacts	Negligible impacts (see Sections 4.2, 5.2, and 9.2). Avoidance of sulfur dioxide, nitrogen oxide, carbon monoxide, carbon dioxide, and particulate emissions.	SMALL
Water-related impacts	Small impact on surface and groundwater use and water quality. Water effluents would be regulated by MDEQ's Environmental Protection Division under an NPDES permit (see Sections 4.2 and 5.2).	SMALL
Ecological impacts	Loss or disturbance of upland, wetland, and aquatic habitat and associated plant and animal species onsite and along the transmission line corridor. Proposed mitigation would offset some impacts. Operational impacts on most species and habitats are expected to be minor.	SMALL to MODERATE (potential for MODERATE limited toeastern fox snake)
Physical impacts on community	Impacts limited primarily to boundaries of the site; potentially moderate offsite traffic impacts (see Sections 4.4.1 and 5.4.1).	SMALL
Housing	Potential short-term housing shortage (possibly driving up housing prices and rental rates) in Monroe County during the 10-year construction period (see Section 4.4.4.3).	SMALL
Traffic	Short-term stress on the local road network because of congestion during construction affecting commuting patterns and potential degradation from vehicles used for construction and operational activities (see Sections 4.4.4.1 and 5.4.4.1).	MODERATE
Public services	Minimal short-term strain on community services in Monroe County during early stages of 10-ear construction period (see Section 4.4.4.4).	SMALL
Recreation	Because the in-migrating workforce for construction and operations would be small relative to the population of the region, there would be little marginal impact on recreation from Fermi 3 (see Sections 4.4.1.4, 4.4.3.4, 5.4.1.4, and 5.4.3.4).	SMALL

Table 10-4. (contd)

Benefit-Cost Category	Description (except where noted, all costs in 2008 U.S. dollars)	Impact Assessment[(a)]
Cultural resources	There would be an adverse effect on a historic property if Fermi 1 was demolished for the Fermi 3 project. Detroit Edison has committed to developing procedures to manage cultural resources in the event of an inadvertent discovery onsite (see Sections 4.6 and 5.6).	MODERATE
Health impacts (nonradiological and radiological)	Impacts of radiological exposures on construction workers would be SMALL. Radiological doses to the public and occupational workers would be monitored and controlled in accordance with regulatory limits (see Sections 4.8, 4.9, 5.8, and 5.9). Nonradiological health impacts on the public and occupational workers would be SMALL; hazards would be monitored and controlled in accordance with regulatory limits (see Sections 4.8 and 5.8).	SMALL
Nonradioactive waste	Permitted site stormwater releases to surface water. Minor, localized, and temporary air emissions from construction equipment and temporary stationary sources. Creation of solid wastes, causing minor consumption of local or regional landfill space, offset by payment of tipping fees for waste disposal. Generation of small amounts of hazardous and mixed wastes leading to minor consumption of regional hazardous waste treatment or disposal capacity, offset by treatment and disposal costs (see Sections 4.10 and 5.10).	SMALL
Radioactive waste	Storage, treatment, and disposal of radioactive low-level waste and spent nuclear fuel. Commitment of near-surface and geological resources for disposal of radioactive waste (see Section 6.1.6).	SMALL[(e)]

(a) Impact assessments are listed for all impacts evaluated in detail as part of this EIS. The details on impact assessments are found in the indicated sections of this EIS.
(b) Internal costs are costs incurred by Fermi to implement proposed construction and operation at the Fermi site. Note that no impact assessments are provided for these private financial impacts.
(c) Based on Yucca Mountain waste maintenance levy (WNA 2007).
(d) Decommissioning costs are included in total operating costs.
(e) This conclusion is conditional on the results of the ongoing rulemaking to update the Waste Confidence Decision and Rule (see Section 6.1.6).

capital cost." Capital costs are those incurred during construction and include engineering, procurement, and construction costs, measured during the period(s) when the actual outlays for equipment, construction, and engineering are expended. Overnight costs assume that the plant is constructed "overnight," with no interest included in the capital cost estimate. Studies of new power plant construction indicate that the estimated construction costs of a nuclear power plant average approximately $4000 per kilowatt (kW) of electrical generating capacity (MIT 2010).

Operation Costs

Operation costs are frequently expressed in terms of the levelized cost of electricity, which is the price per kWh of producing electricity, including the cost needed to cover operating costs and annualized capital costs. Overnight capital costs account for a third of the levelized cost, and interest costs on the overnight costs account for another 25 percent (University of Chicago 2004). A recent Massachusetts Institute of Technology (MIT) study concluded that at an 85 percent capacity factor, electricity generation costs vary between 6.7 and 7.0 cents per kWh, depending on the economic life of the plant (MIT 2010). Estimates include decommissioning but, because of the effect of discounting a cost that would occur as late as 40 years in the future, decommissioning costs have relatively little effect on the levelized cost.

Fuel Costs

From the outset, the basic attraction of nuclear energy has been its low fuel costs when compared to those of coal-, oil-, and gas-fired plants. Uranium, however, has to be processed, enriched, and fabricated into fuel elements, and about half of the cost results from enrichment and fabrication. Allowances must also be made for the management of radioactive spent fuel and the ultimate disposal of this spent fuel or the wastes separated from it. Even with these costs included, the total fuel costs of a nuclear power plant are typically about a third of those for a coal-fired plant and between a quarter and a fifth of those for a natural gas combined-cycle plant (University of Chicago 2004). The International Energy Agency estimated the average fuel cost for a nuclear generating plant to be less than one-half cent per kWh at a 5 percent discount rate.

Waste Disposal

The backend costs of nuclear power contribute a very small share to total cost, both because of the long lifetime of a nuclear reactor and the fact that provisions for waste-related costs can be accumulated over that time. It should also be recognized, however, that radioactive nuclear waste poses unique disposal challenges for long-term management. The United States and other countries have yet to implement final disposition of spent fuel or high-level radioactive waste streams created at various stages of the nuclear fuel cycle. Because these radioactive wastes present some danger to present and future generations, the public and its elected representatives, as well as prospective investors in nuclear power plants, properly expect continuing and substantial progress toward a solution to the waste-disposal problem. Successful operation of a geological repository would ease, but not solve, the waste-disposal issue for the United States and other countries, if nuclear power expands substantially (MIT 2003).

Decommissioning

In 10 CFR 50.75, the NRC has requirements for licensees to provide a reasonable assurance that funds would be available for the decommissioning process. Because of the effect of discounting a cost that would occur as much as 40 years in the future, decommissioning costs have relatively little effect on the levelized cost of electricity generated by a nuclear power plant (WNA 2007), estimated to be between 0.1 and 0.2 cents per kWh, which is no more than 5 percent of the cost of the electricity produced (WNA 2007).

10.6.2.2 External Costs

External costs are social and/or environmental effects caused by the proposed construction and operation of a new power reactor at the Fermi site. This EIS includes the NRC staff’s analysis that weighs the environmental impacts of constructing and operating a new nuclear unit at the Fermi site or at alternative sites and mitigation measures available for reducing or avoiding these adverse impacts. It also includes the review team’s recommendation to the Commission regarding the proposed action.

Environmental and Social Costs

Chapter 4 of this EIS describes the impacts on the environment from building Fermi 3 with respect to land use, air quality, water, terrestrial and aquatic ecosystems, socioeconomics, historic and cultural resources, environmental justice, and nonradiological and radiological health effects. It also describes measures and controls to limit adverse impacts during the building of Fermi 3. Chapter 5 examines the impacts associated with the operation of Fermi 3 for an initial 40-year period on these same topic areas, as well as postulated accidents. Applicable measures and controls that would limit the adverse impacts of station operation during the 40-year operating period are considered.

Chapter 6 similarly addresses the environmental impacts from the (1) uranium fuel cycle and solid waste management, (2) transportation of radioactive material, and (3) decommissioning of Fermi 3. Chapter 7 of this EIS places all of the potential impacts of the new unit in the context of all past, present, and reasonably foreseeable future activities in the general area that may have a connection to the region. Chapter 9 includes the review team’s assessment of alternative sites, alternative power generation systems, and alternative cooling system designs. In Chapter 10, impacts were also compared to the adverse impacts for the alternative sites. Section 10.2 identifies unavoidable adverse impacts of the proposed action (i.e., impacts after consideration of proposed mitigation actions), and Section 10.4 identifies irretrievable commitments of resources.

Unlike the situation when electricity is generated from coal and natural gas, the normal operation of a nuclear power plant does not result in significant emissions of criteria air pollutants (e.g., nitrogen oxides or sulfur dioxide), methyl mercury, or greenhouse gases associated with global warming and climate change. Combustion-based power plants are responsible for 36 percent of the carbon dioxide, 64 percent of the sulfur dioxide, 26 percent of the nitrogen oxide, and 13 percent of the mercury emissions from industrial sources in the United States (DOE/EIA 2006). The majority of the electric power industry's emissions are likely from coal-fired plants. Chapter 9 of this EIS analyzes coal- and natural-gas-fired alternatives to the building and operation of Fermi 3. Air emissions from these alternatives and nuclear power are summarized in Chapters 4, 5, and 9.

10.6.3 Summary of Benefits and Costs

Detroit Edison's business decision to pursue expansion of Fermi generating capacity by adding a nuclear reactor is an economic decision, based on private financial factors subject to regulation by the Michigan Public Service Commission. The internal costs to construct additional units appear to be substantial; however, Detroit Edison's decision to pursue this expansion implies that the company has already concluded that the private, or internal, benefits of the proposed facility outweigh the internal costs. Although no specific monetary values could reasonably be assigned to the identified societal benefits, it would appear that the potential societal benefits of the proposed expansion of Fermi generating capacity are substantial. In comparison, the external socioeconomic and environmental costs imposed on the region appear to be relatively small.

As described in Section 8.4, there is increasing baseload demand and decreasing baseload supply in the region of interest. Without additional baseload generating capacity, Detroit Edison's electricity network will fail to maintain an adequate power reserve margin to meet its public service obligations to provide adequate power and will jeopardize the utility's commitment to provide power to other electric service providers within the region. Fermi 3 would help meet the increasing baseload demand in the region by supplying average annual electrical energy generation of about 12,000,000 megawatt-hours (MWh).

As described in this section, the additional direct and indirect creation of jobs would place some temporary burdens on local services and infrastructure, but the additional annual taxes and revenue generated by the new workers would contribute to the local economy and stimulate future growth. By comparison, the external socio-environmental costs imposed on the region appear to be relatively small.

The review team concludes, on the basis of the assessments summarized in this EIS, that the building and operation of the proposed Fermi 3, with mitigation measures identified by the review team, would accrue benefits that most likely would outweigh the economic, environmental, and social costs associated with constructing and operating a new unit at the Fermi site.

10.7 Staff Conclusions and Recommendations

The NRC staff's recommendation to the Commission related to the environmental aspects of the proposed action is that the COL should be issued.[(a)] The staff's evaluation of the safety and emergency preparedness aspects of the proposed action will be addressed in the staff's safety evaluation report that is anticipated to be published in the future.

The staff's recommendation is based on (1) the ER submitted by Detroit Edison (Detroit Edison 2011a); (2) consultation with Federal, State, Tribal, and local agencies; (3) the review team's own independent review; (4) the staff's consideration of public scoping comments; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and in the EIS. In addition, in making its recommendation, the staff determined that none of the alternative sites assessed is obviously superior to the Fermi site. The NRC's determination is independent of the USACE's determination of a Least Environmentally Damaging Practicable Alternative pursuant to Clean Water Act Section 404(b)(1) guidelines and its required PIR. The USACE's independent regulatory permit decision documentation will reference relevant analyses from the EIS and, as necessary, include a supplemental PIR; CWA 404(b)(1) evaluation; cumulative impact analysis; compensatory mitigation plan that is in accordance with 33 CFR Part 332, "Compensatory Mitigation for Losses of Aquatic Resources;" and other information and evaluations that may be outside the NRC's scope of analysis and not included in this EIS, but that are required by the USACE to support its permit decision.

10.8 References

10 CFR Part 50. Code of Federal Regulations, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

(a) As directed by the Commission in CLI-12-16 (NRC 2012b), NRC will not issue the COL prior to completion of the ongoing rulemaking to update the Waste Confidence Decision and Rule (see Section 6.1.6).

33 CFR Part 320. Code of Federal Regulations, Title 33, *Navigation and Navigable Waters*, Part 320, "General Regulatory Policies."

33 CFR Part 332. Code of Federal Regulations, Title 33, *Navigation and Navigable Waters*, Part 332, "Compensatory Mitigation for Losses of Aquatic Resources."

36 CFR Part 800. Code of Federal Regulations, Title 36, *Parks, Forests, and Public Property*, Part 800, "Protection of Historic Properties."

40 CFR Part 230. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 230, "Guidelines for Specification of Disposal Sites for Dredged or Fill Material."

72 FR 57416. October 9, 2007. "Limited Work Authorizations for Nuclear Power Plants." *Federal Register*. U.S. Nuclear Regulatory Commission.

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Detroit Edison Company (Detroit Edison). 2011c. *Detroit Edison Fermi 3 Project, U.S. Army Corps of Engineers and Michigan Department of Environmental Quality, Joint Permit Application.* Revision 0, Detroit Michigan. June. Accession No. ML111940490.

Detroit Edison Company (Detroit Edison). 2011d. *Detroit Edison Fermi 3 Project, U.S. Army Corps of Engineers and Michigan Department of Environmental Quality, Joint Permit Application.* Revision 1, Detroit Michigan. August. Accession No. ML112700388.

Detroit Edison Company (Detroit Edison). 2012a. *Fermi 3 Aquatic Resource Mitigation Strategy and Design.* Submitted to MDEQ on August 3, 2012. Accession No. ML122580003.

Detroit Edison Company (Detroit Edison). 2012b. *Detroit Edison Fermi 3 Construction, Habitat and Species Conservation Plan, Eastern Fox Snake (Elaphe gloydi)*. March 2012, Revision 0. Accession No. ML12163A577.

Detroit Edison Company (Detroit Edison). 2012c. *Detroit Edison Fermi 3 Operational Conservation and Monitoring Plan, Eastern Fox Snake (Elaphe gloydi)*. March 2012, Rev. 0. Accession No. ML12188A150.

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U.S. Nuclear Regulatory Commission (NRC). 2011. Staff Memorandum from S. Flanders, DSER Division Director, to B. Clayton, RENV Branch Chief, "Addressing Construction and Preconstruction, Greenhouse Gas Issues, General Conformity Determinations, Environmental Justice, Need for Power, Cumulative Impact Analysis, and Cultural/Historic Resources Analysis Issues in Environmental Impact Statements." March 4, 2011. Accession No. ML110380369.

U.S. Nuclear Regulatory Commission (NRC). 2012a. "Memorandum of Agreement between the U.S. Nuclear Regulatory Commission and the Michigan State Historic Preservation Officer Regarding the Demolition of the Enrico Fermi Atomic Power Plant, Unit 1 Facility Located in Monroe County, Michigan, Submitted to the Advisory Council on Historic Preservation Pursuant to 36 CFR 800.6(b)(1)." Accession No. ML12089A007.

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Appendix A

Contributors to the Environmental Impact Statement

Appendix A

Contributors to the Environmental Impact Statement

The overall responsibility for the preparation of this environmental impact statement was assigned to the Office of New Reactors, U.S. Nuclear Regulatory Commission (NRC). The U.S. Army Corps of Engineers (USACE) is participating as a cooperating agency. The environmental impact statement was prepared by members of the Office of New Reactors with assistance from other NRC organizations, the USACE, Argonne National Laboratory, Energy Research, Inc., Ecology and Environment, Inc., and Dade Moeller and Associates.

Name	Affiliation	Function or Expertise
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John Fringer	Office of New Reactors	Deputy Project Manager, Cultural Resources, Nonradiological Health and Waste
Tomeka Terry	Office of New Reactors	Project Manager
Barry Zalcman	Office of New Reactors	Senior Staff Oversight, Cumulative Impacts
Jack Cushing	Office of New Reactors	Senior Staff Oversight
Peyton Doub	Office of New Reactors	Land Use, Terrestrial Ecology, Transmission Lines
Daniel Barnhurst	Office of New Reactors	Hydrology, Surface Water
Laurel Bauer	Office of New Reactors	Geology
Michael Masnik	Office of New Reactors	Aquatic Ecology, Transmission Lines
Daniel Mussatti	Office of New Reactors	Socioeconomics, Environmental Justice, Need for Power, Benefit-Cost Balance
Andrew Kugler	Office of New Reactors	Alternative Energies, Alternative Sites
Stacey Imboden	Office of New Reactors	Cumulative Impacts
Seshagiri Tammara	Office of New Reactors	Demography
Charles Hinson	Office of New Reactors	Radiological Health Impacts – Occupational
George Cicotte	Office of New Reactors	Radiological Health Impacts – Effluent
Brad Harvey	Office of New Reactors	Meteorology and Air Quality
Don Palmrose	Office of New Reactors	Radiological Health Impacts, Radioactive Waste Systems, Uranium Fuel Cycle, Accidents
Stan Echols	Office of Nuclear Material Safety and Safeguards	Uranium Fuel Cycle
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Adrianne Carr		Hydrology – Groundwater
John Quinn		Geology, Hydrology – Surface Water
Sunita Kamboj		Radiological Health, Nonradiological Health, Waste Systems, Decommissioning
Young-Soo Chang		Meteorology, Air Quality
Bruce Biwer		Transportation
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	ENERGY RESEARCH, INC.	
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Natasha Snyder		Historic and Cultural Resources
David Weeks		Terrestrial Ecology
Jone Guerin		Demography, Socioeconomics, Environmental Justice
	DADE MOELLER & ASSOCIATES, INC.	
David McCormack		Uranium Fuel Cycle

(a) Argonne National Laboratory is operated for the U.S. Department of Energy by UChicago Argonne, LLC.

Appendix B

Organizations Contacted

Appendix B

Organizations Contacted

The following Federal, State, regional, Tribal, and local organizations were contacted during the course of the U.S. Nuclear Regulatory Commission staff's independent review of potential environmental impacts from the construction and operation of a new nuclear unit, Enrico Fermi Unit 3, at the Detroit Edison Company Enrico Fermi Atomic Power Plant site in Monroe County, Michigan:

Advisory Council on Historic Preservation, Washington, D.C.

Bay Mills Indian Community, Brimley, Michigan

American Museum of Nuclear Science and History, Albuquerque, New Mexico

American Nuclear Society, La Grange Park, Illinois

Delaware Nation, Anadarko, Oklahoma

Forest County Potawatomi Community of Wisconsin, Crandon, Wisconsin

Grand Traverse Band of Ottawa and Chippewa Indians, Suttons Bay, Michigan

Great Lakes Fisheries Commission, Lansing, Michigan

Hannahville Indian Community, Wilson, Michigan

Huron Potawatomi, Inc., Fulton, Michigan

International Joint Commission, Great Lakes Water Quality Board, Washington, D.C.

Keweenaw Bay Indian Community, Baraga, Michigan

Lac Vieux Desert Band of Lake Superior Chippewa Indians, Watersmeet, Michigan

Little River Band of Ottawa Indians, Manistee, Michigan

Little Traverse Bay Bands of Odawa Indians, Harbor Springs, Michigan

Match-e-be-nash-she-wish Band of Pottawatomi Indians of Michigan, Dorr, Michigan

Michigan Department of Environmental Quality, Lansing, Michigan

Michigan Department of Natural Resources, Lansing, Michigan

Michigan State Historic Preservation Office, Michigan Historical Center, Department of History, Arts and Libraries, Lansing, Michigan

Michigan Natural Features Inventory, Lansing, Michigan

Monroe County Community College, Monroe, Michigan

Monroe County Historical Commission, Monroe, Michigan

Monroe County Historical Museum, Monroe, Michigan

National Marine Fisheries Service, Northeast Regional Office, Gloucester, Massachusetts

New York State Department of Environmental Conservation, Steam Electric Unit, Bureau of Habitat, Division of Fish, Wildlife, and Marine Resources, Albany, New York

Ohio Department of Natural Resources, Division of Natural Areas and Preserves, Ohio Natural Heritage Data Base, Columbus, Ohio

Ottawa Tribe of Oklahoma, Miami, Oklahoma

Pokagon Band of Potawatomi Indians, Dowagiac, Michigan

Saginaw Chippewa Indian Tribe of Michigan, Mt. Pleasant, Michigan

Sault Ste. Marie Tribe of Chippewa Indians of Michigan, Sault Ste. Marie, Michigan

Shawnee Tribe, Miami, Oklahoma

U.S. Department of the Interior, Office of Environmental Policy and Compliance, Philadelphia, Pennsylvania

U.S. Environmental Protection Agency, Region 5, Chicago, Illinois

U.S. Fish and Wildlife Service, East Lansing Michigan Field Office, East Lansing, Michigan

Wyandotte Nation, Wyandotte, Oklahoma

Appendix C

NRC and USACE Environmental Review Correspondence

Appendix C

NRC and USACE Environmental Review Correspondence

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) or the U.S. Army Corps of Engineers (USACE) and Detroit Edison Company (Detroit Edison), and other correspondence related to the environmental review for a combined license (COL) application for Enrico Fermi Unit 3 (Fermi 3) near Monroe, Michigan. This application was submitted by the Detroit Edison.

All documents, with the exception of those containing proprietary information, are available through the Commission's Public Document Room, at One White Flint North, 11555 Rockville Pike (first floor), Rockville, MD, and are available electronically from the Public Electronic Reading Room found on the Internet at the following Web address: http://www.nrc.gov/reading-rm.html. From this site, the public can gain access to the NRC's Agencywide Document Access and Management System (ADAMS), which provides text and image files of NRC's public documents in the component of ADAMS. The ADAMS accession numbers for each document are included below.

September 18, 2008	Letter from Mr. J.M. Davis, Detroit Edison, to NRC transmitting application for Combined License for the Fermi Nuclear Power Plant (Accession No. ML082730763).
October 10, 2008	Letter from Mr. Chandu Patel, NRC, to Mr. Jack M. Davis, DTE, acknowledging receipt of the combined license application for Fermi Nuclear Power Plant, Unit 3 (Accession No. ML082381079).
December 3, 2008	Letter from Mr. G.P. Hatchett, NRC, to Mr. J.M. Davis, Detroit Edison, transmitting Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Related to a Combined License for Fermi Nuclear Power Plant, Unit 3 (Accession No. ML083110329).
December 10, 2008	Letter from Mr. Stephen Lemont, NRC, to Ms. Margo Zieske, Monroe County Libraries, regarding maintenance of reference materials at the Dorsch Library for the environmental review of the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML082560486).

December 23, 2008	Notice of Public Meeting to discuss Environmental Scoping Process for the Fermi Nuclear Power Plant Combined License Application for Unit 3 (Accession No. ML083500473).
December 23, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Mr. Craig Czarnecki, Field Supervisor, U.S. Fish and Wildlife Service, regarding request for participation in the environmental scoping process and a list of protected species within the area under evaluation for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083151398).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Ms. Mary Colligan, NOAA National Marine Fisheries Service, Northeast Regional Office, regarding request for participation in the environmental scoping process and a list of protected species within the area under evaluation for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083151403).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Ms. Patricia Jones, Ohio Department of Natural Resources, regarding request for participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083151404).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Mr. Kelley Smith, Chairman, Great Lakes Fisheries Commission, regarding request for participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083151400).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Mr. Don Klima, Director, Office of Federal Agency Programs, Advisory Council on Historic Preservation, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083151399).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Mr. Warren C. Swartz, President, Keweenaw Bay Indian Community, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083190398).

December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to the Honorable Jeffrey D. Parker, President, Bay Mills Indian Community, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083190083).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Robert Kewaygoshkum, Chairman, Grand Traverse Band of Ottawa and Chippewa Indians, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083190375).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Mr. James Williams, Jr., Chairman, Lac Vieux Desert Band of Lake Superior Chippewa Indians, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083190406).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Mr. Frank Ettawageshik, Chairman, Little Traverse Bay Bands of Odawa Indians, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083190425).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to the Honorable John A. Miller, Chairman, Pokagon Band of Potawatomi Indians, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083190442).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Mr. Aaron Payment, Chairperson, Sault Ste. Marie Tribe of Chippewa Indians of Michigan, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083190489).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Mr. Kenneth Meshigaud, Chairman, Hannahville Indian Community, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083190379).

December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Ms. Laura Spurr, Chairperson, Huron Potawatomi, Inc., regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083190382).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Mr. Fred Cantu, Jr., Chief, Saginaw Chippewa Indian Tribe of Michigan, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083190448).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Mr. David K. Sprague, Chairman, Match-e-be-nash-she-wish Band of Pottawatomi Indians of Michigan, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083190436).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to The Honorable Larry Romanelli, Little River Band of Ottawa Indians, regarding request for participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083190415).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Mr. James G. Chandler, International Joint Commission, regarding request for participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083151401).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Mr. Brian D. Conway, Michigan State Historic Preservation Officer, regarding request for participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083151405).
December 24, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Ms. Leni Wilsmann, Michigan Natural Features Inventory, regarding request for participation in the scoping process and list of State Listed Protected Species for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083151402).

December 31, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Mr. Harold G. Frank, Forest County Potawatomi, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083520641).
December 31, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Ms. Anna Miller, U.S. EPA Region 5, regarding request for participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083590143).
December 31, 2008	Letter from Mr. Gregory P. Hatchett, NRC, to Mr. Steven Chester, Director, Michigan Dept. of Environmental Quality, regarding request for participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083590138).
December 31, 2008	Letter from Mr. Gregory P. Hatchett, NRC to Mr. Ron Sparkman, Shawnee Tribe, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083530066).
December 31, 2008	Letter from Mr. Gregory P. Hatchett, NRC to Mr. Edgar L. French, Delaware Nation, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083530050).
December 31, 2008	Letter from Mr. Gregory P. Hatchett, NRC to Ms. Leaford Bearskin, Wyandotte Nation, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083530077).
December 31, 2008	Letter from Mr. Gregory P. Hatchett, NRC to Mr. Charles Todd, Ottawa Tribe of Oklahoma, regarding request for consultation and participation in the scoping process for the environmental review for the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML083530043).

January 21, 2009	Letter from Ms. Mary A. Colligan, NOAA National Marines Fisheries Service Northeast Region, to Mr. Gregory P. Hatchett, NRC, providing information on endangered and threatened species and Essential Fish Habitat within the project area for the Fermi Nuclear Power Plant (Accession No. ML090711069).
January 28, 2009	Letter from Mr. Craig Czarnecki, U.S. Fish and Wildlife Service, to Mr. Gregory P. Hatchett, NRC, providing information on endangered and threatened species within the project area for the Fermi Nuclear Power Plant (Accession No. ML090750973).
February 9, 2009	Letter from Mr. Kenneth Westlake, U.S. Environmental Protection Agency, to Mr. Michael Lesar, NRC, providing comments on the scope of the Fermi Nuclear Power Plant Environmental Impact Statement (Accession No. ML090650467).
March 3, 2009	Letter from Mr. John Konik, U.S. Army Corps of Engineers, to Mr. Scott Flanders, NRC, regarding cooperating status on the Fermi Nuclear Power Plant Environmental Impact Statement (Accession No. ML090850037).
March 3, 2009	Summary of the Public Scoping Meetings Conducted Related to the Combined License Application Review of the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML090291080).
May 12, 2009	Letter from Mr. Stephen Lemont, NRC, to Mr. Peter Smith, DTE Energy, transmitting requests for additional information for the environmental review of the Fermi Nuclear Power Plant, Unit 3 combined license application (Accession No. ML090980159).
June 19, 2009	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML091940218).
July 2, 2009	Scoping Summary Report Related to the Environmental Scoping Process for the Fermi Nuclear Power Plant, Unit 3 Combined License Application Review (Accession No. ML091520145).
July 31, 2009	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML092290662).

August 25, 2009	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML092400535).
August 28, 2009	Trip Report for the Fermi 3 Environmental Site Audit from February 2-6, 2009 (Accession No. ML092390538).
August 28, 2009	Trip Report for the Fermi 3 Alternatives Site Visit from January 12-13, 2009 (Accession No. ML092390543).
September 30, 2009	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML093350028).
October 30, 2009	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML093090165).
November 13, 2009	Letter from Mr. Ryan Whited, NRC, to Mr. Peter Smith, DTE, regarding project manager change for the combined license environmental review for Fermi Nuclear Power Plant, Unit 3 (Accession No. ML093000568).
November 23, 2009	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML093380365).
December 23, 2009	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML093380362).
December 23, 2009	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML093650121).

January 29, 2010	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML100331451).
February 15, 2010	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML100541329).
February 16, 2010	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML100500278).
March 24, 2010	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML100850542).
March 30, 2010	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML100960472).
July 9, 2010	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML ML102000566).
July 26, 2010	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML102180224).
September 1, 2010	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML102510498).

October 29, 2010	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML103120126).
December 2, 2010	Letter from Bruce A. Watson, NRC, to Mr. Brian D. Conway, Michigan State Historic Preservation Officer, initiating Section 106 process for the Fermi Nuclear Power Plant, Unit 1 license termination plan review (Accession No. ML101790096).
December 16, 2010	Letter from Mr. Ryan Whited, NRC, to Mr. Brian D. Conway, Michigan State Historic Preservation Officer, regarding Section 106 process for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML101820302).
January 10, 2011	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting updates to the Fermi 3 combined license application (COLA) reflecting changes to the Fermi site layout (Accession Nos. ML110280350, ML110280351, ML110280352, ML110280353).
February 14, 2011	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting Detroit Edison Company application for a combined license for Fermi 3 update and establishment of the licensing-basis information freeze point for the Fermi 3 COLA (Accession No. ML110600656).
March 4, 2011	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting responses to environmental requests for additional information for the combined license application for the Fermi Nuclear Power Plant, Unit 3 (Accession No. ML110670232).
May 13, 2011	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, Detroit Edison Company responses to NRC transmitting requests for additional information letter related to the environmental review (Accession No. ML11136A278).
June 17, 2011	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, Detroit Edison response to NRC questions related to the environmental review-site selection process (Accession No. ML11171A2960).
June 17, 2011	Letter from Randall D. Westmoreland, Detroit Edison, to Michigan Department of Environmental Quality, transmitting the Joint Permit Application for Detroit Edison, Fermi 3 Nuclear Power Plant (Accession No. ML111940490).

July 7, 2011	Letter from Mr. Peter W. Smith, Detroit Edison, to NRC, transmitting Detroit Edison Company's responses to NRC questions related to the environmental review and supplemental response (Accession No. ML11192A190).
July 15, 2011	Letter from Peter W. Smith, Detroit Edison, to NRC, updates to the Fermi 3 combined license application (COLA) reflecting changes to conform with the Fermi 3 Joint Permit Application (Accession No. ML112000169).
August 11, 2011	Summary of Public Teleconferences with Detroit Edison Company to Discuss Status and Progress of Fermi 3 Combined License Environmental Review (Accession No. ML111870069).
August 22, 2011	Letter from John Fringer, NRC, to Martha MacFarlane Faes, Michigan State Historic Preservation Office, regarding Request for Review of Supplemental Information Related to Section 106 Process for the Fermi Nuclear Power Plant, Unit 3 Combined License Application Review – SHPO #ER06-683 (Accession No. ML112070027).
August 24, 2011	Letter from John Fringer, NRC, to Martha MacFarlane Faes, Michigan State Historic Preservation Office, regarding Draft Memorandum of Agreement Between the U.S. Nuclear Regulatory Commission and the Michigan State Historic Preservation Officer Regarding the Demolition of the Enrico Fermi Atomic Power Plant, Unit 1 Facility Located in Monroe County, Michigan – SHPO #ER06-683 (Accession No. ML112070043).
September 16, 2011	Letter from John Konik, U.S. Army Corps of Engineers, to Bruce Olson, NRC, regarding concurrence in the release of the Fermi 3 Draft EIS for public comment (Accession No. ML112660005).
November 17, 2011	Email from John Fringer, NRC, to Donald Ferencz, regarding notification of and request for comments on proposed options to mitigate the adverse impacts of the potential demolition of Fermi 1 (Accession No. ML12129A340).
November 17, 2011	Email from John Fringer, NRC, to Philip Harrigan, regarding notification of and request for comments on proposed options to mitigate the adverse impacts of the potential demolition of Fermi 1 (Accession No. ML12129A348).

November 17, 2011	Email from John Fringer, NRC, to David Nixon, regarding notification of and request for comments on proposed options to mitigate the adverse impacts of the potential demolition of Fermi 1 (Accession No. ML12129A343).
November 17, 2011	Email from John Fringer, NRC, to Christine Kull, regarding notification of and request for comments on proposed options to mitigate the adverse impacts of the potential demolition of Fermi 1 (Accession No. ML12129A350).
November 17, 2011	Email from John Fringer, NRC, to Mike Hartman, regarding notification of and request for comments on proposed options to mitigate the adverse impacts of the potential demolition of Fermi 1 (Accession No. ML12129A339).
November 17, 2011	Email from John Fringer, NRC, to Laura Scheele, American Nuclear Society, regarding notification of and request for comments on proposed options to mitigate the adverse impacts of the potential demolition of Fermi 1 (Accession No. ML12129A341).
November 17, 2011	Email from John Fringer, NRC, to James Walther, regarding notification of and request for comments on proposed options to mitigate the adverse impacts of the potential demolition of Fermi 1 (Accession No. ML12129A345).
November 17, 2011	Email from Donald Ferencz to John Fringer, NRC, responding to notification of and request for comments on proposed options to mitigate the adverse impacts of the potential demolition of Fermi 1 (Accession No. ML12129A355).
November 17, 2011	Email from David Nixon to John Fringer, NRC, responding to notification of and request for comments on proposed options to mitigate the adverse impacts of the potential demolition of Fermi 1 (Accession No. ML12129A344).
November 18, 2011	Email from Christine Kull to John Fringer, NRC, responding to notification of and request for comments on proposed options to mitigate the adverse impacts of the potential demolition of Fermi 1 (Accession No. ML12129A359).

November 21, 2011	Email from James Walther to John Fringer, NRC, responding to notification of and request for comments on proposed options to mitigate the adverse impacts of the potential demolition of Fermi 1 (Accession No. ML12129A361).
December 1, 2011	Email from Philip Harrigan to John Fringer, NRC, response to notification of and request for comments on proposed options to mitigate the adverse impacts of the potential demolition of Fermi 1 (Accession No. ML12129A360).
December 19, 2011	Email from Laura Scheele, American Nuclear Society, to John Fringer, NRC, responding to notification of and request for comments on proposed options to mitigate the adverse impacts of the potential demolition of Fermi 1 (Accession No. ML12143A465).
January 9, 2012	Letter from Lisa Chetnik Treichel, U.S. Department of the Interior, to Bruce Olson, NRC, providing review comments on the Draft Fermi 3 Environmental Impact Statement (Accession No. ML12026A464).
January 10, 2012	Letter from Kenneth Westlake, U.S. Environmental Protection Agency, to Cindy Bladey, NRC, providing review comments on the Draft Fermi 3 Environmental Impact Statement (Accession No. ML12018A211).
March 7, 2012	Letter from Scott C. Flanders, NRC, to Reid Nelson, Advisory Council on Historic Preservation, regarding transmittal of signed Memorandum of Agreement (Accession No. ML120450110).
March 30, 2012	Letter from Anthony H. Hsia, NRC, to Scott Hicks, U.S. Fish and Wildlife Service, regarding submittal of the Biological Assessment for the proposed Enrico Fermi Nuclear Power Plant, Unit 3 (Accession No. ML120260586).
June 8, 2012	Letter from Scott Hicks, U.S. Fish and Wildlife Service, to Anthony H. Hsia, NRC, regarding Endangered Species Act Section 7 consultation for the Fermi 3 Nuclear Power Plant, Monroe County, Michigan (Accession No. ML12178A137).
June 13, 2012	Letter from G. Vinson Hellwig, Michigan Department of Environmental Quality, to Lillian L. Woolley, Detroit Edison Company, regarding a request for a state determination that air emissions from Fermi 3 do not exceed State Implementation Plan emission budgets for southeast Michigan (Accession No. ML12178A156).

June 20, 2012	Letter from Peter W. Smith, Detroit Edison, to NRC, transmitting Detroit Edison Company response to NRC request for additional information letter no. 76 related to the environmental review (Accession No. ML12174A273).
June 21, 2012	Letter from Peter W. Smith, Detroit Edison, to NRC, transmitting Detroit Edison Company supplemental response to NRC request for additional information letter no. 76 related to the environmental review (Accession No. ML12178A449).
June 21, 2012	Letter from Peter W. Smith, Detroit Edison, to NRC, transmitting Detroit Edison Company response to NRC request for additional information letter no. 75 related to air conformity requirements (Accession No. ML12179A185).
October 9, 2012	Letter from John Konik, U.S. Army Corps of Engineers, to Bruce Olson, NRC, regarding concurrence in the release of the Fermi 3 Final EIS (Accession No. ML122840677).

Appendix D

Scoping Comments and Responses

Appendix D

Scoping Comments and Responses

On December 10, 2008, the U.S. Nuclear Regulatory Commission (NRC) published a Notice of Intent to prepare an environmental impact statement (EIS) and conduct a scoping process in the *Federal Register* (FR) (73 FR 75142) with regard to the combined license (COL) application received from Detroit Edison Company (Detroit Edison) for one unit identified as Enrico Fermi Unit 3 (Fermi 3), to be located at its existing Fermi site. The Fermi site is located in eastern Monroe County, Michigan, along the western shore of Lake Erie, approximately 24 mi northeast of Toledo, Ohio, 30 mi southwest of Detroit, Michigan, and 7 mi from the United States-Canada border. This EIS has been prepared in accordance with provisions of the National Environmental Policy Act of 1969, as amended (NEPA), Council on Environmental Quality guidelines, and Title 10 of the Code of Federal Regulations (CFR) Parts 51 and 52. As outlined by NEPA, the NRC initiated the scoping process with the issuance of the *Federal Register* Notice. The NRC invited the applicant; Federal, Tribal, State, and local government agencies; local organizations; and individuals to participate in the scoping process by providing oral comments at the scheduled public meeting and/or submitting written suggestions and comments no later than February 9, 2009.

D.1 Overview of the Scoping Process

The scoping process provides an opportunity for public participants to identify issues to be addressed in the EIS and highlight public concerns and issues. The Notice of Intent identified the following objectives of the scoping process:

- Define the proposed action that is to be the subject of the EIS.
- Determine the scope of the EIS and identify the significant issues to be analyzed in depth.
- Identify and eliminate from detailed study those issues that are peripheral or that are not significant.
- Identify any environmental assessments and other EISs that are being or will be prepared that are related to but not part of the scope of the EIS being considered.
- Identify other environmental review and consultation requirements related to the proposed action.
- Identify parties the NRC must consult with under the National Historic Preservation Act, as set forth in 36 CFR 800.8(c)(1)(i).

- Indicate the relationship between the timing of the preparation of the environmental analyses and the Commission's tentative planning and decision-making schedule.
- Identify any cooperating agencies and, as appropriate, allocate assignments for preparation and schedules for completing the EIS to the NRC and any cooperating agencies.
- Describe how the EIS will be prepared, including any contractor assistance to be used.

Two public scoping meetings were held at the Monroe County Community College's La-Z-Boy Center Meyer Theater in Monroe, Michigan, on Wednesday, January 14, 2009. Approximately 100 people attended the afternoon scoping meeting, and approximately 60 attended the evening session. The scoping meetings began with NRC staff members providing a brief overview of the COL process and the NEPA process. After the NRC's prepared statements, the meeting was open for public comments. Forty afternoon scoping meeting attendees and 25 evening attendees provided either oral comments or written statements that were recorded and transcribed by a certified court reporter. Twenty-five written statements were received during the meeting. In addition to the oral and written statements provided at the public scoping meeting, 26 letters and 51 emails were received during the scoping period.

Transcripts for both the afternoon and evening scoping meetings can be found in the NRC Agency Document Access and Management System (ADAMS), under accession numbers ML090440586 and ML090440588, respectively. The written comments provided at the public meetings can be found in ADAMS under accession numbers ML090440585, ML090480683, and ML090430317. ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams/web-based.html (in the Public Electronic Reading Room). (Note: the URL is case-sensitive.) Additional comments received later in letters or emails are also available. A meeting summary memorandum under accession number ML090291080 was issued March 3, 2009.

At the conclusion of the scoping period, the NRC staff reviewed the scoping meeting transcripts and all written material received during the comment period and identified individual comments. These comments were organized according to topic within the proposed EIS or according to the general topic, if outside the scope of the EIS. Once comments were grouped according to subject area, the NRC staff determined the appropriate response for each comment. The staff made a determination on each comment that it was one of the following:

- A comment that was actually a question and introduced no new information.
- A comment that was either related to support of or opposition to combined licensing in general (or specifically the Fermi 3 COL) or that made a general statement about the COL process. In addition, it provided no new information and did not pertain to 10 CFR Part 52.
- A comment about an environmental issue that

  - provided new information that would require evaluation during the review or
  - provided no new information.
- A comment that was outside the scope of the COL, which included, but was not limited to, a comment on the safety of the existing units.

Preparation of the EIS has taken into account the relevant issues raised during the scoping process. The comments received on the draft EIS will be considered in the preparation of the final EIS. The final EIS, along with the NRC staff's Safety Evaluation Report (SER), will provide much of the basis for the NRC's decision on whether to grant the Fermi 3 COL.

The comments related to this environmental review are included in this appendix. They were extracted from the *Fermi Nuclear Power Plant, Unit 3, Combined License Scoping Summary Report* and are provided for the convenience of those interested specifically in the scoping comments applicable to this environmental review. The comments that are outside the scope of the environmental review for the proposed Fermi 3 site are not included here. These include comments related to:

- safety
- emergency preparedness
- NRC oversight for operating plants
- security and terrorism
- support or opposition to the licensing action, licensing process, nuclear power, hearing process, or the existing plant.

More detail regarding the disposition of general or out of scope comments can be found in the Scoping Summary Report. To maintain consistency with the Scoping Summary Report, the comment source ID and comment number along with the name of the commenter used in that report is retained in this appendix.

Table D-1 identifies in alphabetical order the individuals providing comments during the scoping period, their affiliation, if given, and the ADAMS accession number that can be used to locate the correspondence. Although all commenters are listed, the comments presented in this appendix are limited to those within the scope of the environmental review. Table D-2 lists the comment categories in alphabetical order and commenter names and comment numbers for each category. The balance of this appendix presents the comments themselves with NRC staff responses organized by topic category. Table D-3 presents the comment categories in the order to be presented.

Table D-1. Individuals Providing Comments during the Scoping Comment Period

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Corres-pondence ID
–, Richa	Self	Email (ML091020580)	0006
Anderson, Alan	Southern Wayne County Regional Chamber	Meeting Transcript (ML090440586)	0058
Askwith, Annemarie	Self	Email (ML090401003)	0027
B., M. J.	Self	Meeting Transcript (ML090440585)	0082
Baker, Mildred M	Self	Email (ML090401002)	0026
Barnes, Kathryn	Don't Waste Michigan, Sherwood Chapter	Meeting Transcript (ML090480683)	0083
Barnes, Kathryn	Self	Meeting Transcript (ML090440588)	0059
Barnes, Kathryn	Self	Meeting Transcript (ML090480683)	0083
Bell, Mary Faith	Sisters, Servants of IHM	Letter (ML090440092)	0063
Bettega, Gayle	Self	Email (ML090410070)	0047
Biernot, Marilyn	Self	Email (ML090340438)	0020
Bihn, Sandy	Western Lake Erie Association	Meeting Transcript (ML090440585)	0082
Bihn, Sandy	Western Lake Erie Association	Meeting Transcript (ML090440586)	0058
Brown, George	City of Monroe	Meeting Transcript (ML090440586)	0058
Browne, Elizabeth M.	Land and Water Management Division, Michigan Department of Environmental Quality	Letter (ML0906504561)	0079
Campana, Jean Ann	Self	Letter (ML0904402021)	0075
Cappuccilli, Al	Self	Meeting Transcript (ML090440585)	0082
Carey, Corinne	Don't Waste Michigan	Email (ML09120578)	0004
Carroll, Connie	United Way of Monroe County	Meeting Transcript (ML090440586)	0058
Carroll, Connie	United Way of Monroe County	Meeting Transcript (ML090440588)	0059
Colligan, Mary A.	National Marine Fisheries Service, Northeast Region	Letter (ML090711069)	0085
Conner, Mary V.	Self	Email (ML090401007)	0030

Table D-1. (contd)

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Corres-pondence ID
Cumbow, Kay	Citizens for Alternatives to Chemical Contamination	Email (ML090410081)	0051
Cumbow, Kay	Citizens for Alternatives to Chemical Contamination	Meeting Transcript (ML090440586)	0058
Czarnecki, Craig A.	U.S. Fish and Wildlife Service, East Lansing Office	Letter (ML090750973)	0087
D'Amour, James Carl	Self	Email (ML090401016)	0038
Davis, Gary	Self	Letter (ML09040093)	0064
Diederichs, Dorothy	Self	Letter (ML09040094)	0065
Drake, Gerald A.	Self	Email (ML090410097)	0054
Duggan, Marion	Self	Letter (ML0904400870)	0067
Dyson, Ed	Self	Meeting Transcript (ML090440586)	0058
Eddy, Dorothy	Sisters, Servants of the Immaculate Heart of Mary	Letter (ML090440196)	0069
Edwards, Gordon	Canadian Coalition for Nuclear Responsibility,	Email (ML090410071)	0048
Ellison, Jacob	Self	Meeting Transcript (ML090440586)	0058
Englund, Lance	Self	Email (ML090401035)	0041
Farris, Mark	Self	Meeting Transcript (ML090440588)	0059
Fedorowicz, Meg	Self	Email (ML090410092)	0052
Feldpausch, Larry	Self	Meeting Transcript (ML090440586)	0058
Feldpausch, Regina A.	Self	Letter (ML0906504611)	0077
Fischer, Lydia	Self	Meeting Transcript (ML090440586)	0058
Freiburger, Chris	MDNR	Email (ML090401006)	0029
Fulara, Dan	Self	Meeting Transcript (ML090440588)	0059
Green, Frank	Self	Meeting Transcript (ML090440588)	0059
Gruelle, Martha	Wildlife Habitat Council	Meeting Transcript (ML090440585)	0082

Table D-1. (contd)

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Corres-pondence ID
Guthrie, Patricia	Self	Email (ML0904430199)	0055
Hart, Donna	Self	Email (ML090350415)	0021
Henige, Ann	Self	Meeting Transcript (ML090440588)	0059
Henige, Ann	Self	Meeting Transcript (ML090480683)	0083
Henige, Margaret Ann	IHM Sisters	Letter (ML090440091)	0062
Hesson, Gerald	Self	Meeting Transcript (ML090440586)	0058
Holden, Anna	Self	Meeting Transcript (ML090440586)	0058
Hungerman, Marie Gabriel	Self	Email (ML090400999)	0024
Ingels, Mike	Self	Meeting Transcript (ML090440588)	0059
Kamps & Keegan, Kevin and Michael	Self	Meeting Transcript (ML090430317)	0084
Kamps, Kevin	Beyond Nuclear	Email (ML090410076)	0050
Kamps, Kevin	Beyond Nuclear	Letter (ML09028048060)	0057
Kamps, Kevin	Beyond Nuclear	Meeting Transcript (ML090440586)	0058
Kamps, Kevin	Beyond Nuclear	Meeting Transcript (ML090440588)	0059
Karas, Josephine	Self	Letter (ML090440197)	0070
Kaufman, Hedi	Self	Email (ML090401038)	0042
Kaufman, Hedi	Self	Meeting Transcript (ML090480683)	0083
Kaufman, Hedwig	Self	Meeting Transcript (ML090440588)	0059
Kaufman, Hedwig	Self	Meeting Transcript (ML090480683)	0083
Keegan, Michael	Self	Meeting Transcript (ML090440586)	0058
Keegan, Michael	Self	Meeting Transcript (ML090440588)	0059
Keith, Fred	Self	Meeting Transcript (ML090440586)	0058
Lavelline, Joe	Michigan Chapter of the American Nuclear Society	Meeting Transcript (ML090440586)	0058
Lavelline, Joe	Michigan Chapter of the American Nuclear Society	Meeting Transcript (ML090440588)	0059

Table D-1. (contd)

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Corres-pondence ID
Lavelline, Joe	Michigan Chapter of the American Nuclear Society	Meeting Transcript (ML090480683)	0083
Lawson, Ph.D., Charles	International Joint Commission	Email (ML090270697)	0015
Lawson, Ph.D., Charles	International Joint Commission	Letter (ML090440198)	0071
Leonard, Dolores	Self	Email (ML090291092)	0017
Lodge, Terry	Self	Email (ML090410065)	0045
Lodge, Terry	Self	Meeting Transcript (ML090440585)	0082
Lodge, Terry	Self	Meeting Transcript (ML090440586)	0058
Mahoney, Charlie	Four-M Associates-Communications Group	Email (ML090230099)	0010
Mangano, Joseph	Self	Meeting Transcript (ML090430317)	0084
Mantai, Frank	Self	Meeting Transcript (ML090440588)	0059
Mantai, Frank	Self	Meeting Transcript (ML090480683)	0083
Marks, Esq., D.Min, Betram	Self	Email (ML090230107)	0014
May, Ron	DTE Energy	Meeting Transcript (ML090440586)	0058
May, Ron	DTE Energy	Meeting Transcript (ML090440588)	0059
McArdle, Ed	Self	Meeting Transcript (ML090440586)	0058
McGuire, Jim	Area Agency on Aging	Meeting Transcript (ML090440586)	0058
Mechtenberg, Marilynn	I.H.M.	Email (ML090400997)	0023
Mentel, Floreine	Monroe County	Meeting Transcript (ML090440586)	0058
Mentel, Floreine	Monroe County	Meeting Transcript (ML090440588)	0059
Meyer, Richard	Self	Meeting Transcript (ML090440586)	0058
Meyers, Marcie	Self	Meeting Transcript (ML090440588)	0059
Micka, Jeanne	Lotus Garden Club of Monroe	Meeting Transcript (ML090440585)	0082
Micka, Jeanne	Lotus Garden Club of Monroe	Meeting Transcript (ML090440586)	0058

Table D-1. (contd)

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Corres-pondence ID
Micka, Richard	Experiential Tourism Task Group War of 1812 Bicentennial Steering Committee	Meeting Transcript (ML090440585)	0082
Micka, Richard	Experiential Tourism Task Group War of 1812 Bicentennial Steering Committee	Meeting Transcript (ML090440586)	0058
Micka, Richard	Experiential Tourism Task Group War of 1812 Bicentennial Steering Committee	Meeting Transcript (ML090440588)	0059
Miller, Anna	U.S. EPA-Region 5	Email (ML090401019)	0040
Mitchell, Rita	Self	Email (ML090401017)	0039
Morris, Bill	Self	Meeting Transcript (ML090440586)	0058
Morris, Bill	Self	Meeting Transcript (ML090440588)	0059
Morris, William P.	Monroe County Industrial Development Corporation	Meeting Transcript (ML090440585)	0082
Mumaw, Joan	IHM Sisters, Monroe	Meeting Transcript (ML090440588)	0059
Mumaw, Joan	IHM Sisters, Monroe	Meeting Transcript (ML090480683)	0083
Nash, Sarah	Self	Email (ML090401013)	0036
Nett, Ann C.	Self	Email (ML090401011)	0034
Newman, Kent	Self	Email (ML090120581)	0007
Newnan, Hal	Self	Meeting Transcript (ML090440586)	0058
Nixon, Dave	Monroe County Community College	Meeting Transcript (ML090440588)	0059
Nordness, Dorothy	Self	Email (ML090410095)	0053
Oberleiter, Tracy	Monroe County Economic Development Corporation	Meeting Transcript (ML090440585)	0082
Oberleiter, Tracy	Monroe County Economic Development Corporation	Meeting Transcript (ML090440586)	0058

Table D-1. (contd)

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Corres-pondence ID
Oberleiter, Tracy	Monroe County Economic Development Corporation	Meeting Transcript (ML090440588)	0059
Patterson, John	Monroe County Convention & Tourism Bureau	Email (ML090230104)	0012
Petrak, IHM, Genevieve	Sisters, Servants of the Immaculate Heart of Mary	Letter (ML090440088)	0060
Pfeiffer, Jelica B.	Self	Letter (ML0906504661)	0078
Pfeiffer, Jelica B.	Self	Meeting Transcript (ML090440586)	0058
Pitoniak, Gregory	SEMCA	Meeting Transcript (ML090440588)	0059
Pitoniak, Gregory	SEMCA	Meeting Transcript (ML090480683)	0083
Rabaut, Martha	Self	Email (ML090350435)	0022
Richmond, Roberta	Sisters, Servants of the Immaculate Heart of Mary	Letter (ML090440089)	0061
Richters, Karina	City of Windsor	Email (ML090410074)	0049
Ripple, Florence	Self	Letter (ML0906504651)	0076
Ripple, John	Self	Letter (ML090440200)	0073
Rivera, Gloria	Self	Email (ML090291091)	0016
Ryan, Janet	IHM	Letter (ML0906504681)	0081
Rysztak, Robert	Self	Email (ML090401009)	0032
Rysztak, Robert	Self	Email (ML0904021008)	0031
Sanchez, Mira	Self	Email (ML090230106)	0013
Sargent, Lori	Michigan Dept. of Natural Resources	Email (ML090401014)	0037
Sargent, Lori	Michigan Dept. of Natural Resources	Letter (ML090750975)	0086
Schemanksi, Sally	Self	Email (ML090340437)	0019
Schwartz, R.	Self	Email (ML090020433)	0002
Scobie, Randall	Self	Letter (ML090440201)	0074
Seubert, Nancy	IHM Sisters	Meeting Transcript (ML090440586)	0058

Table D-1. (contd)

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Corres-pondence ID
Seubert, Nancy	IHM Sisters	Meeting Transcript (ML090480683)	0083
Shiffler, Nancy L.	Self	Email (ML090401005)	0028
Shumaker, John	Self	Email (ML090401018)	0056
Simonton, Aaron	The Monroe Center for Healthy Aging	Email (ML090120579)	0005
Simpson, Robert	Self	Meeting Transcript (ML090440586)	0058
Smolinski, Myron	Self	Meeting Transcript (ML090440586)	0058
Spencer, Dr. Donald A.	Monroe County Intermediate School District	Meeting Transcript (ML090440585)	0082
Spencer, Dr. Donald A.	Monroe County Intermediate School District	Meeting Transcript (ML090440586)	0058
Stock, Ed & Kim	Self	Email (ML090230105)	0011
Stone, Paula	CASEnergy Coalition	Email (ML090410069)	0046
Sweat, Ron	Plumbers and Pipefitters, Local 671	Meeting Transcript (ML090440585)	0082
Sweat, Ron	Plumbers and Pipefitters, Local 671	Meeting Transcript (ML090440586)	0058
Sweat, Ron	Plumbers and Pipefitters, Local 671	Meeting Transcript (ML090440588)	0059
Tigay, Barry	Oakland Psychological Clinic, P.C.	Email (ML090140205)	0009
Timmer, Marilyn	Self	Letter (ML090440199)	0072
Tinnirello, Nicole	Self	Letter (ML090440086)	0066
Van Ooteghem, Rose Bernadette	Self	Email (ML090401000)	0025
Vaughn, Charlene Dwin	Advisory Council on Historic Preservation	Email (ML090410060)	0044
VItale, Fred	Self	Email (ML090401012)	0035
Walby, Charlotte	Self	Letter (ML090440195)	0068
Walker, Joseph	Self	Email (ML083640037)	0003

Table D-1. (contd)

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Corres-pondence ID
Weber, Margaret	Adrian Dominican Sisters	Meeting Transcript (ML090440585)	0082
Weber, Margaret	Adrian Dominican Sisters	Meeting Transcript (ML090440586)	0058
Westlake, Kenneth A.	Office of Enforcement and Compliance Assistance, U.S. EPA Region 5	Letter (ML0906504671)	0080
White, Greg	Michigan Department of Energy, Labor and Economic Growth	Meeting Transcript (ML090440586)	0058
Wolfe, Joan	Self	Meeting Transcript (ML090440588)	0059
Wolfe, Joan	Self	Meeting Transcript (ML090480683)	0083
Wolfe, Robert	Self	Meeting Transcript (ML090440588)	0059
Worrell, Mark	City of Monroe	Meeting Transcript (ML090440586)	0058
Yascolt, Stas	Self	Meeting Transcript (ML090440586)	0058
Zorn, Dale	Self	Meeting Transcript (ML090440588)	0059

Table D-2. Comment Categories with Associated Commenters and Comment IDs

Comment Category	Commenter (Comment ID)
Accidents-Design Basis	• Meyer, Richard (0058-125) • Ryan, Janet (0081-2)
Accidents-Severe	• Barnes, Kathryn (0059-13) (0083-23) • Cumbow, Kay (0051-4) • Kamps, Kevin (0050-3) (0050-8) (0058-71) • Newnan, Hal (0058-81) • Sanchez, Mira (0013-2) • Timmer, Marilyn (0072-2) • Wolfe, Joan (0059-50) (0083-4)
Alternatives-Energy	• Askwith, Annemarie (0027-2) • Barnes, Kathryn (0059-20) (0083-34) • Bettega, Gayle (0047-7) • Campana, Jean Ann (0075-1) • Conner, Mary V. (0030-2) • Cumbow, Kay (0058-25)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
	• D'Amour, James Carl (0038-1) • Davis, Gary (0064-2) • Edwards, Gordon (0048-9) • Farris, Mark (0059-67) • Henige, Ann (0059-40) (0083-10) • Henige, Margaret Ann (0062-2) • Kamps, Kevin (0050-24) (0050-25) (0059-74) (0059-76) • Karas, Josephine (0070-4) • Keith, Fred (0058-139) • Lodge, Terry (0058-115) • Mantai, Frank (0059-24) • May, Ron (0058-4) (0058-6) (0059-36) • McArdle, Ed (0058-103) • Meyer, Richard (0058-128) • Mitchell, Rita (0039-4) (0039-7) • Nett, Ann C. (0034-4) • Newman, Kent (0007-3) • Newnan, Hal (0058-85) • Pfeiffer, Jelica B. (0058-31) • Rivera, Gloria (0016-4) • Rysztak, Robert (0031-7) (0032-2) • Schwartz, R. (0002-2) • Shiffler, Nancy L. (0028-4) • Simpson, Robert (0058-41) • Sweat, Ron (0058-145) (0059-31) (0082-6) • Tinnirello, Nicole (0066-2) (0066-4) • VItale, Fred (0035-2) • White, Greg (0058-64) • Wolfe, Joan (0059-53) (0083-6) • Wolfe, Robert (0059-57)
Alternatives-Sites	• Bihn, Sandy (0058-56) (0082-25)
Benefit-Cost Balance	• –, Richa (0006-1) • Askwith, Annemarie (0027-3) • B., M. J. (0082-40) • Barnes, Kathryn (0059-19) (0083-33) • Carey, Corinne (0004-8) • Davis, Gary (0064-1) • Drake, Gerald A. (0054-4) • Edwards, Gordon (0048-1) (0048-2) (0048-7) • Englund, Lance (0041-2) • Farris, Mark (0059-66) (0059-69) • Fedorowicz, Meg (0052-1) (0052-3)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
	• Fischer, Lydia (0058-89) • Henige, Margaret Ann (0062-1) • Holden, Anna (0058-98) (0058-102) • Kamps, Kevin (0050-23) (0059-73) • Karas, Josephine (0070-2) • Keegan, Michael (0058-63) • Mahoney, Charlie (0010-5) • Mantai, Frank (0083-36) • McGuire, Jim (0058-136) • Meyer, Richard (0058-130) • Nett, Ann C. (0034-3) • Nordness, Dorothy (0053-5) (0053-6) • Pfeiffer, Jelica B. (0058-30) • Pitoniak, Gregory (0083-21) • Schemanksi, Sally (0019-10) • Seubert, Nancy (0058-18) (0083-35) • Tinnirello, Nicole (0066-1) • Weber, Margaret (0058-69) (0082-35) • Wolfe, Joan (0059-47) (0059-52) (0059-54) (0083-1) (0083-7) • Wolfe, Robert (0059-59) • Yascolt, Stas (0058-32)
Cumulative Impacts	• Askwith, Annemarie (0027-1) • Bihn, Sandy (0058-46) (0058-49) (0058-50) (0058-51) (0058-55) (0058-58) (0082-13) (0082-15) (0082-17) (0082-24) • Carey, Corinne (0004-9) • Freiburger, Chris (0029-6) • Guthrie, Patricia (0055-3) • Kamps, Kevin (0050-12) (0050-14) (0050-19) • Leonard, Dolores (0017-2) • May, Ron (0059-35) • Mumaw, Joan (0059-42) (0083-9) • Newman, Kent (0007-1) (0007-2) • Schemanksi, Sally (0019-6) • Shiffler, Nancy L. (0028-1) (0028-3)
Ecology-Aquatic	• Barnes, Kathryn (0059-16) (0083-31) • Bihn, Sandy (0058-45) (0058-47) (0058-48) (0058-52) (0058-54) (0082-10) (0082-12) (0082-20) (0082-21) (0082-23) • Colligan, Mary A. (0085-1) (0085-2) (0085-3) • Cumbow, Kay (0058-27) • D'Amour, James Carl (0038-2) • Englund, Lance (0041-4) • Freiburger, Chris (0029-1) (0029-3) (0029-4) (0029-5)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
	• Hungerman, Marie Gabriel (0024-1) • Kamps, Kevin (0050-15) (0050-17) (0050-21) • McArdle, Ed (0058-109) • Mitchell, Rita (0039-6) • Schemanksi, Sally (0019-5) • Wolfe, Joan (0059-49) (0083-3)
Ecology-Terrestrial	• Browne, Elizabeth M. (0079-3) (0079-5) • Czarnecki, Craig A. (0087-1) (0087-2) (0087-3) (0087-4) • Freiburger, Chris (0029-8) (0029-9) (0029-11) • Gruelle, Martha (0082-1) • May, Ron (0058-10) • Micka, Jeanne (0058-123) (0082-26) • Micka, Richard (0082-28) • Miller, Anna (0040-2) • Sargent, Lori (0037-1) (0086-1) • Westlake, Kenneth A. (0080-2)
Geology	• Miller, Anna (0040-3) • Westlake, Kenneth A. (0080-3)
Health-Non-Radiological	• Cumbow, Kay (0051-5)
Health-Radiological	• Anderson, Alan (0058-86) • Barnes, Kathryn (0059-12) (0059-18) (0083-22) • Bell, Mary Faith (0063-1) • Bettega, Gayle (0047-5) • Cumbow, Kay (0051-7) (0058-19) (0058-22) (0058-24) • Diederichs, Dorothy (0065-1) • Drake, Gerald A. (0054-3) • Duggan, Marion (0067-1) • Guthrie, Patricia (0055-1) (0055-2) • Kamps, Kevin (0050-6) (0050-7) (0050-9) (0050-11) (0050-13) (0050-16) • Karas, Josephine (0070-3) • Keegan, Michael (0059-64) • Lawson, Ph.D., Charles (0015-2) (0071-2) • Mangano, Joseph (0084-1) • McArdle, Ed (0058-106) • Meyers, Marcie (0059-88) • Mitchell, Rita (0039-2) • Mumaw, Joan (0059-41) (0059-43) (0083-8) (0083-13) (0083-14) • Nash, Sarah (0036-1) • Nett, Ann C. (0034-2) • Petrak, IHM, Genevieve (0060-1)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
	• Pfeiffer, Jelica B. (0058-28) (0058-29) (0078-1) • Ryan, Janet (0081-1) (0081-4) • Rysztak, Robert (0031-5) (0032-3) (0032-4) (0032-5) • Schemanksi, Sally (0019-3) (0019-8) • Simpson, Robert (0058-40) • Walby, Charlotte (0068-1) • Wolfe, Joan (0059-48) (0083-2) • Wolfe, Robert (0059-58) • Yascolt, Stas (0058-34) (0058-35) (0058-36) (0058-37)
Historic and Cultural Resources	• Micka, Richard (0082-29) (0082-32) • Vaughn, Charlene Dwin (0044-1)
Hydrology-Groundwater	• Barnes, Kathryn (0059-17) (0083-32)
Hydrology-Surface Water	• Bihn, Sandy (0058-53) (0082-11) (0082-14) (0082-18) (0082-19) (0082-22) • Browne, Elizabeth M. (0079-2) (0079-4) • Cumbow, Kay (0058-26) • Dyson, Ed (0058-134) • Freiburger, Chris (0029-2) (0029-7) • Holden, Anna (0058-100) • Kamps, Kevin (0050-18) (0050-20) • Kaufman, Hedwig (0083-30) • McArdle, Ed (0058-108) (0058-110) • Rivera, Gloria (0016-3) • Rysztak, Robert (0031-4) • Schemanksi, Sally (0019-4) • Shiffler, Nancy L. (0028-2) • Weber, Margaret (0058-68) (0082-34)
Land Use-Site and Vicinity	• Browne, Elizabeth M. (0079-1) • Ingels, Mike (0059-80) • Micka, Richard (0058-124) (0059-87) (0082-27) (0082-30) (0082-31)
Meteorology and Air Quality	• Edwards, Gordon (0048-3) • Lavelline, Joe (0058-120) • McArdle, Ed (0058-107) • Mitchell, Rita (0039-3)
Need for Power	• Baker, Mildred M (0026-1) • Barnes, Kathryn (0059-14) (0059-15) (0059-22) (0083-24) (0083-25) • Bettega, Gayle (0047-1) (0047-3) (0047-6) • Biernot, Marilyn (0020-1) • Bihn, Sandy (0058-57) (0082-16) • Carey, Corinne (0004-1) (0004-2) (0004-3)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
	• Drake, Gerald A. (0054-1) (0054-6) • Dyson, Ed (0058-133) • Edwards, Gordon (0048-4) (0048-8) (0048-10) • Englund, Lance (0041-1) (0041-5) (0041-7) • Farris, Mark (0059-70) • Fischer, Lydia (0058-90) • Freiburger, Chris (0029-10) • Green, Frank (0059-83) • Holden, Anna (0058-97) • Kamps, Kevin (0050-1) (0050-4) (0050-5) (0059-78) • Karas, Josephine (0070-1) • Kaufman, Hedi (0042-1) (0042-2) (0042-3) (0083-28) • Kaufman, Hedwig (0059-45) • Keegan, Michael (0059-63) • Keith, Fred (0058-138) • Leonard, Dolores (0017-1) (0017-4) • Mahoney, Charlie (0010-3) • Mantai, Frank (0059-25) • May, Ron (0058-5) (0058-8) (0059-34) (0059-39) • McGuire, Jim (0058-135) • Mechtenberg, Marilynn (0023-4) • Mentel, Floreine (0058-13) (0059-5) • Mitchell, Rita (0039-1) • Mumaw, Joan (0083-17) • Nett, Ann C. (0034-1) • Newnan, Hal (0058-80) (0058-83) (0058-84) • Nixon, Dave (0059-72) • Nordness, Dorothy (0053-1) (0053-2) (0053-3) (0053-7) • Pfeiffer, Jelica B. (0078-2) • Pitoniak, Gregory (0083-19) • Rivera, Gloria (0016-1) • Rysztak, Robert (0031-1) (0031-2) (0031-6) (0032-1) (0032-8) • Schemanksi, Sally (0019-1) (0019-11) • Schwartz, R. (0002-1) • Shumaker, John (0056-1) • Simpson, Robert (0058-42) • Timmer, Marilyn (0072-3) (0072-4) • Tinnirello, Nicole (0066-3) • VItale, Fred (0035-1) • Walker, Joseph (0003-1) • White, Greg (0058-65) • Wolfe, Robert (0059-55) (0059-56) (0059-60) (0059-61) • Worrell, Mark (0058-93) (0058-95) (0058-96)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
	• Yascolt, Stas (0058-39) • Zorn, Dale (0059-3)
Process-ESP-COL	• Browne, Elizabeth M. (0079-6) • Carey, Corinne (0004-4) (0004-5) (0004-10) • Cumbow, Kay (0051-1) (0051-8) (0058-23) • D'Amour, James Carl (0038-4) • Fischer, Lydia (0058-87) • Kamps & Keegan, Kevin and Michael (0084-2) • Kamps, Kevin (0050-22) (0057-2) • Kaufman, Hedi (0083-26) • Keegan, Michael (0058-62) • Leonard, Dolores (0017-3) • Lodge, Terry (0058-117) (0058-118) (0082-37) • May, Ron (0058-3) (0058-7) (0058-9) (0058-11) (0059-38) • McArdle, Ed (0058-105) • Meyer, Richard (0058-132) • Rysztak, Robert (0032-7) • Shiffler, Nancy L. (0028-5) • Spencer, Dr. Donald A. (0058-59) • Stock, Ed & Kim (0011-2)
Process-NEPA	• Askwith, Annemarie (0027-4) • Carey, Corinne (0004-7) • Cumbow, Kay (0051-2) (0051-3) (0058-20) • Fischer, Lydia (0058-88) • Hart, Donna (0021-2) • Kamps, Kevin (0057-1) • Kaufman, Hedi (0083-29) • Keegan, Michael (0058-61) (0059-62) • Lawson, Ph.D., Charles (0015-1) (0071-1) • Lodge, Terry (0045-1) (0045-2) (0045-3) (0045-4) (0058-116) • Miller, Anna (0040-1) (0040-4) • Richters, Karina (0049-1) • Simpson, Robert (0058-43) • Stock, Ed & Kim (0011-1) • Westlake, Kenneth A. (0080-1) (0080-4)
Socioeconomics	• Anderson, Alan (0058-79) • Brown, George (0058-1) (0058-2) • Cappuccilli, Al (0082-38) • Carroll, Connie (0058-44) (0059-82) • Ellison, Jacob (0058-111) (0058-112) • Englund, Lance (0041-6)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
	• Fulara, Dan (0059-71) • Gruelle, Martha (0082-2) • Hesson, Gerald (0058-147) • Ingels, Mike (0059-79) (0059-81) • Kamps, Kevin (0059-75) • Keith, Fred (0058-140) (0058-141) • Lavelline, Joe (0058-119) (0058-121) (0058-122) (0059-84) (0059-85) (0059-86) (0083-11) (0083-12) (0083-15) • Mahoney, Charlie (0010-1) (0010-2) (0010-4) • Marks, Esq., D.Min, Betram (0014-1) (0014-2) • May, Ron (0059-37) • McArdle, Ed (0058-104) • McGuire, Jim (0058-137) • Mentel, Floreine (0058-12) (0058-14) (0058-15) (0058-16) (0058-17) (0059-4) (0059-6) (0059-7) (0059-8) • Meyer, Richard (0058-127) (0058-129) (0058-131) • Morris, Bill (0058-78) (0059-9) (0059-10) (0059-11) • Morris, William P. (0082-36) • Oberleiter, Tracy (0058-76) (0058-77) (0059-26) (0059-27) (0082-39) (0082-42) • Patterson, John (0012-1) • Pitoniak, Gregory (0059-23) (0083-18) (0083-20) • Scobie, Randall (0074-1) • Simonton, Aaron (0005-1) (0005-2) • Smolinski, Myron (0058-113) (0058-114) • Spencer, Dr. Donald A. (0058-60) (0082-8) (0082-9) • Stone, Paula (0046-1) • Sweat, Ron (0058-142) (0058-143) (0058-144) (0058-146) (0059-28) (0059-29) (0059-30) (0059-32) (0059-33) (0082-3) (0082-4) (0082-5) (0082-7) • Tigay, Barry (0009-1) • White, Greg (0058-66) • Worrell, Mark (0058-94) • Zorn, Dale (0059-1) (0059-2)
Transportation	• Mechtenberg, Marilynn (0023-2)
Uranium Fuel Cycle	• Barnes, Kathryn (0059-21) • Bettega, Gayle (0047-2) (0047-4) • Carey, Corinne (0004-6) • Conner, Mary V. (0030-1) • Cumbow, Kay (0051-6) (0058-21) • D’Amour, James Carl (0038-3)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
	• Drake, Gerald A. (0054-2) (0054-5) • Eddy, Dorothy (0069-1) • Edwards, Gordon (0048-5) (0048-6) • Englund, Lance (0041-3) • Farris, Mark (0059-68) • Fedorowicz, Meg (0052-2) (0052-4) • Feldpausch, Larry (0058-91) (0058-92) • Feldpausch, Regina A. (0077-1) • Hart, Donna (0021-1) • Holden, Anna (0058-99) (0058-101) • Kamps, Kevin (0050-2) (0050-10) (0058-70) (0058-72) (0058-73) (0058-74) (0058-75) (0059-77) • Kaufman, Hedi (0083-27) • Kaufman, Hedwig (0059-44) (0059-46) • Keegan, Michael (0059-65) • Mechtenberg, Marilynn (0023-1) (0023-3) • Meyer, Richard (0058-126) • Mitchell, Rita (0039-5) • Newnan, Hal (0058-82) • Nordness, Dorothy (0053-4) • Rabaut, Martha (0022-1) • Richmond, Roberta (0061-1) • Ripple, Florence (0076-1) • Ripple, John (0073-1) • Rivera, Gloria (0016-2) • Ryan, Janet (0081-3) • Rysztak, Robert (0031-3) (0032-6) • Sanchez, Mira (0013-1) • Schemanksi, Sally (0019-2) (0019-7) (0019-9) • Timmer, Marilyn (0072-1) • Van Ooteghem, Rose Bernadette (0025-1) • Weber, Margaret (0058-67) (0082-33) • Wolfe, Joan (0059-51) (0083-5) • Yascolt, Stas (0058-33) (0058-38)

Table D-3. Comment Categories in Order as Presented in This Report

D.1.1 Comments Concerning Process – ESP – COL
D.1.2 Comments Concerning Process – NEPA
D.1.3 Comments Concerning Land Use – Site and Vicinity
D.1.4 Comments Concerning Meteorology and Air Quality
D.1.5 Comments Concerning Geology
D.1.6 Comments Concerning Hydrology – Surface Water
D.1.7 Comments Concerning Hydrology – Groundwater
D.1.8 Comments Concerning Ecology – Terrestrial
D.1.9 Comments Concerning Ecology – Aquatic
D.1.10 Comments Concerning Socioeconomics
D.1.11 Comments Concerning Historic and Cultural Resources
D.1.12 Comments Concerning Health – Non-Radiological
D.1.13 Comments Concerning Health – Radiological
D.1.14 Comments Concerning Accidents – Design Basis
D.1.15 Comments Concerning Accidents – Severe
D.1.16 Comments Concerning the Uranium Fuel Cycle
D.1.17 Comments Concerning Transportation
D.1.18 Comments Concerning Cumulative Impacts
D.1.19 Comments Concerning the Need for Power
D.1.20 Comments Concerning Alternatives – Energy
D.1.21 Comments Concerning Alternatives – Sites
D.1.22 Comments Concerning Benefit-Cost Balance

D.1.1 Comments Concerning Process – ESP – COL

Comment: Finally, you've heard about the application that we put in. We spent a couple of years on it. It's now going through the process. We're very comfortable with where we are, and we feel that it would be an important step to really search through this application process and ensure that we're on the right track. (**0058-11** [May, Ron])

Comment: You're aware that we filed a combined license application for Fermi 3 in September. You just heard that. And we also think that today's hearing is not only an important milestone for that licensing process, but it also provides us, with you as our neighbors, many of you as our customers, gives you an opportunity to influence the way we're thinking about this, but also the way your community is shaping up. And we don't take that lightly. We know the NRC is very interested in your comments, but we are as well.

I would also like to make it clear that this is a process for us. So we haven't decided to build a nuclear power plant. We decided to put a license in for that building if eventually we decide to. And, why would we do that? (**0058-3** [May, Ron])

Comment: But it won't take care of the day when the wind doesn't blow or the sun doesn't shine; and what do we want to have that next power be? And we're thinking that we should not avoid looking hard at a nuclear power plant. And there's no good way to do that, in my feeling, and I think our company as well, without actually going through the process. So we really feel comfortable with the fact that we put our application in. We're in the game, but we haven't committed yet to build. (**0058-7** [May, Ron])

Comment: And I would say overall we're looking at a GE plant, not a plant from France. We are looking at a company called Detroit Edison to own and operate this plant. We did not put an application in for loan guarantees, so there's nothing out there currently that would say that we're trying to do something in some sort of way that would obligate future generation, or some of the statements around other taxpayers. (**0059-38** [May, Ron])

Response: *The comments are general in nature and outline Detroit Edison's plans for the project; the comments do not provide new information relating to environmental effects of the proposed action, and will not be evaluated in the EIS.*

Comment: Although no other MDEQ divisions have comments on this project at this time, we recommend that the NRC and DEC maintain communications with the appropriate MDEQ staff throughout the planning, permitting, and development processes. The LWMD will be in contact with those divisions, as well as coordinating with the Michigan Department of Natural Resources (MDNR) on their fisheries and wildlife comments and the U.S. Army Corps of Engineers, as this project progresses. Based on our preliminary review of potential impacts to rare resources on the site, the LWMD may have significant concerns about this project. We recommend that DEC schedule a pre-application meeting with us as soon as possible. The pre-application form can be found under Information at www.michigan.gov/deqwetlands. (**0079-6** [Browne, Elizabeth M.])

Response: *In developing the EIS, the NRC staff will interact with Federal and State agencies, including the Michigan Department of Natural Resources and Environment and others, to obtain information relevant to the environmental review.*

Comment: Where do you follow the standards of the International Joint Commission, by irrefutable Treaty applicable to our precious Great Lakes and Fermi's location on Lake Erie? (**0004-4** [Carey, Corinne])

Response: *In developing the EIS, the NRC staff will interact with Federal and State agencies, as well as the International Joint Commission (IJC), to obtain information relevant to the environmental review. In fact, the NRC staff specifically solicited scoping comments from the IJC, and the IJC provided comments that will be considered as NRC's environmental review proceeds.*

Comment: Where do you respect and include testimony and hearings with the many highly expert scientists and organizations such as NIRS and NEIS and Sierra, etc. etc. etc.? (**0004-5** [Carey, Corinne])

Response: *The NRC staff prepares an EIS in accordance with the requirements of NEPA, 10 CFR Part 52, and 10 CFR Part 51. In its review, the NRC staff focuses on the environmental effects of construction and operation of a new reactor. The staff's review is based on information presented in the COL application Environmental Report (ER) submitted by the applicant and information obtained from independent sources. During the scoping process, interested organizations and the public are invited to participate by submitting comments. The information presented in the applicant's ER is open for comment during the scoping process. If a member of the public is aware of something missing from the ER, or if other information is available that the NRC staff needs to be aware of for its review, the NRC staff is interested in obtaining that information during the scoping process so that it may be considered.*

Comment: Until, and IF ever, NRC processes act in the necessary far more scientific way, you and those processes regarding nuclear uses are to be held highly suspect and rejected for the sake of we, the living, and our grandchildren, and theirs... (**0004-10** [Carey, Corinne])

Comment: I contend it is on these environmental issues alone that the NRC should discontinue further review of DTE Energy's applications for construction of a new facility until these matters are resolved. (**0038-4** [D'Amour, James Carl])

Response: *These comments provide general information in opposition to NRC's COL process and will not be evaluated further. The NRC staff will carefully review the application against its regulations that are intended to protect public health and safety and the environment.*

Comment: Why the rush? Money? Why not wait to see what programs President Obama can implement with wind and solar? Both are probably less expensive, less harm to human and animals alike. There is a thinking these days about renewable energy and energy efficiency. (**0017-3** [Leonard, Dolores])

Comment: Since we can't get rid of the waste of Fermi 1&2, why is Fermi 3 being rushed into as the way to go? (**0032-7** [Rysztak, Robert])

Comment: There are two comment periods right now going on, both on emissions and influence from nuclear power plants. Both of them encompassed the Thanksgiving holiday and the Christmas holiday, and they all come before the Obama administration can be involved in setting those standards. (**0058-23** [Cumbow, Kay])

Response: *As an independent executive agency accountable to Congress, NRC has a timely obligation to initiate the review in response to a COL application as long as the application is considered by the NRC staff to be technically sufficient and complete. Decisions regarding which generation sources and alternatives to deploy are made by the applicant and regulatory bodies such as State energy planning agencies. The alternatives must be technically viable, feasible, and competitive. Alternative actions such as the no-action alternative (energy efficiency and demand-side management), new generation alternatives, purchased electrical power, alternative technologies (including renewable energy such as wind and solar), and the combination of alternatives will be considered in Chapter 9 of the EIS.*

Comment: There are many other critical issues, that need to be addressed and cannot be addressed in this short time period. (**0051-8** [Cumbow, Kay])

Response: *The licensing process for COL applications is specified in 10 CFR Part 52; it will take several years to complete. The process includes a detailed review of an applicant's COL application to determine the environmental effects of construction and operation of a nuclear power facility. After review of the application against the regulations and regulatory guidance, a hearing will be conducted to determine whether it is appropriate to grant the license. Safety issues as well as environmental issues will be evaluated before a decision on an application is reached. As described in the regulations, based on the finding of its review, NRC can deny issuance of a license if it would not meet the regulatory requirements.*

Comment: I just want to really encourage DTE and the NRC to employ a deliberative process that will ensure that Fermi 3, if it is built, is safe and a clean alternative for its users, and I believe that it can be. (**0058-59** [Spencer, Dr. Donald A.])

Response: *This comment provides general information in support of NRC's COL process and will not be evaluated further. NRC will carefully review the application against its regulations that are intended to protect public health and safety and the environment.*

Comment: The procedure is premature because the Nuclear Regulatory Commission has not yet approved the design of the reactor that Detroit Edison said it intends to order. That is the GE-Hitachi Economic Simplified Boiling Water Reactor. The design has been abandoned by several other utilities and isn't yet certified by federal officials. It does not make sense to make comments on a reactor design which does not exist. If in fact design has been abandoned by several other utilities and isn't yet certified by federal officials, which new plant design will be chosen? (**0011-2** [Stock, Ed & Kim])

Comment: The application proposes the use of an Economic Simplified Boiling Water Reactor (ESBWR), a design which is not yet complete and which has not yet been certified by the NRC.

Five other proposed uses of this design around the country have been cancelled, and the Department of Energy has indicated that this design will not receive any of the nuclear loan guarantee funding already approved by Congress.

DTE will inevitably have withdraw this design and resubmit the application, making this current process a waste of time and taxpayer money. (**0028-5** [Shiffler, Nancy L.])

Comment: DTE's proposed Economically Simplified Boiling Water Reactor (ESBWR) design is woefully incomplete, and thus the current NRC licensing proceeding is premature. Hundreds of thorny technical questions have yet to be answered, and no date certain has been established for final NRC certification. The two largest nuclear power utilities in the U.S., Exelon of Chicago and Entergy of New Orleans, have cancelled four ESBWRs due to the design's uncertain status. It is absurd for the concerned public to be asked to comment on the environmental impacts of a proposed reactor design that does not yet exist. This proceeding should be suspended until the ESBWR design is finalized and NRC-certified. (**0050-22** [Kamps, Kevin])

Comment: I ask that the NRC's review of the Environmental Report be suspended until a reactor is chosen that has a finalized design that citizens can actually critique. Simply stated, a reactor is the heart of a reactor project. The ESBWR does not have a finalized design nor is it certified or approved by the NRC. To shut the public out of the scoping process for the EIS for a reactor project before a reactor is chosen is saying that every reactor is alike, with the same risks. This and many of the reactors being chosen today are untried in the real world and the citizens are the guinea pigs, both financially and in the case of safety questions and the long-term protection of the ecosystem, as any serious accident or incident with a nuclear reactor could prove devastating to the Great Lakes and its inhabitants, whose lives are tied intimately to the Great Lakes, for fisheries (a four billion dollar industry), drinking water, recreation, and tourism. (**0051-1** [Cumbow, Kay])

Comment: A compelling reason to grant the 120 day extension to the comment deadline is the fact that the ESBWR design is not yet certified by NRC. In fact, GE-Hitachi has yet to finish the design. There remain hundreds of unresolved technical issues. Thus, it is impossible for us to comment meaningfully on a design that is neither complete nor certified. Some nuclear utilities (Exelon, Entergy), in fact, have cancelled their involvement with the ESBWR design, given its incomplete status. It would be a violation of the public's good will and good faith to rush this Fermi 3 licensing proceeding only to have DTE Energy cancel its pursuit of the ESBWR design -- a not unlikely possibility, given recent developments -- for concerned citizens and environmental organizations would have participated in good faith, only to have their significant investment of time, work and resources wasted when DTE announces it has decided to cancel its ESBWR proposal.

For the reasons laid out above, and on behalf of our members in Michigan and Ohio, I request a 120 day extension to the environmental scoping deadline for public comments on Fermi 3. This would make much more possible meaningful public involvement by a much larger number of concerned citizens and environmental organizations. (**0057-2** [Kamps, Kevin])

Comment: The other problem I see, and I've provided a letter to the Nuclear Regulatory Commission today, is this problem of the economically simplified boiling water reactor design. The problem with it is that it doesn't exist. It has to undergo a formal rulemaking, which is just barely gotten off the ground, which is not anticipated to be completed before 2011, and yet you're being asked to comment on a boiling water reactor design that will be different in some major respects from existing reactor designs, that is not proven, that is not economically going to be sanctioned for taxpayer underwriting by the Department of Energy at any point in the near future; that in effect will not be finalized or certified, if indeed it is -- I understand the NRC staff has asked many, many dozens of very complex and intelligent questions. But it's a design that won't exist yet by March 9th, 2009. Public organizations and people who want to have a trial, contenting that there are problems with the idea of putting up a Fermi 3, have to have identified their experts, have to of identified their information and evidence to combat a design that they don't know for sure will be the ultimate design.

In this proceeding by early February, you are being asked to talk about environmental considerations for design that is neither approved nor is final. Without a fixed, certified, ESBWR design, public commentors in this ongoing NEPA proceeding, and the adjudicatory proceeding, of which it will ultimately be a part, can't meaningfully comment concerning operational prospects and associated environmental effects, accident scenarios, and the fallout, if you will, from those. Nor can they be afforded an understanding of the ongoing routine radiation emissions that come from all operating nuclear power plants. (**0058-117** [Lodge, Terry])

Comment: The public faces these deadlines to comment in this NEPA proceeding and to decide whether or not and how to join the issues by March 9th in the adjudicatory proceeding without knowing with any certainty even whether it will be an ESBWR. Any licensing efforts that are conducted by the NRC will, as a result, be riddled with doubts and conditions which will of course heighten the growing perception that the fix is in and that this process is, unfortunately, merely bread and circuses. (**0058-118** [Lodge, Terry])

Comment: this is all premature because we are asked to be making comment on a reactor design which does not exist. Recently there have been several revelations. There were six -- there were five utilities which chose to go with the economically simplified boiling water reactor. Five of those utilities have canceled those projects.

General Electric's Hitachi's Economic Simplified Boiling Water Reactor Design, proposed by DTE to be built as a new Fermi 3 reactor, has not even been completed, let alone certified by the U.S. NRC. The ESBWR has suffered many recent setbacks calling into serious question its viability.

November 24th, Exelon, the largest nuclear utility in the nation, canceled their facilities in Texas. Just this past Friday, Entergy and Dominion canceled the ESBWR as well. That leaves Detroit Edison standing alone as the only utility embracing this uncompleted design, which is not scheduled for review until mid 2011. So we are asked to be making comment, environmental comment, on a facility that doesn't even exist and has not been tested. So we need to go back to square one. This whole EIS scoping meeting is invalid because we do not have a valid reactor design which to challenge, which to address.

The ESBWR design has over 200 requests for additional information. There are many many unresolved problems. For Detroit Edison to pursue this utility, this design, they are putting the ratepayers and the taxpayers in great jeopardy. This is a design that is not going to come to fruition. Detroit Edison needs to come clean with it. What this meeting amounts to is a bait and switch. They will be aborting this design and choosing another, so this is all premature. (**0058-62** [Keegan, Michael])

Comment: I say no to Fermi 3 because recent news confirmed that this type of reactor, the ESBWR, has yet to be completed, making today's NRC hearing premature. This of course I am reiterating a point by a couple of people who spoke before me. The viability of this type of reactor is seriously in doubt. Out of the six such reactors that had been proposed to be built by different utilities in different states, five have been canceled, and only one, DTE, is proposing to build and its plans are left standing. Obviously there are serious doubts about the worthiness and viability of this design.

In fairness to the public and ratepayers, DTE should withdraw its application and NRC should suspend this proceeding until the ESBWR design has been certified, which will be no earlier than 2011, if ever.

That is the path chosen by the second largest nuclear generator in the US, Entergy, which on January 9 was the third utility to announce the cancellation of its ESBWR reactor proposal at each of two sites previously chosen. The truth seems to be that there are no nuclear reactors ready to install right now. (**0058-87** [Fischer, Lydia])

Comment: The other is the fact that that application that we've put in has chosen the ESBWR. It's one that like the other applications throughout the country, are looking to have their designs approved by the NRC. We are as well. And that's in flight. We won't get the license as we just heard, until after those designs are approved. (**0058-9** [May, Ron])

Comment: The Michigan Chapter of the Sierra Club, Beyond Nuclear, Citizens for Alternatives to Chemical Contamination, Citizens Resistance at Fermi 2, Coalition for a Nuclear-Free Great Lakes, Don't Waste Michigan, and Toledo Coalition for Safe Energy, along with several individual residents in the Monroe, Michigan area respectfully request that the U.S. Nuclear Regulatory Commission immediately suspends the current proceedings aimed and review and ultimately, approval of DTE Energy Company's combined construction and operating license application ("COLA") for Fermi 3, a proposed new nuclear power plant near Monroe, Michigan.

These public organizations and citizens make this request to suspend the COLA adjudication for Fermi 3 pending the commencement and completion of the design certification rulemaking proceeding or the proposed Economically Simplified Boiling Water Reactor ("ESBW") design on which DTE's COLA depends. We ask that the Commission repudiate a recent policy statement that would unlawfully remove the COLA's design-related contents from the scope of issues that may be challenged in the COLA adjudication and refer those issues to be resolved in a separate, parallel rulemaking proceeding to our knowledge has not been scheduled or commenced, the Policy Statement on the Conduct of New Reactor Licensing Proceedings, 72 Fed. Reg. 20 963 (April 17, 2008) (2008 Policy Statement). The 2008 Policy Statement - which is not enforceable law or regulation -should be ignored because it violates Section 189a of the Atomic Energy Act ("AEA"), as well as judicial precedents interpreting the AEA, and the NRC s Part 52 regulations for the conduct of licensing proceedings on COLAs. Pacific Gas & Electric Co. v. FPC, S06 F. 2d 33, 38-39 (D.C. C r . 1974) (when an agency applies a policy in a particular situation, it must be prepared to support the policy just as if the policy state lent had never been issued). The Commission should further reconsider and revoke a recent... (**0082-37** [Lodge, Terry])

Comment: General Electric-Hitachi's so-called Economic Simplified Boiling Water Reactor (ESBWR) design, proposed by DTE to be built as the new Fermi 3 reactor, has not even been completed, let alone certified by the U.S. Nuclear Regulatory Commission. The ESBWR has suffered many recent setbacks, calling into serious question its viability.

On November 23, 2008 there were six ESBWRs proposed to be built across the country: one by Dominion Nuclear at North Anna, Virginia; others by Entergy Nuclear at Grand Gulf, Mississippi and River Bend, Louisiana; two more by Exelon Nuclear at Victoria County Station, Texas; and the sixth by DTE at Fermi nuclear power plant near Monroe, Michigan.

However, on November 24th the ESBWR dominoes began to fall. That's when Exelon announced it would abandon the ESBWR design for its proposed two new reactors at Victoria County Station, Texas

Texans for a Sound Energy Policy had objected to NRC allowing an ESBWR licensing proceeding to continue, given the incomplete status of the design. In fact, they argued that the continuation of the licensing proceeding would violate federal laws and NRC regulations. Such pressure contributed to the nuclear utility, Exelon, the largest in the U.S., announcing that it was no longer considering the ESBWR design for its Victoria County Station, Texas twin reactor project. Exelon notified NRC it would seek another reactor design, stating technologies other than the ESBWR provide the project greater commercial and schedule certainty...As a result, Exelon is considering reactor technologies that have more mature designs, more certain cost structures and better availability of information than the ESBWR."

January 9, 2009 marked Black Friday for the ESBWR design. Entergy, the second-largest nuclear generator in the United States, announced cancellation of its ESBWR new reactor proposals at both Grand Gulf, Mississippi and River Bend, Louisiana. An Entergy press release reported:

The company asked the Nuclear Regulatory Commission on Friday to suspend reviews specific to GE Hitachi's Economic Simplified Boiling Water Reactor after unsuccessful attempts to come to mutually acceptable business terms with GEH [General Electric-Hitachi]. Entergy Nuclear also will temporarily defer environmental reviews related to the construction and operating license applications for potential projects at its nuclear sites at Grand Gulf, near Port Gibson, Miss., and River Bend, near St. Francisville, La. Paul Hinnenkamp, vice president of Entergy Nuclear's business development function, said ... this action simply reflects the fact that we have not been able to come to mutually agreeable terms and conditions with GEH for the potential deployment of an ESBWR."

Later that same day, Reuters reported that Dominion Resources Inc. had likewise been unable to reach an agreement with GE Hitachi to pursue development of a new nuclear plant in Virginia.... Reuters went on: [Spokesman]. Jim Norvelle said Dominion has decided to open a competitive bidding process to select a new engineering, procurement and construction partner for a proposed single new reactor at the North Anna nuclear station in Virginia. While Exelon, Entergy, and Dominion have pledged to continue pursuing new reactors at these same sites, they have made clear that they would not be ESBWRs. (**0084-2** [Kamps & Keegan, Kevin and Michael])

Response: *10 CFR 52.55(c) allows a COL applicant, at its own risk, to reference a design that is under review by NRC but not yet certified. The Economic Simplified Boiling Water Reactor (ESBWR) design is one such design currently under review. However, a COL cannot be issued by NRC until the reactor design is certified by NRC. Applicants select a reactor technology based on their own business criteria. If the ESBWR does not receive certification, then Detroit Edison Company (Detroit Edison) would have to determine whether it would proceed with a different reactor technology. A change in the reactor technology would need to be considered by NRC to determine whether the change would be significant in terms of the environmental impacts of construction or operation.*

Comment: I have a complaint about the documents. I've got an old type phone-in type computer that operates on the phone line, called phone modem, and it takes a long time to download documents. And to take up space and time at a library to download some of this stuff, you know, is asking a lot. And so I haven't read the Environmental Review by the company. So some of the things I may say may not be pertinent. But I would appreciate if hard copy documents could be available in more locations. Perhaps -- there's a reference library at the University of Michigan-Dearborn, there's one at the Centennial Library in Dearborn, Detroit Library I'm sure has one, probably Toledo also. That would be helpful. (**0058-105** [McArdle, Ed])

Comment: I understand that at this time DTE/Detroit Edison and NRC documentation regarding the Fermi 3 project is available for public review at only the main branch (Ellis Branch) of the Monroe County Library. Fermi 2 is in Frenchtown Charter Township and I understand that the DTE/Detroit Edison proposal is to build Fermi 3 next to Fermi 2. The main branch of the Monroe County Library is not in Frenchtown Charter Township. However three other branches of that library are. Could you add those three other branches and the Frenchtown Township government center to the list of locations where Fermi 3 environmental review and other documentation will be available for review? (**0083-26** [Kaufman, Hedi])

Response: *Detroit Edison's ER is available for public inspection at the NRC Public Document Room in Rockville, Maryland. The ER is also available electronically through NRC's ADAMS Web site at http://www.nrc.gov/reading-rm/adams.htmland at http://www.nrc.gov/reactors/new-reactors/col/fermi.html. The Public Document Room can also be contacted at http://www.nrc.gov/reading-rm/pdr/copy-service.html to request a paper copy or CD/DVD of the document for a fee. NRC also wanted to ensure that there was an opportunity for meaningful public participation in the environmental review for such circumstances where electronic access could be difficult; consequently, the NRC staff is providing local access to Detroit Edison's ER and certain other documents at the Ellis Reference & Information Center of the Monroe County Library System in Monroe, Michigan. The NRC staff believes that these options offer reasonable opportunities for public access.*

Comment: As far as a reactor design, the criticism of a license for that reactor vessel, it's an upscale of what already exists. It's just adding more fuel bundles in a larger diameter vessel, so not very much to think about. (**0058-132** [Meyer, Richard])

Response: *The comment refers to characteristics of the ESBWR design. It provides no new information relevant to the environmental review and will not be considered further.*

D.1.2 Comments Concerning Process – NEPA

Comment: For all actions significantly affecting the quality of the human environment, the federal agency must provide a detailed statement on the environmental impact of the proposed action, alternatives to the proposed actions, and any irreversible and irretrievable commitments of resources that would occur with implementation of the action. 42 U.S.C. 4332(2)(C). The Environmental Impact Statement must contain a full and fair discussion of significant environmental impacts that is supported by evidence that the agency has made the necessary environmental analyses. 40 C.F.R. 1502.1. The discussion must include an analysis of the direct, indirect, and likely cumulative impacts of the proposed action. See 40 C.F.R. 1508.7, 1508.8, 1508.25. Federal agencies also must analyze and discuss significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts. 40 C.F.R.1502.9(c). To satisfy NEPA, the NRC must demonstrate it has taken a hard look at the environmental consequences of the proposed action. To comply with NEPA's "hard look" requirement an agency must adequately identify and evaluate environmental concerns. Friends of the Bow v. Thompson, 124 F.3d 1210, 1213 (10th Cir. 1997).

NEPA's twin objectives are to ensure that the federal agency consider[s] every significant aspect of the environmental impact of a proposed action and to inform the public that it has indeed considered environmental concerns in its decision-making process. Earth Island Inst. v. U.S. Forest Serv., 442 F.3d 1147, 1153-54 (9th Cir. 2006); Baltimore Gas & Elec. Co. v. Natural Res. Def. Council, 462 U.S. 87, 97 (1983). See also 40 C.F.R. 1500.1(b), (c). Thus, NEPA procedures must insure that environmental information is available to public officials and citizens before decisions are made and before actions are taken [emphasis supplied]... Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA. Id. 1500.1(b).

NEPA's emphasis on the importance of coherent and comprehensive up-front environmental analysis. . . ensure[s] informed decision-making to the end that the agency will not act on incomplete information, only to regret its decision after it is too late to correct. Blue Mtns. Biodiversity Project v. Blackwood, 161 F.3d 1208, 1216 (9th Cir. 1998). In Foundation on Economic Trends v. Heckler, 756 F.2d 143 (D.C. Cir. 1985), the D.C. Circuit Court of Appeals characterized NEPA litigation as the critical juncture in judicial enforcement of the hard look doctrine, to ensure that the agency has adequately considered and disclosed the environmental impacts of its actions and that its decision is not arbitrary or capricious. Id. at 151. The purpose of NEPA is to ensure that agencies do not make uninformed - as opposed to unwise - decisions. Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 348 (1989). (**0045-2** [Lodge, Terry])

Response: *The comment relates to the requirements set forth in NEPA for preparing an EIS. Section 102 of NEPA directs that an EIS be prepared for major Federal actions that have the potential to significantly affect the quality of the human environment. NRC has implemented Section 102 of NEPA in 10 CFR Part 51. Further, in 10 CFR 51.20, the Commission has determined that the issuance of a COL under 10 CFR Part 52 is an action that requires an EIS. The comment is consistent with NRC policy and practice, but it provides no specific information* *related to the proposed licensing action for the Fermi 3 nuclear plant, and will not be considered in developing the EIS.*

Comment: The scoping for the draft EIS should include a thorough review of all environmental and safety implications to Essex County, Ontario, Canada including the City of Windsor. The following entities shall be invited to participate in the scoping process:

The City of Windsor and other municipalities bordering the Detroit River and Lake Erie;

The County of Essex;

The Ontario Ministry of the Environment; and

Environment Canada.

Further notifications shall be direct to:
City Clerk's Office
City of Windsor
350 City Hall Square, Rm 201
Windsor, Ontario Canada
N9A 6S1 (**0049-1** [Richters, Karina])

Response: *The environmental impacts in Canada from the construction or operation of the proposed Fermi 3 nuclear plant will be considered as appropriate. Public notices of the scoping process were provided in a* Federal Register *(FR) Notice of Intent to conduct scoping (73 FR 75142), advertisements in U.S. and Canadian newspapers, and a press release.*

Comment: Due to the timing of the past meeting, in the dead of winter, the federal Nuclear Regulatory Commission should extend the deadline for accepting comments on the scope of the planned federal environmental review of the proposal for at least 90 days and hold another hearing in the spring when the weather would be better and provide a better input by the community at large. (**0011-1** [Stock, Ed & Kim])

Comment: If the NRC does not suspend review of the Environmental Report (the scoping process for the EIS), then I call for an extension of the comment period for 120 days. The NRC scheduled a short comment period for 1771 pages - actually much greater than that with referenced materials - and over the Christmas/New Year's holiday when citizens have hefty civic and family responsibilities. The official notice of the only public meetings was made on Christmas Eve. The only public meetings were held in bitter winter weather with snow-covered roads and black ice that made travel treacherous. There were days that documents could not be accessed from the NRC's website, by the NRC's own admission, and those with dial-up computers could not download larger documents. Another public meeting should be scheduled to take the place of the ones that occurred in treacherous weather. (**0051-2** [Cumbow, Kay])

Comment: On behalf of our members in Michigan and Ohio, I am writing to request a 120 day extension to the current Feb. 9, 2009 deadline for public comment on the environmental scoping for the proposed Fermi 3 reactor near Monroe, Michigan. I also request that NRC hold another public meeting, like the one held on Jan. 14th at Monroe County Community College, only this time in the spring, when the weather is more conducive to a large public turn out.

Ever since the Fermi 3 licensing proceeding was first announced in early December, 2008 in the Federal Register, I have had repeated problems utilizing NRC's website and ADAMS system to access relevant documents due to the NRC system's dysfunctionality. Such problems were especially bad during the holiday season between Christmas and New Year's, when preparations for the Jan. 14th meeting were urgently needed to be undertaken. Given the immense size of the documentation -- nearly 2,000 pages for the Environmental Report alone, and around 17,000 pages for the overall Combined Construction and Operating License Application (COLA) -- it is eminently reasonable for NRC to grant a 120 day extension to the current deadline. This is the only way for ordinary citizens concerned about the Fermi 3 proposal to read and analyze such incredibly long and technical documents, and seek expert assistance in their analysis and in the preparation of comments to NRC in response.

NRC's publication of the press release announcing the Jan. 14th public meeting late in the afternoon on Christmas Eve also served to significantly lower public involvement. In fact, the press release was obscured by the fact that it was not posted on the NRC's homepage, but only in its press release archives, even on the initial day of its publication.

This poor public notification was compounded by the extreme winter weather that occurred on Jan. 14th. NRC should have realized that holding a public meeting on Jan. 14 in southeast Michigan on the Great Lakes shore ran a high risk of experiencing severe winter weather that would dramatically lower public turn out. The blowing and drifting snow, and extreme cold, deterred a significant number of persons from venturing forth to the meeting on Jan. 14th. An entire carpool of concerned citizens from Ann Arbor, who oppose the Fermi 3 reactor, phoned to inform me that the extreme winter weather would make it impossible for them to attend either of the day's sessions. The impacts and risk of this extreme cold was made all the more clear by the dead car battery experienced by NRC's Gregory Hatchett that day. The extreme cold was near record breaking, and The Weather Channel on cable television, and other authorities, were explicitly urging vulnerable persons -- such as the elderly -- to remain indoors and not risk outdoor travel given the hazardous road conditions. All of this dramatically reduced what would have been a much larger turn out at the public meeting. By way of comparison, a much larger crowd of participants from the public attended the NRC introductory meeting last August 20th, 2008 at the same location. However, that event was not an official NRC meeting for the acceptance of official public comment into the NEPA record. For these reasons, I request a hearing during more reasonable weather conditions, such as in May or June. This would be made possible by a 120 day extension to the comment period. (**0057-1** [Kamps, Kevin])

Comment: I first want to say that this is being done way too hastily, and that we had 1,771 pages to review over the Christmas and New Year's holiday. And that's when people have a lot of other family and community obligations. This room should be packed, and one reason it isn't is because of those holiday considerations. This is also one of the coldest weeks in the year. And, that happens in January. (**0058-20** [Cumbow, Kay])

Comment: I want to go on record as stating this whole process is premature. I object to being publicly notified on Christmas Eve that there would be a meeting; and I object to the meeting being held in the middle of a Michigan winter, when the probability of people attending this proceeding, this hearing, would likely be diminished. So I am requesting an extension of the comment period for an additional 90 days; and I am requesting that another meeting of this type be held in the spring, when people can come out and they don't have to brave the coldest night of the year, last night, and the weather condition. So I object to this entire process. (**0058-61** [Keegan, Michael])

Comment: And again, one wonders about the timing of these hearings. (**0058-88** [Fischer, Lydia])

Comment: I must say I'm presenting under protest, in that the notification, the public notification occurred on Christmas Eve and the meeting was scheduled in the heart of a Michigan winter, and as you can see the weather is quite inclement. If you were to schedule a meeting where you didn't want the public to be participating, it would be January 14th, in the middle of blizzards and record cold temperatures. (**0059-62** [Keegan, Michael])

Comment: I request an extension of the public comment deadline, 30 days beyond Feb. 9. (**0083-29** [Kaufman, Hedi])

Response: *More than one month prior to receipt of the Fermi 3 COL application, NRC conducted a Public Outreach Meeting in the site vicinity to heighten public awareness of the NRC process for conducting licensing reviews under 10 CFR Part 52. At that meeting, the NRC staff discussed both the safety and environmental reviews that would be conducted. Public involvement and comments are invited and encouraged throughout the environmental review of a project, and NRC formally solicits both written and oral comments from members of the public at two different times during the review.*

The scoping process is the public's first opportunity for comment, and is conducted to define the proposed action, determine the scope of the environmental impact statement, and identify significant issues to be analyzed. NRC conducted scoping meetings near the proposed site to *facilitate public participation. NRC published the Federal Register notice that informed the public of the times and locations. As outlined at the Public Outreach Meeting, the dates of public scoping meetings were contingent upon when the application was submitted to NRC and the resulting environmental review schedule. NRC also published meeting notices in newspapers in communities near the plant and posted a notice of the meeting on the NRC's website for the project. The website provides addresses for written comments to be submitted in person, by mail, or electronically. The deadline for comments is usually 60 days following the publication in the* Federal Register *of the Notice of Intent to conduct scoping.*

The public's second opportunity to comment will occur after the draft EIS is published. NRC will file the draft EIS with the U.S. Environmental Protection Agency (EPA), and the EPA will issue a Notice of Filing in the Federal Register *to formalize the start of the public comment period. The NRC staff places a Notice of Availability in the* Federal Register *and on the NRC website indicating that the draft EIS has been issued, with instructions for the public and other interested parties on how to obtain copies. Those persons already on the mailing list will receive copies of the NRC notice and the draft EIS without further action. The draft EIS will also be available on the NRC website. The notice will request comments on the draft EIS and will provide addresses for delivering or sending the comments to NRC. Usually, a 75-day period is allotted for the public's review and the receipt of comments. During the public comment period, the NRC staff will hold a second set of public meetings in the vicinity of the proposed site to present the results of the draft EIS to the public and to obtain comments, both oral and written, from the public.*

Comment: When do you sponsor open direct public discussion-debates with these experts, rather than the biased, staged dog-and-pony shows which few concerned public citizens attend, partly because of distrust via past experiences, partly because advance notice of such meetings is inadequate, limited and never visibly itemized at the meetings. (**0004-7** [Carey, Corinne])

Response: *It is the policy of NRC to involve the public in the Commission's decision making process; therefore, NRC elects to conduct open public scoping meetings in association with its environmental review process. Meetings are generally held in a location accessible by the largest population that will experience the most direct environmental impact as a result of the proposed action. In the case of the proposed Fermi 3 nuclear plant, this population is located in the area of Monroe County, Michigan. The scoping period was open for 60 days, and during that time, the public and other agencies were welcome to provide verbal comments at scoping meetings or to submit written comments. NRC will hold additional public meetings after the draft EIS is published. Separate meetings will be held by NRC in association with the safety review process.*

Comment: However, the IJC does have additional responsibilities under the Canada-U.S. Great Lakes Water Quality Agreement and is pleased, therefore, that your environmental assessment will consider the potential impact of the proposed plan on water quality, aquatic biota and their habitat, or other environmental resources. (**0015-1** [Lawson, Ph.D., Charles])

Comment: U.S. Environmental Protection Agency (EPA) staff members were pleased to be a part of the Fermi 3 site audit visit in early February. We have a better understanding of the topics the Nuclear Regulatory Commission (NRC) will cover in its Environmental Impact Statement (EIS) for this project, a new reactor unit associated with the existing Fermi Nuclear Power Plant in Monroe County, Michigan. (**0040-1** [Miller, Anna])

Comment: Thank you for inviting us to participate in the site audit and for considering our comments on the EIS scope. We look forward to working with your staff during the environmental review process. (**0040-4** [Miller, Anna])

Comment: However, the IJC does have additional responsibilities under the Canada-U.S. Great Lakes Water Quality Agreement and is pleased, therefore, that your environmental assessment will consider the potential impact of the proposed plan on water quality, aquatic biota and their habitat, or other environmental resources. (**0071-1** [Lawson, Ph.D., Charles])

Comment: U.S. Environmental Protection Agency (EPA) staff members were pleased to be a part of the Fermi 3 site audit visit in early February. We have a better understanding of the topics the Nuclear Regulatory Commission (NRC) will cover in its Environmental Impact Statement (EIS) for this project, a new reactor unit associated with the existing Fermi Nuclear Power Plant in Monroe County, Michigan. (**0080-1** [Westlake, Kenneth A.])

Comment: Thank you for inviting us to participate in the site audit and for considering our comments on the EIS scope. We look forward to working with your staff during the environmental review process: (**0080-4** [Westlake, Kenneth A.])

Response: *NRC conducts a number of activities during its review that will involve direct interactions with other governmental organizations. The comments are general in nature, provide no new information related to the impacts of construction or operations of the proposed Fermi 3 nuclear plant, and will not be considered in developing the EIS.*

Comment: Please advise me how the Nuclear Regular Commission intends to move on this possibility. Who will be involved in the decision? Will the local community have a voice? (**0021-2** [Hart, Donna])

Response: *The licensing process for COL applications is specified in Title 10 of the Code of Federal Regulations (10 CFR) Part 52. The process includes a detailed review by the NRC of an applicant's COL application to determine the safety and environmental effects of construction and operation of a nuclear power facility. After review of the application against the regulations, a hearing will be conducted to determine whether it is appropriate to issue the license. Both* *safety issues and environmental issues will be evaluated before a decision on an application is reached. As described in the regulations, based on the finding of its review, NRC can deny issuance of a license if it would not meet the regulatory requirements.*

Public involvement and comments are invited and encouraged throughout the environmental review of major Federal actions; the issuance of a COL would be a major Federal action and, therefore, requires the development of an EIS. NRC formally solicits both written and oral comments from members of the public at two different times during the environmental review, at the beginning of the process during environmental scoping for the EIS and when the draft EIS is issued.

Comment: If is very difficult to change habits. I ask you to be brave in taking action to avoid the possibility of serious or irreversible environmental harm even when scientific knowledge is incomplete or inconclusive. I ask you to be courageous in taking in the information that we are learning and in learning from any mistakes from your field. We humans can now affect the global climate, environment and life by our actions. We can add to the burden of a withering planet or we can bring enormous relief and safety. Please turn all your leadership toward clear energy solutions in favor of long-term care and flourishing Earth's human and ecological communities. Sincerely counting on your openness and determination to support thoughtful energy plans. (**0027-4** [Askwith, Annemarie])

Response: *NRC does not have a role in establishing the energy policy of the United States. NRC does not promote the use of nuclear power as a preferred energy alternative, and it does not regulate alternatives to producing electricity that do not involve nuclear power. Establishing energy policy is the domain of the President, the Congress, and the U.S. Department of Energy. Nevertheless, as part of NRC's environmental review, alternative actions such as the no-action alternative (energy efficiency and demand-side management), new generation alternatives, purchased electrical power, alternative technologies (including renewable energy such as wind and solar), and the combination of alternatives will be considered in Chapter 9 of the EIS.*

Comment: A NEPA document in connection with Fermi 3 will be a vain undertaking unless the Nuclear Regulatory Commission administratively forbids the initiation of any physical construction or preconstruction activities at the Fermi 3 site until the completion and finalization of an Environmental Impact Statement and selection of a preferred alternative.

In 2007 the Nuclear Regulatory Commission promulgated a new, de-regulated definition of construction as that term applies to the building of new nuclear power plants. Under the new 10 C.F.R. 50.10(a)(2), the following activities were relieved of all NRC oversight:
> Site exploration
> Procurement
> Logging, clearing of land, grading

> Excavation for any structure
> Fabrication at other than the final onsite, in-place location (modules)

At the same time, the limited work authorization - the first point at which NRC build authority must be sought - was moved higher/later in the licensing continuum. The new LWA list of allowable activities contained in the revised 10 C.F.R. 50.10(d)(1) includes:
> Driving of pilings
> Subsurface preparation
> Placement of backfill, concrete, or permanent retaining walls
> Installation of foundation

The drastic alteration of the meaning of construction circumvents NEPA. By allowing excavation activity, for example, the utility commences an irretrievable commitment to a nuclear-fired power plant long before the completion of an Environmental Impact Statement which is supposed to seriously consider reasonable alternatives. This manifests an undeniable bias toward central baseload plant construction and precludes substantive consideration of any other alternatives such as wind, solar, geothermal and energy conservation. By de-regulating the nuclear plant construction process from NEPA restrictions, the Commission is handing DTE, as applicant, the sunk costs argument, i.e., that because the utility has incurred expenses for its project, it should not, nay, must not, be denied an NRC license to complete it.

If the Commission were to allow any acts of construction to proceed before the completion of the NEPA process, such is illegal because it is contrary to NEPA. Because such enabling would act to deprive the public of the benefit of the procedural protections of NEPA, the NRC revamping of its definition of construction comprises a denial of due process and is unconstitutional as applied. (**0045-1** [Lodge, Terry])

Comment: The present process allows DTE to, de facto, irretrievably commit to the project and to invest heavily in construction prior to the de jure selection of a preferred alternative. This makes the environmental document into a farce. A project being built while it is being licensed is far more difficult to stop than a project which seeks merely paper approval. Sunk costs significantly undermine the effectiveness of environmental laws. And besides massive investment, the work undertaken prior to a final EIS drastically affects the environment and natural resources - the very resources that should have been protected until more thorough analysis of the project's impact on the environment was conducted. By the time opponents of the project can get a court to consider enjoining the project, the court faces a fait accompli.

The First Circuit Court of Appeals illustrated in Sierra Club v. Marsh the dangers that sunk costs pose in the NEPA context. There, the Court of Appeals vacated a district court ruling denying a preliminary injunction to environmental plaintiffs. The plaintiffs sought to halt the construction of a causeway to an island that the State of Maine wanted to develop into a marine terminal. The district court had denied the preliminary injunction in the belief that the harm to the environment was not irreparable because the causeway always could be removed at a later time.

The Court of Appeals vacated the district court's decision not to issue a preliminary injunction, Sierra Club v. Marsh, 872 F.2d 497, 500-501 (1st Cir. 1989) because setting aside an agency's decision at a later date would not undo environmental harm. Moreover, the commitment of resources already made to the project would influence any re-evaluation of the merits of the project. The appellate panel held that it is far easier to influence an initial choice than to change a mind already made up and that the harm at stake is a harm to the environment, but the harm consists of the added risk to the environment that takes place when governmental decision makers make up their minds without having before them an analysis (with prior public comment) of the likely effects of their decision upon the environment. Id. Hence premature decisions irreparably harm the environment, by increasing the risk to the environment.

Congress promulgated NEPA to ensure that federal projects were not initiated until an accurate assessment of the project's impact on the environment was complete. Vermont Yankee Nuclear Power Corp. v. National Resources Defense Council, Inc., 435 U.S. 519, 558 (1978) (finding Congress passed NEPA to ensure that federal agencies consider the environmental consequences of proposed actions during the decision-making process, thereby insuring fully informed and well-considered decisions); Massachusetts v. Watt, 716 F.2d 946, 953 (1st Cir. 1983) ([NEPA's] purpose is to require consideration of environmental factors before project momentum is irresistible, before options are closed, and before agency commitments are set in concrete. (quoting W. Rogers, Environmental Law 7.7 at 767 (1977)); Arlington Coalition on Transp. v. Volpe, 458 F.2d 1323, 1333 (4th Cir.) (stating that the purpose of NEPA [is] to insure that actions by federal agencies be taken with due consideration of environmental effects), cert. denied sub nom. Fugate v. Arlington Coalition on Transp., 409 U.S. 1000 (1972).

Regulations issued pursuant to NEPA state that until an agency issues a record of decision ... no action concerning the proposal shall be taken which would: (1) have an adverse environmental impact; or (2) limit the choice of reasonable alternatives. 40 C.F.R. 1506.1 (1995); see also 40 C.F.R. 1501.2 (stating that agencies must integrate the NEPA process with other planning at the earliest possible time to insure that planning and decisions reflect environmental values. (**0045-3** [Lodge, Terry])

Comment: In the case of Fermi 3, the Commission should immediately forbid any physical activity at the proposed plant site by DTE or its contractors and subcontractors which is designed to further a build alternative at the proposed site for Fermi 3, pending formal and final completion of an EIS and the selection of a preferred alternative. To allow otherwise violates NEPA and invites a lawsuit. (**0045-4** [Lodge, Terry])

Comment: I call for the NRC to not allow any preconstruction activity until a full EIS is completed and all alternatives are examined in a comprehensive way. Allowing preconstruction activity defeats the purpose of NEPA, as well as not allowing examination or mitigation of preconstruction activity by NEPA. (**0051-3** [Cumbow, Kay])

Comment: I'd like to talk about the integrity of the NEPA process. I appreciate greatly the fact that the Nuclear Regulatory Commission has professional staff who are devoted to ensuring that NEPA's complied with. And it's not the people here today I have problems with. I have problems with the former Commissioner Merrifield, who departed the NRC in 2007 only after he had hand-carried through the process a rule change that deregulated the construction process so that Detroit Edison, and other utilities, are able to undertake serious construction of nuclear power plants before the NEPA process is completed. And to my knowledge it's the only agency that I've ever encountered that is able to -- that has enabled its client population to do that.

When there's a timber cut, Environmental Impact Statement process, the trees don't get cut before the ultimate decision is made and the environmental considerations denominated. When the Department of Energy wants to detonate a test weapon at the Nevada Test Site, they don't set off the bomb before they've completed the NEPA process. When your State Highway Department of Transportation wants to build an interstate through your living room, they don't get to start the bulldozers and knock over houses before they've completed the NEPA process, ruled in or ruled out alternatives. (**0058-116** [Lodge, Terry])

Comment: The other thing that I was concerned about was that these plants, like Fermi, are able to build part of their structure outside the regulation of a permit. In other words, if I want to lay all the concrete that it's going to take to build the plant, I don't have to wait for the permit to be approved to go ahead and start building.

It's kind of a flaw in the law because, as I see it, it looks like the taxpayer is subsidizing the possibility that there will be any kind of a refusal of the NRC to approve the plant. So if the plant has a chance of being refused, then the taxpayer will pick up the cost of all of the structures that are built without the approval.

The only way that I can see that somebody would go ahead and start building structures like these, is if they already knew that the approval would take place. If that's not correct I would like somebody to tell me why someone would spend millions and millions of dollars without having any idea of whether they would be reimbursed. (**0058-43** [Simpson, Robert])

Response: *These comments refer to a 2007 amendment to the Commission's regulations concerning limited work authorizations (72 FR 57416, October 9, 2007). In 10 CFR sections 50.10(a) and 51.4, the definition of construction is limited to activities which are for safety-related structures, systems, or components (SSCs) and certain other SSCs. A limited work* *authorization, construction permit, or COL is required before performing such activities. Activities that do not fall within NRC's definition of construction, such as clearing and grading, excavating, building transmission lines, and erecting support buildings are considered preconstruction activities that do not require NRC authorization. Most of these activities are regulated by other local, State, Tribal, or Federal agencies and require permits from them to proceed. In its environmental review, NRC must consider preconstruction activities in the context of cumulative impacts. These impacts will be evaluated in Chapters 4 and 7 of the EIS.*

D.1.3 Comments Concerning Land Use – Site and Vicinity

Comment: Ironically the War of 1812 Bicentennial planning process shares the same timeframe as the Environmental Review process for Fermi unit 3. And in accordance the State of Michigan Centers for Regional Excellence Program, groups tourism with energy production as collaborative activities. In fact, the seven-and-a-half mile radius from Fermi unit 3 includes all of the cultural, historical, recreational, and natural sites being considered as bicentennial legacy projects.

The group I represent will be long gone before Fermi unit 3 is operational. However, the Experiential Tourism Task Group War of 1812 Bicentennial Steering Committee in Monroe County was charged with the responsibility of creating bicentennial legacy projects to enhance tourism. Our objective is to marshal all of the heritage resources on the waterfront to make a compelling experience for visitors to the Lake Erie west region. Efforts are underway with the help of the Native American community, to bring back wild rice as an 1812 bicentennial project. Fermi unit 3 has ample areas suitable for the propagation of wild rice. This would be a cultural, economic endeavor that would bridge the gap to future generations. It would start the process of reintroducing missing species that once were abundant in the Lake Erie marshes. The Downriver link, Greenways Initiative, has advocated a non-motorized trail around Fermi unit on North Dixie Highway. The National Park Service promotes the rivers trails, and conservation assistance program that would supplement this effort.

Within the seven-and-a-half radius of Fermi Unit 3, the U.S. Fish and Wildlife Service has established an international wildlife refuge. The National Park Service operates the Motor City's National Heritage area, and is exploring the establishment of a National Battlefield Park, that would connect to the North Country National Scenic Trail near Fort Meigs in Perrysburg, Ohio. The US Army Corps of Engineers operates a confined disposal facility on the St. Lawrence Seaway at Pointe Mouillee, that is the world's largest freshwater marsh restoration project. This is all exciting news, and the combined license application should be updated to reflect these initiatives, and the application should join in the effort to create a center for regional excellence built on the energy industry in the Lake Erie West region. (**0058-124** [Micka, Richard])

Comment: One of the key elements in the State centers of regional excellence program is energy production. Another element is tourism. Ironically both of these elements have come together on the shores of Lake Erie. All the bicentennial heritage resources, cultural, historic, recreational, and natural, are within the seven-and-a-half mile radius of Fermi Unit 3, proposed Fermi Unit 3.

The planning process for the bicentennial coincides with the environmental review process for Fermi Unit 3. The greatest challenge for the Bicentennial Task Group is achieving center of regional excellence status in capacity building, which is the hallmark of sustainable energy production.

This sphere of influence surrounding the existing Fermi nuclear power plant makes it a prime candidate to become a center of regional excellence under the Governor's transformation initiative. The scoping process for Fermi's Unit 3 comes at a critical time. Achieving center of regional excellence could be a byproduct of the Fermi Unit 3 environmental report and would benefit the entire community.

The Fermi 3 scoping process and environmental report provide a compilation of all the efforts undertaken to date to restore environmental resources on the shore of Lake Erie. So there's an immediate result and benefit from this process that we're taking under our administration here this evening. So have heart and stay with the program. (**0059-87** [Micka, Richard])

Comment: The 7.5 Mile Radius within the Fermi Unit 3 Sphere of Influence can become a Center for Regional Excellence (CRE) under the Governor's Transformation Initiative. It needs to be packaged in such a way that it fulfills the Cultural, Economic, Development Action Strategy proposed by the State of Michigan. An Energy Corridor along the West Shore of Lake Erie would benefit the Community Cultural Economic Development Readiness Initiative. This process uses a prescribed Set of Capacity Building Tools toward attainment of Community Empowerment and Actualization Goals. The COLA already uses these tools in bringing about Sustainable Energy Resources such as Efficiency, Research, Assessment, Evaluation, Consultancy, Training, Mentoring, Planning, Partnerships, Collaborations and Incentives. Fermi Unit 3 can lead by example. As a member of the Community, Fermi Unit 3 should work with Monroe County to implement a Cultural, Economic, Development Action Strategy (copy attached). The entire Electrical Generation Resources of Monroe County should be harnessed to create a Center for Regional Excellence. The Energy Story needs to be told specifically where Stewardship of Natural Resources is concerned. Finally, there are two 1812 Legacies within the 7.5 mile Radius that need to be explored.

Wild Rice. Efforts are under way with the help of the Native American Community to bring back Wild Rice as an 1812 Bicentennial Project. Fermi Unit 3 has ample areas suitable for the propagation of Wild Rice. This would be a cultural, economic endeavor -that would bridge the gap to future generations. It would start the process of reintroducing missing species that once were abundant in the Lake Erie Marshes.

Non-Motorized Transportation. The Downriver Linked Greenways Initiative (Brochure attached) has advocated a non-motorized trail around Fermi Unit 3 on North Dixie Hwy. (Hull's Road). This is a CRE Project and could become a part of the Fermi Unit 3 Evacuation Plan. The NPS promotes the Rivers, Trails and Conservation Assistance (RICA) Program that would supplement this effort. (**0082-31** [Micka, Richard])

Response: *These interdisciplinary comments relate to existing and proposed land use, cultural resources, and ecology in the site vicinity. These aspects of the affected environment will be discussed in Chapter 2 of the EIS. General impacts of the proposed action on land use, including expected permanent and temporary land use changes at the site in the vicinity, in the region, and in offsite areas such as affected transmission corridors, will be evaluated in Chapters 4 and 5 of the EIS. Impacts specifically related to the 1812 Bicentennial Project will be addressed in the cultural resources impact discussions in Chapters 4 and 5 of the EIS. Impacts specifically related to the possible reestablishment of wild rice in the wetlands along Lake Erie will be addressed in the terrestrial ecology impact discussions in those same chapters. Cumulative impacts of the proposed action will be discussed in Chapter 7 of the EIS.*

Comment: if there is some way of better connecting the natural spaces we still have along the shoreline. These power plants, whether they're coal or nuclear, tend to be dead spots for outdoor recreation. Hikers can't access them generally, and fishermen oftentimes have to deal with sometimes water access problems because of security in the age of terrorism. And I guess what I'm asking DTE maybe to do is to do some compensation for the local residents to have some positive environmental and recreational impact in addition to the plant development. (**0059-80** [Ingels, Mike])

Response: *Impacts of construction and operation of the proposed Fermi 3 nuclear plant on recreational opportunities, and a discussion of any possible and appropriate mitigation measures, will be presented in the land use impact discussions in Chapters 4 and 5 of the EIS.*

Comment: Staff of the MDEQ has conducted an initial review of the proposal, which indicates that this project is located within Michigan's coastal management boundary and is subject to Federal Consistency requirements. Before the U.S. Nuclear Regulatory Commission can issue the proposed COL, staff of the LWMD will need to review the proposed project for Federal Consistency with Michigan's Coastal Management Program (MCMP), as required by Section 307 of the Coastal Zone Management Act, PL 92-583, as amended. This will happen after the final EIS has been submitted to our office with a request for Coastal Zone Management certification of Federal Consistency. A determination of Federal Consistency with the MCMP requires evaluation of a project to determine if it will have an adverse impact on coastal, land, or, water uses or coastal resources. Projects are evaluated using the permitting criteria contained in the regulatory statutes administered by the MDEQ. These statutes constitute the enforceable policies of the MCMP. The statutes that this project will be reviewed against for Federal Consistency are found in Michigan's NREPA. The COL proposes state regulated construction activities which will require state permits and may cause significant impacts, as discussed in more detail below. (**0079-1** [Browne, Elizabeth M.])

Response: *Prior to issuance of a COL for the proposed Fermi 3 nuclear plant, Detroit Edison will be required to demonstrate compliance with all applicable Federal and State laws and regulations including those of the Coastal Zone Management Act.*

Comment: Figure 2.4-6 illustrates the Detroit River International Wildlife Refuge Boundary. The south extent of the Boundary follows 1-75 to the Ohio line. It does not terminate at the River Raisin Federal Navigation Channel (Monroe Harbor) as indicated in Figure 2.4-6.

Paragraph 2.2.1.2.5 (Page 2-18) Natural and Recreational Areas. The ER indicates that the Detroit River International Wildlife Refuge (DRIWR) is not open to the public. There are units within the Refuge such as Humbug Marsh (Trenton, MI) and Erie Marsh (Erie, MI) that are open to the public at certain times of the year. In the future, the Refuge will encourage public visitation. The Fermi Unit 3 Area is not open to the public. (**0082-27** [Micka, Richard])

Response: *This comment provides information on land use categories and restrictions in the vicinity of the Fermi site, particularly as related to the Detroit River International Wildlife Refuge. This information will be considered in Chapter 2 of the EIS.*

Comment: Figure 2.1-2 illustrates a 7.5 mile Radius around the Fermi Unit 3 vicinity. This radius encompasses a number of Heritage Resource Sites in the Coastal Zone of Monroe County, MI.

RECREATIONAL. Sterling State Park and Downriver Linked Greenways Initiative. (Michigan DNRJ National Park Service/Rivers, Trails & Conservation Assistance Program).

NATURAL. Detroit River International Wildlife Refuge -Eagle Island Marsh (US Fish & Wildlife Service/DRIWR). (**0082-30** [Micka, Richard])

Response: *This comment provides information on land use categories and restrictions in the vicinity of the Fermi site, particularly as related to Heritage Resource Sites. This information will be considered in Chapter 2 of the EIS.*

D.1.4 Comments Concerning Meteorology and Air Quality

Comment: Construction of the project would create additional greenhouse gases from the cement required for the project, as well as the transportation used to move materials to the area. (**0039-3** [Mitchell, Rita])

Comment: The proponents should be required to do a complete carbon- footprint analysis involved in the construction of the plant and the preparation of materials and equipment, including the carbon emissions associated with uranium mining, refining, enrichment, and fuel fabrication. (**0048-3** [Edwards, Gordon])

Comment: One cannot read a newspaper or watch a television news program without seeing references to the desire for decreased reliance on carbon-based fuels for national security and environmental reasons, to name a few.

The Fermi 3 project provides a step in the right direction towards achieving this goal. (**0058-120** [Lavelline, Joe])

Response: *The NRC staff will evaluate air quality impacts associated with the construction and operation of the Fermi 3 nuclear power plant (including those from carbon and other greenhouse gas emissions) in Chapters 4 and 5, respectively, of the EIS. Carbon emissions from the uranium fuel cycle will be addressed in Chapter 6 of the EIS.*

Comment: I don't know if the cooling towers are included, but if there are I know some cooling towers use fungicides and algaecides to reduce the buildup of algae within cooling towers. Some of these things are chlorinated chemicals which would also have environmental impacts to the air, to the water, and so forth. (**0058-107** [McArdle, Ed])

Response: *The NRC staff will examine the potential impacts of water treatment chemicals used in cooling towers. Results of the analysis will be presented in Chapter 5 of the EIS.*

D.1.5 Comments Concerning Geology

Comment: We understand the site may have subsurface karst geology. We recommend the EIS address whether there is karst geology and, if present, evaluate how this geologic setting may influence the project's environmental impacts. To facilitate our review, we would appreciate knowing whether karst geology is present, as soon as this information is available. (**0040-3** [Miller, Anna])

Comment: We understand the site may have subsurface karst geology. We recommend the EIS address whether there is karst geology and, if present, evaluate how this geologic setting may influence the project's environmental impacts. To facilitate our review, we would appreciate knowing whether karst geology is present, as soon as this information is available. (**0080-3** [Westlake, Kenneth A.])

Response: *The presence of karst geology in southeastern Michigan will be investigated, and the findings will be presented as background information in Chapter 2 (Affected Environment) of the EIS. If karst is present, it will be evaluated accordingly. Plant safety issues related to karst geology will be addressed in Chapter 2 of NRC's Safety Evaluation Report.*

D.1.6 Comments Concerning Hydrology – Surface Water

Comment: Water implications: Lake Erie is the shallowest of the Great Lakes. Nuclear energy uses a great deal of water. As the effects of global warming are realized, Lake Erie, as the shallowest of the Great Lakes, will be at the greatest risk. Utilization of, and contamination of great quantities of Lake Erie water is not environmentally responsible. The Great Lakes watershed contains a fifth of Earth's fresh water. Protection of the Great Lakes requires that all development projects such as additional nuclear power plants, be considered for long-term generational effects. We cannot replace the Great Lakes, Lake Erie, or the River Raisin, the waters upon which the Fermi(s) depend. We cannot live without water--clean, non-radiated water. (**0016-3** [Rivera, Gloria])

Comment: In addition to releasing radioactive and toxic poisons into Lake Erie, Fermi currently uses the lake to cool the power plant. (**0019-4** [Schemanksi, Sally])

Comment: The EIS should take into account predicted decreases in Lake Erie water levels due to global warming - 3 to 6 feet over the next 60 to 70 years - when considering the implications for water intake and thermal releases.

The analysis should focus on western Lake Erie, the shallowest part of the lake, rather than using the entire lake in its overall analysis.

Data on phosphorous in the application is out of date. Dissolved phosphorous levels have been increasing. (**0028-2** [Shiffler, Nancy L.])

Comment: Are the temporal, special, thermal and volumetric characteristics of the buoyant plume adequately predicted? The Combined License Application (COL) indicates water will be discharged offshore and the plume is expected to be dissipated approximately 1,291 feet from shore. The model predicts a mixing zone of 130 feet long by 226 feet wide, for a total plume area of 0.67 acres. The Department has observed significant direct and indirect negative effects to aquatic resources from power plants discharging to the Michigan waters of the Lake Erie basin. Based on that experience we request clarification of the following questions: 1. Is there a predicted sinking plume? If so, are the temporal, special, thermal and volumetric characteristics of the buoyant plume adequately predicted? 2. Is the volume, velocity, time of passage and time-temperature information in the intake facilities, through the plant, in the discharge facilities, and in the centerline of the thermal plume adequately predicted? (**0029-2** [Freiburger, Chris])

Comment: The Department would like a better explanation regarding the fate of the chemicals used to treat the cooling water and their potential impacts to water quality in the discharge area. The COL indicates that the levels will be monitored as part of the NPDES permit, but we suggest that a detailed description of how those would be treated or managed within the mixing zone be included. (**0029-7** [Freiburger, Chris])

Comment: Will more nuclear power demand more water for future cooling demands? Will people have less water rights because cooling issues demand more water? (**0031-4** [Rysztak, Robert])

Comment: Lake Erie's shallow western basin cannot tolerate the thermal pollution from yet one more large-scale thermo-electric power plant. Lake Erie already faces major lake level loss and retreat of its waters from the current lakeshore due to climate change. It already has a significantly higher air temperature than the rest of the Great Lakes, which contributes to evaporation of Lake Erie's waters. Such water loss will exacerbate overheating, especially in the shallow waters of Lake Erie's western basin, with a current average depth of just 24 feet. (**0050-18** [Kamps, Kevin])

Comment: Given this massive thermal pollution, Fermi 3 should be required to utilize the best available dry cooling tower technology, to minimize or even eliminate water withdrawals from, and heat discharges, into Lake Erie. In addition, DTE's Monroe Coal Plant should be required to install an additional best-available-technology cooling tower. Fermi 3's intake and outfall is Lake Erie but during at least some conditions the intake and outfall would impact the nearby Maumee Bay estuary, the average depth of which is just five feet, and which is already impacted by the neighboring DTE Monroe coal burning power plant, which uses an average of 1.9 billion gallons of water a day, as well as the adjacent Fermi 2 nuclear plant, which uses an additional tens of millions of gallons a day. Such impacts must be evaluated. (**0050-20** [Kamps, Kevin])

Comment: when we look at the Great Lakes, which have many nuclear plants around us, Michigan is the most exposed of all the states in terms of the Great Lakes waters and the possibility of damaging those waters, because the lower peninsula is surrounded on three sides by water. The upper peninsula is totally surrounded by Great Lakes water.

So protecting the Great Lakes is a great issue for us as Michigan citizens in the development of our economy and the sustainability of our population, (**0058-100** [Holden, Anna])

Comment: Another thing I came across was an article in Waste News about the EPA having a mercury reduction program for the Comanche Nuclear Power Station in Texas. They didn't explain how mercury was used. I don't know if it was part of the process or instrumentation or disposal of old instruments or what. But I think if there's any possibility of mercury contamination that should be looked at also. (**0058-110** [McArdle, Ed])

Comment: If there's going to be any heat transference into the Lake into Brest Bay area, how can we sustain that? You know, we used to have Perch Town Derby. The Lake doesn't freeze anymore. There's been impacts. (**0058-134** [Dyson, Ed])

Comment: I would just like to say further that global warming -- nuclear power plants need cooling water. So if you've got hot water coming in, then you have to shut down your reactors. (**0058-26** [Cumbow, Kay])

Comment: Others have already spoken eloquently of the impact on Lake Erie. Just let me restate and affirm that we cannot replace the Great Lakes, Lake Erie, or the River Raisin, the rivers upon which Fermi depend. We cannot live without water, clean, non-radiated water. (**0058-68** [Weber, Margaret])

Comment: Climate change is predicted to decrease water levels in Lake Erie from a little less than 3' to up to 6' in the next 60 -70 years. Predicted decreases in water levels would literally mean that there would be no water in Maumee Bay which is water that is used by other power plants and proposed for Fermi 3. Climate change projected impacts on Western Lake Erie and projected decreasing Lake Erie water levels should be part of the environmental review. (**0082-11** [Bihn, Sandy])

Comment: a determination should be made on the impacts of the up to 49 million gallons of additional heated discharge waters from the proposed Fermi 3. The application uses all of Lake Erie as the source of water available and impacted when in fact the waters used and needed for the plant lie entirely with the Western Basin of Lake Erie. The assessment needs to look at water quantities in Western Lake Erie and Maumee Bay -not all of Lake Erie. Western Lake Erie holds only 5% of the volume of Lake Erie. (**0082-14** [Bihn, Sandy])

Comment: The application talks about the influence of the Detroit River on Toledo's water intake and then fails to include the Toledo water intake in its environmental analysis. This analysis needs to be conducted as part of the environmental assessment. (**0082-18** [Bihn, Sandy])

Comment: Water implications: Lake Erie is the shallowest of the Great Lakes. Nuclear energy uses a great deal of water. As the effects of global warming are realized, Lake Erie, as the shallowest of the Great Lakes, will be at the greatest risk. Utilization of, and contamination of great quantities of Lake Erie water is not environmentally responsible. The Great Lakes watershed contains a fifth of Earth's freshwater. Protection of the Great Lakes requires that all development projects such as additional nuclear power plants, be considered for long-term generational effects. We cannot replace the Great Lakes, Lake Erie, or the River Raisin, the waters upon which the Fermi(s) depend. We cannot live without water-clean, non-radiated water. (**0082-34** [Weber, Margaret])

Response: *The construction and operation of a nuclear power plant involves the consumption of water. While NRC does not regulate or manage water resources, it does have the responsibility under NEPA to assess and disclose the impacts of the proposed plant on water resources. In Chapters 4 and 5 of the EIS, the NRC staff will independently evaluate impacts of the use of water from Lake Erie on the lake, and will evaluate the effects of the thermal and effluent discharges on the western Lake Erie basin, as well as on other parts of the lake, as appropriate. This evaluation will consider lake conditions during construction and operation of the proposed plant.*

Comment: Also, the surface water analysis seems to only include Monroe, Michigan. It should include all the counties. (**0058-53** [Bihn, Sandy])

Comment: The application only looks at Monroe County for Surface Water -the surface water analysis should include Lucas (Ohio), Ottawa (Ohio), Monroe(Michigan) and Wayne (Michigan). (**0082-22** [Bihn, Sandy])

Response: *The analysis of surface water issues to be presented in Chapters 4 and 5 of the EIS will include all of the western basin of Lake Erie and the rest of the lake, as appropriate. Surface water reviews addressed in the analysis will pay particular attention to counties where the water resource is being impacted. Thus, all counties adjacent to the lake will be covered by the analysis. More detailed attention will be paid to those counties, such as Monroe County, where particular issues can be identified.*

Comment: Also the short and long range Great Lakes levels I'm sure should be addressed, and I'm thinking of not just the water depletion because of global warming, but also the short term seiche events -- if I pronounce that right -- when wind blows the water back and forth, and the winds are supposed to be increasing. (**0058-108** [McArdle, Ed])

Response: *The comment refers to the effects of seiches on lake water levels. The effects of seiches on water availability during operations will be discussed in Chapter 5 of the EIS. Seiches also relate to plant safety, which will be addressed in the NRC staff's Safety Evaluation Report for Fermi 3.*

Comment: It appears that at least one stream flows through the DEC property, regulated under Part 301 of the NREPA. We recommend that all stream areas be identified and that any potential impacts be avoided and minimized in the planning process. Stream impacts that can not be avoided in the construction process may require stream mitigation. Typical mitigation for stream impacts include stream restoration using natural channel design principals, maintaining and/or establishing streamside buffers, and installing stream crossings that clear span the stream to bankfull width. (**0079-4** [Browne, Elizabeth M.])

Response: *Swan Creek is the only stream in the vicinity of the Fermi site. Water from the creek would not be used by Fermi 3. However, environmental effects of work on and along the stream, if this occurs, will be evaluated in the EIS.*

Comment: The application does not mention the practice of open lake dumping up to 800,000 cubic yards of sediments by the Army Corps of Engineers for the Toledo shipping channel. The turbidity from the open lake dumping would impact the intake of Fermi 3 and should be reviewed. (**0082-19** [Bihn, Sandy])

Response: *The open lake dumping mentioned in the comment occurred in Maumee Bay, about 3.5 mi northwest of Toledo Harbor Light, and more than 10 mi from the proposed Fermi 3 nuclear plant. The impacts of open dumping projects are addressed by the U.S. Army Corps of Engineers. However, the effects of such dumping, if any, will be evaluated as appropriate in Chapter 7 (Cumulative Impacts) of the EIS.*

Comment: Is the water intake for Frenchtown and Monroe considered in the environmental review? (**0083-30** [Kaufman, Hedwig])

Response: *The effects of Fermi 3 operations on water quality and availability at the water intake structures for Frenchtown and Monroe will be discussed in Chapter 5 of the EIS.*

Comment: The drainage area for the unnamed tributary to Lake Erie at the site is less than two square miles, and does not fall under the state's Floodplain Regulatory Authority, found in Part 31 of the NREPA. A state floodplain permit will not be required from the LWMD at this site.

While Part 31 does not regulate the floodplains of the Great Lakes, it should be noted that the floodplain for Lake Erie affects the project site. The floodplain limits are shown on the Monroe County Flood Insurance Rate Map (FIRM) panel 26115C0259 D, dated April 20, 2000. The 1 percent annual chance (100-year) flood elevation and the 0.2 percent annual chance (500-year) flood elevation for Lake Erie have been computed to be 578.8 feet, National Geodetic Vertical Datum of 1929 (NGVD 29) and 579.7 feet, NGVD 29, respectively. The State building code requires that a critical facility (such as a power plant) constructed in the floodplain, be elevated or flood-proofed one foot above the 0.2 percent annual chance flood elevation.

Frenchtown Township is also designated as a Flood Risk Area (FRA) under Part 323, of the NREPA. Construction standards in the FRA program are similar to those found in the State building code and the National Flood Insurance Program (NFIP). Frenchtown Township has local permitting authority under the FRA Program and the building inspector should be closely involved in review throughout this project. (**0079-2** [Browne, Elizabeth M.])

Response: *The environmental impacts of construction and operation of Fermi 3 on the floodplains for Lake Erie and for Swan Creek will be evaluated in Chapters 4 and 5 of the EIS. Safety issues related to potential floods are outside the scope of the environmental review, but will be evaluated by the NRC staff in its Safety Evaluation Report.*

D.1.7 Comments Concerning Hydrology – Groundwater

Comment: They [nuclear reactors] also can leak elements such as tritium into the groundwater. (**0059-17** [Barnes, Kathryn])

Comment: They also can leak elements such as tritium into the groundwater. Radioactive elements cause cancer. (**0083-32** [Barnes, Kathryn])

Response: *Groundwater monitoring systems will be installed to detect releases to the subsurface if they occur. The movement of groundwater under the Fermi site, as well as the monitoring systems, will be evaluated in Chapters 4 and 5 of the EIS. The NRC staff will also review the consequences of an accidental release of radionuclides into groundwater in its Safety Evaluation Report.*

D.1.8 Comments Concerning Ecology – Terrestrial

Comment: The COL includes more recent data on the terrestrial/wetland resources near the project which highlights the very high diversity of plants and organisms in the coastal wetlands of Lake Erie. The COL describes the significant loss of these wetland complexes in the Michigan waters of Lake Erie. Given the diversity of habitats, and the high level of loss of these habitats, the Department opposes any net loss of wetlands for this project. The COL indicates the 126-acres of fill is small based on the U.S. Nuclear Regulatory Commission (NRC) criteria and should not require mitigation. The Department strongly disagrees. All wetland fill must be mitigated, especially in areas of high value habitat that is already incredibly rare in this basin. This is required pursuant to State law and cannot be waived. A complete description of the wetland mitigation project to offset impacts at the site must be included. The following information should be of use to you in developing appropriate wetland mitigation sites and design.

The diverse coastal wetlands in association with the secluded uplands on the property proposed for development provide good habitat for a variety of wildlife species. Lake Erie is a traditional migration route for waterfowl, marsh birds, wading birds, neotropicals and raptors. Birds such as Great Blue Herons and Great Egrets rest in the trees. They feed in the shallow waters near the shorelines and in the wetlands of the wildlife refuge. Ospreys and Bald Eagles have been observed feeding within the shallow waters of the Fermi 2 Nuclear Power Plant (Department staff personal observations).

Historically the coastal marshes of the western Lake Erie area are important spring, fall and winter, staging, feeding and resting areas for waterfowl. The insects, invertebrates, crustaceans and mollusks that are supported within these wetland communities are also an important source of food for various fish and wildlife species. The emergent and shoreline habitats also provide opportunities for nesting and brood cover for both game birds and non-game birds. No net loss of undisturbed coastal wetland in the Western Lake Erie area is very crucial to this area. (**0029-8** [Freiburger, Chris])

Response: *The NRC staff will address potential impacts to terrestrial and wetland species and habitats, including wetlands in coastal and inland areas, in Chapters 4 and 5 of the EIS. The EIS will document how Detroit Edison has avoided or minimized impacts on wetlands and other waters of the United States. Potential mitigation measures will also be addressed in Chapters 4 and 5 of the EIS.*

Comment: The environmental section indicates a diverse population of amphibians and reptiles utilizing the variety of habitats located at the FERMI 3 site. Many of these species are dependent on the land/water interface for various life stages, foraging, reproduction, and hibernation. These special needs require minimal disturbance of the wetland areas and also emphasize the need for mitigation for any proposed wetland losses in the vicinity of the project. The environmental analysis must address specific impacts to these organisms as a result of proposed actions. (**0029-9** [Freiburger, Chris])

Response: *The NRC staff will address potential impacts to amphibians and reptiles as well as potential mitigation measures for these animals in Chapters 4 and 5 of the EIS.*

Comment: The western Lake Erie basin has historically been an important area for duck hunting. Duck hunting parties have continued using marshes and shorelines of this area. Because the area falls within important bird migration corridors it is critical to minimize any habitat loss or impart any activity that would unnecessarily disturb wildlife.

For current project operation, buoyed areas limit fishing and boating access in the vicinity of the plant. The Department acknowledges the importance of protecting the facilities and believes that current standards seem appropriate. Please address any proposed changes in current practices. (**0029-11** [Freiburger, Chris])

Comment: One of Wildlife Habitat Council's core activities is our certification of those corporate locations that maintain wildlife management programs. About 500 corporate habitat programs in 17 countries are now certified by Wildlife Habitat Council, including the one at DTE Energy's

Fermi 2 Power Plant. That is how I am acquainted with the history of land stewardship at Fermi 2.

Certification of a program by Wildlife Habitat Council requires substantial documentation of valid habitat enhancement activities, which DTE Energy's Fermi 2 plant has provided regularly since the year 2000. Plant employees help maintain about 650 acres of wildlife habitat. They have built nesting platforms for raptors and planted native plant meadows. The Fermi 2 wildlife team helps conserve 48 acres of vital coastal wetlands by battling invasive plants like purple loosestrife and phragmites; in so doing they preserve rare wetland plants as well as important stopover and over-wintering habitats for migrating waterfowl and raptors.

Fermi 2's location makes these actions all the more important. The plant is located along major migratory flyways for songbirds and raptors, which pass through by the millions each spring and fall. Migratory bird populations are threatened by habitat loss not only on each end of their journey, but also along the way as they seek necessary stop-over sites to rest and re-fuel.

At the same time, the Fermi 2 plant property includes coastal marsh wetlands, which have nearly disappeared from the southern Great Lakes. Wetlands are the most productive and diverse temperate zone ecosystems, and their loss means the loss of many species. So Fermi 2's stewardship has regionwide impact. (**0082-1** [Gruelle, Martha])

Response: *The NRC staff will address potential impacts to wetlands (including coastal marshes) and to shorelines with respect to their use as waterfowl and other migratory bird habitat in Chapters 4 and 5 of the EIS.*

Comment: A response to a threatened/endangered species review of the Fermi 3 proposed project in Wayne County, Michigan was sent from this office to the Black & Veatch Corporation November 28, 2007. In that response four endangered or threatened animal species were listed as being present in the area as were three species of threatened plants. Upon review of this report I noticed some discrepancies and causes for concern in regard to threatened species protection.

One animal species that is of primary concern in the area is the Eastern fox snake (*Pantherophis gloydi*). On page 2-333 of the Environmental Report it states that "nine occurrences were reported in Monroe County... the snake was sighted two times on the Fermi property in June 2008." There is a discrepancy to this statement on page 4-45 where it states "The eastern fox snake (a Michigan threatened species) has not been observed on the Fermi property, but the potential for its occurrence on the property does exist."

According to our records there is a viable population of Eastern fox snake at the site of the proposed project. We believe that going forward with the construction would not only kill snakes but destroy the habitat in which they live and possibly exterminate the species from the area. We would like to see a plan for protection of this rare species with regard to this new reactor project. (**0037-1** [Sargent, Lori])

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According to our records there is a viable population of Eastern fox snake at the site of the proposed project. We believe that going forward with the construction would not only kill snakes but destroy the habitat in which they live and possibly exterminate the species from the area. We would like to see a plan for protection of this rare species with regard to this new reactor project. (**0086-1** [Sargent, Lori])

Response: *The presence of the eastern fox snake on the site will be acknowledged in Chapter 2 of the EIS. The NRC staff will address potential impacts to the eastern fox snake and its habitat and describe potential mitigation in Chapters 4 and 5 of the EIS.*

Comment: EPA encourages selection of alternatives with the least impact to wetlands. Therefore, we recommend a complete evaluation of the wetlands impacted by each feasible alternative site. We also encourage facility footprints within the plant site that will avoid or minimize wetlands impacts. If there are wetlands impacts, we recommend characterization and mitigation information be included in the EIS and not deferred to the permit stage. (**0040-2** [Miller, Anna])

Comment: EPA encourages selection of alternatives with the least impact to wetlands. Therefore, we recommend a complete evaluation of the wetlands impacted by each feasible alternative site. We also encourage facility footprints within the plant site that will avoid or minimize wetlands impacts. If there are wetlands impacts, we recommend characterization and mitigation information be included in the EIS and not deferred to the permit stage. (**0080-2** [Westlake, Kenneth A.])

Response: *In Chapter 9 of the EIS, the NRC staff will describe the potential environmental impacts (including potential impacts to wetlands) of siting the project at alternative sites. Chapter 4 of the EIS will describe how ground-disturbing activities at the proposed site were planned to minimize wetland impacts, characterize unavoidable wetland impacts, and discuss possible wetland mitigation measures.*

Comment: We are committed, Detroit Edison, DTE Energy is committed to environmental stewardship. We've done that at Fermi site specifically in the form of the Wildlife Habitat Council certification, Clean Corporate Citizen designations, and the Michigan Department of Environmental Quality. We've set aside more than 600 acres of that site for inclusion in the Detroit River International Wildlife Refuge. We feel that the environment is not only crucial to this particular site, but it's a motto that we have throughout our company in terms of respect that's a core value, and to respect our community and our environment is really important to us. (**0058-10** [May, Ron])

Comment: It should also be noted during the development of the EIS that DTE and the US Fish and Wildlife Service have entered into a cooperative management agreement for 656 acres at the Fermi Power plant for the Detroit River International Wildlife Refuge. Refuge staff work closely with DTE on wildlife management activities. The Refuge has also acquired 65 acres (i.e., Fix Unit) at the mouth of Swan Creek immediately adjacent to the Fermi site. Refuge staff will continue to be actively involved in wildlife management throughout the planning process. (**0087-1** [Czarnecki, Craig A.])

Response: *The NRC staff will review and evaluate habitat loss and associated impacts, including areas currently within the Detroit River International Wildlife Refuge, in Chapters 2, 4, and 5 of the EIS.*

Comment: The wetlands on the property have been identified by DEC consultants and reviewed by MDEQ staff under MDEQ Wetland Identification Program (WIP) File 08-58-0003-WA. The WIP report dated November 7, 2008, identified the location and regulatory status of each wetland area under the authority of Part 303 of the NREPA. Based on the WIP report, a significant portion of the DEC property contains regulated wetlands, with most of the wetlands on the site being Great Lakes coastal wetlands. With historic losses of greater than 95 percent of the coastal wetlands of western Lake Erie, the wetlands on site represent a very important and rare natural resource for the State of Michigan. The Environmental Report describes the wetland impacts as moderate. In fact, it appears that the project as proposed would be one of the largest impacts to coastal wetlands in the history of Michigan's wetland statute.

Under Part 303, permits are required for any wetland dredging, filling, draining, and/or maintaining a use or development in a wetland. The location, type, function, and value of the wetlands on site should be considered during design and any impacts avoided and minimized to the greatest extent possible. Any proposed impact areas should be identified (including impacts from temporary and permanent parking, construction activities, and transmission lines) and reviewed through an environmental assessment of the site that evaluates plant and animal species and habitat diversity, water quality functions, fish and wildlife habitat, the location of rare or imperiled communities, threatened and endangered species, and any other important features of the wetland areas. All feasible and prudent alternatives to temporary and permanent impacts should be considered (including alternative configurations, acquiring adjacent properties, etc.). If the project will be phased, an overall site plan will be needed and reviewed as part of the alternatives analysis for the first permit application. Wetland impacts will require wetland mitigation and a combination of wetland restoration and preservation of on-site or off-site rare wetland communities (e.g., Lake Erie coastal wetlands, lake plain prairies, etc.) should be considered. (**0079-3** [Browne, Elizabeth M.])

Response: *The NRC staff will address potential impacts to wetlands in Chapters 4 and 5 of the EIS. The EIS will also include a cumulative analysis of wetland losses on the western shore of Lake Erie resulting from the Fermi 3 project combined with past and reasonably foreseeable future activities.*

Comment: Part 325, of the NREPA, regulates construction activities such as fills, docks, seawalls, dredging, outfall/intake pipes etc. and occupations of Great Lakes public trust bottomlands and waters. Part 325 requires the DEQ to protect the natural resources, public trust, and riparian rights of property owners when issuing a permit for construction activities in the Great Lakes.

An application for a permit will be required pursuant to Part 325 for any construction activity in Lake Erie below the natural ordinary high water mark at the site, including the wetlands connected to Lake Erie north and south of the power plant complex. (**0079-5** [Browne, Elizabeth M.])

Comment: Stream crossings and wetlands will be affected by the construction of Fermi 3 and the associated transmission lines. The Michigan Department of Environmental Quality (MDEQ) should be contacted to determine if permits are required for this activity in wetlands and stream crossings. Pursuant to the Natural Resources and Environmental Protection Act, the State of Michigan regulates certain activities in wetlands and inland lakes and streams. Development that would impact wetlands may require a permit for which this office may have review authority under the FWCA. In the review of these permit applications, we may concur with or without conditions or object to permit issuance depending on whether the proposed work may impact the Service's trust fish and wildlife resources. We recommend you contact the MDEQ, Land

and Water Management Division, Southeast Michigan District Office in Warren at 586/753-3700 for information concerning the need for permits under State law.

Wetland impacts should be avoided or minimized to the maximum extent possible. Any wetlands unavoidably destroyed during power plant and transmission line construction should be compensated by enhancing existing low quality wetlands or creating wetlands equivalent to those destroyed adjacent and/or contiguous with those wetlands impacted. This approach is consistent with the Service's mitigation policy. (**0087-3** [Czarnecki, Craig A.])

Response: *The NRC staff will address impacts to wetlands, waterways, and other natural resources, including possible mitigation measures, in Chapters 4 and 5 of the EIS. The EIS will note each Federal and State environmental permit required for the project, but Detroit Edison will apply for the permits independently of the EIS.*

Comment: Paragraph 2.4 Ecology (Page 2-321) and Table 2.4-2 (Page 2-888). 216 Plant Species are listed as found on the property. This is an impressive list, but does not include plants that should be present but are not. Industrial activity has disturbed this wetland ecosystem (the estuary of Swan Creek). Some plant species such as wild rice (*Zizania*) and Native Reed Grass or Cane (*Phragmites Communis*) have been extirpated (re: Michigan Waterfowl Management, Miles Pirnie, 1935). (**0082-28** [Micka, Richard])

Response: *The comment presents information about the site prior to development that will be included in the affected environment discussion in Chapter 2 of the EIS. The cumulative loss of rare plants and their habitat along the western shore of Lake Erie will be considered in Chapter 7 of the EIS.*

Comment: There are no specific locations for the proposed action. Therefore, the following list provides federally listed or candidate species information at the county level.

St. Clair: Indiana bat, rayed bean, Eastern prairie fringed orchid

Washtenaw: Indiana bat, Eastern massasauga, Mitchell's satyr butterfly, Eastern fringed prairie orchid

Wayne: Indiana bat, Eastern massasauga, Northern riffleshell, rayed bean, Eastern prairie fringed orchid

Lenawee: Indiana bat, Eastern massasauga, rayed bean

Monroe: Indiana bat, Kamer blue butterfly, Northern riffleshell, rayed bean, Eastern prairie fringed orchid.

For future endangered and threatened species list requests and consultations with the Service, refer to our endangered species and technical assistance website at http://www.fws.gov/midwest!endangered/section7/s7process/index.htm.

Further, please contact the Michigan Department of Natural Resources Endangered Species Assessment website, www.mcgi.state.mi.us/esa and contact Lori Sargent at sargentl2@michigan.gov or 517/373-1263 for information regarding the protection of threatened and endangered species under state law. State law requires a permit in advance if any work that could potentially damage, destroy or displace State listed species. (**0087-2** [Czarnecki, Craig A.])

Response: *The NRC staff will address potential impacts to Federal and State rare, threatened, and endangered species and habitats in Chapters 4 and 5 of the EIS. NRC will also comply with Section 7 of the Endangered Species Act by preparing a biological assessment of potential impacts to Federally listed species and completing any necessary formal consultation with the U.S. Fish and Wildlife Service and National Marine Fisheries Service. Any permits needed to comply with laws that protect State-listed threatened and endangered species would be listed in the EIS, but, as noted above, Detroit Edison will apply for the permits independently of the EIS.*

Comment: We recommend that the proposed transmission line corridors follow established right-of-ways to the maximum extent possible and to avoid large, contiguous tracts of forests. Utilizing existing footprints will diminish forest fragmentation and unnecessary habitat destruction. Studies indicate forest fragmentation has resulted in declining populations of several species of neotropical passerines. If NRC presently knows or when they know the total acreage of impacts to forested and wetland habitats, we request this information be sent to us. (**0087-4** [Czarnecki, Craig A.])

Response: *In Chapter 4 of the EIS, the NRC staff will address impacts to forest habitats, including forest fragmentation impacts and impacts to neotropical passerines and other forest-interior species, resulting from transmission line construction.*

Comment: The following references in the Environmental Report Highlight Lotus Ecology: Appendix 2A, Flora, page 2-877. Appendix 2-B, Life Histories of Threatened and Endangered Species, pages 2-888. Table 2.4-2, page 2-373, page 2-321, paragraph 2.4. Ecology, page 2.333, paragraph 2.4.1.2.2.2 really, American Lotus. Page 2-395, Table 2.4-6, Wildlife Habitat Council for July 2000, page 2-432, figure 2.4-17, important species transmission corridor.

These references to Michigan symbol for clean water of the American Lotus, are clearly indicative that the applicant has conducted due diligence in the COLA process. We appreciate that.

The Lotus Garden Club conducts tours of the Lotus beds in mid summer. Through the generosity of local utilities, the public is able to see their floral heritage on our waterfront. These tours take place after coordination with the utilities and in keeping with the requirements of Homeland Security.

Fermi unit 3 is situated in Laguna Beach, which is noted for extensive beds of American Lotus, *Nelumbo lutea*. This circumstance provides a much needed sanctuary for this threatened species. The Nuclear Regulatory Commission needs to know that the utilities have expended themselves well beyond the call of duty to host Lotus tours in those areas that are not off limits. This allows citizens of Monroe and areas to enjoy their rich heritage without compromising the integrity of any sensitive areas. But more importantly it has brought all of the utilities together in a cooperative spirit to promote biodiversity on their private holdings. The community benefits from this cooperation.

At one point in time the American Lotus was nearly extinct on the western shores of Lake Erie. Thanks to the likes of DTE Energy and other industrial concerns, the Lotus have come back. This provides an excellent model for restoration of other species that have been displaced by development over the recent years. We encourage you to make a list of those missing plants to see if they can be restored.

And I'd like to add to that. This brochure that was out front says it all. Every time you look at a brochure from Detroit Edison, or Fermi, or the International Wildlife Refuge, or the City or County of Monroe, you see the American Lotus. And the utilities were very influential with the Chamber of Commerce and the community as a whole to appear before the State of Michigan, and it took a three year process, to have the American Lotus listed as American's symbol for clean water. And we thank you for your assistance and success in this.

And the Lotus is rather like the canary in the marsh. Lotus clean the wetlands and they are a symbol of rebirth and life. They show that the water and the air is reasonably clean, and it gives habitat to flora and fauna of all types. The sturgeon are coming back, there's a lot of good signs. Look how well our eagles are doing. And each year when we have our Lotus tour, we give away a bag, or some similar gift like this, to all of our esteemed visitors. (**0058-123** [Micka, Jeanne])

Comment: These references to Michigan's Symbol for Clean Water (American Lotus) are clearly indicative that the Applicant has conducted due diligence in the COLA Process. We appreciate that.

The Lotus Garden Club conducts tours of the Lotus Beds in mid-summer. Through the generosity of local Utilities, the Public are able to see their Floral Heritage on the waterfront.

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At one point in time, the American Lotus were nearly extinct on the West Shore of Lake Erie. Thanks to the likes of DTE Energy and other industrial concerns, the Lotus have come back. This provides an excellent model for restoration of other species that have been displaced by development over the years. We encourage you to make a list of those missing plants to see if they can be restored. (**0082-26** [Micka, Jeanne])

Response: *The NRC staff will address impacts to American lotus and other rare, threatened, and endangered species in Chapters 4 and 5 of the EIS. The EIS will also consider the cumulative loss of rare plants and their habitat along the western shore of Lake Erie.*

D.1.9 Comments Concerning Ecology – Aquatic

Comment: Billions of fish and larvae are sucked into the station's cooling condensers and killed upon discharge with the heated water, hotter than the intake temperature. These discharges include major reductions of fish species and habitat. (**0019-5** [Schemanksi, Sally])

Comment: My concern is thermal pollution of our Great Lakes, specifically, Lake Erie.

Already several energy plants on shores of Lake Erie are polluting the waters in the western basin (which is about 24 feet deep). Trenton Channel coal plant, Monroe coal fire Plant (part of the Detroit Edison complex); Whiting coal plant at Luna Pier; Davis Besse nuclear plant at Oak Harbor and Bay Shore coal plant at Maumee Bay all send hot water into the Lake to the detriment and even destruction of fish and algae blooms and are creating a dead zone in the Lake.

My request is for cooling towers to mitigate the thermal load. The plans for Fermi 3 include only one cooling tower. More are needed. New environmental study is needed to assess real needs. NRC inspection needs to be increased in this regard. (**0024-1** [Hungerman, Marie Gabriel])

Comment: Of primary concern are issues related to fish entrainment and impingement, water quality, and wetlands. The application includes lengthy discussions of species of concern which do require special attention, but the EIS must include monitoring for all species within the area of impact. Many wildlife species that utilize the refuge and fish species in the vicinity of the project are important game and non-game animals and fish. This includes species that perform a vital role in the ecosystem as forage. (**0029-1** [Freiburger, Chris])

Comment: The environmental report utilized phytoplankton and icthyoplankton results from studies conducted for the FERMI 2 project. While the vicinity is most likely acceptable for use, the most recent of this data is from the early 1990s. This data is probably not current enough to evaluate the potential effect of the FERMI 3 project when it goes on line. The report describes the significant improvements in water quality in Lake Erie, and it continues to improve. This may have changed the composition and abundance of these organisms. Therefore:

Are the seasonal phytoplankton populations by number and species known sufficiently well to detect possible changes in the receiving waterbody?

Are the seasonal phytoplankton populations by number and species known sufficiently well to detect possible changes in the discharge area and adjacent waters?

Relative to phytoplankton of the discharge area adjacent waters and the receiving waterbody, is it known or predicted what proportions of the populations are exposed to stresses caused by plant operation?

Are the effects of such exposures on phytoplankton populations (e.g., impairment or stimulation of productivity, time-temperature tolerances, population shifts both local and waterbody-wide, etc.) known or predicted?

Are the seasonal populations of benthic and attached algae in the discharge area and adjacent waters known sufficiently well to detect possible changes?

Are the effects of the plan operation on populations of benthic and attached algae considered, known or predicted? (**0029-3** [Freiburger, Chris])

Comment: The COL has a fairly comprehensive review of the aquatic invertebrate populations in the vicinity of the proposed project. However, given the current changes in water quality and the effects of invasive macro invertebrates such as dreissenid mussels (zebra and quagga), this composition can change significantly between the current review and the start up of the proposed project. Therefore:

Are the macro invertebrate populations in the discharge area and adjacent waters know sufficiently well to detect possible changes?

Are effects of plant operation on the macroinvertebrate populations considered, known or predicted?

Are the aquatic macrophyte populations in the discharge area and adjacent waters known sufficiently well to detect possible changes?
Are effects of plant operations on aquatic macrophyte populations considered, known or predicted? (**0029-4** [Freiburger, Chris])

Comment: The report includes data from joint MDNR and U.S. Fish and Wildlife Service (USFWS) fish surveys from 2004. This information is the most current public information on these fish populations. The COL reviewed substantial improvements to fish populations in the Lake Erie basin and the significance of those populations to the economy of the vicinity. Both commercial and recreational fisheries in the western basin of Lake Erie are sources of revenue for the local economies. This data will be 15-years old however by the time the proposed project goes on line. Therefore:

Is the seasonal abundance of fish eggs and larvae by species known sufficiently well to detect possible changes in the discharge area and adjacent waters?

Is it known or predicted what portion of the populations of fish eggs and larvae are exposed to stresses caused by plant operation?

Are the effects of such exposures on fish eggs and larvae considered known or predicted?

Is it known or predicted what impact such effects will have on fish populations in the discharge area, adjacent waters and the receiving waterbody?

Are the seasonal abundance and habits of adult fish by species known sufficiently well to detect possible changes in the discharge area and adjacent waters?

Is it considered, known or predicted what effect operation of the facility will have on these fish and their activities? (**0029-5** [Freiburger, Chris])

Comment: Use of Lake Erie, our warmest Great Lake, to assist with cooling water from the proposed new plant will have a detrimental effect on the wildlife of Lake Erie, a source of fresh water that is still recovering from significant pollution from the mid-20th century. (**0039-6** [Mitchell, Rita])

Comment: The environmental impact on Lake Erie with thermal and radiation to the Lake water, fish, and wildlife in the region is extremely objectionable. (**0041-4** [Englund, Lance])

Comment: Detroit Edison's Environmental Report holds that there are currently no problems with phosphorus contamination or algae in Lake Erie, which is false. NRC should address these issues, and the cumulative impacts that can be expected from adding yet another reactor at the Fermi power plant site. (**0050-17** [Kamps, Kevin])

Comment: Fermi 3 would harm Lake Erie's remarkably productive fisheries. Fermi 3's water usage would worsen the impingement and entrainment of Lake Erie biota already occurring at the numerous large-scale thermo-electric power plants sited on its shores. Negative impacts, including fish kills, must be prevented, to protect sports fisheries as well as Native American fishing rights recognized by legally-binding treaties signed by the U.S. federal government. Harm to all life stages of Lake Erie biota must be analyzed by NRC, and mitigated by DTE at Fermi 3. (**0050-21** [Kamps, Kevin])

Comment: If you've got too hot of water going out, you also have to shut your reactors because it ruins habitat for fish, for other macro-invertebrates. And this happened recently in Europe and also in the United States, when they had heat waves, that they had to shut down reactors because either the water coming in was too hot or going out was too hot.

Up at the Bruce, there normally is ice that covers Lake Huron up by there. But since the Bruce has been online, ice doesn't form around the Bruce. That ice further -- it serves to reflect the sun's radiation. If you've got too hot of water everywhere, you're not going to have that ice reflecting the sun's rays. (**0058-27** [Cumbow, Kay])

Comment: When Davis Besse was built, the permit was granted in 1989 -- or 1979, excuse me -- the Ohio Sea Grant people made the following statement: No new plants, and they were referring to power plants, should be constructed anywhere in the western basin of Lake Erie. If these suggestions are followed, new plants can be constructed on Lake Erie, and they meant the central and the eastern basin, without harming the valuable and growing fishery.

This statement was made by Drs. Reutter and Herrndoff from Ohio State University's Sea Grant program. Since the statement clearly says that no new power plant should be constructed here in the western basin, and the only place that they should be constructed, if in Lake Erie, is the central and eastern basin.

Fermi 3 is planned to be located in the shallowest, fishiest, most vulnerable waters of the Great Lakes, and they would combine with five other power plants that currently draw over 3 billion gallons of water in this area a day. These are the shallowest 24-foot of water in the Great Lakes. (**0058-45** [Bihn, Sandy])

Comment: And I wish that the Environmental Impact Statement would include the following considerations, which when I reviewed it [Environmental Report], it did not.

Also, there would be additional heated discharge waters from this plant, 49 million gallons of water in addition to the 3 billion. I think there should be an assessment of all the five plants and the cumulative impacts they're currently having. And then the additional impact on all these factors with the new plant. (**0058-48** [Bihn, Sandy])

Comment: the impingement and entrainment estimates need to be updated. (**0058-54** [Bihn, Sandy])

Comment: Nuclear reactors cause thermal pollution and kill fish. (**0059-16** [Barnes, Kathryn])

Comment: The application uses phosphorous data from 1997 -2003 and says phosphorous (algal blooms) is not a problem. Not true. Research clearly shows that since 1995 dissolved phosphorous and algal blooms including microcystis, in the Maumee River and Western Lake Erie are increasing. Ohio EPA has a Phosphorous Task Force trying to find ways to reduce the increasing green waters. The Lake Erie Protection Fund and the USEPA Great Lake's office are currently seeking grant proposals to find ways to reduce phosphorous and algal blooms in Western Lake Erie. The environmental assessment needs to include impacts on phosphorous and nutrient growth and algal blooms from the thermal use of up to 49 million gallons a day. (**0082-20** [Bihn, Sandy])

Comment: The fish impingement/entrainment discussion needs to be updated from Fermi 2 estimates. The assessment needs to look at the cumulative impact of adding one more fish killing source.. and the decreasing yellow perch populations and the increased controls on commercial fishermen in Ohio. The environmental assessment should include these factors. (**0082-23** [Bihn, Sandy])

Comment: Nuclear reactors cause thermal pollution, and kill fish. (**0083-31** [Barnes, Kathryn])

Response: *The EIS analysis will use the most recently available information to characterize the existing ecological conditions in the vicinity of the Fermi site and to analyze potential impacts from the project on aquatic ecosystems. The NRC staff will evaluate the impacts related to construction and operation, including impingement, entrainment, chronic and acute thermal impacts, and water quality (including phosphorus levels). The NRC staff will also address cumulative impacts to the aquatic environment in the vicinity of the Fermi site. The NRC staff recognizes the dynamic nature of Lake Erie and the Great Lakes, and will consider the possibility of continued change in the ecosystem in its assessment. Existing conditions will be described in Chapter 2 of the EIS. The impacts of construction and operation on aquatic ecosystems and water quality will be discussed in Chapters 4 and 5 of the EIS. The cumulative impacts of construction and operation will be presented in Chapter 7 of the EIS.*

Comment: Western Lake Erie and its shallow waters provide among the best habitat for walleye fishing in the world. The thermal load of a new reactor sited at Fermi (as well as existing facilities at Fermi and Davis-Besse east of Toledo, Ohio) would have a detrimental effect on this habitat. This can be mitigated by the construction of new cooling tower at the Fermi facility. However, the current plans for Fermi do not envision this construction, and would perhaps make the construction of this new facility cost-prohibitive. (**0038-2** [D'Amour, James Carl])

Response: *The proposed design for the Fermi 3 nuclear plant identifies the construction of a new cooling tower on the Fermi site. The NRC staff will assess potential impacts to aquatic biota in Lake Erie, including the walleye and other fish species, from thermal discharge of the proposed Fermi 3 nuclear plant in Chapter 5 of the EIS. The cumulative impacts of construction and operation will be presented in Chapter 7 of the EIS.*

Comment: And I wish that the Environmental Impact Statement would include the following considerations, which when I reviewed it [Environmental Report], it did not.

Also, the Maumee Bay estuary was not delineated in the Environmental Impact Statement. The impact statement used Fermi 2 data, which are very outdated, for accumulative fish impingement and entrainment impacts from the plant. (**0058-47** [Bihn, Sandy])

Comment: When the permit for Davis Bess was granted, the Ohio Sea Grant people made the following statement: No new plants (power) should be constructed anywhere in the Western Basin of the Lake (Erie). If these suggestions are followed, new plants can be constructed on Lake Erie Without harming the valuable and growing fishery. J.M. Reutter and C.E. Herdendorf, Environmental Impact Appraisal of the Davis Besse Nuclear Power Plant 1979

Since the statement clearly says that no new power plants should be constructed in Western Lake Erie, then the only place that new power plants should be considered would be in the Central and Eastern Basins of Lake Erie. The Fermi 3 nuclear power plant is planned to be located in the shallowest, fishiest waters of Lake Erie and the Great Lakes. Lake Erie has more consumable fish than all the other Great Lakes combined and a majority of Lake Erie's fish are in the Western Basin of Lake Erie(which includes Maumee Bay and the Maumee River). The average depth of Lake Erie in the area of the plant is but 24' and the average depth of the Maumee Bay estuary is only 5'. The proposed Fermi 3 nuclear power plant would draw up to 49 million gallons of water a day from Lake Erie and Maumee Bay and kill millions more fish. Fermi 3 would be the 6th power plant killing more fish and heating more water causing Western Lake Erie Waterkeeper Western Lake Erie Association westernlakeerie.org added ecological impacts on already stressed green waters. When I was driving down traveling on Bayshore Rd. last night, I could visibly see the Consumer's Whiting Plant, the DTE Monroe Plant, Fermi 2, First Energy Bayshore and the smoke from Davis Besse. Obviously, the plants are within a 20 mile radius and the use of the water, fish kills and thermal plumes from the power plants impact the shallow waters of Lake Erie and Maumee Bay. (**0082-10** [Bihn, Sandy])

Comment: The application says there are no estuaries near the plant. This is not true. The shallow fishy average 5' depth Maumee Bay estuary exists west of the plant and needs to be assessed as part of the environmental impact study. (**0082-12** [Bihn, Sandy])

Response: *The EIS analysis will use the most recently available information about aquatic biota and water quality to characterize the existing conditions in the vicinity of the Fermi site and to analyze potential impacts from the project on the aquatic ecosystem. The staff will also review historical data, including past recommendations related to power development in the western basin of Lake Erie, in its review. Existing conditions will be described in Chapter 2 of the EIS. The impacts of construction and operation (including impacts associated with impingement, entrainment, and thermal discharge) will be discussed in Chapters 4 and 5, respectively. The cumulative impacts of construction and operation will be presented in Chapter 7 of the EIS. Information about the conditions in Maumee Bay and potential impacts to Maumee Bay from the proposed project will be evaluated, as appropriate, in the EIS.*

Comment: One statement in the Environmental Impact Statement [sic - Environmental Report] that really stood out to me was that there is no phosphorus problem in Western Lake Erie, and we have no algae problem. Let me tell you folks, go out there in the summer. Last year researchers tell me that the microcystis in the algae was the worst that they've ever seen. We're going back to the `70s in terms of warm water, decreasing water caused by decreasing water level and increased nutrients in the water, the impact of lower water levels and increased nutrients. And what would happen from this plant doing more warming of the water to those factors needs to be considered.

There is a new algae out there called *Lyngbya wollei* that seems to be harbored here in the Monroe area. And we need to look at what the impact of that is and why it came, and then how this new plant might contribute more to those type of algae. (**0058-52** [Bihn, Sandy])

Comment: A new form of algae - *Lyngbya wollei* - is in Maumee Bay and Western Lake Erie. This benthic algae is spreading in Maumee Bay and Western Lake Erie. It appears that the *Lyngbya* thrives in what is known at Warm Water Bay at DTE's Monroe coal fired 1.9 billion gallons per day warm water discharge. The warm water combined with the sewage from the River Raisin appear to provide the ideal environment for *Lyngbya* to thrive. What will the impact of Fermi 3 be on the spread of *Lyngbya*? Should DTE be required to do mitigation at the Monroe coal fired plant because of the *Lyngbya* problem? (**0082-21** [Bihn, Sandy])

Response: *The NRC staff will consider potential effects of the proposed facility on water quality in Lake Erie and the potential influences of construction and operation of the proposed facility on the spread of Lyngbya wollei. These topics will be discussed in Chapters 4 and 5 of the EIS.*

Comment: The environmental assessment must address the effects on the Lake and ecosystem of the water cooling needs of the reactor. The current report does not address the projected scientific reality of dramatically lower water levels in Lake Erie. (**0059-49** [Wolfe, Joan])

Comment: The environmental assessment must address the effects on the lake and ecosystem of the water cooling needs of the reactor. The current report does not address the projected scientific reality of dramatically lower water levels in Lake Erie. (**0083-3** [Wolfe, Joan])

Response: *The NRC staff will consider water use (including consumptive water use) relative to the inflow and volume of water for Lake Erie and the western basin. The effects of water levels in Lake Erie will also be considered in the analysis. Existing conditions will be described in Chapter 2 of the EIS. The impacts of construction and operation will be discussed in Chapters 4 and 5, respectively. The cumulative impacts of construction and operation will be presented in Chapter 7 of the EIS.*

Comment: Endangered Species Act: No species listed by NMFS as threatened or endangered, or species proposed for listing occur in Lake Erie. Additionally, there is no critical habitat designated by NMFS in the area and no proposed critical habitat in the area. There are also no candidate species under NMFS jurisdiction that occur in the project area. As such, no further coordination with NMFS on the effects of the action on listed species or their critical habitat is necessary and NMFS does not anticipate the need for consultation pursuant to Section 7 of the Endangered Species Act of 1973, as amended, for the subject Federal action. (**0085-1** [Colligan, Mary A.])

Comment: As noted above, as no species listed as threatened or endangered by NMFS occur in the action area, no consultation pursuant to Section 7 of the ESA is necessary for the NRC's proposed action. Based on the information provided herein, NMFS does not anticipate participating in the public meeting or site audit. Additionally, we do not anticipate providing further scoping comments or comments on any draft or final EIS related to this action. NMFS appreciates the opportunity to provide the NRC with information on our trust resources and we look forward to continuing to work cooperatively with you on minimizing impacts of NRC actions to NMFS trust resources. (**0085-3** [Colligan, Mary A.])

Response: *The NRC staff will evaluate the potential impacts on threatened and endangered species from construction and operation of the proposed Fermi 3 nuclear plant in Chapters 4 and 5 of the EIS. As stated in the comment, no species listed as threatened or endangered by the National Marine Fisheries Service (NMFS) occur in the action area, and no consultation with the NMFS pursuant to Section 7 of the Endangered Species Act (ESA) will be necessary for the proposed action.*

Comment: Essential Fish Habitat and Fish and Wildlife Coordination Act: The Magnuson-Stevens Fishery Conservation and Management Act (MSA) and the Fish and Wildlife

Coordination Act require Federal agencies to consult with one another on activities that may adversely impact fisheries resources and their habitats. Since Essential Fish Habitat has not been designated, pursuant to the MSA, for species in Lake Erie or other Great Lakes there is no requirement to consult under that authority. Although anadromous fish resources and their habitats may be impacted by the activity, NMFS does not have sufficient staff resources to engage in the review or consultation on this activity pursuant to the Fish and Wildlife Coordination Act. (**0085-2** [Colligan, Mary A.])

Response: *As stated in the comment, Essential Fish Habitat has not been designated, pursuant to the Magnuson-Stevens Fishery Conservation and Management Act, for species in Lake Erie or other Great Lakes. Therefore, no consultation on Essential Fish Habitat will be conducted for the Fermi 3 project.*

Comment: Toxic discharges from Fermi 3 would threaten Lake Erie's fragile ecosystem. Biocides, such as chemicals used to control zebra mussels, would be used in significant quantities and then released into Lake Erie. Cleaning solvents, heavy metals, and even fossil fuels integral to Fermi 3's operations would also be released into Lake Erie. Over a decade ago, the U.S.-Canadian International Joint Commission called for the virtual elimination of toxic chemicals into the Great Lakes, a goal Fermi 3 would not meet. Lake Erie, already suffering from phosphorus contamination and risking a return of algal blooms and consequent dead zones, is too fragile for yet another large-scale source of significant toxic contamination. (**0050-15** [Kamps, Kevin])

Comment: Also in the chemical area, the Zebra Mussel control and how's that accomplished. I presume there's chemicals involved in that. Zebra Mussels have shut down nuclear plants. I'm thinking of one article I read about in New York. (**0058-109** [McArdle, Ed])

Response: *Potential effects of chemical releases on aquatic resources, including biocides used to control organisms such as zebra mussels that can foul cooling water systems, will be evaluated in Chapter 5 of the EIS.*

D.1.10 Comments Concerning Socioeconomics

Comment: In addition to being a good corporate citizen, DTE Energy is a very substantial piece in the Michigan economic puzzle. As noted earlier in this text, I am the Chair of the SEMCA Workforce Board. SEMCA is officially designated by the State of Michigan to serve as the Michigan Works Agency for Monroe and Wayne Counties, excluding the city of Detroit, under the Federal Workforce Investment Act (WIA). As a Michigan Works Agency, our primary responsibility is to assist the residents of our region with obtaining employment. To help them achieve employment in high demand occupations and/or growing industries, we utilize State and Federal resources to provide them with the funding for relevant training. In the current changing economy, our workforce has experienced a substantial loss of jobs and we find that their current skills may not match those needed in the jobs that are currently available. Consequently, the unemployment rate in our region is at a 20 year high, with Monroe Co. at 9.6%. Wayne Co. incl. Detroit at 10.6% and Lucas Co. Ohio, incl. Toledo at 9.2%. It is in this context that I provide the following to you today. I am strongly urging the NRC to include in the scope of the Environmental Impact Statement for the Fermi 3 Nuclear Power Plant a full analysis of the economic benefits of constructing and operating such a plant in our region. (**0010-2** [Mahoney, Charlie])

Comment: The jobs created by Fermi 3 would be a significant boost to this region and state during the construction phase, the Nuclear Energy Institute estimates that 2,400 construction jobs would be created. And they say a plant of this size would require DTE to add 700 permanent employees. And we know how real these jobs are: DTE currently has about 2,000 employees in Monroe Co. alone. None of these figures speak to the tremendous # of spin-off jobs created by the businesses that would serve the plant and its employees. Before I close, let me reassure you that this region knows the importance of providing our workforce with the skills necessary to obtain employment in the energy industry. Many of our laid-off workers have work experience or skills that make them ideal candidates for retraining in energy industry occupations. As I am sure you will hear in the testimony of others, Monroe Community College and other institutions are involved in energy occupation training and continue to work with DTE and others to assure their programs are responsive to the specific current and future needs of the energy industry. To this end DTE Energy and Monroe Community College have joined to create a program for a Nuclear Engineering Technology Associates Degree which began this month. And we at SEMCA place a high priority on encouraging careers in the energy field and providing training funding for appropriate candidates. (**0010-4** [Mahoney, Charlie])

Comment: Now that there's a proposal for a Fermi 3 to be built, this will open many job opportunities for our community. (**0058-112** [Ellison, Jacob])

Comment: If the plant comes to fruition it will add jobs and further economic enhancement in all areas of distress in the County. (**0058-113** [Smolinski, Myron])

Comment: The construction of another unit at Fermi would benefit the whole community, with hundreds of good paying jobs. These jobs contribute millions of dollars to the local economy. And a badly needed revenue source for our local and state governments, so that they may continue to provide the services that we have come to expect. This will affect all business, from the grocery store, restaurant, the gas station, the car dealer, and the landlords with housing to rent. Building another unit at Fermi would be a win for everyone in the community. (**0058-146** [Sweat, Ron])

Comment: A new nuclear plant would benefit the economy with an influx of good paying jobs for skilled workers and well educated professionals. The five-year construction phase would alone create as many as 2,400 jobs. Then when the plant begins operation, 400 to 700 permanent high-tech jobs would be produced, many of which require professional degrees.

In addition, a new nuclear plant would create another 400 to 700 jobs and businesses that supply goods and services to support the plant. Many of these businesses would be the high-tech that we would need, and they're going to attract the bright, young professionals who are at the core of the most vibrant economics in the County today. (**0058-15** [Mentel, Floreine])

Comment: Finally, Detroit Edison's significant investment in a new nuclear plant would stabilize the local tax base, which has been battered by falling home prices and industrial losses. The average nuclear plant generates total state and local tax revenue of almost $20 million each year. (**0058-16** [Mentel, Floreine])

Comment: The other thing, certainly we all support here in this community, regardless of our views about the types of energy production we would like to see in this country, are the long term, sustainable jobs, and the continued community participation that the development of this additional facility would bring to this community. (**0058-2** [Brown, George])

Comment: The economic values of such a project will benefit the entire State of Michigan that is enduring the worst economic conditions in the nation. This project, as did the Fermi 2 project, will inject a much needed infusion into our economy that will provide construction and operating employment; off premise support business; and employment opportunities. A much needed new industrial tax base that will provide for public services -- all important ingredients to better quality of life in Michigan and Monroe County. (**0059-1** [Zorn, Dale])

Comment: In the current transitioning economy our workforce has experienced a substantial loss of jobs, and finding that their current skills may not match those needed. Consequently the unemployment rate in our region is at 20-year highs with Monroe County at 9.6 percent, Wayne County, including Detroit, at 10.6 percent, and Lucas County, Ohio, including Toledo, at 9.2 percent. It is in this context that I appear before you today. I'm strongly urging the NRC to include in the scope of the Environmental Impact Statement for Fermi 3 nuclear power plant, a full analysis of the economic benefits of constructing such a plant in our region. From an energy perspective the proposed new plant would help assure that the energy needs of our region will be met for decades to come, and economic growth clearly cannot be sustained unless an adequate, reasonably priced energy supply is available.

Equally important, the jobs created by Fermi 3 would be a significant boost to this region and state. During the construction phase the Nuclear Energy Institute estimates that 2400 construction jobs would be created. And they say a plant of this size would require DTE to add 700 permanent employees. And we know how real these jobs are. DTE is a highly respected employer who currently has about 2,000 employees in Monroe County alone. None of these figures speak to the tremendous number of spinoff jobs created by the businesses that would serve the plant and its employees.

Before I close, let me reassure you that this region knows the importance of providing our workforce with the skills necessary to obtain employment in the energy industry. Many of our laid off workers have work experience or skills that make them ideal candidates for retraining in energy industry occupations. As I am sure you will hear in testimony of others, Monroe Community College and other institutions, are already heavily committed to energy industry occupation training, and continue to work with DTE and others to assure their programs are responsive to the specific current and future needs of the energy industry. And we at SEMCA place a very high priority on encouraging careers in the energy field and providing training funding for appropriate candidates. In conclusion, as the NRC proceeds with the environmental impact analysis for this proposed plant, I implore you to include a comprehensive analysis of the potential economic benefits it will generate for Michigan and our region. This is clearly an essential component to assure balance in your final conclusions on the costs and benefits of the proposed plant. (**0059-23** [Pitoniak, Gregory])

Comment: Construction of another unit would provide hundreds of good paying jobs. These jobs contribute millions of dollars to the local economy, and provide a badly needed revenue source for our local and state governments, which in turn helps these government entities provide the services that we have come to rely on. Construction of another unit would affect all businesses in the community, from the grocery store to the restaurant to the gas station to the car dealers to the landlords that have vacancies to rent. (**0059-32** [Sweat, Ron])

Comment: A new nuclear power plant would benefit the economy with an influx of good paying jobs for skilled workers and well educated professionals. The five year construction phase would allow and create as many as 2400 jobs. Then when the plant begins operation, 400 to 700 permanent high tech jobs would be produced, many of which require professional degrees. And I know many people here have asked, my child can't find a job after they graduate from college. Here's the chance that they can stay in their hometown of Monroe, and find a job that pays well.

In addition, a new nuclear plant, with those 4 to 700 jobs and businesses that supply goods and services to support the plant. Many of these businesses would be the high tech ventures that are attractive to the bright, young professionals, who are at the core of the most vibrant economics in the County today.

Finally, Detroit Edison, with their investments in a new nuclear plant, would stabilize the local tax base, which has been battered by failing home prices and industrial losses. The average nuclear plant generates total state and local tax revenue of almost 20 million each year. (**0059-7** [Mentel, Floreine])

Comment: As the events of recent months have shown us all too clearly, the economy of southeast Michigan is suffering. Unemployment is nearing double digits, home foreclosures are at historic levels, property values declined by twenty (20) percent in 2008 and the Detroit auto companies, along with their suppliers, are struggling to survive.

The impacts are being deeply felt in the Monroe County area, which is reeling from announced job cuts at several of area industries and businesses, both large and small. Automotive Components Holdings is closing its Monroe operation, resulting in the elimination of 480 jobs. La-Z-Boy Incorporated has cut 60 jobs at its world headquarters. Holcim has announced the closing of its cement-making plant by mid-2009, eliminating 163 jobs, and most recently announced additional job reductions at the regional headquarters in the Village of Dundee. Another 140 people will be left jobless with the closing of International Paper operations in Monroe and Brownstown Township. Several smaller manufacturing companies have had to reduce their workforce due to cutbacks in the automobile industry and the local economic conditions.

Due to conditions such as these, many of our young people have to leave home to start out their careers in other areas of the country that are enjoying more robust economies. Our brightest and most earnest workers may well become Monroe County's largest export!

A new nuclear power plant would benefit our local economy with an influx of good paying jobs for skilled workers and well educated professionals. These new employment opportunities would assist us to keep our young people right here in Monroe County and strengthen our family units. The five (5) year construction phase would alone create as many as 2,400 jobs and when the plant is in operation 400-700 permanent high-tech jobs would be created, many of which require professional degrees.

In addition, a new nuclear plant would generate another 400-700 jobs in businesses that supply goods and services to support the plant. Many of these businesses would be the high-tech, entrepreneurial ventures that are attractive to the bright, young professionals who are at the core of the most vibrant economies in the country today.

Monroe County must change and adapt to these economic realities by developing new industry and business opportunities that grow out of innovation and new technology. Bringing to fruition the potential plans by Detroit Edison to pursue the construction of a new nuclear power plant on the site of Fermi 2 may well be a bridge to that future.

Finally, the possibility of Detroit Edison making a significant investment in a new nuclear plant would help stabilize the local tax base, which has been battered by falling home prices and losses of local industries and businesses. A new nuclear power plant would help our municipalities sustain, and in some cases restore, the level of services expected by their constituents. Providing these new employment opportunities may well serve to help preserve our family unity. (**0082-36** [Morris, William P.])

Comment: Should the licensing process lead to a decision of building another nuclear plant, our local and state economy will benefit by some $430 million annually through the increased sales of goods and services from the plant's operation as it filters through our local economy. It will also add an additional $40 million annually in total labor income that will be spent in our communities. The EDC recognizes that this is a rare and unique opportunity that other communities could only dream about. We therefore fully support DTE's license application and stand ready with anticipation to assist the process in any way possible. (**0082-42** [Oberleiter, Tracy])

Comment: In the current changing economy, our workforce has experienced a substantial loss of jobs and find that their current skills may not match those needed in the jobs that are currently available. Consequently, the unemployment rate in our region is at 20 year highs, with Monroe Co. at 9.6%. Wayne Co. incl. Detroit at 10.6% and Lucas Co. Ohio, incl. Toledo at 9.2%. It is in this context that I provide the following to you today. I am strongly urging the NRC to include in the scope of the Environmental Impact Statement for the Fermi 3 Nuclear Power Plant a full analysis of the economic benefits of constructing and operating such a plant in our region. (**0083-18** [Pitoniak, Gregory])

Comment: The jobs created by Fermi 3 would be a significant boost to this region and state during the construction phase, the Nuclear Energy Institute estimates that 2,400 construction jobs would be created. And they say a plant of this size would require DTE to add 700 permanent employees. And we know how real these jobs are: DTE currently has about 2,000 employees in Monroe Co. alone. None of these figures speak to the tremendous # of spin-off jobs created by the businesses that would serve the plant and its employees.

Before I close, let me reassure you that this region knows the importance of providing our workforce with the skills necessary to obtain employment in the energy industry. Many of our laid-off workers have work experience or skills that make them ideal candidates for retraining in energy industry occupations. As I am sure you will hear in the testimony of others, Monroe Community College and other institutions are already heavily into energy occupation training and continue to work with DTE and others to assure their programs are responsive to the specific current and future needs of the energy industry. And we at SEMCA place a high priority on encouraging careers in the energy field and providing training funding for appropriate candidates. (**0083-20** [Pitoniak, Gregory])

Response: *The EIS will evaluate the expected economic impacts of construction and operation activities including any local purchasing of construction and production inputs, local and in-migrating labor, local spending of earnings, and tax revenues generated by local purchasing activities or from real property assessments. This information will be presented in Chapters 4 and 5 of the EIS.*

Comment: It was recently reported that a new Wind Turbine manufacturing plant will be locating to the Monroe County area adding new jobs. Many new Solar panel plants are moving to Michigan for alternate energy production, which could also locate in the Monroe area. Also, the job requirements for running a nuclear power plant are for very highly skilled workers with special training from outside the area which would do nothing to the advantage of the unemployed and displaced auto workers. (**0041-6** [Englund, Lance])

Response: *The comment refers to other energy-related activities that are proposed for Michigan and Monroe County and that could contribute to cumulative socioeconomic impacts. Potential cumulative impacts will be discussed in Chapter 7 of the EIS. In addition, the EIS will evaluate the economic impacts of construction and operation of the proposed Fermi 3 plant, including local and in-migrating labor, in Chapters 4 and 5 of the EIS.*

Comment: And also the fact sheet from GE Hitachi. Notice that GE is headquartered in Schenectady, New York. The Hitachi is in Japan, and so how many local jobs does that mean? I don't know.

Also, keep in mind that there's only one manufacturer in the world that makes a reactor vessel, and that is Japan Steel. They can only make, according to Blumberg News, four per year, and they have a multi-year backlog, and a company has to plunk down $100 million to get in the line. So even if this is approved, it could be a long time coming, and in the meantime we could all be out of a job, so. (**0058-104** [McArdle, Ed])

Comment: In terms of jobs, where would those jobs actually be associated with Fermi 3? GE Hitachi, the originator of the ESBWR design, is a Japanese corporation. Fermi 3's reactor pressure vessel, and other large components, would likely be manufactured at Japan Steelworks, which is one of the only facilities on the planet that can make such large nuclear components. (**0059-75** [Kamps, Kevin])

Response: *The EIS will evaluate the expected economic impacts of construction and operation activities including local and in-migrating labor and any local purchasing of construction and production inputs. This information will be presented in Chapters 4 and 5 of the EIS. Some purchases of construction and production inputs will be outside the local area, and these inputs will be identified in Chapter 4.*

Comment: I love to hike and spend most of my free time in the outdoors, and I guess I'd ask the NRC to consider the needs of outdoor recreationalists in the environmental impact review. One of the aspects that I don't think has been mentioned tonight is the aesthetic issue with nuclear power plants. These things, however clean they may be, they look pretty jarring when you see them. If you grew up in Monroe you know what it's like to navigate by power plant stacks and cooling towers, and I'm just wondering if there's a way to make the nuke plant, Fermi 3, look better and more in line with the green aspects of the shoreline. (**0059-79** [Ingels, Mike])

Comment: One other aspect is social justice. Monroe County provides a lot of the power for Southeast Michigan. It's a working class town. We do a lot of things here. We work hard and we provide power to places like Ann Arbor and Bloomfield Hills and all these great places that don't have power plants. And I'd ask that something be given to Monroe to really soften the impact of that, because, you know, again, our shoreline I really think is our future, and I think every power plant we put there is a little bit of an obstacle to presenting our County as a green place and I think maybe some people don't live here and don't site their businesses here because they see the brown streak across the sky. (**0059-81** [Ingels, Mike])

Response: *The EIS will evaluate the physical impacts of the construction and operation of the proposed plant on the visual aesthetics of the area in Chapters 4 and 5 of the EIS. Measures to mitigate the physical impacts will also be discussed in those chapters.*

Comment: I live directly across Swan Creek from DTE Energy Fermi II Nuclear Power Plant and have a full view of one cooling tower staring me in the face every day. If DTE Energy builds another cooling tower where proposed, I will have two cooling towers staring me in the face. This additional cooling tower will have a negative impact on my residential property value. Also, if DTE Energy adds a third nuclear reactor, that means they have increased the size of the plant by 33%, adding a 33% increase for potential accident, further having a negative impact on residential property value. I feel DTE Energy should be required to conduct a near-plant property value impact study in an attempt to determine property value declines as a result of the plant expansion. (**0074-1** [Scobie, Randall])

Response: *The NRC staff will evaluate the effects of the construction and operation of the proposed Fermi 3 plant on local property values in Chapters 4 and 5 of the EIS, based on an analysis of existing studies.*

D.1.11 Comments Concerning Historic and Cultural Resources

Comment: On January 8, 2009, the Advisory Council on Historic Preservation (ACHP) received from the Nuclear Regulatory Commission (NRC) a notification pursuant to Section 800.8(c) of the ACHP 's regulations, Protection of Historic Properties (36 CFR 800), regarding the referenced project. We appreciate receiving your notification. which establishes that NRC will use the process and documentation required for the preparation of an EA/FONSI or an EIS/ROD to comply with Section 106 of the National Historic Preservation Act in lieu of the procedures set forth in 36 CFR 800.3 through 800.6.

In addition to notification to the ACHP, NRC must also notify the Michigan State Historic Preservation Officer and meet the standards in Section 800.8(c)(l)(i)through (v) for the following:

identifying consulting parties;

involving the public;

identifying historic properties and assessing the undertaking's effects on historic properties: and consulting regarding the effects of the undertaking on historic properties with the SHPO/THPO, Indian tribes and Native Hawaiian organizations that might attach religious and cultural significance to affected historic properties, other consulting parties, and the ACHP, where appropriate during NEPA scoping, environmental analysis, and the preparation of NEPA documents.

To meet the requirement to consult with the ACHP as appropriate, the NRC should notify the ACHP in the event NRC determines, in consultation with the SHPO/THPO and other consulting parties, that the proposed undertaking(s) may adversely affect properties listed, or eligible for listing, on the National Register of Historic Places (historic properties). In addition, Section 800.8(c)(2)(i) requires that you submit to the ACHP any DEIS or EIS you prepare. Inclusion of your adverse effect determination in both the DEIS/EIS and in your cover letter transmitting the DEIS/EIS to the ACHP will help ensure a timely response from the ACHP regarding its decision to participate in consultation. Please indicate in your cover letter the schedule for Section 106 consultation and a date by which you require a response by the ACHP.

The regulations do not specifically require that an agency submit an EA to the ACHP. However, keep in mind that, in the case of an objection from the ACHP or another consulting party, Sections 800.8(c)(2)(ii) and (c)(3) provide for ACHP review of an EA (in addition to a DEIS or EIS) to determine whether preparation of the EA, DEIS or EIS has met the standards set forth in Section800.8(c)(l)and/or to evaluate whether the substantive resolution of the effects on historic properties proposed in an EA, DEIS or EIS is adequate.

If NRC's determination of adverse effect will be documented in an EA, we request that you notify us of the adverse effect and provide adequate documentation for its review. The ACHP's decision to review an EA, DEIS or EIS will be based on the applicability of the criteria in Appendix A of the ACHP's regulations. Thank you for your notification pursuant to Section 800.8(c). (**0044-1** [Vaughn, Charlene Dwin])

Response: *Consultation in compliance with the Advisory Council on Historic Preservation's (ACHP's) regulations, Protection of Historic Properties (36 CFR Part 800), will be discussed in Chapter 2 of the EIS. Historic and cultural resources, including historic properties as defined in 36 CFR 800.16(1), will be discussed in Chapter 2 of the EIS. Impacts to and mitigation measures for historic and cultural resources, including historic properties as defined in 36 CFR 800.16(1), will be discussed in Chapters 4 and 5 of the EIS.*

Comment: Figure 2.1-2 illustrates a 7.5 mile Radius around the Fermi Unit 3 vicinity. This radius encompasses a number of Heritage Resource Sites in the Coastal Zone of Monroe County, MI.

CULTURAL. Monroe Harbor is classified as a Working Waterfront (US Army Corps of Engineers).

HISTORICAL. River Raisin Battlefield (National Park Service). (**0082-29** [Micka, Richard])

Comment: Within the 7.5 miles Radius of Fermi Unit 3, the US Fish & Wildlife Service has established an International Wildlife Refuge, the NPS operates the Motor Cities National Heritage Area (Map attached) and is exploring the establishment of a National Battlefield that would be connected to the North Country National Scenic Trail near Fort Meigs in Perrysburg, Ohio. The US Army Corps of Engineers, Detroit District, operates a Confined Disposal Facility on the St. Lawrence Seaway at Pie-Movillee. This is exciting news. The COLA (ER) should be updated to reflect these initiatives and the Applicant should join in the effort to create a Center for Regional Excellence built on the Energy Industry in the Lake Erie West Region! (**0082-32** [Micka, Richard])

Response: *Historic and cultural resources, including historic properties as defined in 36 CFR 800.16(1), will be discussed in Chapter 2 of the EIS. Impacts to and mitigation measures for historic and cultural resources, including historic properties as defined in 36 CFR 800.16(1), will be discussed in Chapters 4 and 5 of the EIS.*

D.1.12 Comments Concerning Health – Non-Radiological

Comment: In regards to health issues: ...cooling tower reservoirs and thermal discharges can act to harbor or accelerate some etiologic agents that ultimately affect human health once released into the environment. These etiological agents include, but are not limited to, the enteric pathogens Salmonella spp., Vibrio spp. and Shigella spp., and Plesiomonas shigelloides, as well as Pseudomonas spp., toxin-producing algae such as Karenia brevis, noroviruses, and thermophilic fungi. Etiological agents also include the bacteria Legionella spp., which causes Legionnaires' disease, and free-living amoebae of the genera Naegleria, Acanthamoeba, and Cryptosporidium. Exposure to these microorganisms, or in some cases the endotoxins or exotoxins produced by the organisms, can cause illness or death. Thermo-stable viruses are also considered etiological agents and are subject to review for this impact analysis.

These etiological agents could prove very costly to human health if there were an inversion and there was a mix of smog and fog. This needs to be examined. (**0051-5** [Cumbow, Kay])

Response: *The health impacts of etiological agents as related to Fermi 3 operations will be addressed in Chapter 5 of the EIS.*

D.1.13 Comments Concerning Health – Radiological

Comment: In this regard, you may wish to take note of a number of reports issued by the IJC that touch on these matters. For your convenience, these are identified below:

Reports in 1977, 1983 and 1987 reviewed radioactivity in the Great Lakes Basin.

In 1994, the Seventh Biennial Report on Great Lakes Water Quality recommended that radionuclides which meet the definition of persistent toxic substance be included in the governments' strategy for virtual elimination.

In 1996, the Eighth Biennial Report on Great Lakes Water Quality devoted a section to radioactive substances and recommended that the use and storage of radioactive materials and nuclear wastes be addressed under the Great Lakes Water Quality Agreement.

In 1997, the Nuclear Task Force established by the DC in 1995 to review and assess the status of radioactivity in the Great Lakes issued a report on the sources of various radioactive isotopes as well as the movement and distribution of radionuclides.

Also in 1997, a report entitled The IJC and the 21st Century devoted a section to nuclear issues.

In 1998, the Ninth Biennial Report on Great Lakes Water Quality included three recommendations with respect to radioactivity.

In 2002, the Eleventh Biennial Report had a full chapter entitled Nuclear Issues.

The foregoing reports and others may be accessed on the IJC's website at www.ijc.org. If assistance is required, your staff is invited to contact Frank Bevacqua, IJC Public Information Officer, who may be reached at: bevacquaf@washington.ijc.org or 202-736-9024. (**0015-2** [Lawson, Charles, Ph.D.])

Comment: The IJC, the International Joint Commission for the Great Lakes for the U.S. and Canada said in 1978, that there are some substances that are so toxic that they should not be produced in the Great Lakes basin. In the early 1990's, the IJC acknowledged that there are radionuclides that meet the definition of persistent toxins, and that they recommended to the governments of the U.S. and Canada that they phase out all of those radionuclides that met that definition. And the definition is, any toxin that bioaccumulates and has at least a half life of eight weeks in water. That would shut down every single nuclear power plant in the Great Lakes basin. (**0058-19** [Cumbow, Kay])

Comment: In this regard, you may wish to take note of a number of reports issued by the IJC that touch on these matters. For your convenience, these are identified below:

-Reports in 1977, 1983 and 1987 reviewed radioactivity in the Great Lakes Basin.

-In 1994, the Seventh Biennial Report on Great Lakes Water Quality recommended that radionuclides which meet the definition of persistent toxic substance be included in the governments' strategy for virtual elimination.

-In 1996, the Eighth Biennial Report on Great Lakes Water Quality devoted a section to radioactive substances and recommended that the use and storage of radioactive materials and nuclear wastes be addressed under the Great Lakes Water Quality Agreement.

-In 1997, the Nuclear Task Force established by the IJC in 1995 to review' and assess the status of radioactivity in the Great Lakes issued a report on the sources of various radioactive isotopes as well as the movement and distribution of radionuclides.

-Also in 1997, a report entitled The IJC and the 21st Century, devoted a section to nuclear issues.

In 1998, the Ninth Biennial Report on Great Lakes Water Quality included three recommendations with respect to radioactivity. In 2002, the Eleventh Biennial Report had a full chapter entitled Nuclear Issues." (**0071-2** [Lawson, Ph.D., Charles])

Response: *The comments refer to a number of reports issued by the IJC on the water quality of the Great Lakes Basin. These reports will be considered when evaluating the health impacts of Fermi 3 operations in Chapter 5 of the EIS.*

Comment: Nuclear reactors routinely release millions of curies of radioactive isotopes into the air and water each year unreported and unmonitored. The Nuclear industry does not regulate these radioactive elements because they consider them biologically inconsequential. These radioactive releases include the noble gases Krypton, Xenon and Argon. They emit gamma radiation, which can mutate the genes in the eggs and sperm and cause genetic mutations. (**0019-3** [Schemanksi, Sally])

Comment: In the areas around nuclear power plants are the people monitored through doctors for health effects of the nuclear releases? Nuclear power never was too cheap to meter was always so very dangerous to life and will outlive all generations of humanity. (**0031-5** [Rysztak, Robert])

Comment: Even the regular releases of nuclear power plants, radio-active isotopes, have ill effects on the fish, the animals and the people. High cancer rates run nationwide. (**0032-3** [Rysztak, Robert])

Comment: Who studies the effects of radiation in the Great Lakes region? Who studies the health of the people in the cities of the nuclear power plants? Are they monitored in comparison to people in non-nuclear power plant areas? (**0032-5** [Rysztak, Robert])

Comment: The pollution resulting from a nuclear power plant is unacceptable and is dangerous to the health of too many citizens. (**0034-2** [Nett, Ann C.])

Comment: The geographic region is the state's most-populated, and the proposed Fermi III project would be placing residents of two states and Canada in jeopardy, in the immediate region, from the potential of uncontrolled nuclear reactions, as well as proximity to storage of spent radioactive waste. (**0039-2** [Mitchell, Rita])

Comment: Routine radioactivity releases from Fermi 3 would harm human health. Even new reactors like Fermi 3 will release significant amounts of radioactivity directly into the environment. These would include so-called planned and permitted releases from the reactor's routine operations, as well as unplanned releases from leaks and accidents. Atomic reactors are designed to release radioactive liquids and gases into the air, water, and soil, which can then bio-concentrate in the ecosystem and human bodies. Liquid releases, which at Fermi are discharged into Lake Erie, include tritium, which can incorporate into the human biological system, even down to the DNA level. Once organically bound, tritium can persist in the human body for long periods, emitting damaging radioactive doses. Tritium can cross the placenta from mother to fetus. Current radiation health standards are not protective of women, children, nor fetuses. The Institute for Energy and Environmental Research has launched a campaign called Healthy from the Start, which urges NRC, EPA, and other agencies to protect the more vulnerable Reference Pregnant Woman from such radioactive hazards as tritium, rather than Reference Man as is currently done. The State of Colorado has instituted a tritium regulation 40 times stronger than the federal standard; California has a 50-fold stronger standard. Michiganders deserve equally strong protection. (**0050-6** [Kamps, Kevin])

Comment: Many radionuclides released routinely by nuclear plants bioaccumulate and bioconcentrate in the food chain, and these should all be accounted for. (**0051-7** [Cumbow, Kay])

Comment: Tritium is a very important isotope that is routinely emitted in large quantities into the air and waste water from nuclear power plants. Tritium, which is radioactive for 248 years is released continuously from reactors into the air and into lakes, rivers, or seas - depending upon reactor location. There is vast literature on the biological effects of tritium demonstrating that it causes chromosomal breaks and aberrations. (Helen Caldicott, Nuclear Power Is Not the Answer). What studies are being done on the long term effects of tritium which cannot be filtered out and is released in the form of radioactive water vapor or water. What are the levels of tritium in the air and the drinking water of Monroe County? (**0055-2** [Guthrie, Patricia])

Comment: All nuclear power plants release radionuclides into the air and into the water. Some are planned releases; some are not planned by either leaks or accidents. Radioactive emissions are quite insidious because normally, under normal circumstances, people cannot sense them with their senses. They can't smell them, they can't taste them, they can't -- you need expensive equipment to detect them, and nuclear power plants do not have to have to keep -- they don't do monitoring on a 24/7 basis. They don't monitor through all their vents. There's a lot of ways that radioactive waste can get out. (**0058-24** [Cumbow, Kay])

Comment: Atomic reactors are designed to release radioactive liquids and gases into the air, water, and soil. Gaseous releases include Xenon 135, a noble gas which quickly decays into Cesium 135, which then falls out onto the soil and surface waters. Cesium is readily taken up by the human body, where it lodges in muscle tissue such as the heart. (**0058-34** [Yascolt, Stas])

Comment: I have taught radiation science in college, and I'm on the National Radiation Committee for the Sierra Club. But that's not really the reason that I am here today, because I think everybody knows that radiation exposure is bad for us. I have all the --even though I was very careful when I was working, I have all the medical problems that are associated with excess radiation. (**0058-40** [Simpson, Robert])

Comment: I know the horrible nightmare of a cancer diagnosis. Living under the shadow of that debilitating, painful, and life threatening disease, it is becoming an epidemic. To expose a population to the threat of that disease is a crime. Dr. Sternblast, who is doing a large project to analyze radioactive elements stored in baby teeth, is convinced that more than any other factor, radiation is the cause of the cancer epidemic. Main radiation factors include fallout and nuclear reactor emissions. Nuclear reactors create radiation. The worst scenario is a large explosion such as Chernobyl. However, nuclear reactors routinely omit radiation into the atmosphere by way of releases that is gaseous and thermal. Since, like pesticides, radiation is bio accumulative, and enviro accumulative, there is no safe measure for repeated emissions and exposures. Like pesticides, radiation is carcinogenic and mutagenic. It is also teratogenic, and it is a feticide. (**0059-12** [Barnes, Kathryn])

Comment: Radioactive elements cause cancer. (**0059-18** [Barnes, Kathryn])

Comment: The environmental assessment must address the well known health effects of both low level and catastrophic radioactive emissions from nuclear power plant operation. (**0059-48** [Wolfe, Joan])

Comment: we would not have the environmental problems that we have today with -- wait, I thought everybody said the deer were nice on that park. Well, deer don't know that they are dying and getting cancer. They do. There are environmental costs that are largely unseen, they are very quiet. But because there are deer walking around in a park doesn't mean that it's benign. We know from study after study. The very first ones which were done were really done in Hiroshima and Nagasaki. The results of radiation are dramatic, life-ending, and terrible. (**0059-58** [Wolfe, Robert])

Comment: I have become aware of the dangers of radioactive gases (Iodine 131) that are regularly flushed into the atmosphere by the Nuclear Power Plant yet permitted by NRC, and dismissed as noble gases and therefore chemically inert. However, scientists have indicated that they actively decay to daughter isotopes. Does living near a nuclear power plant increase the exposure to Iodine-131? Would this risk increase with an added nuclear plant? Are the annual Fermi II Iodine-131 releases still among the highest among US reactors? Are there any recent studies in this regard available? (**0065-1** [Diederichs, Dorothy])

Comment: I am concerned about the radioactive gases which are actively flushed into the atmosphere. Planned Purges are officially permitted by the NRC so that utility operators can decrease the intensely radioactive environment into which maintenance workers must enter. Older reactors are allowed twenty-two purges per year during cold shutdown.

What studies have been done on the impact of these planned purges on pregnant women and children and the elderly, many of whom have a weakened immune system? Will construction of Fermi III increase the risk of exposure to harmful radioactive substances? (**0068-1** [Walby, Charlotte])

Comment: Dr. Helen Caldicott lists numerous dangerous, carcinogenic elements produced by nuclear power plants:
-Iodine 131, which bio-concentrates in leafy vegetables and milk and can induce thyroid cancer
-Strontium 90, which bio-concentrates in milk and bone, and can induce breast cancer, bone cancer and leukemia
-Cesium 137, which bio-concentrates in meat, and can induce a malignant muscle cancer called a sarcoma
-Plutonium 239, which can cause liver cancer, bone cancer, lung cancer, testicular cancer and birth defects. (**0081-1** [Ryan, Janet])

Comment: What are the health impacts of adding another nuclear power plant to our community? (**0081-4** [Ryan, Janet])

Comment: The environmental assessment must address the well-known health effects of both low-level and catastrophic radioactive emissions from nuclear power plant operation. (**0083-2** [Wolfe, Joan])

Comment: I know the horrible nightmare of a cancer diagnosis. Living under the shadow of that debilitating, painful, and life threatening disease is becoming an epidemic. To expose a population to the threat of that disease is a crime. Dr. Sternglass, who is doing a large project to analyze radioactive elements stored in baby teeth, is convinced that more than any other factor, radiation is the cause of the cancer epidemic. Main radiation factors include fallout and nuclear reactor emissions. Nuclear reactors create radiation. The worst scenario is a large explosion such as Chernobyl. However, nuclear reactors routinely emit radiation into the atmosphere by way of releases -- i.e. gaseous and thermal. Since, like pesticides, radiation is bio accumulative, and enviro accumulative, there is no safe measure for repeated emissions and exposures. Like pesticides, radiation is carcinogenic and mutagenic. It is also tetrogenic and is a feticide. (**0083-22** [Barnes, Kathryn])

Response: *The comments refer to human health effects of radiological releases from nuclear power plants. In Chapter 5 of the EIS, the NRC staff will evaluate human health impacts of effluent releases from the operation of the proposed Fermi 3 plant.*

Comment: The 1993 accident at Fermi 2 and subsequent release of radio-active water into Lake Erie in 1994 was not a good thing. How many similar releases of radiation can our waterways stand before they become radio-active? (**0032-4** [Rysztak, Robert])

Comment: Large-scale accidental tritium leaks into groundwater in Illinois, that had been covered up for a decade by the nuclear utility and state environmental agency, were uncovered in early 2006 by a concerned mother whose daughter had contracted brain cancer at age 7. A cluster of rare childhood brain cancers were then documented in the community of Morris, Illinois, home to three atomic reactors and a high-level radioactive waste storage facility. The scandal led to the revelation of widespread accidental tritium releases nationwide at almost all atomic reactors. (**0050-7** [Kamps, Kevin])

Comment: Incredibly, Fermi 1 experienced an accidental release of thousands of gallons of tritium-contaminated water in 2007, 35 years after the reactor had been permanently shut down! The nearby Davis-Besse reactor also recently admitted tritium leaks into the environment. (**0050-9** [Kamps, Kevin])

Comment: Liquid releases, which at Fermi are discharged into Lake Erie, include tritium, which is radioactive hydrogen. Tritium flows wherever water flows. It is prohibitively expensive to filter out. So, NRC allows it to be released into the environment. Tritium can incorporate into the human biological system even down to the DNA level. Once organically bound, tritium can persist in the human body for long periods, emitting dangerous, damaging, radioactive doses. Tritium can cross the placenta from mother to fetus. (**0058-35** [Yascolt, Stas])

Comment: Large scale accidental tritium leaks into groundwater in Illinois have been covered up for a decade by the nuclear utility and state environmental agency. They were uncovered in early 2006 by a concerned mother, whose daughter had contracted brain cancer at age 7. A cluster of rare childhood brain cancers were then documented in the community of Morris, Illinois, home to three nuclear reactors and a high level radioactive waste storage facility. The scandal led to a revelation of widespread accidental tritium releases nationwide at almost all atomic reactors. These are the documented ones. We don't know about the undocumented ones. (**0058-36** [Yascolt, Stas])

Comment: Accidents at atomic reactors can lead to a large scale release of harmful radioactivity into the environment. For instance, right here at the poster child for anti-nuke, right here at Fermi, we had the Fermi 2 turbine disintegrated in 2007. Now, it seems incredible that it could happen, but actually this brought about a release of radioactive water.

I can't believe that it happens, as many safeguards that are built in, but these things do happen. It seems impossible, but it did happen, right here. On top of that, this also happens to be the place, the site that we have the example of Fermi 1, the sodium reactor. And there actually was a release, believe it or not, in 2007, of water on the decommissioning of Fermi 1. I believed for years and years that it was a problem that was long solved. It continues on, the legacy. We are to leave this to our children, our grandchildren, our great-grandchildren, for generations, for thousands of years. (**0058-37** [Yascolt, Stas])

Response: *The comments refer to potential accidental radiological releases. In Chapter 5 of the EIS, the NRC staff will evaluate human health impacts from radiation exposure during operation of the proposed Fermi 3 unit, including unanticipated operational occurrences. Chapter 5 also will evaluate the risks associated with postulated reactor accidents.*

Comment: They will be dangerous virtually forever. In June 2005, the National Research Council found that scientific evidence shows that exposure to radiation at even barely detectable doses can cause DNA damage that leads to cancer. There is no safe dose of exposure to radiation, no matter how small. In Monroe County, the cancer death rate has jumped from 2% above the U.S. in the early 1980s [when no reactors operated] to 10% above the U.S. in this decade. Cancer mortality in children who are most susceptible to radiation soared from 39% below the U.S. to 58% above the U.S.

Dr. John Gofman, one of the world's foremost radiation researcher has spent over fifty years on the study of low-level radiation. A physician and doctor of nuclear/physical chemistry, Dr. Gofman co-discovered uranium-233 and isolated the world's first workable plutonium for the Manhattan Project. . He concludes: There is no safe dose or dose-rate of ionizing radiation with respect to the induction of human cancer. It would be impossible for low total doses of ionizing radiation, received slowly from routine occupational environmental sources, to be less carcinogenic than the same total doses received acutely. There is very strong support in the direct human evidence for recognizing that the cancer risk is probably more severe per dose unit at low doses than at moderate and high doses.

The nuclear industry does not have the technical ability to keep exposure to zero. They allow workers to be irradiated at so called allowable levels and the public to be poisoned at allowable levels. They continue to spread the myth that there is a safe dosage. Past estimates of safe levels have been continuously underestimated. In 1910, safe allowable exposure was thought to be 100 rems per year for workers; today it is 5 rems per year. The British National Radiological Board has lowered its permissible levels to 2 rems. A study published in 1991, in the Journal of the American Medical Association reveals the occurrence of leukemia is 63% higher among white male atomic workers at Oak Ridge National Laboratory than among all U.S. white males. Most of the workers in the study received total radiation doses of less than 1 rem total exposure throughout their entire employment. (**0019-8** [Schemanksi, Sally])

Comment: I am concerned about the potential long-term health risks (specifically for children) posed by living close to two nuclear power plants. When the nuclear industry calculates "acceptable" radiation exposure for the public, it uses a model of a standard, healthy 150 pound man. But the population is far from homogeneous. Old people, immuno-depressed patients, normal children and some with specific, inherited diseases are many times more susceptible to the deleterious effects of radiation than normal adults. (Helen Caldicott, Nuclear Power Is Not the Answer)

In the only attempt federal officials have made to examine cancer rates near U.S. nuclear plants, a study published in the European Journal of Cancer Care found that Leukemia death rates in U.S. children near nuclear reactors rose sharply (vs. the national trend) in the past two decades. The greatest mortality increases occurred near the oldest nuclear plants, while declines were observed near plants that closed permanently in the 1980s and 1990s. (European Journal of Cancer Care. 17(4):416-418, July 2008. MANGANO, JOSEPH; SHERMAN, JANETTE D.)

Given these factors, how can we be assured that increasing nuclear power generation in Monroe County does not put our children at risk? Does the Nuclear Regulatory Commission have any processes in place to assess this risk?
(**0036-1** [Nash, Sarah])

Comment: As confirmed for the seventh time by the U.S. National Academy of Sciences in 2006 in its Biological Effects of Ionizing Radiation report (BEIR VII), every exposure to radiation increases the risk to human health. Radioactivity can damage tissues, cells, DNA and other vital molecules, potentially causing programmed cell death (apoptosis), genetic mutations, cancers, leukemias, birth defects, and reproductive, immune, cardiovascular and endocrine system disorders. (**0050-11** [Kamps, Kevin])

Comment: the first thing that comes to mind is a baseline for radiation and other pollution exposure to air, land, water, sediment, fish, wildlife, and incorporating not just the Great Lakes, but the Detroit River, Raisin River, Swan Creek, where there is potential for plant uptake or food chain bioaccumulation of radiation or other pollutants that has already occurred from Fermi 1, Fermi 2. And before you can make an estimate of a modeling of how much would occur from a potential Fermi 3. (**0058-106** [McArdle, Ed])

Comment: BEIR 7, which was published in 2005 by the National Academy of Sciences, they reconfirmed that there is no safe threshold for human health for exposure to radiation. In the fall of this year, the Committee to Bridge the Gap, they discovered that EPA was in the process of gutting, secretly, radiological protections standards for the U.S. (**0058-22** [Cumbow, Kay])

Comment: As confirmed for the seventh time by the U.S. National Academy of Sciences in 2006, every exposure to radiation increases the risk to human health. Radioactivity can damage tissues, cells, DNA, and other vital molecules, potentially causing program cell death, apoptosis, genetic mutations, cancers, leukemias, birth defects, and reproductive immune cardiovascular and endocrine system disorders.

Among the many environmental concerns surrounding nuclear power plants, there is one that provokes public anxiety like no other, the fear that children living near nuclear facilities face an increased risk of cancer. The carcinogenic effects of radioactive exposure are most severe among infants and children. Leukemia is the type of childhood cancer most closely associated with exposures to toxic agents, such as radiation, and has been most frequently studied by scientists.

In the U.S., childhood leukemia incidents has risen 28.7 percent from 1975 to 2004. According to CDC data, suggesting that more detailed studies on causes are warranted. I would like to bring several of the recent studies as short as possible. The first one I am referring to is the one done by epidemiologist Joseph Mangano, Director of the Radiation and Public Health Project, and toxicologist Jeannette Sherman, who is a Medical Doctor of the Environmental Institute at Western Michigan University. They analyzed leukemia deaths in children under 19 years of age. In the 67 counties located near 51 nuclear power plants, starting from 1957 until 1981, so from `57 to `81 it's referring when the nuclear power plants were started.

The same counties have been also studied in a NCI study. About 25 million people live in these 67 counties, and the 51 plants represent nearly half of the U.S. total. Using mortality statistics from the U.S. Centers for Disease Control and Prevention, Mangano and Sherman found that in

1985 to 2004, the change in local child leukemia mortality versus the U.S. average, compared to the earliest years of reactor operations were as follows: An increase of 13.9 percent near nuclear plants started in the year `57 until 1970, so-called oldest plants, so an increase of almost 14 percent near oldest nuclear plants. I'm talking about children leukemia death rates. An increase of 9.4 percent near nuclear plants started in `71 until `81, an increase of 9.4 percent in children living near newer nuclear power plants. And a decrease of 5.5 percent near nuclear plants started in `57 until `81 and later shut down. So we have a decrease in children leukemia deaths, 5.5 percent of decrease if the children were living nearby to a shutdown nuclear plant.

The conclusion that the author made is the13.9 percent rise near the older plant suggests a potential of great effect of greater radioactive contamination near aging reactors, while the 5.5 percent decline near closed reactors suggest a link between less contamination and lower leukemia rates. The large number of child leukemia deaths in the study, like there were 1,292 children who died of leukemia during the study, makes many of the results of the study statistically significant. (**0058-28** [Pfeiffer, Jelica B.])

Comment: So there are valuable studies that can support our study that I just presented, and reaction of German government and British government, how seriously they are taking those U.S. studies now. And based on it I'm calling for a moratorium of not issuing more permits for new nuclear reactors because there's still too many questions to be answered and more studies to be done.

Another point, reason for moratorium, is the fact that EPA has no regulations in place limiting the presence of radioactive elements in our air, water, and soil. So we want to give a bit of time to EPA to come to those standards.

Third point: Considering the high vulnerability to radiation in our children and pregnant women, the reference, man, should be changed to reference, pregnant woman. (**0058-29** [Pfeiffer, Jelica B.])

Comment: I am concerned about the impact that another nuclear power plant would have on those with compromised immune systems. What studies have been done on the cumulative low levels of radiation on pregnant women, children and the elderly? Can you assure us that the construction of Fermi III will not effect the health of those with compromised immune system? (**0060-1** [Petrak, IHM, Genevieve])

Comment: I am particularly concerned about the health risks of nuclear power. How can you assure us that building of Fermi III is safe for us and especially for our pregnant mothers and their unborn children? Scientific research tells us that there are no safe levels of exposure to radioactive substances. Can you assure us that the building of a new nuclear power plant will not impact in a negative way the health of our citizens. (**0063-1** [Bell, Mary Faith])

Comment: The thing about radiation is you can't see it or smell it so it is difficult to provide evidence of its presence as a pollutant. But it does accumulate in body tissue and may cause damage to the structure of DNA.

The National Academy of Science's National Research Council in its report on the health effects of radiation exposure, states that the preponderance of scientific evidence shows that exposure to radiation, at even barely detectable doses, can cause DNA damage that leads to cancers, especially in fetuses and children. There is no threshold of exposure below which low levels of ionizing radiation can be demonstrated to be harmless or beneficial. The health risks, particularly the development of solid cancers in organs, rise proportionately with exposure?[2]

What is not fully appreciated is that these chemicals do not do their worst damage by exposing people to radiation in the environment. Rather the real damage is done through ingesting them through breathing, drinking and through the food chain, especially through fresh milk and other dairy products, concentrating in key organs like the lung, thyroid, bone marrow and the female breast. These internal radiation doses are especially harmful to infants in the womb, children and older people with weaker immune systems.

[2] BEIRVII: Health Risks from Exposure to Low Levels of Ionizing Radiation , National Academies Press, 500 Fifth Street, NW, Washington, DC 20001; (**0083-13** [Mumaw, Joan])

Response: *The comments refer to the health effects of exposure to low levels of radiation, the BEIR VII report (Health Risks from Exposure to Low Levels of Ionizing Radiation), and the cancer statistics in the areas surrounding nuclear power plants. The NRC staff will evaluate human health impacts of radiation exposure from the operation of the proposed Fermi 3 nuclear plant in Chapter 5 of the EIS. The NRC staff will also discuss the dose standards used in the assessment.*

Comment: Given Fermi 3's inevitable radiological and toxic releases, drinking water intakes from Lake Erie must be required to constantly monitor contaminants in order to adequately protect public health. NRC should address the synergistically harmful health impacts due to human exposures to radioactivity and toxic chemicals. (**0050-16** [Kamps, Kevin])

Response: *This comment relates to the possible synergistic effect of chemicals and radiation and the cumulative impacts of the proposed Fermi 3 plant. The NRC staff will evaluate cumulative impacts from the operation of the proposed Fermi 3 plant in Chapter 7 of the EIS.*

Comment: **T**he rising cancer death rate in Monroe County is 45% above the U.S. average. Apparently there is a link to the fact that all reactors routinely emit over 100 radioactive chemicals into air and water that are known carcinogens. (**0047-5** [Bettega, Gayle])

Comment: Fermi 2's operations are correlated with local increases in cancer rates and other diseases, a radioactive health risk that Fermi 3 would make even worse. Janette Sherman, MD of the Environmental Institute at Western Michigan University published Childhood Leukaemia Near Nuclear Installations in a recent edition of the European Journal of Cancer Care. Using mortality statistics from the U.S. Centers for Disease Control and Prevention, Sherman examined data from 1985-2004 and determined that when measured against background levels in the rest of the U.S., leukemia rates have increased for children that live near nuclear reactors. She found an increase of 13.9% near nuclear plants started up between 1957-1970 (oldest plants); an increase of 9.4% near nuclear plants started up between 1971-1981 (newer plants); and a decrease of 5.5% near nuclear plants started up between 1957-1981 and later shut down.

Joe Mangano of the Radiation and Public Health Project has documented that in the early 1980s, before Fermi 2 began operating in 1988, the Monroe County cancer death rate was 36th highest of 83 Michigan counties. But by the early 2000s, it had moved up to 13th highest. From 1979-1988, the cancer death rate among Monroe County residents under age 25 was 21.2% below the U.S. rate. But from 1989-2005, when Fermi 2 was fully operational, the local rate was 45.5% above the U.S. rate. The energy efficiency and renewable alternatives to Fermi 3 do not involve such radioactive health risks. (**0050-13** [Kamps, Kevin])

Comment: Fermi 1 was a fast breeder reactor, which was supposed to produce more fuel in the form of Plutoniuum-239 (Pu-239) than it used of Uranium-235. Glenn Seaborg, co-discoverer of Pu-239, described it as "fiendishly toxic".

The nuclear industry promotes reprocessing (they like to call it "recycling") high level radioactive "spent" fuel to extract Pu-239 for more fuel. Pu-239 has a radioactive half-life of 24,000 years and a hazardous-to-health life of 240,000 years.

Many years ago experiments were done on young adult beagles. They were injected with small doses of Pu-239. They died from bone cancer. If they inhaled Pu-239 the dogs died of lung cancer (Science, February 22, 1974). Extrapolating to humans, a millionth of an ounce would have the same effect.

The British Ministry of Health has reported finding Pu-239 in children's deciduous (baby) teeth. The concentration increased the closer they lived to the Sellafield reprocessing plant indicating that the plant was the source of Pu-239.

In France Pu-239 has been found on the Normandy beach. A reprocessing plant is located on the English Channel upstream at LaHague. An increase in childhood cancer has been reported in children who visited the beach frequently (British Medical Journal, January 11, 1997).

The German Federal Radiation Protection Agency, the government's advisor on nuclear health, concluded that children under the age of 5 years were more likely to develop leukemia if they lived near a nuclear power plant. Germany plans to close all 16 nuclear power plants by 2020. (**0054-3** [Drake, Gerald A.])

Comment: I am concerned about the impact that Fermi III will have on the health of residents of Monroe County and environs, especially those whose immune system would make them susceptible to a variety of damaging effects.

The elderly, immuno-depressed patients, normal children, and some with specific, inherited diseases are many times more susceptible to the deleterious effects of radiation than normal adults. Overall, about forty-two people out of a hundred are expected to develop cancer in their lifetimes from all causes. (Helen Caldicott, Nuclear Power Is Not the Answer) (**0055-1** [Guthrie, Patricia])

Comment: We have radioactive releases from nuclear power plants in the Great Lakes Basin handout that anyone who lives in this area should see. Do you really want your kids to have brain tumors, birth defects, cancers, leukemia, and reproductive immune, cardiovascular and endocrine system disorders? I hope not. (**0058-86** [Anderson, Alan])

Comment: My concerns regarding the impact of the building of a new nuclear power plant on the site at Fermi 2 focus on the environment and the health of the community of Monroe. While DTE intends to minimize environmental impacts, routine releases will occur in both liquid and air emissions. Current radiation health standards, as used by the EPA and the NRC are referenced to healthy men. The reference man is a statistical model. He dates to 1974, but he's perpetually aged between 20 and 30 years old. He weighs 170 pounds, stands 5 feet 7 inches, and hails from Western Europe or North America. And, he represents everyone in the US when it comes to setting regulations for acceptable standards of exposure to ionizing radiation.

What about pregnant women, children, and the frail elderly? What studies have been done on the effect of sustained low level radiation in fetuses, children, and the elderly, who have weakened immune systems? This is of special concern to us because we have 180 elderly residents at the IHM Sisters Mother House which is within the Fermi environmental zone, the 10 miles.

Routine radioactive discharges by nuclear power plants are deemed legal and judged to be safe by the NRC and the industry. Some of this is so radioactive it is stored onsite. Any loss of cooling water from mechanical failure or terrorist attack would cause a catastrophe. Routine releases of lower level radioactive chemicals into the water are done in order to relieve pressure in the containment area and to limit the presence of radioactive and corrosive chemicals that damage reactor parts. The discharge for Fermi is very close to the water supply for the City, and for Frenchtown Township. Not all radioactive isotopes can be filtered from the water prior to its release.

Fermi 2, after an accident on Christmas Day in 1993, released over a million gallons of radioactively contaminated water into Lake Erie. Other chemical releases are made into the air. By breathing in radiation from the air or drinking water that is contaminated, we ingest these chemicals. They in turn release fast moving subatomic particles into our bodies that smash into and break molecules causing cancer, birth defects and genetic mutations. Radioactive iodine aims for the thyroid. Strontium goes for the bones, and tritium behaves like water, dispersing throughout the body and entering cells where it can disrupt the DNA. Tritium cannot be filtered out. What studies have been done on the long term effect of tritium, which is released into the air and water by nuclear power plants? (**0059-41** [Mumaw, Joan])

Comment: The thing about radiation is you don't see it or smell it, so it's difficult to provide evidence of its presence as a pollutant. But it does accumulate in body tissue and may cause damage to the structure of DNA. The National Academy of Sciences National Research Council, on its report on health effects of radiation exposure, states that the preponderance of scientific evidence shows that exposure to radiation at even barely detectible doses over long periods of time, can cause DNA damage that leads to cancer, especially in fetuses and children.

What is not fully appreciated is that chemicals do not do their worst damage by exposing people to radiation in the environment. Rather, the real damage is done through ingesting them through breathing, drinking, and through the food chain, especially through fresh milk and other dairy products, concentrating in organs like the lung, thyroid, bone marrow, and the female breast. These internal radiation doses are especially harmful to infants in the womb, children, and older people with weaker immune systems.

In Monroe County the cancer death rate is 10 percent above the national average. Cancer mortality in children, who are most susceptible to radiation, soared from 21 percent, the average in the 1980's, to 45 percent above the national average in 2005. What studies have been done in Monroe County on the incidences of cancer, especially in children, and its possible causes? This is of concern to us as Sisters, many of whom have spent several years in Monroe studying and teaching in local schools. And several of our women are currently undergoing treatment for cancer.

Health and the environmental policies have long observed the precautionary principle. The principle developed at the Wingspread conference in 1998 asserts that before using a new technology or starting a new activity, there is a duty to take anticipatory action to prevent harm. It also declares that responsibility for the proof of harmlessness rests with the proponent rather than the public. Can you, DTE, and the NRC, assure us that Fermi 3 will be safe? Can you assure us that the health of the community is not being and will not be compromised by the inevitable release of radioactive contaminants into air and water?

Please do not rush to build an expensive and quite possibly harmful nuclear reactor until all the heath issues are studied by independent researchers and the public is informed of any risk. (**0059-43** [Mumaw, Joan])

Comment: I've been in contact with an eminent epidemiologist, Joseph Mangano. He works with the Radiation and Public Health project. His work is reviewed by several MDs, several PhDs, biostatisticians.

The following is a statement by Joseph J. Mangano. Joseph Mangano, Masters Public Health, Masters of Business Administration, is Director, Secretary, and Executive Director of the Radiation and Public Health Project. Mr. Mangano is a public health administrator and researcher and has studied the connection between low dose radiation exposure and subsequent risk of disease, such as cancer, and damage to newborns. He has published numerous articles and letters in medical journals in addition to books, including low level radiation and immune systems disorders, and atomic air legacy. Here he examines the connection between radiation exposure and current widespread health problems. He cites the rising local cancer rates, suggests a link between the Fermi 2 reactor and cancers. January 14th, 2009, the cancer death rate in Monroe County has been rising since the late 1980's when the Fermi 2 nuclear reactor began operating according to this new analysis. The rising cancer has been sharpest among children and adolescents who are most susceptible to the harmful effects of radiation exposure. The analysis uses official data from the US Centers for Disease Control and Prevention. The increasing cancer rate death among Monroe County residents, especially young people, suggest a link with radioactive chemicals emitted from the Fermi reactor, says Joseph J. Mangano, MPH, MPA, Executive Director of the Radiation Public Health Project.

Because Monroe County has a low risk population that is well educated, high income, and has few language barriers, rising cancers are unexpected and all potential causes should be investigated by health officials.

Fermi 2 reactor began operating June 21st, 1985, and went commercial January 1988. However, it ran very little after the initial low power startup. The 1998 startup was the full commercial operation. In the early 1980's the Monroe County cancer death rate was 36th highest of 83 Michigan counties. By early 2000 it had moved up to 13th highest. From 1979 to 1988, pre-Fermi, the cancer death rate for Monroe County residents under 25 years of age was 21 percent below the US rate. But from 1989 to 2005, when Fermi 2 was fully operational, the local rate was 45.5 percent above the US national average.

All nuclear reactors produce electricity by splitting uranium atoms which creates high energy needed to heat water. This process all creates over 100 radioactive chemicals not found in nature, including strontium 90, cesium 137 and iodine 131. While most of these chemicals are retained in reactors and stored as waste, a portion is routinely released in the local air and water. They enter human bodies through breathing and the food chain, and raise cancer risk by killing and injuring cells in various parts of the body. They are especially harmful to children.

The findings come at a time when a new reactor has been proposed at the Fermi plant. The original Fermi 1 reactor, which was a site of a partial core meltdown accident in 1966, shut down permanently in 1972, and I might add, was taken apart by the pipefitters of Local 671. Of a work force of 39, 35 died within a few years of taking it apart, from cancers of the organ. Please check your data and go back to your records. Data on cancer risk from Fermi radioactive emissions. The Fermi 2 reactor is located in Monroe County and started in 1985, now commercial in '88. Monroe County has no obvious cancer risk. It has high income, low poverty, well-educated population with few language barriers and access to excellent healthcare in nearby major cities. Thus, an increase in cancer is unexpected. This change should be investigated and one potential cause should be ruled out from radioactive emissions fr (**0059-64** [Keegan, Michael])

Comment: I'm just amazed that after listening to Michael Keegan talk about the higher cancer rates since Fermi's been running -- I mean we're talking cancer, we're talking people dying. I heard people talk about babies dying and pregnant women losing their babies. And then other people talk about they are supporting Fermi 3 because Detroit Edison helps with the Science Fair. And I don't mean to be rude, but we're talking cancer. We're talking waste that is deadly for two millenniums plus. And they don't know what to do with it. They're talking cancer. And then other people have come up shown that there's more jobs if we chose alternative energy. So I don't understand any of the reasoning to support Fermi 3, causes cancer and not as many jobs. So I guess -- you know, I've come to a million anti-Fermi meetings and I rarely talk. But it's like, come on, think about it. We're talking cancer, high rates of cancer in Monroe County. You know? Yeah, we're a company town. They've done a good job of selling their plant and supporting the Red Cross and the United Way and the schools. We're talking cancer. (**0059-88** [Meyers, Marcie])

Comment: I am concerned about the impact of radiation exposure on the elderly, immunosupressed persons, children, and the population in general in Monroe County. It seems quite peculiar that Monroe's mortality rate is above that of Michigan for the years 2000-2005, all cancers combined (ICD-10 codes COO-D48.9). Will the NRC be asking the Health Department to investigate this discrepancy? And how can we be assured that increasing nuclear power generation does not put our citizens, especially children and young adults at risk? Thank you for giving serious consideration to these issues before moving forward with plans to build Fermi 3. (**0067-1** [Duggan, Marion])

Comment: The people of Monroe do not need more risks to healthy living. (**0070-3** [Karas, Josephine])

Comment: I. Recent Essential Facts on Health Hazards of Nuclear Generating Reactors

1. Thus U.S. National Academy of Sciences has confirmed in 2006, for the seventh time, conclusive evidence that every exposure to radiation increases the risk to human health. Radioactivity can damage tissues, cells, DNA and other vital molecules, potentially causing programmed cell death (apoptosis), genetic mutations, cancers, leukemias, birth defects and reproductive, immune, cardiovascular and endocrine system disorders.

2. Among the many environmental concerns surrounding nuclear power plants, there is one that provokes public anxiety like no other: the fear that children living hear nuclear facilities face an increased risk of cancer. In fact, the carcinogenic effects of radiation exposure are most severe among infants and children. Leukemia is most closely associated with exposures to toxic agents such as radiation, and has been most conclusively studied by scientists. In the U.S., childhood leukemia incidence has risen 28.7% from 1975 to 2004, according to CDC data, suggesting that more detailed studies on causes are warranted.

3. The November, 2008 issue of the European Journal of Cancer Care published a US study of children living near nuclear plants. The authors are epidemiologist Joseph Mangano, MPH MBA, Director of the Radiation and Public Health Project and Janette Sherman, MD, of the Environmental Institute at Western Michigan University. They analyzed leukemia deaths in children ages 0-19 in the 67 counties near 51 nuclear plants from 1957-1981. Nearly 25 million people live in these counties, and the 51 plants represent nearly half of the U.S. total. Using mortality statistics from the U.S. Centers for Disease Control and Prevention, Mangano and Sherman found that in 1985-2004, the change in local child leukemia mortality (v. the US) compared to the earliest years of reactor operations were:

-An increase of 13.9% near nuclear plants started 1957-1970 (the oldest plants, still operational).

-An increase of 9.4% near nuclear plants started 1971-1981 (newer plants).
-A decrease of 5.5% near nuclear plants started 1957-1981 and later decommissioned.

The 13.9% rise in mortality rates near the older plants suggests a potential effect of greater radioactive contamination near aging reactors, while the 5.5% decline near closed reactors suggests a link between less contamination and lower leukemia rates. The large number of child leukemia deaths in the study (1292) make the results statistically significant.

4. Before Mangano and Sherman's study, a 2007 meta-analysis was published in the European Journal of Cancer Care by researchers from the Medical University of South Carolina. That report reviewed 17 medical journal articles on child leukemia rates near 136 reactors, and found that all 17 detected elevated rates. These were nuclear sites in the UK, Canada, France, Germany, Japan, Spain and the USA. The incidence of leukemia in children under 9 living close to the sites showed an increase of 14 to 21 per cent, while death rates from leukemia were raised by 5 to 24 percent, depending on their proximity to the nuclear facilities (European Journal of Cancer Care, vol 16,p 355). This study updates, with largely consistent findings, an analysis conducted in the late 1980s by the National Cancer Institute (NCI). That analysis, mandated by Senator Edward M. Kennedy (D-MA), is the only attempt that US federal officials have made to examine cancer rates near US nuclear plants.

5. In addition are two new KiKK studies conducted by German researchers of the University of Mainz (KiKK is a German acronym for Childhood Cancer in the Vicinity of Nuclear Power Plants), whose results were published in 2008 in the International Journal of Cancer (vol 122, p 721) and the European Journal of Cancer (vol 44, p 275). These found higher incidences of cancers and a stronger association with nuclear installations than all previous reports. The main findings reported a 60 percent increase in solid cancers and a 117 percent increase in leukemia among young children living near all 16 large German nuclear facilities between 1980 and 2003. The most striking finding was that those who developed cancer lived closer to nuclear power plants than randomly selected controls. Children living within 5 kilometers of the plants were more than twice as likely to contract cancer as those living farther away. This finding has been accepted by the German government as definitive. This indicates twice as many cases of leukemia among children living near nuclear power plants.

The German federal agency for irradiation protection has called the study a significant argument against nuclear power. “Given the particularly high risk of nuclear radiation for children, and the inadequacy of data on the emissions of nuclear power plants, we must take the correlation between distance of residence and high risk of leukemia very seriously,” Wolfram Koenig, director of the agency, stated at a press conference.

The Mainz findings are consistent with others in France and Britain. In France, one such study in 1997, and another in 2001, showed a higher incidence of leukemia among children living near nuclear power plants.

6. The 1997 French study, led by Jean Francois Viel, Professor of public health at the France Comte University, 300 km east of Paris, found that children frequenting the beaches at Cotentin on the Atlantic coast near the nuclear power plant of La Hague, or living within a radius of 35 km of the plant, suffered leukemia well above the national average.

Another French study from 2001 by Alfred Spira, of the National Institute of Health and medical Research, confirmed Viel's results. Spira, who had first rejected the results of Viel's study, later changed his opinion when he found a disproportionately high number of cases of leukemia among people below 25 years old and living within 35 km of La Hague. When the sample studied was narrowed to children ranging from 5 to 9 years old, living within 10 km of the nuclear facility, the cases of leukemia were 6.38 times the national average.

7. A British study from 2002 confirmed an older one from 1990 showing that the incidence of leukemia among children of workers at the Sellafield nuclear power 400 km north of London was twice the national average. Investigation by Heather Dickinson and Louise Parker from the Children's Cancer Research Unit at the University of Newcastle confirmed the earlier results. Using data from 1957 to 1991, the researchers found that children of workers at Sellafield were more likely to suffer leukemia and non-Hodgkins lymphoma (NHL, a group of cancers affecting the white blood cells) that the national average. In their study, Dickinson and Parker conclude that the Sellafield workers' children born in Seascale (the village near the Sellafield nuclear reprocessing plant) ran on average 15 times higher risk of developing leukemia and NHL, and that the Sellafield workers' children outside Seascale ran twice the risk.

II. Discussion of Further Considerations

The findings reported in the 1980s and 1990s regarding leukemia clusters are again being repeated. A Report in 2004 by the Committee Examining Radiation Risks of Internal Emitters - 79 - set up by the UK government points out that the models used to estimate radiation doses from sources emitted from nuclear facilities are riddled with uncertainty. For example, assumptions about how radioactive material is transported through the environment or taken up and retained by local residents may be faulty.

If radiation is indeed the cause of the cancers detected, how might local residents have been exposed? Most of the reactors in the KiKK study were pressurized water designs notable for their high emissions of tritium, the radioactive isotope of hydrogen. Last year, the UK government published a report on tritium that concluded that its hazard risk should be doubled. Tritium is most commonly found incorporated into water molecules, a factor not fully taken into account in the report. So this could make it even more hazardous.

As we begin to pin down the likely causes of elevated cancer rates, the new evidence of an association between increased cancers and proximity to nuclear facilities support the following:

Pregnant women and young children should be advised to move away from them. Local residents should be advised not to eat vegetables from their gardens. (**0078-1** [Pfeiffer, Jelica B.])

Comment: In Monroe County, the cancer death rate is 10% above the national average. Cancer mortality in children, who are most susceptible to radiation, soared from 21% below the US average in the 1980s to 45% above the national average in 2005!3 What studies have been done in Monroe County on the incidence of cancer, especially in children, and possible causes? This is of concern to IHM Sisters, many of whom spent several years in Monroe studying and teaching in local schools. Several of these women are undergoing treatment for cancer.

3 US Centers for Disease Control and Prevention, http://cdc.wonder.gov, underlying cause of death (**0083-14** [Mumaw, Joan])

Comment: My concerns regarding the impact of the building of a new nuclear power plant on the site of Fermi II focus on the environment and the health of the community of Monroe. While DTE intends to minimize environmental impacts, routine releases will occur in both liquid and air emissions.

Current radiation health standards as used by the EPA and NRC are referenced to healthy men. The reference man is a statistical model. He dates to 1974, but he's perpetually aged between 20 and 30 years old. He weighs 170 pounds, stands 5 feet 7 inches and hails from Western Europe or North America. And he represents everyone in the United States when it comes to setting regulations for acceptable standards of exposure to ionizing radiation.1

What about pregnant women, children and the frail elderly? What studies have been done on the effect of sustained low-level radiation in fetuses, children and the elderly who have weakened immune systems? This is of special concern to us as there are 180 elderly residents at the IHM Sisters Motherhouse which is within the Fermi EPZ.

Routine radioactive discharges by nuclear power plants are deemed legal and judged to be safe by the NRC and the industry. These releases can include more than 100 different chemicals, including cesium-137, iodine-I31, strontium-90 and tritium. Some of this is so radioactive it is stored on site. Any loss of cooling water from mechanical failure or terrorist attack would cause a catastrophe. Routine releases of lower level radioactive chemicals into the water are done in order to relieve pressure in the containment area and to limit the presence of radioactive and corrosive chemicals that damage reactor parts. The discharge for Fermi is very close to the water supply for the county. Not all radioactive isotopes can be filtered from the water prior to its release.

Fermi II, after an accident at the reactor on Christmas Day, 1993, released over a million gallons of radioactively contaminated water into Lake Erie. Other chemical releases are made into the air. By breathing in radiation from the air, or drinking water that is contaminated, we ingest these chemicals. They in turn release fast moving sub-atomic particles into our bodies that smash into and break molecules causing cancer, birth defects, and genetic mutations. Radioactive iodine aims for the thyroid, strontium goes for the bones and tritium behaves like water dispersing throughout the body and entering cells where it can disrupt DNA. Tritium cannot be filtered. What studies have been done on the long term effect of tritium which is released into the air and water by nuclear power plants?

1 Enszer, Julie R., 'Reference Man' May Lose Radioactivity Modeling Job, Women's E News, November 13, 2007. (**0083-8** [Mumaw, Joan])

Comment: The cancer death rate in Monroe County has been rising since the late 1980s, when the Fermi 2 nuclear reactor began operating, according to a new analysis. The rise in cancer has been sharpest among children and adolescents, who are most susceptible to the harmful effects of radiation exposure. The analysis uses official data from the U.S. Centers for Disease Control and Prevention.

The increasing cancer death rate among Monroe County residents, especially young people, suggests a link with the radioactive chemicals emitted from the Fermi reactor, says Joseph J. Mangano MPH MBA, Executive Director of the Radiation and Public Health Project research group. Because Monroe County has a low risk population that is well educated, high income, and has few language barriers, rising cancer rates are unexpected, and all potential causes should be investigated by health officials.

Fermi 2 reactor began operating June 21, 1985. However, it ran very little after the initial low-power start-up until a warranty run in January of 1988, marking the commercial start-up of the reactor. In the early 1980s, the Monroe County cancer death rate was 36th highest of 83 Michigan counties, but by the early 20005, it had moved up to 13th highest. From 1979-1988, the cancer death rate among Monroe County residents Sources:

Fermi 2 incurred near miss accidents on March 28, 2001 (emergency diesel generator was inoperable for over 7 days) and August 14, 2003 (loss of offsite power due to northeast blackout). Source: Greenpeace USA. An American Chernobyl: Nuclear Near Misses at U.S. Reactors Since 1986. www.greenpeace.org, April 26, 2006.

U.S. Centers for Disease Control and Prevention, http://cdc.wonder.gov, underlying cause of death. Death rates are adjusted to 2000 U.S. standard population. Includes ICD9 codes 140.0-239.9 (1979-1983) and ICD-IO codes COO-D48.9 (2000-2005). Whites account for over 95% of Monroe residents.

Cancer Death Rates, Monroe County vs. U.S. 1979-1988 and 1989-2005, age 0-24

	Monroe County		**Deaths/100,000 Pop.**		
Period	**Cancer Deaths**	**Avg. Pop.**	**Monroe**	**U.S.**	**%vs. US**
1979-1988	22	56,234	3.91	4.96	**-21.2%**
1989-2005	42	51,407	4.86	3.79	**+45.5%**

(**0084-1** [Mangano, Joseph])

Response: *The comments refer to the cancer statistics in the area surrounding the Fermi site and the health effects of radiation exposure. The NRC staff will evaluate human health impacts from radiation exposure from the operation of the proposed Fermi 3 plant in Chapter 5 of the EIS. Chapter 5 will also discuss the dose standards used in the assessment.*

D.1.14 Comments Concerning Accidents – Design Basis

Comment: The things that cannot be predicted are the only things that seemed to have happened that cause of grief. The turbine generator set at Fermi, when that happened and spilled a lot of water. I attended the St. Mary's meeting there with the water purification engineer for the plant, and it was very difficult to get across that this water, when it was to be discharged to the Lake, would be purer than the water of the Lake itself. I have been at Prairie Island, Donald C. Cook, Fermi 2, Prairie plant, over on the far end of the Lake, Marble Hill, the Clinton project. I was INPO Representative for Indiana Public Service. I've been at Three Mile Island two times after the accident writing procedures for those people, including radiological control and administrative procedures that had to do with control of chemicals and estimating. (**0058-125** [Meyer, Richard])

Comment: How many radioactive spills and shutdowns have taken place in U.S. nuclear power plants over the past 30 years? How likely or unlikely would new nuclear plants be to have such an accident? What would be the result? (**0081-2** [Ryan, Janet])

Response: *The comments refer to nuclear accidents and their consequences. The environmental impacts of postulated accidents will be evaluated, and the results of this analysis will be presented in Chapter 5 of the EIS. The impacts of past operation of Fermi 1 and 2, including accidental releases of radiologically contaminated materials, will be considered in Chapter 7 of the EIS.*

D.1.15 Comments Concerning Accidents – Severe

Comment: How do we stay safe? I live in the 1 mile red zone of that plant, I would hate to become a statistic. I can see the Davis Bessie plant across the lake on a clear day - I believe the people who live it that area have to take iodine tablets, because of problems that have been discovered at the plant. Now every isn't 100% safe, but when something goes wrong at a nuclear plant it can have a wide range of health problems, environmental problems that can last for years and decades beyond the occurrence - Chernobyl. (**0013-2** [Sanchez, Mira])

Response: *The environmental impacts of postulated accidents (i.e., design basis and severe accidents) will be evaluated, and the results of this analysis will be presented in Chapter 5 of the EIS.*

Comment: The inevitable safety risks of accidents associated with Fermi 3 favor efficiency and renewables as safer alternatives. A 1982 NRC report showed that a major accident at Fermi 2 releasing catastrophic amounts of radioactivity could cause 8,000 peak early fatalities, 340,000 peak early injuries, 13,000 peak cancer deaths, and $136 billion in property damage. Given population growth since, casualties would be even worse in the present day. And when adjusted for inflation, such damages would now top $288 billion. Similar or even worse casualties and damages could result from an accident at the larger Fermi 3 reactor. In fact, untested new reactors with undetected technical glitches are at significantly increased risk of suffering a major accident. Fermi 1, Three Mile Island and Chernobyl were new reactors when they suffered their infamous accidents. Old reactors are also at elevated accident risk due to age-related breakdown of safety significant systems, as occurred at Davis-Besse nuclear plant near Toledo in 2002. Thus, the geriatric Fermi 2 and the brand new Fermi 3, immediately adjacent to one another, would represent the worst of both worlds, the extremes of atomic reactor risks. An accident at one could even spread to the other. (**0050-3** [Kamps, Kevin])

Response: *The EIS will include an evaluation of the risks associated with potential severe accidents including accidents that involve reactor core melts. The potential consequences of postulated design basis and severe accidents will be discussed in Chapter 5 of the EIS. The evaluation in the EIS will include an estimate of the cumulative risk of severe accidents for all units at the Fermi site.*

Comment: Accidents at atomic reactors can lead to the large-scale release of harmful radioactivity into the environment. For example, the turbine explosion at Fermi 2 reactor on Christmas Day, 1993 led to DTE's release of two million gallons of radioactively contaminated water into Lake Erie. A new reactor at Fermi will effectively double such accident risks: break in phase accident risks at the new Fermi 3 reactor, and break down phase accident risks at the deteriorated, old Fermi 2 reactor. (**0050-8** [Kamps, Kevin])

Response: *This comment refers to nuclear accidents and their consequences. The environmental impacts of postulated accidents will be evaluated, and the results of this analysis will be presented in Chapter 5 of the EIS. In addition, the evaluation will include an estimate of the cumulative risk of severe accidents for all units at the Fermi site.*

Comment: Even Fermi 1's melted down fuel from its 1966-we-almost-lost-Detroit accident, still sits in so-called temporary storage in Idaho. I thought I'd mention the Fermi 1 meltdown because John McCain didn't seem to know about it when he visited Fermi last August, and the Nuclear Energy Institute's top lobbyist in Washington, DC, in an interview on NPR radio, seemed to not know about that meltdown either. (**0058-71** [Kamps, Kevin])

Comment: The children of Hiroshima and Chernobyl are a tragic testament of the destruction of DNA by radiation. Workers at nuclear power plants face increased risks of exposure to radiation, especially when there are accidents.

Recent accidents have been the collapse of a road in Covert. A car fell through the road, broke cables, then washed downstream in the flooded Brandywine Creek. Embattled Palisades was left without communications while Verizon workers tried to sift through the ice, mud, and water to fix the severed cables. At DC Cook a rotor blade spun off, spilling fuel and causing a fire. Firemen spent hours trying to stop the blaze. That facility is shutdown and over 300 engineers are reportedly working on the problem. In Vermont a cooling tower collapsed.

The list of nuclear reactor problems is endless. Internal sabotage may be another issue. Palisades has had repeated incidents over the decade. Safety levers are glued down, and recently workers were locked in the reactor until the next shift arrived. Workers were unable to phone out for help. This is before the flooding incident. Fermi 3, and any other new nuclear reactors, may face internal problems. Even with employee screenings things can happen.

In the 1990's, the day they almost lost Detroit, Fermi had a near meltdown, and the plant was flooded with water to cool it. The contaminated water was released into Lake Erie, despite efforts to stop it. We are always a heartbeat away from Chernobyl. To think that cannot happen here is ignorance and arrogance.

At an environmental conference I attended, Dr. Helen Caldicott gave a dramatic slide show of the results of Three Mile Island. Nature has mutated. In the area surrounding the nuclear power plant, dandelions have three heads, animals were born with extra appendages, women miscarried. Nothing will ever be the same there. (**0059-13** [Barnes, Kathryn])

Comment: The children of Hiroshima and Chernobyl are a tragic testament to the destruction of DNA by radiation. Workers at nuclear power plants face increased risks of exposures to radiation, especially when there are accidents." Recent accidents have been the collapse of a road in Covert. A car fell through the road, broke cables, then washed downstream in the flooded Brandy-wine Creek. Embrittled Palisades was left (**0083-23** [Barnes, Kathryn])

Response: *These comments refer to nuclear accidents and their consequences. The environmental impacts of postulated accidents will be evaluated, and the results of this analysis* *will be presented in Chapter 5 of the EIS. The reference to Hiroshima is beyond the scope of the analysis in this EIS, and it will not be addressed in the EIS.*

Comment: The 50 mile plume, which is considered to be the area of greatest impact, is much shorter than what I perceive as the hazard zone for the reactor planned to be built, and this is true in several ways. First off, it's obvious that winds and waterways carrying fallout from a supposed meltdown or military strike explosion are going to keep carrying radioactive materials far beyond 50 miles.

In the case of Chernobyl, as for any reactor meltdown, people, animals, and agriculture, air, water and soil, beyond 300 miles were and are directly adversely affected. To arbitrarily set the limits at 50 miles must be slightly convenient for both the Nuclear Regulatory Commission and industry, in this case DTE. But it dramatically shorts the public commons. Actually wind currents from Chernobyl have spread all around the world, and much may have precipitated into the Great Lakes. Any meltdown or blast from any one of the Fermi's would likely take out the other two nearby facilities, causing even greater calamities. There is much more to be considered regarding physical distance. (**0058-81** [Newnan, Hal])

Response: *Chapter 5 of the EIS will include an evaluation of the risks associated with potential severe accidents including accidents that involve reactor core melts. The evaluation will include estimates of health and economic risks to a distance of 50 mi from exposure to the plume and from exposure to contaminated land and water. These risks will be compared with risks associated with the existing units. The NRC staff has determined that consequences beyond 50 mi are very small. In addition, the severe accident consequence analysis assumes a complete wash down of the contaminated plume between 40 and 50 mi of the accident.*

Comment: If a major waste leakage or a meltdown were to occur, a water source critical to millions would be in jeopardy. Pure water on planet Earth is a major concern now. Who knows how costly, pervasive and long-lasting that destruction would be? (**0072-2** [Timmer, Marilyn])

Response: *The potential consequences of postulated design basis and severe accidents will be discussed in Chapter 5 of the EIS.*

D.1.16 Comments Concerning the Uranium Fuel Cycle

Comment: Where do you present a thoroughly responsible management method for the full cycle of radioactive materials, front to back end, including its risks during transport, storage and management? (**0004-6** [Carey, Corinne])

Comment: Now Fermi has been there and running for quite some time and knock on wood will continue to do so safely. But my major concern to this what is going to happen to the waste produced at the plant? Yucca mountain was discussed and it still hasn't be approved for depository purposes of nuclear waste. So what happens, where does this go? I would like to think that nuclear energy is one of our future sources of power, but where does the waste go? (**0013-1** [Sanchez, Mira])

Comment: Nuclear Waste: first and foremost, there is nothing environmentally responsible or sustainable in nuclear waste. High level radioactive waste will be with us for thousands of years. We do not have any depository for the waste even after decades of analysis and debate. Even if the proposed Yucca site were opened today it would be filled by the time the waste of Fermi 3 and other proposed nuclear plants are operating. Given this reality, there is no foundation for assuming that there will be a political or technological solution to this highly toxic material. Creating more nuclear waste when there is no place to put what we already have is akin to financial institutions creating investment vehicles when they had no understanding of the financial risk or financial assets unpinning the offerings. We are all realizing the folly of that attempt. Simply put, creating more nuclear waste is an additional fouling of our home, our nest, our earth. (**0016-2** [Rivera, Gloria])

Comment: The nuclear fuel chain is complex, impossible to monitor, usually effects poor and indigenous communities, produces substantial amounts of toxic and radioactive waste and has tragic consequences for human health and the environment. It is a cycle of destruction at every step.

Environmental concerns must start at the beginning of the cycle and not at the power plant. In terms of radiation doses and number of people affected, uranium mining is one of the very hazardous steps in the cycle. Mining is one of the most CO_2 intensive industrial operations. Mining contaminates drinking water from aquifers, rivers, lakes and streams with arsenic, radium, thorium and other heavy metals. Tailings, which become hills of fine sand-like solids, retain 80-90 % of the radioactivity of the ore that is left in piles to blow in the wind. Thorium 230 in tailings decays into radium-226, which in turn decays into radon-222, which can cause lung cancer. The radioactive hazards of tailings will persist for over 100,000 years.

The conversion of yellowcake to Uranium Hexafluoride UF_6 creates airborne and waterborne uranium and chemicals such as hydrofluoric acid, nitric acid and fluorine gas. Uranium is an alpha emitter and is extremely hazardous to ingest or inhale.

The enrichment process includes discharges of polychlorinated biphenyls [PCB'S], chlorine, ammonia, nitrates, zinc and arsenic. The two enrichment plants in Portsmouth, Ohio and Paducah, Kentucky released 818,000 pounds of Freon in 1999. There are over 700,000 tons of uranium hexafluoride in decaying metal canisters at Ohio, Kentucky and Tennessee sites. (**0019-2** [Schemanksi, Sally])

Comment: The fission process at a nuclear power plant creates over 240 dangerous fission products. Some of these radioactive wastes have hazardous lives of tens of thousands of years. The NRC, in evaluating these hazardous radioactive compounds, stated they will remain well above unrestricted release levels for a period of time far exceeding the known lifetime of any manmade structure. (**0019-7** [Schemanksi, Sally])

Comment: Theoretical hypotheses that conclude that radioactive substances can be handled and stored safely, without incident, do not match up with reality. No substantial proof has ever been presented through past experiences or through extensive testing that it is even possible to build a safe, leak proof dump. Any construction worker will tell you control of the movement of water is impossible. We have no control over the movement of a substance through the surface and subsurface of the earth. We cannot predict a stable society for hundreds, less thousands of years, nor can we prevent earthquakes, tornadoes, wars, terrorism, human error or common traffic accidents involving transport of radioactive waste.

The nuclear industry has created an elaborate scheme to divert responsibility for this dangerous radioactive waste. If these wastes were so harmless and a safe technology existed to handle them, the generators would remain titleholders. The nuclear industry has billions of dollars and a slate of experts. Their conclusions are very clear: They do not want title to this waste. There is no safe technology. (**0019-9** [Schemanksi, Sally])

Comment: I am very concerned about the nuclear waste - both high and low levels of radioactive nuclear waste that's already existent. The possibility of adding more is frightening. There are currently 104 nuclear powerplants in the U.S. To add to that number, with no long-term plan in sight flies in the face of good judgment. The possibility of an additional plant in this area (Monroe Michigan) could be a threat to the common good. (**0021-1** [Hart, Donna])

Comment: For some time, I have been aware of a movement toward building a third Fermi Nuclear Power Plant. Having studied issues regarding nuclear power, I feel great concern over such a possibility.

This concern focuses especially on what I perceive as an inability of the industry and the DOE to safely store nuclear waste. The efforts at Yucca Mountain have proved unsuccessful. Some nuclear waste has a half life of thousands or millions of years. Producing it without a plan for its safe storage seems extremely irresponsible. The current practice of temporarily storing the waste at the nuclear power plant site is not a satisfactory solution.

We place a heavy burden on our generation and on the generations to come when we produce such a dangerous product which we do not know how to safely store. Decisions made about this issue bear heavy responsibility.

I am relying on you to carry out your duty as a government agency responsible for enforcing EPA regulations and for granting or denying a license to operate a nuclear power plant. Please advise me how the NRC is going to deal with the issue of nuclear waste and what impact the reality of its dangers will have on the licensing decision. (**0022-1** [Rabaut, Martha])

Comment: I am concerned about the issue of the storage of radioactive waste, which should be a major consideration in the construction of the proposed nuclear power plant: Fermi III.

First, although nuclear power plants supply almost 20 percent of the electricity in the United States, the dangers of nuclear waste far outweigh the advantages. There is no safe place for storage in our country. Yucca Mountain is an unstable geologic location. (**0023-1** [Mechtenberg, Marilynn])

Comment: Finally, what about the waste sites? In a geologic repository, isn't seepage a possibility? If the waste got into the soil, vegetation growing from it, if eaten, could harm individuals. Also, radionuclides are carcinogenic. (**0023-3** [Mechtenberg, Marilynn])

Comment: My concern is that thus far U.S. has not yet successfully provided sites for the existing radioactive nuclear waste from its 104 nuclear plants. The effort of the Yucca Mountain, Nevada site is failing. There are millions of gallons of radioactive waste, thousands of tons of spent nuclear fuel and materials and huge quantities of contaminated soil and water at 108 sites throughout U.S. These wastes are endangering plant, animals and humans who inhale, ingest and absorb them. I am asking the U.S. Nuclear Regulatory Commission and the DOE to address this serious deficiency before any plans are proposed for any new construction of nuclear power plants. (**0025-1** [Van Ooteghem, Rose Bernadette])

Comment: My concern is the Storage of the Spent Rods since nothing has been determined as yet of where or how this problem will be solved. We now know that President Obama will withdraw the License Application for Yucca Mountain site.

Since I reside on the shores of Lake Erie, I have a real concern of storing the waste in cement casks for an unlimited number of years without any data on file for safety of leaching and seeping... I am requesting a reply from the NRC to inform me of how these problems will be addressed. (**0030-1** [Conner, Mary V.])

Comment: The nuclear waste issue is still unresolved. Yucca Mountain is above the water table while Canada plans to put mid-level waste under Lake Huron, so it all seems like a big guess as to which is the safest disposal method. The transportation routes to Yucca Mountain endanger every American home. With worst case scenarios to consider with every shipment, thousands planned, too risky. If on site storage becomes the future of the waste issue instead of Yucca Mountain, then how will that affect the water rights of the Great Lakes region? (**0031-3** [Rysztak, Robert])

Comment: The nuclear waste issue is still unresolved. Not only is Yucca Mountain a bad idea, all the transportation routes to get the waste to Nevada is even worse, as ideas go. (**0032-6** [Rysztak, Robert])

Comment: There is also the "on the ground" literally storage of onsite radioactive waste, awaiting final resolution of the Yucca Mountain question in terms of national storage of waste. How will construction and operation of the new facility compound this situation as it appears as I write this, the question of Yucca Mountain remains unresolved in the permanence of the decision to build the Nevada facility, as well as transportation of these materials to the facility. (**0038-3** [D'Amour, James Carl])

Comment: Reliance on nuclear energy will result in creation of mining waste at whatever is the source of nuclear fuel. I believe that we should minimize mining impact on our planet. (**0039-5** [Mitchell, Rita])

Comment: The NRC does not regulate the disposition of the nuclear waste rods from the new proposed plants. It was noted in the last NRC Meeting that I attended, that there are some 101 Nuclear Power plants now operation in the US, and that by 2020 or sooner, if all the waste rods from these plants were shipped to Yucca Mt in Nevada, it would be filled to capacity. To date, no state has allowed moving these waste rods across their borders to be moved to the proposed Yucca Mt site. I was also recently advised that Yucca Mt. is in an earthquake region with possible ground water contamination and exposure to the waste rod radiation. (**0041-3** [Englund, Lance])

Comment: There is still no final storage solution for nuclear waste that remains deadly for 100,000 years. How crazy can we be to risk the possibility of destroying every living thing in this region should the temporary cement casks leak. Until there is a permanent storage solution, a permit should be denied. Even then, the danger of transporting such dangerous waste negates any possible benefit from such a plant. (**0047-2** [Bettega, Gayle])

Comment: Even more alarming is the fact that Fermi 2 has nowhere to store it's low level radioactive wastes at this time. That issue must be solved before there is even a consideration of Fermi 3. (**0047-4** [Bettega, Gayle])

Comment: When reactors were originally built, nuclear proponents optimistically hoped that the nuclear waste problem would somehow be solved in a timely fashion. Now we know better. Wherever a reactor is built, the high-level waste that it produces will stay on site for decades, and possibly even in perpetuity. The proponent should be required to justify siting a nuclear reactor near one of the largest and most important bodies of fresh water on the North American continent, given the fact that these wastes may remain there indefinitely. Would NRC willingly approve a high-level waste repository right on the edge of the Great Lakes? (**0048-5** [Edwards, Gordon])

Comment: The proponent should be required to examine the life-cycle environmental impacts of the reactor, including the steps in the uranium fuel chain: perpetual management of radioactive tailings, total reclamation of uranium mining areas, health and environmental impacts of enrichment facilities, as well as eventual reprocessing of irradiated nuclear fuel at some future time. This proponent should be required to include in this examination an accurate summary of the environmental impacts to date of such activities in various locales throughout the USA and elsewhere in the world. (**0048-6** [Edwards, Gordon])

Comment: Radioactivity releases occur not only at reactors, but at every step of the nuclear fuel chain. Accurate accounting of all radioactive wastes released to the air, water and soil from the entire reactor fuel production system is simply not available. The nuclear fuel chain includes uranium mines and mills (often located near indigenous peoples communities), chemical conversion, enrichment and fuel fabrication plants, reactors, and radioactive waste storage pools, casks, trenches and other dumps. Fermi 3 would increase the risk that new uranium mining in the Great Lakes basin, such as at Eagle Rock near Marquette and the Keweenaw Bay Indian Community in Michigan's Upper Peninsula, would go ahead. (**0050-10** [Kamps, Kevin])

Comment: There are no safe, sound solutions for the deadly radioactive wastes that Fermi 3 would generate. The Obama administration has pledged to cancel the proposed Yucca Mountain dumpsite in Nevada, due to its geologic unsuitability. Reprocessing irradiated nuclear fuel, to extract plutonium for supposed re-use, risks nuclear weapons proliferation and disastrous radioactive contamination of the air and water, and would cost taxpayers hundreds of billions of dollars. On-site storage in indoor pools or outdoor dry casks, as currently done at Fermi 2, risks catastrophic radioactivity releases due to accident or attack, as well as eventual leakage due to breakdown of the storage containers. A 2001 NRC report, for example, revealed that 25,000 fatal cancers could result downwind of a waste pool fire. A 1998 anti-tank missile test at the U.S. Army's Aberdeen Proving Ground showed dry casks vulnerable to attack. Even consolidating wastes at centralized interim storage centers would leave them vulnerable to accidents or attacks, and risks environmental injustice, as low income communities of color are most often targeted. All away-from-reactor storage proposals would risk severe accidents or attacks upon shipping containers on the roads, rails, or waterways, including the Great Lakes. Even Fermi 3's so-called low level radioactive wastes have nowhere to go. Barnwell, South Carolina has closed its dumpsite to Michigan wastes. Every low level dump opened in the U.S. has leaked, and most have had to be closed. An imminent Texas dump may be licensed to accept wastes from Fermi 3 sometime in the future, but puts the underlying Ogallala Aquifer at risk of radioactive contamination. Especially considering cleaner alternatives, such as efficiency and renewables, it is a moral transgression against future generations to create a forever deadly hazard like radioactive waste, just to generate 40 to 60 years of electricity. Fermi 3 would increase the risk that Michigan would be targeted for a national high-level radioactive waste dumpsite, and/or a regional low level dump, as has occurred in the past. (**0050-2** [Kamps, Kevin])

Comment: I am not as confident that we will learn how to dispose of nuclear waste and we already have 2 plants here in Monroe, whose waste is waiting for someone to figure out how to dispose of it. (**0052-2** [Fedorowicz, Meg])

Comment: How we will be storing the radioactive waste. (**0052-4** [Fedorowicz, Meg])

Comment: The US has had since the 1940s to solve the problem of safely storing radioactive waste from nuclear power plants. It is still not solved. And so much of it sits, in temporary storage arrangements. Some has been moved from place to place, hoping for a final resting place, but it has found no welcome. Until this issue is solved for the already spent fuel, the NRC should not approve any licenses for new facilities. (**0053-4** [Nordness, Dorothy])

Comment: It is unacceptable to dispose of this lethal waste in a water-soluble medium, rock salt, in a State practically surrounded by one of the largest bodies of fresh water on Earth. (**0054-2** [Drake, Gerald A.])

Comment: Dr. James Watson, Professor of Molecular Biology, Harvard University, and winner of the 1962 Nobel Prize for Medicine stated "an increasing number of our most informed scientific minds have very deep qualms about the widespread introduction of more nuclear power... I fear that when the history of this century is written, the greatest debacle of our nation will be... our creation of vast armadas of plutonium, whose safe containment will represent a major precondition for human survival, not for a few decades, or hundreds of years, but for thousands of years more than human civilization has so far existed." (**0054-5** [Drake, Gerald A.])

Comment: I would urge the scoping study to take a very hard look and examination of the risks that are involved in not having a safe way of disposing nuclear waste. (**0058-101** [Holden, Anna])

Comment: Uranium mining: And uranium mining is brought up in the Environmental Review. Uranium mining, the milling, the refining, the conversion, the enrichment, the transport, all carry a hefty carbon footprint. You cannot separate uranium from nuclear power plants. These processes, especially mining, is extremely toxic radioactive waste that affect the health of local communities and local watersheds.

Fish do not live in the Serpent River near where the uranium tailing piles are piled up there. These radioactive wastes last virtually forever. The lethal irradiated fuel that is produced has to be kept isolated from the food chain and our watersheds for over a million years, and the U.S. Government acknowledges that. We don't have containers that will last that long. So what we have essentially done is condemn every generation following us to guarding these wastes from terrorists, to watching these wastes for leaks, and then repackaging them when they leak -- a dangerous, expensive, and maybe impossible job. (**0058-21** [Cumbow, Kay])

Comment: Then we want to address the problem of our long term costs, and we're talking thousands, tens of thousands, millions of years of exposure to radioactives. I don't think there's a proponent of nuclear energy here today that will say both permitted and accidental releases do not happen. And they do not happen only at reactors. They happen at every step of the fuel change. Accurate accounting of all radioactive wastes, released to the air, water, soil, from the entire reactor fuel production system, is simply not available.

The nuclear fuel chain includes uranium mines and mills, chemical conversions, enrichment, and fuel fabrication plants, reactors and radioactive waste storage ponds, casks, trenches, and other dumps.

Even new reactors like Fermi 3 will release significant amounts of radioactivity directly into the environment. These would include so-called planned and permitted releases from the reactor's routine operations, as well as unplanned releases from leaks and accidents. (**0058-33** [Yascolt, Stas])

Comment: The low level radioactive wastes generated at the Fermi nuclear power plant are piling up and piling up and piling up. There's no place for them to go. Fermi is actually adding to our problems, and we're to build yet another one? (**0058-38** [Yascolt, Stas])

Comment: there is nothing environmentally responsible or sustainable in nuclear waste. High level radioactive waste will be with us for thousands of years. We do not have any depository, even after decades of analysis and debate. As we all know, even if Yucca were to be approved today, it would be filled by the time the waste from Fermi 3 and other proposed nuclear reactors would be online.

Given this reality, there is no foundation for assuming that there will be a political or technological solution to this highly toxic material. Creating more nuclear waste when there is no place to put what we already have, is akin to the financial institutions creating, investment vehicles when they had no understanding of the financial risk or the financial assets underpinning the offerings that they were giving.

We are all today realizing the folly of that attempt in the financial world. Simply put, creating more nuclear waste is an additional fowling of our home, our nest, our earth. (**0058-67** [Weber, Margaret])

Comment: my comments today are about the radioactive waste impacts of the proposed Fermi 3 reactor. Previous speakers in favor of this proposal spoke of Fermi 3 as environmental friendly, emissions free and clean. I would say that it is none of those things, based upon the radioactive waste generation alone. Electricity is about the fleeting byproducts of atomic reactors. The actual product is forever deadly radioactive waste.

There is no safe, sound solution for these radioactive wastes that would be generated by Fermi 3. Over 65 years after Enrico Fermi first split the atom during the Manhattan Project in Chicago to create the bomb, and over 50 years since commercial nuclear power began in the United States, we still do not have a geologic repository for permanent disposal of high level radioactive waste. No country on the planet that has nuclear power has a geologic repository. (**0058-70** [Kamps, Kevin])

Comment: The proposed dump site at Yucca Mountain, Nevada, looks very doubtful to ever open. President Elect Barack Obama has indicated he will withdraw the US Department of Energy's license application to the NRC to construct and operate the dump, due to the site's geologic unsuitability. Yucca's earthquake plagued rock formations are so fractures and fissured, that they leak water like a sieve. Any radioactive waste buried there would eventually escape into the environment, massively contaminating the drinking water supply for a farming community downstream, as well as for the Timbisha Shoshone Indian Reservation, for Death Valley National Park, and the National Wildlife Refuge, containing rare, endangered, and unique desert species.

Besides it geologic and hydrologic unsuitability, Yucca should never have been targeted in the first place. It is sacred Western Shoshone Indian land, as recognized by the so-called Peace and Friendship Treaty of Ruby Valley signed by the US Government in 1863. To the present day the Western Shoshone still conduct ceremonies at Yucca.

This environmental injustice, or radioactive racism, has also taken the form of so-called interim storage sites for high level radioactive waste, also known as parking lots dumps. The Department of Energy, the Nuclear Regulatory Commission, and the nuclear industry have targeted the Mescalero Apache in New Mexico, the Skull Valley Goshutes in Utah, and dozens of additional tribes. Although they have yet to open such a dump, such environmentally racist targeting continues still.

In December, the Department of Energy reported to Congress and the President, that a second national radioactive waste dump will be needed if new reactors, such as Fermi 3, are built. DOE reports that Michigan had previously been considered as a national dump site due to granite formations, and is now being considered again.

In addition, shale deposits are being considered for dump sites, including in Michigan and Ohio. In fact, every single Great Lakes state is on DOE's target list. The construction and operation of Fermi 3 would increase the risk that Michigan or Ohio would be targeted for a national high level radioactive waste dump. And I should add that in 1957 the National Academy of Science targeted Michigan for the salt formations in the Detroit area for this national dump site.

Other illusions of solutions are also dangerously flawed. Reprocessing or plutonium extraction from high level radioactive waste is disastrously polluting, astronomically expensive to taxpayers, and risks nuclear weapons proliferation. So-called regional interim storage, consolidating wastes at DOE sites or reactor sites such as Fermi, would simply create a radioactive waste shell game. The wastes would have to be moved again someday, effectively doubling the radioactive Russian roulette of shipping risks, or accidents or attacks on the highways, railways, and waterways, including the Great Lakes. (**0058-72** [Kamps, Kevin])

Comment: The lack of solutions means that radioactive wastes will continue to pile up at the Fermi site, vulnerable not only to accidents and attacks, but even eventual leakage to the environment as the containers degrade and fail. There is so much radioactivity in the wastes currently stored at Fermi, that releases to the environment could spell catastrophe for the entire region. A new reactor at Fermi would make this crisis much worse. Adding to the risks of eventual leakage is the fact that the hold-tight containers for dry cask storage chosen by DTE at Fermi are known to be flawed.

An industry whistle-blower, supported by an NRC dry cask storage inspector in this Midwest region, have discovered and made known that quality assurance violations on the hold-tight casks are wide spread. They question the structural integrity of the casks sitting still, let alone being transported. (**0058-73** [Kamps, Kevin])

Comment: The only real solution to the radioactive waste problem is to stop making it in the first place. Fermi 3 should be stopped because of the deadly radioactive wastes it would generate, which would remain hazardous to all life forever after. (**0058-74** [Kamps, Kevin])

Comment: The NRC's nuclear waste confidence decision is more of a con game. It's a confidence game. It's an absurd policy.

I would like to conclude by mentioning that in addition so-called low level radioactive wastes generated at the Fermi 3 and Fermi 2 are already piling up with nowhere to go at Fermi 2. Some of these wastes can deliver a lethal, fatal radiation dose within 20 minutes, and must be handled remotely and encased in radiation shielding.

The national so-called low level radioactive waste dump at Barnwell, South Carolina, closed its doors to Michigan on July 1st, 2008. Fermi 3 would increase the mounting low level radioactive waste problem for which there is no solution. It would put Michigan back on the target list for a low level radioactive waste dump.

In the 1980's seven other Midwestern states had targeted several sites in Michigan, including Riga, St. Clair County, and Ontonagon, for a regional low level radioactive waste dump, a threat that was staved off by a groundswell of grass roots citizen opposition, the same thing that will stop Fermi 3.

Currently the most likely place Fermi 3's low level radioactive wastes would be dumped is at Waste Control Specialists in Andrews County, Texas, a new dump right on the New Mexico border. This dump site risks radiological contamination of the precious Ogallala Aquifer that spans numerous Great Plains states. (**0058-75** [Kamps, Kevin])

Comment: Next is the consideration of time. It is sheer hubris, pride, to consider guarding and safekeeping all the radioactive materials for the millions of years they will remain hazardous. And I'd like to just point out that that's against the short term economic impact that I, in Warren, will experience if this plant doesn't possibly go through, as well as the people in Monroe.

Is our short term interest like the next 50, 60, 70 years really the crucial thing here? I say, no, it's not. We are dealing -- when we consider building a Fermi 3, we're acting like young boys with a science kit they don't know how to use. Any kind of toxic material, except for radioactive probably, will probably come out of that experiment. Do we really want to mess with that? No.

Okay. For one thing the proposed Fermi 3 project is a commercial industrial one, whose useful life will end in 20 to 60 years, if they're lucky. But where and how is the money for safeguarding being given to be accumulated. It's not. Right? You need to have a plan to safeguard this stuff for millions of years. And how effective can that be? 2000 years ago Jesus was born, right? How likely is that? And how effective can that be over eons involved. (**0058-82** [Newnan, Hal])

Comment: The other issue that I would like for the scoping process to focus on is the risk associated with the disposal of nuclear waste. And this, again, has already been stated by several of the speakers. We know that there is no safe disposal process at this time. This goes back to the first nuclear activity that took place in World War II. We go back that far, and there is still no clue as to how we can have any kind of protection against the radioactivity as it's involved with the nuclear waste (**0058-99** [Holden, Anna])

Comment: Lastly, my question is, where will the nuclear waste go? So far there has been no answer to that. It is not right to dump nuclear waste on Indian land. It is not safe to transport it. It is not safe to store it. There are a multitude of unsolved problems in this huge topic. That is, Cask 4 with bad welds at Palisades; beach contamination in Wisconsin where a cask blew its lid off; Yucca Mountain earthquake; fisheries flooding; overturned semis spilling radioactive waste in Arizona; et cetera. An individual in Kalamazoo County stored barrels of radioactive materials and other toxins on his land. Now authorities are trying to clean up the mess. (**0059-21** [Barnes, Kathryn])

Comment: the questions that I asked regarding the amount of spent fuel being kept at Fermi are part of my main concern that the disposal of nuclear waste, the problem of disposal of nuclear waste is a huge problem in the world, not just in the United States.

I can't argue that the Detroit Edison site is a clean site, that there are beautiful plants and animals, beautiful plants going there and animals running around, that Detroit Edison is a good neighbor. No argument against that. And I can't argue that atomic energy doesn't release carbon dioxide, it doesn't contribute to the problems that coal fired plants do. But the problem is that the waste product has not been taken care of. We've got it piled up all over the world.

I didn't attend the meeting in September, or this fall, when a group of people was here and talked about the reprocessing of spent nuclear fuel. I'm not a scientist, I don't know a whole lot about it. But from what I've read about the reprocessing of spent nuclear fuel, it is not the solution to the nuclear waste problem. It's dirty; it's done in France at a place called La Hague, that's one of the biggest places where they do it. And radioactive water is poured into the Atlantic Ocean. (**0059-44** [Kaufman, Hedwig])

Comment: There's an outfit called Clean and Safe Energy, which is a proponent of reprocessing of spent nuclear fuel. The GNEP -- what's it called? The Global Nuclear Enrichment Partnership is an agency that was formed by the federal government a couple of years ago, in which countries are invited to join this partnership and they will be the exclusive providers of the reprocessing for spent nuclear fuel. If the problem of the disposal of nuclear spent fuel would go away I'd feel more comfortable about nuclear energy. But, I don't because it hasn't gone away. (**0059-46** [Kaufman, Hedwig])

Comment: The assessment must address the unsolved problem of long term storage of radioactive waste from operation of the proposed nuclear reactor. (**0059-51** [Wolfe, Joan])

Comment: I would like to leave you with one comment by E.F. Schumacher, author of Small Is Beautiful. It is a book that was popular in the late `60s, `70s, and he's referring to nuclear power.

"No degree of prosperity could justify the accumulation of large amounts of highly toxic substances which nobody knows how to make safe and which remain incalculable danger to the whole of creation for historical or even geological ages. To do such a thing is a transgression against life itself, a transgression infinitely more serious than any crime perpetrated by man. The idea that a transgression is an ethical, spiritual, and metaphysical monstrosity, it means conducting the economical affairs of a man as if people did not matter at all." (**0059-65** [Keegan, Michael])

Comment: The proponents of nuclear energy are willing to trade two generations of electricity for hundreds of thousands of years of deadly waste. Just 10,000 years ago where we are sitting tonight, there was a sheet of ice a mile thick. And who can predict what the earth is going to be like a short thousand years from now? (**0059-68** [Farris, Mark])

Comment: I am terribly concerned about nuclear waste. There is no long term solution for its storage.. There are over 100 nuclear power plants in operation today which are temporarily storing the waste on site. Until we can find or create a long term solution for such waste, we should not construct a new nuclear power plant. We are poisoning our environment, and ourselves. Radionuclides are carcinogenic... I am asking that you let me know what you know about permanent storage of nuclear waste. (**0061-1** [Richmond, Roberta])

Comment: I am concerned about the ongoing problem of storing nuclear waste. President Obama has indicated that he will withdraw the license to operate the facility at Yucca Mountain. How will the industry and the Department of Energy deal with the safe long-term storage of nuclear waste? Temporary storage of the waste on site is unacceptable. Unless there is a fail-proof facility to store thousands of tons of waste that has already been generated, building a new nuclear power plant would be a waste of money. This issue is not only a concern to me. It is a concern to the people in Monroe and all of Michigan for years to come. I hope that as a government agency, you will carry out your responsibility for enforcing regulations in this manner. (**0069-1** [Eddy, Dorothy])

Comment: I am deeply concerned about the potential risks to future generations of the deadly nuclear waste that is stored at the Fermi II site. The idea of building a Fermi III before dealing with this major concern is most confounding to me. (**0072-1** [Timmer, Marilyn])

Comment: We have no business building a second nuclear power plant in Monroe County Michigan until we have established a permanent place to dispose of the spent nuclear fuel produced by the power plants we are currently operating. NO NEW NUCLEAR PLANTS UNTIL THE SPENT FUEL DISPOSAL PROBLEM IS SOLVED. (**0073-1** [Ripple, John])

Comment: The spent fuels from Fermi II reactor are currently being stored on site, as are the radioactive wastes from 104 other currently active reactors. As you are aware, some of these elements in the spent fuels will remain radioactive for millions of years, continuing to impact the health of man and the environment. Until the spent fuels from all nuclear reactor sites have been removed to a safe depository, I ask that no more permits to build be issued. To do so would be irresponsible. Please respond to my concerns. (**0076-1** [Ripple, Florence])

Comment: My concern is how the industry and DOE are dealing with the safe, long-term storage of nuclear wastes, some which have half-lives in the thousands of years and some in millions of years. The efforts at Yucca Mountain, Nevada are failing. As a matter of fact, President Obama has indicated he will withdraw the license application to operate the facility. I understand the concern at Yucca Mountain is the unstable geologic strata.

With the opening of Yucca Mountain in doubt, there is no facility anywhere in the United States to store waste for the long term. Meantime the 104 nuclear power plants in operation today are temporarily storing the waste on site. That is unacceptable. Until there is a reliable, failproof facility to store the thousands of tons of waste already produced, a moratorium on new construction of nuclear power plants should be declared.

Not only is this issue a big concern to me, it is a concern for my children and grandchildren. As the government agency responsible for enforcement of the regulations for nuclear power and the radioactive waste that is generated, I am counting on you to carry out your duty. Please advise me how the NRC is going to deal with the enforcement mandate. (**0077-1** [Feldpausch, Regina A.])

Comment: How and where will the highly radioactive waste be stored? What are the political challenges regarding storing radioactive waste? How will these challenges be addressed? (**0081-3** [Ryan, Janet])

Comment: Nuclear Waste: first and foremost, there is nothing environmentally responsible or sustainable in nuclear waste. High level radioactive waste will be with us for thousands of years. We do not have any depository for the waste even after decades of analysis and debate. Even if the proposed Yucca site were opened today it would be filled by the time the waste of Fermi 3 and other proposed nuclear plants are operating. Given this reality, there is no foundation for assuming that there will be a political or technological solution to this highly toxic material. Creating more nuclear waste when there is no place to put what we already have is akin to financial institutions creating investment vehicles when they had no understanding of the financial risk or financial assets unpinning the offerings. We are all realizing the folly of that attempt. Simply put, creating more nuclear waste is an additional fouling of our home, our nest, our earth. (**0082-33** [Weber, Margaret])

Comment: The assessment must address the unsolved problem of long-term storage of radioactive waste from operation of the proposed nuclear reactor. These serious environmental and health costs outweigh any potential benefits of building Fermi 3. (**0083-5** [Wolfe, Joan])

Response: *The safety and environmental effects of long-term storage of spent fuel onsite have been evaluated by the NRC and, as set forth in the Waste Confidence Rule at 10 CFR 51.23, the NRC generically determined that if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite or offsite independent spent fuel storage installations. Further, the Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial high-level waste and spent fuel originating in any such reactor and generated up to that time. The impact of the uranium fuel cycle, including disposal of low-level radioactive waste and spent fuel, will be considered in Chapter 6 of the EIS. The generic impacts of the fuel cycle are codified in 10 CFR 51.51(b), Table S-3,* *Table of Uranium Fuel Cycle Environmental Data. Per 10 CFR 51.51 and the guidance in Section 5.7 of NUREG-1555, the NRC staff will rely on Table S-3 as a basis for the impact of uranium fuel-cycle impacts. Health impacts associated with reactor operations will be addressed in Chapters 4 and 5 of the EIS.*

Comment: The CO2 that is produced by uranium mining, milling and further processing must be taken into account, as well as the ecological devastation to watersheds and communities where the uranium is mined and processed. (**0051-6** [Cumbow, Kay])

Response: *The impact of the uranium fuel cycle, including carbon emissions, will be considered in Chapter 6 of the EIS. The generic impacts of the fuel cycle are codified in 10 CFR 51.51(b), Table S-3, Table of Uranium Fuel Cycle Environmental Data. Per 10 CFR 51.51 and the guidance in Section 5.7 of NUREG-1555, the NRC staff will rely on Table S-3 as a basis for the impact of uranium fuel-cycle impacts.*

Comment: President-Elect Obama has indicated he will withdraw the Department of Energy's license application to the Nuclear Regulatory Commission to operate the Yucca Mountain, Nevada, radioactive storage facility because of its geologic unsuitability.

Last December the Department of Energy reported to Congress and President Bush a second radioactive waste disposal site will be needed if new reactors like Fermi 3 are built. (**0058-91** [Feldpausch, Larry])

Comment: My two questions: Has Michigan been chosen as one of our Great Lakes states as a site for this radioactive disposal? And secondly, where in the State would the disposal site be located, the upper peninsula or the lower peninsula? And why would the decision be made to choose one of our peninsulas? I think it's important, I think it's incumbent upon the NRC to get those two questions answered because I think that they ought to be factored in their decision making. (**0058-92** [Feldpausch, Larry])

Response: *Potential future high-level and low-level radioactive waste disposal facilities are out of the scope of the EIS, which is concerned with the potential environmental effects of construction and operation of the proposed Fermi 3 unit.*

Comment: Spent fuel being considered waste is one of the things that I have been very adamant that we're really misnaming it. It is stuff that we are wasting that shouldn't be. Fuel element that comes out of the reactor when it's being changed, still has heat energy rev of about 12,000 BTU per hour, which can last over 10 years, by using the heat available from those fuel bundles. (**0058-126** [Meyer, Richard])

Response: *This comment expresses concern that current spent fuel management practices do not take advantage of waste heat generated by the spent fuel. The comment provides no new information related to the environmental review and will not be considered further in the EIS.*

Comment: And then look at where our uranium comes from. For the past decade and more, 50 percent of US nuclear fuel, the uranium that goes into it, has come from Russia. Given current headlines about Russian power politics cutting off natural gas supplies to Europe, how smart is that to rely on Russia like that? Other US uranium supplies comes from indigenous peoples lands in places like Canada and Australia, and the Navajo and Pueblo lands of the desert southwest, associated with many environmental justice violations. (**0059-77** [Kamps, Kevin])

Response: *This comment discusses the available uranium-ore supply and associated potential impact on the viability of the nuclear industry and is outside the scope of the environmental review. The comment will not be evaluated in the EIS.*

Comment: (2) When does Fermi 2's current operating license expire?
(3) How much spent fuel is stored at Fermi 2 now and how much will be stored at Fermi 2 by the expiration date of Fermi 2's license.
(4) Where will Fermi 3's spent fuel be stored if the Nevada federal government storage facility is not built in the near future?
(5) What will be the annual rate of accumulation of spent fuel from Fermi 3? (**0083-27** [Kaufman, Hedi])

Response: *The term of Fermi 2's operating license and its relationship to the proposed Fermi 3 unit will be considered in Chapter 7 of the EIS. In addition, the quantity of spent fuel stored at Fermi 2 and its relationship to the proposed Fermi 3 unit will be considered in that chapter. The impact of the uranium fuel cycle, including disposal of low-level radioactive waste and spent fuel, will be considered in Chapter 6 of the EIS. The generic impacts of the fuel cycle are codified in 10 CFR 51.51(b), Table S-3, Table of Uranium Fuel Cycle Environmental Data. Per 10 CFR 51.51 and the guidance in Section 5.7 of NUREG-1555, the NRC staff will rely on Table S-3 as a basis for the impact of uranium fuel-cycle impacts.*

D.1.17 Comments Concerning Transportation

Comment: Second, the danger of the transportation of nuclear waste materials to a potential storage site is significant. If they are transported by train, one has only to think of the recent derailment of a train, the devastation of which made the national news. If derailment occurred, the location of the load of waste would endanger people living in the vicinity. (**0023-2** [Mechtenberg, Marilynn])

Response: *The environmental impacts of transportation of radioactive wastes to and from nuclear power facilities will be addressed in Chapter 6 of the EIS.*

D.1.18 Comments Concerning Cumulative Impacts

Comment: How many non-consequentials impacts does it take to become consequential? (**0004-9** [Carey, Corinne])

Comment: Monroe county's three power plants, two coal burning plants, and the nuclear plant Fermi 2, together account for 25% of water withdrawals from the great lakes. Fermi.3 would add to these withdrawals, all from Lake Erie.

It is anticipated that over the next 60 to 70 years global warming will lower the level of Lake Eire from three to six feet. This change must be taken into account, as the period of change overlaps, the working lifetime of the Fermi 3 plant. (**0007-1** [Newman, Kent])

Comment: In addition, thermal pollution from the two coal plants, in Monroe county, Fermi 2 and Fermi 3, added to higher average water temperatures for Western Lake Erie, together, could harm plants, and animals living in the water. (**0007-2** [Newman, Kent])

Comment: I live in a community that has been bombarded by an oil refinery, a salt mine, a city-owned waste treatment facility and a compost facility. No one can tell me that none of these facilities do not do physical, psychological and monetary harm to citizens. Coal is not clean. Nuclear energy/waste is not safe. (**0017-2** [Leonard, Dolores])

Comment: The discharges into Lake Erie and the fallout from the stacks and the accidental discharges are extremely problematic. Many scientists believe that the Great Lakes are at a tipping point. Numerous sources of intensifying stress can overwhelm the natural processes that stabilize and buffer a system from permanent change. Ecosystems can recover from many kinds of disturbances but are not infinitely resilient. (**0019-6** [Schemanksi, Sally])

Comment: As a company who will make a difference, I ask you to face the cumulative, long-term, indirect, long distance and global consequences of a Fermi III and other alternatives. (**0027-1** [Askwith, Annemarie])

Comment: The Environmental Impact Statement (EIS) must address the cumulative impacts of water usage by the proposed plant and existing power plants in Monroe, Toledo, Bay Shore, and Port Clinton. Water intake and usage analyses should include Lucas, Ottawa, and Wayne Counties as well as Monroe County. (**0028-1** [Shiffler, Nancy L.])

Comment: The cumulative impact of another fish kill source should be considered, and the impingement and entrainment data from Fermi 2 needs to be updated. The impact on the Maumee Bay estuary should be included in the analysis. (**0028-3** [Shiffler, Nancy L.])

Comment: The COL discusses its scoring system for projecting impacts on the local and overall ecology of Lake Erie and the project vicinity. The Department believes that the COL should look at both the overall impacts and the cumulative impacts on the local level as well as basin wide. As an example, the COL indicates that the 34,000 gpm of cooling water is a tiny proportion of the whole of Lake Erie, so the impact would be small. It then states that the local potential for withdrawals is not likely to change significantly so the cumulative impacts would be small. The Department maintains that determining the significance or lack thereof, of the local impact of the proposed cooling water use by comparing it to the volume of water in the entirety of Lake Erie is inappropriate. Impacts at the local level are operating at very different scales from those happening lakewide, though certainly both can be impacted by the proposed development and operation of this plant. Furthermore, rationalizing the significance of those impacts, local or cumulative, on the basis that withdrawals are not likely to change does not adequately take into account the impact this development will have either on a local or lakewide (cumulative) scale. Therefore:

Have the waterbody wide effects of preparation of this plant been adequately explored? In conjunction with existing facilities using cooling water from Lake Erie in other states and Canada? (**0029-6** [Freiburger, Chris])

Comment: A new reactor at Fermi would add to the cumulative impact of such routine releases already occurring at operating atomic reactors, namely Fermi 2 and Davis-Besse, on Lake Erie's shallow, fish-rich western basin. (**0050-12** [Kamps, Kevin])

Comment: NRC should address the additional radioactivity exposures caused by discharges from the burning of coal at Monroe County's two fossil fuel plants. Radiation monitoring should be installed at those facilities. The cumulative impacts and incremental changes caused by a new reactor should be evaluated. (**0050-14** [Kamps, Kevin])

Comment: Monroe County already hosts DTE's Monroe (Coal) Power Plant, at 3,000 megawatt-electric, one of the largest in the U.S. It also hosts DTE's Fermi 2 nuclear reactor, as well as Consumers Energy's Whiting Coal Plant. Due to such facilities, many billions of gallons of water are withdrawn from Lake Erie by Monroe County each and every day an incredibly high percentage of water usage in all of Michigan and returned super-heated. Additional nuclear reactors and coal plants in northwest Ohio also contribute heat to Lake Erie's western basin. As already seen throughout the Great Lakes, such overheating could even force the shutdown of thermo-electric power plants on hot summer days, significantly impacting the reliability of the electric grid. (In fact, Fermi 3, at 1,560 megawatts-electric, would introduce significant grid instability if it ever shut down for an extended period for any reason whatsoever, thus increasing potential electricity reliability risks that could well require massive purchases of expensive replacement power.) (**0050-19** [Kamps, Kevin])

Comment: Fermi III will be located near a coal firing plant, which emits sulfur dioxide, nitrous oxide, carbon dioxide and "fine particulate matter," which pose health dangers from lung disease to stroke. Does the radiation emitted from nuclear power plants interact with the emission from coal fired plants operating in close proximity to the nuclear plant? How much more dangerous are the combination of releases than would be if the emissions did not interact? (**0055-3** [Guthrie, Patricia])

Comment: And I wish that the Environmental Impact Statement would include the following considerations, which when I reviewed it [Environmental Report], it did not.

One is the projection of climate change, where they predict that the levels of Lake Erie could drop from 3 to 6 feet. Considering that Maumee Bay, which would be impacted by this plant, whose average was up to 5 feet, western Lake Erie is 24 feet; 3 to 6 feet is very considerable. So please look at climate change as a factor in your consideration for Fermi 3. (**0058-46** [Bihn, Sandy])

Comment: DTE's coal fired power plant, right next door to this, is the fourth largest power plant in North America. If this permit is to be granted, that plant uses 1.9 billion gallons of water a day, it kills millions of fish every day. Hundreds of thousands are impinged, millions are entrained. There should be a cooling tower and there should be mercury reductions at the coal fired power plant as part of the mitigation considerations. (**0058-49** [Bihn, Sandy])

Comment: Also, the environmental impact should consider the impact on sediments and water quality in the basin both from the additional existing plants, and then what would happen with the addition of Fermi 3. (**0058-50** [Bihn, Sandy])

Comment: There is open dumping, over 500,000, up to 800,000 cubic yards a year from the Toledo shipping channel, that go right out in the waters here that you can see here in Western Lake Erie, that would be impacted by the Fermi 3. The turbidity from those waters should be considered as part of the Environmental Impact Statement of the waters they're drawing in. (**0058-51** [Bihn, Sandy])

Comment: Also, the amount of shoreline that doesn't freeze, as someone said, from the Bruce power plant. I can tell you that looking last night -- I was driving home from a meeting -- I can see five power plants today from the shoreline on Bay Shore Road and Oregon, Ohio. You can actually see Bay Shore Power Plant, you can see Consumers Power Plant, you can see DTE, and you can see the smoke from Davis Besse, and you can see Fermi 3. I mean these plants within a mile radius. What is the saturation level of having too many power plants in our area? (**0058-55** [Bihn, Sandy])

Comment: if it is to be built then there ought to be mitigation at the Monroe power plant. (**0058-58** [Bihn, Sandy])

Comment: The plants we have we want to ensure that they comply with the law, and that they operate well. Those plants include Fermi 2, but it also includes the fossil plants, including Monroe's large facility just upriver, or just up the Lake from there. Those plants are currently being refitted. They are being complied with the environmental laws that have been passed, and we are doing everything possible to allow those plants to be operated in a cleaner and less toxic way. Those are environmental activities. There's a lot of money involved with that, of course, and that's a short term issue. (**0059-35** [May, Ron])

Comment: Fermi 3 will be located close to a coal firing plant which emits particulates that are very dangerous to our health. Actually scientists contend that people are exposed to higher radiation doses living near a coal fire plant than living near a nuclear power plant. What studies have been done on the interaction of radiation emitted from nuclear power plants with that produced by coal fired plants? Is it true that radiation bonds with particulates from the coal fired plants which are then ingested by humans and animals causing damage to our health? Wouldn't this kind of information be pertinent for the environmental analysis for Fermi 3? (**0059-42** [Mumaw, Joan])

Comment: The cumulative impact of fish kills from the five existing power plants and the impacts of adding Fermi 3 should be assessed. There needs to be a determination of the cumulative impacts of the fish kills at the existing five operating power plants in the far Western Basin of Lake Erie and Maumee Bay and then a determination of how many more fish Fermi 3 would kill and what the impacts on the fishery and aquatic life would be.

The Environmental Impact analysis should likewise determine the impact to the ecosystem from heating the billions of gallons at the existing operating five power plants. (**0082-13** [Bihn, Sandy])

Comment: The Environmental Impact should look at mitigation if this permit is to be allowed at the DTE Monroe's Coal Fired Power Plant, the 4th largest power plant in the U.S. Water use, thermal impacts, fish kills and mercury and other emissions to at the nearby Monroe coal fired power plant should be mitigated as part of this permit to reduce the 1.9 billion gallons of day of water used by DTE at this plant. Mitigation should require installing a cooling tower and mercury pollution control equipment at the Monroe plant if Fermi 3 is to get a permit. (**0082-15** [Bihn, Sandy])

Comment: The environmental impact statement should also assess the impact on sediments and water quality by adding a 6th power plant to the existing three coal fired power plants and two nuclear power plants in the Western Basin of Lake Erie. Sediments and water quality in the areas of the existing coal fired power plants and nuclear plants should be assessed for radiation, mercury and other pollutants and then the estimated additional impacts from the proposed Fermi 3 to the sediments and the water should be added. What percentage of water in Maumee Bay is currently used by the existing power plants and how much more would be used by Fermi 3? (Assess the % with the climate change estimated reductions of 3' to 6) (**0082-17** [Bihn, Sandy])

Comment: The impact on keeping the shoreline from freezing and mixing zones caused by thermal impacts should be assessed. Also, the extent and overlapping of the mixing zones at existing power plants from thermal impacts and the proposed Fermi 3 should be mapped and reviewed. This assessment should include the amount of shoreline that is kept from freezing from existing power plants and the additional amount. Mitigation should be required for additional impacts. (**0082-24** [Bihn, Sandy])

Comment: Fermi III will be located close to a coal firing plant which emits particulates that are very dangerous to our health. Actually, scientists contend that people are exposed to higher radiation doses living near a coal-fired plant than living near a nuclear power plant. What studies have been done on the interaction of radiation emitted from nuclear power plants with that produced by coal-fired plants. Is it true that the radiation bonds with particulates from the coal-fired plant which are then ingested by humans and animals causing damage to our health? What research has been done in Monroe County on the possible impact of radioactive releases into the air from Fermi II which is close to a coal firing plant? Wouldn't this information be pertinent for the environmental analysis for Fermi III? (**0083-9** [Mumaw, Joan])

Response: *The cumulative impacts associated with the construction and operation of the proposed Fermi 3 nuclear plant will be evaluated, and the results of this analysis will be presented in Chapter 7 of the EIS.*

D.1.19 Comments Concerning the Need for Power

Comment: From an energy perspective, the proposed new plant would help assure that the energy needs of our region will be met for decades to come - and economic growth clearly cannot be sustained unless an adequate, reasonable energy supply is available. (**0010-3** [Mahoney, Charlie])

Comment: A recent article in the Wall street Journal reported that electricity usage from a number of large utilities across the country has been slowly dropping. Plans made by utilities such as DTE that were based on the assumption of a 1 - 2% annual increase in usage are now out of date. This is especially true in Michigan where population loss, manufacturing cutbacks, and energy efficiency measures have significantly reduced demand. This begs the question - Do We Need a New Nuclear Facility in Michigan?? (**0053-1** [Nordness, Dorothy])

Comment: It is estimated by the year 2030, the average U.S. household will consume about 11 percent more electricity than it does today, due in large measure to the advent of digital technology, according to the Nuclear Energy Institute. (**0058-13** [Mentel, Floreine])

Comment: We appreciate Detroit Edison's taking -- taking a proactive approach of looking at the energy needs of the citizens of our states. From a senior citizen perspective, certainly access to reliable and affordable energy is crucial to their well-being. And while we have a lot of issues and population changes and so forth, one thing that's often overlooked is that the senior population in this State is going to grow tremendously. This year alone, census projects that the growth rate is 118 more seniors per day in the State of Michigan. Again, energy is essential to their well-being.

One of the great success stories in Michigan is their effort to rebalance assistance to those who need long term care, providing people who are formerly warehoused in nursing homes, the ability to live with assistance in community based settings, and we're at the forefront of that.

Electricity and technology is also at the forefront of that. Sixty-four percent of every person that we serve in their home is opposed to the nursing home, depends on technology and electrical devices to provide them monitoring that assures their safety, and the comfort and support of their family members who care for them, much more than anyone else. (**0058-135** [McGuire, Jim])

Comment: And they have a vision of where you need to be in the future, because once our economic problems get by us in this country, there's going to be a great need for power again. And if you don't have it, you're not going to be able to have the success down the road that you did 20, 30 years ago. So if you want to have success in the future, I think these people are a good partner. (**0058-138** [Keith, Fred])

Comment: So I'm wondering why we're heading in that direction when it doesn't seem that we need to, seeing as how, at this point in time, and in the foreseeable future, our energy needs are not rising. If we were to increase to our 10 percent level, that would be an increase in capacity of 1 percent a year, which is above what we are considering what will be necessary by 2015. So I'm just wondering, why is this on the books? (**0058-42** [Simpson, Robert])

Comment: This plant is being viewed for the long haul. This is a plant that will serve this State for 60 to 80 years. It's one that will provide not only long-term good employment, but it will also provide the power that we will need for a very long time. And it's considered baseload plant activity in our company, and therefore we are looking for all of the options, the ones that will fulfill the options associated with a very long term need for our State. (**0058-5** [May, Ron])

Comment: Another component of that energy legislation was in fact a certificate of need process. A review would be conducted by the Michigan Public Service Commission any time a utility would propose to build a baseload power plant. Due to our review, that's been undergoing for several years, including a capacity need for them, study conducted in 2005/2006, and the Michigan 21st Century Energy Plan released in 2007, the State of Michigan recognizes the possible need for new baseload power plants at some point in the foreseeable future. (**0058-65** [White, Greg])

Comment: The need for power from the plant is also far from certain. (**0058-84** [Newnan, Hal])

Comment: there is no convincing evidence that the demand for electricity will grow fast enough in our State to justify the building of this facility. I note that DTE's admission to the NRC on the need for power chapter is largely based on the analysis of the experts at the Michigan Public Service Commission. However, the projections of the Commission were produced over two years ago when the health of the State's economy afforded a far different view of the need for energy than is now the case.

While in mid year 2006, the Public Service Commission estimated that the demand for electricity was only one-and-a-half percent year growth path for several years into the future, that rate has been cut back by several factors -- the loss of population, the mounting unemployment, the shutting of factories, and the foreclosure of thousands of homes that remained unoccupied, among others. Indeed the annual energy outlook of the US Energy Information Agency issued in mid December 2008, just a month ago, for the 2007/2030 period, lowers the national growth rate in electricity used to 1 percent a year. If that's the average for the US, or State's rate is probably close to zero.

Another factor, besides the plummeting economy that should push down the demand for electricity, is the requirement citing by Governor Granholm in mid 2008, which directs the utilities to produce efficiently -- to produce electricity, I'm sorry, from non-sustainable sources. In mid 2008 Governor Granholm signing no bills that require electric utility to establish energy efficiency programs which would obviously cut back on the demand for energy, geared to reducing the consumption of electricity by 1 percent a year.

And on the renewables part, the new law directs the -- mandates the utilities that 10 percent of the electricity produced will come from renewable sources, as I said earlier, and that again will result in lower demand from nuclear and coal sources... we are puzzled by the fact that DTE in recent submissions to the Public Service Commission has downgraded the percent increase, the annual increase in expected demand for electricity. They have done that. However, in their -- as I said earlier, in their need for power chapter they are still relying on a much higher estimate that was put forth, or calculated a couple of years ago. (**0058-90** [Fischer, Lydia])

Comment: While I believe in conservation I also believe in planning ahead. Indeed, wind and water power in the future may be a factor. But realistically we need to plan to develop significant power capabilities to give us a positive economic growth for the future. (**0058-95** [Worrell, Mark])

Comment: there must be some independent evaluation of the economic data that DTE Energy has submitted about the need for future energy in the State of Michigan. During the process when the 21st Century Energy Plan was under development, under the sponsorship of the Michigan Public Service Commission, I acted as a volunteer in the discussions that took place over a period of two years. And one of the factors that we spent a good deal of time on was: what was the basis for the projections that were being made about the future need for electricity in the State of Michigan? And after a great deal of probing and asking for backup data and asking for sources of the information that were being used in that process, we were finally told, well, it all came from the utilities.

Well, we had heard the utilities testify in public hearings earlier that you can't get too much energy, too much electricity, that if you don't need it in Michigan you can always sell it. So I think that an independent evaluation of these projections of DTE Energy of what is needed for the State is a very important part of that scoping process. (**0058-97** [Holden, Anna])

Comment: But the bottom line overall is, we're looking at all choices, and I think we need to. It's a diverse portfolio that we need, and Fermi 3 may just be the opportunity to retire some of those aged fossil plants that we all know are in our system. (**0059-39** [May, Ron])

Comment: Why am I so interested in Fermi? Because it happens to be a subsidiary of DTE Energy, and considering the possible construction of a new nuclear power plant on Fermi 2 site in Newport. Considering a new power plant now, Detroit Edison is acting in the best interest of our customers by making sure it is prepared to meet the State's future energy needs. It is estimated by the year 2030 the average US household will consume about 11 percent more electricity than it does today, due in large measure to the advent of digital technology, according to the Nuclear Energy Institute. (**0059-5** [Mentel, Floreine])

Comment: I had a write-up about the needs assessment that was presented in the report. And I will say that the needs assessment there is based upon business as usual. What it says is that Michigan needs more electricity because the needs are growing at about 1.2 percent annually. The entire basis for that is one report provided to the Governor which had three numbers in it; the growth rate in Southeast Michigan, the rest of the Lower Peninsula, and the UP, all of which were about 1 percent per year. There was no justification, no basis in fact, no evaluation of uncertainty, no sensitivity analysis given for any of those numbers whatsoever.

So far as I can tell the entire basis was one graphic which showed the utilization increasing historically over about a 10 year period, and then that was extrapolated into the future. That historic growth was during a time of population growth in Michigan. Those who know about what's happening to the population in Michigan suspect, with good reason, that that's unlikely to proceed in the future. The entire forecast there about the needs assessment was based upon unsubstantiated numbers from three unnamed utility companies -- I suspect one of them was DTE --and that number was used to extrapolate a straight line growth in utilization into the future. Business as usual is not the answer for Michigan today. (**0059-56** [Wolfe, Robert])

Comment: From an energy perspective, the proposed new plant would help assure that the energy needs of our region will be met for decades to come - and economic growth clearly cannot be sustained unless an adequate, reasonable energy supply is available. (**0083-19** [Pitoniak, Gregory])

Response: *The comment relates to Detroit Edison's statutory obligations to provide energy to citizens in southeast Michigan. It provides no new information, and, therefore, will not be considered further.*

Comment: Detroit Edison specifically has a responsibility to provide power to all of the citizens within Southeast Michigan, and that responsibility comes by way of a franchise governed by a law. So, if you have a responsibility, a company like ours would take that pretty seriously, number one. And number two is, there are penalties by which we would suffer if we didn't provide that energy. (**0059-34** [May, Ron])

Response: *The comment relates to Detroit Edison's statutory obligations to provide energy to citizens in southeast Michigan. It provides no new information, and, therefore, will not be considered further.*

D.1.20 Comments Concerning Alternatives – Energy

Comment: The St. Clair and Detroit rivers currents are strong and could rotate many paddle wheels/generators. How many would be required to generate the same power as Fermi 3? (**0002-2** [Schwartz, R.])

Comment: The output of Fermi.3 has been compared against, all solar power, or all wind power, or all geothermal power. Each of these renewable options, failed to perform as well as Fermi.3. A combination of some solar, some wind, and some geothermal power, should compare better with Fermi.3, than each renewable source alone. Conservation of electricity, was not considered. A significant conservation effort, would make it much more likely, a mixed system of renewable sources, could take the place of Fermi 3, make Fermi 3 unnecessary. (**0007-3** [Newman, Kent])

Comment: Investment: the enormous financial investment in another nuclear power plant is not justified, when the energy needs can be addressed first and foremost by focusing on energy efficiency and conservation. The best bargain for the dollar in energy is conservation and efficiency. Investment in high-cost energy sources such as nuclear power must be the very last resort. Any application for a new nuclear plant must be considered in light of the applicant's investment in the alternatives: beginning with efficiency and conservation and then consideration of the mix of alternative renewable energy options. Investment in multiple sources of renewables, not solely one or the other, is responsible. Diversity of energy sources allows for flexibility. Investment in a nuclear power plant is a poor environmental investment: there are limited financial resources, public or private. What is invested in a nuclear plant cannot be invested in wind, solar, geothermal, efficiency, conservation, etc. The cost of nuclear is akin to putting too many eggs in one basket: it is foolish and too risky for us all, ratepayers and shareholders alike. (**0016-4** [Rivera, Gloria])

Comment: The comparison to renewable sources should be based on a mixture of renewables and conservation rather than comparing nuclear to one alternate source at a time.

There is no need to saddle ratepayers and taxpayers with the cost of this plant when less expensive and more environmentally sensitive alternatives are available. (**0028-4** [Shiffler, Nancy L.])

Comment: We don't need more nuclear power, we need more sensible policies. Wind and solar energies offer clean renewable energy. (**0031-7** [Rysztak, Robert])

Comment: It would be much better to invest in solar and wind energy which in the long run would be cheaper and safer. (**0034-4** [Nett, Ann C.])

Comment: We cannot use nuclear energy as a substitute for coal. We need to turn to more natural methods such as solar, wind and thermal forms of energy. We also need to greatly reduce our energy usage thereby reducing gases that cause global-warming.

We need to revitalize Michigan's economy not with a plan to return to the past but go into the future - we need a green public works project to convert unused and underused factories to produce energy efficient transportation, mass transit vehicles, solar panels, windmills. We need to rebuild health infrastructures for safe drinking water and affordable housing. We need to organize and support local organic farming and a return to local materials for building. A greener life will be a better life for all. (**0035-2** [VItale, Fred])

Comment: The Environmental Report's discussion of alternatives assumes only a direct matchup between renewable energy sources and nuclear; that is, the comparisons in the ER are solely between nuclear and wind, solely between nuclear and solar, and the like, instead of presuming that a mix of solar-passive and solar-photovoltaic, wind, conservation, and other alternatives will be deployed through thousands of market decisions. This to me is a "strawman" argument. In my view, this comparison must be nuclear versus a mix of renewables and conservation, as the state, at least by Governor Granholm's declarations in last week's

Michigan State of the State address, is moving quickly towards that actual scenario. Detroit Edison makes no such comparison here. (**0038-1** [D'Amour, James Carl])

Comment: Citizens of the state will benefit greatly from a program of combined reduction of use of energy, and implementation of renewable energy sources, such as wind, solar and use of geothermal energy. Surely DTE can create projects that will contribute to its bottom line that include green energy sources, and so become a producer of energy that will result in a lowered ecological impact overall. (**0039-4** [Mitchell, Rita])

Comment: Please, let's move forward with clean energy that does not deplete our land and water. Let's make Michigan a leader in use of green energy. (**0039-7** [Mitchell, Rita])

Comment: Investing in strong energy efficiency programs and alternative energy is what we need to save the planet, including ourselves. (**0047-7** [Bettega, Gayle])

Comment: The proponent should be required to conduct a detailed analysis of the potential for liberating or producing the same amount of energy benefits as this reactor would produce, through alternative investments in energy efficiency and alternative energy sources, including wind (both onshore and offshore), co-generation, geothermal energy, solar, etc. (**0048-9** [Edwards, Gordon])

Comment: our organizations call upon NRC to undertake a careful review of the energy efficiency and renewable energy potential available in DTE's service area, and to find that they are the preferred alternative to Fermi 3. (**0050-25** [Kamps, Kevin])

Comment: As I listen to the comments of the people who support DTE, especially the Economic Development folks, Chamber of Commerce people, I wonder why they aren't pushing DTE to deploy wind and solar now, creating jobs now, instead of advocating for a long, drawn out process, a long drawn out process of necessity that will take years to result in the construction of a nuclear power plant. A process that will begin in earnest in 2013, have peak jobs at 2015, `16, or `17. If we have any economic catastrophe in this region we need to deal with it sooner rather than later. (**0058-115** [Lodge, Terry])

Comment: I don't think windmills have much of a payroll, so I'm not very fond of those. And they kind of are an eyesore in my sight. Driving across Southern Minnesota they appeared in groups of three or six. I don't know if that's significance, but I think it had to do with some kind of a government program that allowed a certain amount of money. (**0058-128** [Meyer, Richard])

Comment: The only thing I can say about the windmill is it's a great thing, and it's an additive to power with coal and nuclear. But the days that the wind don't blow, they don't work. You still have to put that power out there somehow. And we all kind of take power for granted. You know, we're used to getting up in the morning and turning on a light switch and the light comes on. What do we do some day when we turn that light switch on and the light comes on about half? You know, these are things that we need to think about. (**0058-139** [Keith, Fred])

Comment: Unfortunately, electricity is a commodity that must be used as it is produced for efficiency and economic reasons. Although wind and solar power may be used as supplements, it is necessary that we have a consistent and reliable source of baseload power. The sun doesn't always shine and the wind doesn't always blow. Numerous suppliers have built power plants using natural gas as a fuel source, but now it's been recognized as being too costly to operate these plants due to the fluctuations in the supply and price of natural gas. Using natural gas as fuel source for power has succeeded in driving up the cost of home heating and causing fuel shortages. (**0058-145** [Sweat, Ron])

Comment: The other thing about this is that it takes a long time to get a nuclear power plant up and running. In that time we could be using energy efficiency, we could be using alternative energy, such as wind and solar, and they could be up and running. No terrorist is going to go after a wind turbine. So, there's a lot of reasons.

Energy efficiency alone could save 50 to 75 percent of our electricity bills, and that's according to Amory Lovins, from Rocky Mountain Institute in Colorado. (**0058-25** [Cumbow, Kay])

Comment: And I kindly ask the company to invest this billion into renewable, clean sources of energy like wind, solar, geothermal, waves and tides of our beautiful Great Lakes that are so abundant in waves, tides, wind and solar. (**0058-31** [Pfeiffer, Jelica B.])

Comment: First of all, you can take the coal plants that are just over the horizon here, and see that we're adding onto those plants environmental equipment that we think is not only essential for our environment, but it does a great deal for employment, it does a lot of other important things for our community, but most of all it cleans our air. And those projects, of course, I'm involved with and lead that effort. But that is current and it's going on as we speak.

Just behind that we're building, and will be building, windmills, and other renewable sources. There's legislation that we not only think was wise, but also really endorsed that has provided this State the opportunity to take up to 10 percent of our load and turn it into sustainable energy. And we think that that's really important. And that is in front of this plant. Those issues that come about in terms of our existing plants and those that are associated with renewable energy and efficiency are all in front of this plant. (**0058-4** [May, Ron])

Comment: what I'm here for is to talk about a fight that we've had for the last two-and-a-half years here in Michigan to get some renewable energy on our legal system into law, and we did. It wasn't much of a bill; it was only a 10 percent, which was probably one of the weakest bills of the 25 or `6 states that have gotten mandates on their books. But we finally got something. Now it looks like to me, with all the -- I want to say more energy plans that are coming into sight now, and coal plants, radiation plants, that we're undermining the intent of our whole trust in the State of Michigan, which was to go to cleaner sources of energy. Instead, it seems to me that everyone is backpedaling. We have a lot of different ways to reach that 10 percent, but if we go ahead with other sources of fossil fuel type energy, we undermine the very intent of the law as we have passed it. (**0058-41** [Simpson, Robert])

Comment: The coal plants that we have, they won't last forever. We may not want them to last forever if we're looking at CO2 and other issues. So what are the alternatives? Well, let's build out those windmills, let's build out those efficiencies that we can, and do it in a way that really provides a real advantage to us short term. (**0058-6** [May, Ron])

Comment: My statement today is in fact in support of the continuation of the combined operating license review process that is the subject of this meeting. Within the last few years the State of Michigan has put a great deal of focus on its energy future. And in fact, as referenced by previous speakers, has recently passed comprehensive energy legislation, intended to provide a framework for moving Michigan forward on its energy policy. Now, this framework does in fact include an aggressive energy efficiency program, a renewable portfolio standard, which is a mandate to build out to 10 percent of its energy supply through renewable energy, which perhaps doesn't sound like a lot when compared to maybe 30 percent from the state of Maine. But when you put it into context, a 10 percent build out in Michigan would make Michigan the third largest developer of renewable energy in the country. So you need to put those kinds of numbers into proper context. (**0058-64** [White, Greg])

Comment: Instead of sinking money into the nightmare problems of the nuclear industry, we should be investing in safe, renewable energies that will make our country safe, energy dependable, and strengthen the economy. This point should make sense to anyone. Even to those who may dispute my points on health issues and the essence of the atom, et cetera. (**0059-20** [Barnes, Kathryn])

Comment: Numerous power suppliers have built power plants using natural gas as a fuel source, but now it has become too costly to operate these plants because of the fluctuations in the price and supply of natural gas. Use of natural gas as fuel for producing electricity has driven up the cost of home heating and created shortages in the gas supply. Electricity, unfortunately, is a commodity that must be used as it is produced for efficiency as well as economic reasons. Although wind and solar power may be used as a supplemental source, it is necessary that a consistent and reliable source of power be maintained. The sun isn't always shining here in Michigan, and the wind isn't always blowing. (**0059-31** [Sweat, Ron])

Comment: we were supportive and really provided a lot of energy behind the new legislation that occurred last fall, that obligates this State and our company specifically, to renewable energy. So those of us that are thinking about renewable being a choice against a Fermi plant, that isn't the choice. The choice is, we will do both. Whether we do a Fermi plant long term or not hasn't been decided. But what has been decided is that we will build windmills, we will look at solar, and those issues are being planned, and these are responsibilities I have as well, in the short term, starting this year.

So we're not looking at Fermi as a replacement for renewables. Actually we're going to build out many hundreds of windmills, and the obligation is to find efficiency and windmills is a shorter term, and really an environmentally sound alternative, to the loads and things that we have an obligation to serve for this community.

So that isn't a trade off. That's a given. The trade off then is the longer term power source. As previously stated, there are opportunities over the course of the next several years to see how those renewable sources work. If there are opportunities to build out even more after that we will do that. But the point is, when the wind doesn't blow and the cloud cover is like today, we will need baseload plants.

And so the next question is, will we have a baseload plant that will contribute to additional CO2, or will we have a baseload plant that will contribute to more fossil fuel burning, or will we have a base loaded plant that would be an alternative to that. And so we, I think, are obligated to take a look at nuclear power. And that obligation is around the choice that says, if we can make it effective, both in terms of cost and in terms of safe operation, which we believe we can, that those choices then would be over the longer term. (**0059-36** [May, Ron])

Comment: Real solutions for the climate crisis include safe and clean energy efficiency, and renewable electricity sources, such as wind and solar power. These have been neglected for decades and urgently deserve more support than dirty and dangerous nuclear power.

And in regards to jobs, the Blue/Green alliance, which is an alliance of the Sierra Club and the US Steelworkers Union, estimates that 35 to 65,000 permanent jobs are obtainable in Michigan via wind power, solar, geothermal, biomass, wave, tidal, genuine renewable green collar jobs, this compared to the 400 to 700 jobs that Fermi 3, that were mentioned by previous speakers.

Amory Lovins at the Rocky Mountain Institute has shown that energy efficiency is 7 to times more cost effective than nuclear power at reducing greenhouse gas emissions. Fermi 3 would provide 1,550 megawatts of electricity. If you look at all the nuclear power currently in Michigan, Fermi 2, Palisades, Cook Units 1 and 2, although one of those units at Cook is down for a year or more at this point, due to a turbine accident. If you add up all the nuclear power currently in Michigan, 4,000 megawatts of electricity, compare that to the 16,000 megawatts of potential wind power identified in Michigan on land. Compare that to the 320,000 megawatts of wind power available to Michigan offshore in the Great Lakes, tremendous potential for wind power in this State. (**0059-74** [Kamps, Kevin])

Comment: Why isn't the $7 billion plus, being used for the development of alternative energy sources like wind, solar and geothermal? These alternative sources would supply ongoing jobs of solar-panel installation, retrofitting buildings that are leaking energy, wastewater reclamation, materials reuse and recycling and much more. (**0062-2** [Henige, Margaret Ann])

Comment: What I am asking from your office is to know whether there are any plans to explore other alternative, renewable ways to acquiring energy in the area. With Monroe being located right along the Lake Erie cost line I was wondering if there has been any attempts to start up a wind farm. The maintenance of such a facility as well as retrofitting buildings that are leaking energy offer the opportunity for job growth and ongoing employment. (**0064-2** [Davis, Gary])

Comment: In this time in our history, when we should be looking for positive ways to effect climate change, as well as helping the world economy wouldn't renewable energy sources be the answer? We should be investing in the energy sources that have much lower lead time than nuclear power. The renewable energy sources of wind, solar and gas also provide ongoing jobs for solar-panel installation, retrofitting building that are leaking energy, wastewater reclamation, materials reuse, recycling and technology advances. All of the mentioned are not a part of the nuclear energy solution. (**0066-2** [Tinnirello, Nicole])

Comment: I believe our country needs to be investing in renewable resources. I ask that this commission review alternative energy resources and look forward to your response. (**0066-4** [Tinnirello, Nicole])

Comment: Governor Granholm announced just this week that Wind Turbines were to be built in Monroe. This is a much safer and cleaner way to make electricity. Let's keep Monroe safe and clean. (**0070-4** [Karas, Josephine])

Comment: Unfortunately electricity is a commodity that must be used as it is produced for efficiency and economic reasons. Although wind and solar power may be used as supplements, it is necessary that we have a consistent and reliable source of base load power. The sun doesn't always shine and the wind doesn't always blow.

Numerous suppliers have built power plants using natural gas as a fuel source, but now it has been recognized as being too costly to operate these plants due to fluctuations in the supply and price of natural gas. Using natural gas as fuel source for power has succeeded in driving up the cost of home heating and causing shortages. (**0082-6** [Sweat, Ron])

Comment: Instead of sinking money into the nightmare of problems of the nuclear industry, we should be investing in safe, renewable energies that will make our country safe, energy dependable, and strengthen the economy. This point should make sense to anyone. Even to those who may dispute my points on health issues and the essence of the atom, et cetera. (**0083-34** [Barnes, Kathryn])

Response: *In Chapter 9 of the EIS, the NRC staff will evaluate all reasonable alternatives to nuclear power that could provide over 1500 MW(e) of baseload power to the Detroit Edison service area. The analysis will evaluate all proven renewable energy alternative technologies, both singly and in combination, for their ability and feasibility in meeting the stated purpose and need of the proposed action. The analysis will also extend to an evaluation of actions not involving new power generation facilities such as energy conservation, energy efficiency, and demand-side management programs.*

Comment: As a company of power, I ask you to actively support energy production which prevents pollution of any part of the environment and allow no build-up of radioactive, toxic or other hazardous substances. (**0027-2** [Askwith, Annemarie])

Response: *NRC does not actively support any form of electric power generation. NRC's mission is the safe regulation of nuclear materials to ensure protection of the public and environment. NRC will not issue a license to construct and operate the Fermi 3 nuclear plant unless it determines the design and the proposed method of operation are safe.*

Comment: The amount of money spent on new Nuclear Power Plants would be better spent on Renewable energy which would create jobs for our suffering economy and our skilled trades which are at 45% unemployed rate. I am requesting a reply from the NRC to inform me of how these problems will be addressed. (**0030-2** [Conner, Mary V.])

Comment: Fermi 3 is not needed, and rather would displace safer, cheaper, and cleaner energy alternatives such as efficiency and wind power, that better fit Michigan's electricity and job creation needs. Michigan's economic depression requires cost-effective green job creation, affordable electricity rates to spur business development, and 21st century environmental entrepreneurship. Investment in efficiency represents the lowest hanging energy fruit, with tremendous potential for ratepayer cost savings, cost-effective climate mitigation, and widespread job creation. As reported by the National Renewable Energy Lab, Michigan has the potential to develop 16,000 megawatts of land-based wind power. In addition, MSU's Land Use Institute reported in Oct., 2008 that over 320,000 megawatts of wind power is available to the Great Lakes State off-shore; environmentally-sensitive, strategic development of even a very small fraction of that huge potential could supply Michigan's electricity needs for the foreseeable future, at more affordable rates than Fermi 3, while more cost-effectively creating much larger numbers of jobs. (**0050-24** [Kamps, Kevin])

Comment: And a power is needed, it would be more environmentally safe and cost effective for society, that is, to increase available power through energy efficiency measures and renewable energy installations which provide many, many, many, many more jobs, and don't have the health cost implications that a nuclear power plant or a coal power plant have.

Therefore, based on all this, building this plant is a bad idea. We would -- the Sierra Club would believe that energy efficiency is the least expensive way to increase the amount of energy we have available, and that renewable energy efficiency measures and renewable energy measures, which are indeed clean, unlike coal, and safe, unlike nuclear, should be used even before considering nuclear power plants. (**0058-85** [Newnan, Hal])

Comment: In my opinion, investment in the nuclear industry is money that could have gone to producing cheap renewable electricity like wind, solar, and geothermal power, not to mention conservation and efficiency efforts. Besides their lower costs for construction and operation, investments in conservation, efficiency, and renewable energy provide ongoing jobs for solar-panel installation, retrofitting buildings that are leaking energy, wastewater reclamation, materials reuse and recycling and much more.

Please keep the above comments in mind as you consider DTE's application to build a new nuclear power plant in Monroe. (**0075-1** [Campana, Jean Ann])

Response: *NRC does not have authority or responsibility by law or regulation to insist that the proposed plant is the least costly alternative to provide power. The EIS will consider (in Chapter 9) the potential for alternative non-nuclear technologies to provide the electricity that could be generated by the proposed plant and the environmental impacts of those alternatives.*

Comment: Wind and solar power offer a much cleaner path to the future. The worst case scenario for nuclear power is devastating, while wind and solar accidents have no worst case scenario. (**0032-2** [Rysztak, Robert])

Response: *In Chapter 9 of the EIS, the NRC staff will evaluate the feasibility of meeting the stated purpose and need of Fermi 3, provision of over 1500 MW(e) of baseload power to the Detroit Edison service area, with alternative technologies, including renewable energy. In Chapter 5 of the EIS, the NRC staff will evaluate the environmental impacts of design basis accidents and severe accidents.*

Comment: First, I can sympathize with people in Monroe and the Chamber people and business people concerned about jobs and what it does to the economy and so forth. I came to Michigan from a depressed area myself when the coal mines shut down, so I can empathize with that. But let me point out that in Time Magazine they do an issue on energy efficiency, which I think is very good, and points out that there are far more jobs in this field and in alternative energy -- this is E-Magazine with the wind power, than there would be with any construction of coal, fossil fuel or nuclear plants. So that's something to keep in mind. (**0058-103** [McArdle, Ed])

Comment: To help sell the idea of a nuclear plant to the Monroe County public it stands to reason that DTE would draw on any perceived benefits the plant would have for the local area. One of these of course being that the jobs created by the construction and operation of the plant. In the County hard hit by layoffs and plant closings related to the automobile slump, the prospect of new jobs would certainly peak public anticipation for a better economy.

At first glance it would seem that DTE's promise of thousands of temporary jobs and many hundreds of permanent operational jobs should be taken as a great positive. But closer examination reveals a much less attractive picture. Competing for the same public support and financial resources is the renewable energy industry. That's solar and wind, et cetera. In these tough economic times it must be asked, which area of energy generation will benefit us most, which would give us the biggest bang for the buck.

One study cited in Environment America report used the example of the largest currently planned -- this was 2008 -- new nuclear plant. It's the Calvert Cliffs Unit 3 in Maryland. According to one study it is expected to generate 4,000 temporary construction jobs and 360 permanent jobs. Assuming a typical cost for a nuclear plant to be about $7 billion, each of those construction jobs comes at a cost of $1.75 million, with the permanent ones at a whopping $19 million per job.

Another study, also from Environment America states, according to the Nuclear Energy Institute, a 1,000 megawatt nuclear plant creates 400 to 700 permanent jobs. Building a nuclear reactor would result in the creation of 1400 to 1800 jobs during construction. Using the best of these numbers together, this works out to be almost $2.5 million per job.

DTE's own figures is found in the environmental report, indicate an estimated maximum of 2900 construction jobs, and up to 700 permanent jobs during operation for a total of 3,600 jobs. DTE estimates the cost of construction at about $10 billion. This works out to be about $2.8 million per job. Most of which would be temporary, that is, less than the 8 years of construction. And of course who would pay for these very expensive nuclear jobs, the electrical customers of DTE of course through higher utility rates.

By contrast, another study indicates that investing $100 billion in energy efficiency and renewable energy over two years would create 2 million jobs. That works out to be only $50,000 per job. Or, in other words, that's about .05. That's 5/100th of a million dollars. Now, compare that to these previous numbers for nuclear jobs.

Still, another study says, study after study has confirmed that a renewable energy sector produces many more jobs. Wind, like solar, produces five times as much employment as nuclear per amount invested.

And what about those Monroe County automotive job losses? Could those unemployed folks count on stepping into the nuclear construction jobs of building a Fermi 3? Not likely, unless they are experienced carpenters, iron workers, equipment operators, mechanical workers, electrical workers, boilermakers, pipefitters, sheet metal workers, insulators, painters or millwrights. Now, how many of those autoworkers would fit into one of these categories. Now, from what I've studied so far it sure sounds like the construction/operation of Fermi 3 would be a real economic boondoggle. We'd be much better off to invest our resources in energy efficiency and renewable energy resources such as solar and wind. (**0059-24** [Mantai, Frank])

Comment: The United Nations Environment Program, the International Labor Organization, the International Organization of Employers, and the International Trade Union Confederation, published a report this past September on green jobs. The report notes that more than 2.3 million green jobs have been created in recent years in the renewable energy sector. Some 4 million direct green jobs, based on improving energy efficiency, already exist in the United States. Buildings could represent a future source of many more green jobs. There are substantial green employment opportunities in retrofitting diesel busses to reduce air pollutants.

Given the economic crisis in the United States, and particularly difficult conditions in Southeast Michigan, I'm wondering about the potential jobs that would emerge from Fermi 3 in a lineup with the employment potential of Green jobs. How many jobs would be created to design, construct, and operate Fermi 3? What are the salaries and tax revenues associated with those new jobs? How many workers would come from Monroe? How many would be brought in from other areas? What is the hiring timeline? How long would the jobs last? How many jobs would be an equal investment in renewable energy create? Where would these renewable energy workers come from? And how much income would be generated? How do nuclear and renewable technologies compare regarding capital and labor intensity? Let's not leave the answers to these questions up to the company that has invested interest in moving Fermi 3 quickly through the NRC application process. (**0059-40** [Henige, Ann])

Comment: The report also gives some assessment of alternative energy sources and conservation. These are extremely important. These are actually where the jobs are going to be. One thing I would like to ask the people, and this is a rhetorical question because you can't answer it. But people who said, Look what Fermi 2 did for our jobs. It gave me my job. A lot of plumbers got jobs, a lot of people got jobs in construction. But what you never heard from was all of the people who would have gotten jobs if we had had an alternative energy construction source. There would have been many more jobs if we would have been building alternative energy sources. That is well documented by the facts. Studies after study have shown that the same investment made to build the same infrastructure for generating electricity, yields many more local, stable, real important jobs, than does nuclear power if that same money is invested in alternative energy sources. So as you look around and you say, Well, gee, isn't everything okay because look where we got our jobs in the past? You could have had more jobs, you could have had more secure jobs, they would have grown in the future. (**0059-57** [Wolfe, Robert])

Comment: The United Nations Environment Programme, the International Labour Organization, the International Organization of Employers and the International Trade Union Confederation published a report this past September on green jobs.

The report notes that more than 2.3 million green jobs have been created in recent years in the renewable energy sector. Some 4 million direct green jobs based on improving energy efficiency already exist in the United States. Buildings could represent a future source of many more green jobs.

There are substantial green employment opportunities in retrofitting diesel buses to reduce air pollutants. Given the economic crisis in the United States and the particularly difficult conditions in southeast Michigan, I'm wondering about the potential jobs that would emerge from Fermi III in a line-up with employment potential of green jobs.

How many jobs would be created to design, construct and operate Fermi III?

What are the salaries and tax revenues associated with those new jobs?

How many workers would come from Monroe and how many would be brought in from other areas?

What is the hiring timeline?

How long would the jobs last?

How many jobs would an equal investment in renewable energy create?

Where would these renewable energy workers come from and how much income would be generated?

How do nuclear and renewable technologies compare regarding capital and labor intensity?

Let's not leave the answers to these questions up to the company that has a vested interest in moving Fermi III quickly through the NRC application process. (**0083-10** [Henige, Ann])

Response: *In Chapters 4 and 5 of the EIS, the NRC staff will evaluate the socioeconomic impacts of construction and operation, respectively, of the proposed action. Consideration will be given to the availability of various job skills in the region rather than assuming all skills are available in the local workforce. In Chapter 9 of the EIS, the NRC staff will evaluate all reasonable alternatives to nuclear power that could provide over 1500 MW(e) of baseload power to the Detroit Edison service area. The analysis will evaluate all proven renewable* *energy alternative technologies, both singly and in combination, for their ability and feasibility in meeting the stated purpose and need of the proposed action. The analysis will also extend to an evaluation of actions not involving new power generation facilities, such as energy conservation, energy efficiency, and demand-side management programs.*

Comment: But instead of dwelling on the limitations of nuclear power, let's focus on alternative ways to meet our electricity needs. The Fermi 3 Combined License Application Environmental Report, discusses wind and solar alternatives in chapter 9, and discusses the projected growth of electricity demand in chapter 8. Both chapters are incomplete and inadequate in their present form and reach the wrong conclusion. The report must comprehensively evaluate an electricity future that combines conservation, energy efficiency, wind turbines, solar technology, power storage capacity, and transmission grid infrastructure.

Chapter 9 dismisses wind and solar technologies as unsuitable for baseload generation because they are intermittent. But, do we need to increase the baseload or do we need to increase the peak generation to meet the peak loads that happen with summer air conditioning? The report fails to consider the natural correspondence between peak solar-electricity generation and peak air conditioning demand. Solar electricity producing in Michigan would be highest exactly when it is needed most during the summer months. The report does not compare the dollar cost of short term storage capacity and transmission grid infrastructure for wind and solar generated electricity, to the costs associated with a Fermi nuclear power plant. Nor does the report compare the environmental and health costs of the proposed Fermi nuclear power plant to those of wind turbines, electricity storage, and transmission grid improvements.

The report claims that many acres would be required for a solar electricity system, acres that would be lost to other uses. The report does not consider the possibility that solar panels could instead be installed on roofs of houses and other buildings, with little loss of land to other uses. Wind and solar technologies could meet the energy needs of Southeast Michigan and would provide a much more cost effective solution than would the untested technology of Fermi 3.

Where will the funds come from for building our new energy infrastructure? These funds will come from future payments by utility customers. The very funds that DTE is proposing to invest in the Fermi 3 nuclear power plant could instead be invested in distributed solar panels connected to the grid, and in wind turbine farms. The report also dismisses solar generation because not much of it has been installed to date in Michigan. That could change quickly if the above funds were used to finance such installations.

What motivated DTE to propose the Fermi nuclear power plant? It may not be as easy for DTE to control and profit from wind and solar electricity generation as from centralized electricity generation. Hence, DTE as a corporation has less incentive to invest in these potentially realistic alternatives. However, DTE customers have a strong incentive to invest in a clean, reliable and safe alternative for Michigan based on solar and wind technologies. (**0059-53** [Wolfe, Joan])

Comment: But instead of dwelling on the limitations of nuclear power, let's focus on alternative ways to meet our electricity needs. The Fermi 3 Combined License Application Environmental Report discusses wind and solar alternatives in Chapter 9 and discusses the projected growth of electricity demand in Chapter 8. Both chapters are incomplete and inadequate in their present form and reach the wrong conclusion. The report must comprehensively evaluate an electricity future that combines conservation, energy efficiency, wind turbines, solar technology, power storage capacity, and transmission grid infrastructure.

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The report does not compare the dollar cost of short-term storage capacity and transmission grid infrastructure for wind and solar generated electricity to the costs associated with a Fermi 3 nuclear power plant. Nor does the report compare the environmental and health costs of the proposed Fermi 3 nuclear power plant to those of wind turbines, electricity storage, and transmission grid improvements.

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What motivated DTE to propose the Fermi 3 nuclear power plant? It may not be as easy for DTE to control and profit from wind and solar electricity generation as from centralized electricity generation. Hence DTE as a corporation has less incentive to invest in these potentially realistic alternatives. However, DTE customers have a strong incentive to invest in a clean, reliable, and safe alternative for Michigan based on solar and wind technologies. (**0083-6** [Wolfe, Joan])

Response: *In Chapter 8 of the EIS, NRC will evaluate the need for power, including the need for baseload power. In Chapter 9 of the EIS, the NRC staff will evaluate all reasonable alternatives to nuclear power that can meet the stated purpose and need of providing over 1500 MW(e) of baseload electric power to the Detroit Edison service area. The analysis will extend to all proven renewable energy technologies, both singly and in combination. The evaluation will also extend to an evaluation of actions not involving the introduction of new power production facilities such as energy conservation, energy efficiency, and demand-side management programs.*

Comment: Germany employs 240,000 people in the manufacture of alternative energies. We have two wind farms in the Thumb area with turbines manufactured by General Electric and John Deere. The only problem is they're manufactured in Germany and Holland. We have an empty auto factory here in Monroe with a Lake shipping port. Hopefully we'll see President-Elect Obama have a major impact on promotion of alternative energy. Hopefully we'll see windmills manufactured at that old empty plant, maybe for export to Europe. (**0059-67** [Farris, Mark])

Response: *The mission of NRC is the regulation of the civilian nuclear industry to ensure public health and safety and protection of the environment. NRC has no role in promoting any form of power generation or manufacturing. This comment provides no additional information relevant to the environmental review and will not be considered further in the EIS.*

Comment: In terms of energy independence and ending our dependence on foreign oil, only 1 to 2 percent of our electricity in the United States comes from burning oil. So this is an apples and oranges comparison. (**0059-76** [Kamps, Kevin])

Response: *The NRC staff must evaluate the Detroit Edison proposal for its ability to satisfy the stated purpose and need. Energy independence and ending our dependence on foreign oil are not within the scope of the staff's environmental review and will not be considered further in the EIS.*

D.1.21 Comments Concerning Alternatives – Sites

Comment: did DTE consider alternative sites in their environmental assessment? (**0058-56** [Bihn, Sandy])

Response: *Alternative sites were considered by Detroit Edison in its ER. The NRC staff will evaluate the impacts of developing a new nuclear plant at alternative sites in Chapter 9 of the EIS.*

Comment: An EIS should include an assessment of alternate sites and a no build. Consumers Power evaluated the site they have here in the Western Lake Erie watershed and instead chose Midland, Michigan. It is hard to imagine that given the shallow fishy waters of Western Lake Erie already burdened by water use from three coal fired power plants and two nuclear plants, that other locations would be a better choice for minimizing water and environmental impacts. Simply put, this is the wrong location for a power plant. These waters are already green again and limits on fish catches are in place because of dwindling quantities. These waters can simply not afford another hit of 498 million gallons a day. (**0082-25** [Bihn, Sandy])

Response: *The NRC staff will evaluate the no-action alternative, as well as impacts of developing a new nuclear plant at alternative sites, in Chapter 9 of the EIS.*

D.1.22 Comments Concerning Benefit-Cost Balance

Comment: Let Fermi 3 be built if there are NO subsidies; that is, if those who control it pay the FULL cost of construction, insurance, decommissioning, and waste disposal. In doing so, the public must be protected by the precautionary principle; that is, it must be assumed that the worst that could happen will happen. Payments - perhaps as bonds - must fully cover that. Residents and taxpayers must not be saddled with any of the financial or other responsibility. (**0006-1** [–, Richa])

Comment: Nuclear power only exists because of constant and consistent financial handouts by the taxpayer. Six of Wall Street's largest investment banks are financially smart enough to know nuclear power is not a good safe investment and too risky. They stated We believe these risks, combined with the higher capital costs and longer construction schedules of nuclear plants as compared to other generation facilities, will make lenders unwilling at present to extend long-term credit. (**0019-10** [Schemanksi, Sally])

Comment: Obviously the cost of a nuclear power plant is exorbitant and difficult to imagine this investment at this time in our history when our country is in such financial straits. (**0034-3** [Nett, Ann C.])

Comment: Fermi 2 has been a dismal failure with cost overruns approaching $6 Billion. This does not make any economic sense at all for the State of Michigan taxpayers to absorb these energy costs, in addition to the new proposed plant. It is much more desirable for the State of Michigan and its SE Region to pursue alternative energy based upon Wind Turbine, Natural gas, or even state of the art scrubber technologies for existing coal fired generator plants. For the price tag of that Fermi 2 Reactor, the State of Michigan could have over 5,000 Wind Turbine generators on line, producing electricity for the power grid with zero thermal and radiation exposure, and no nuclear waste to deal with!!! (**0041-2** [Englund, Lance])

Comment: The proponents should be prevented from availing themselves of pre-emptive bailouts from the federal treasury in the form of loan guarantees. Such loan guarantees are contrary to a free market philosophy and to the level playing field approach which should prevail in any form of responsible and sustainable energy planning. For the federal taxpayers to guarantee all necessary loans without any financial accountability or oversight is to invite abuse and waste of precious capital resources. Too much reckless and irresponsible investment has already taken place in the form of sub-prime mortgages and other schemes which separate the investor from the consequences of bad investment decisions. This should not be allowed to continue. The proponent should be required to justify the investments that will be needed in terms of the willingness of the investor to stand by that investment without requiring federal assistance. (**0048-2** [Edwards, Gordon])

Comment: The proponent should be required to document what efforts have been made by the nuclear industry to persuade insurance companies in North America to remove the nuclear exclusion clause from their insurance policies for property owners. If the nuclear industry believes that these reactors are safe, and not subject to catastrophic accidents, then they should be able to convince the insurers to provide normal coverage to their customers, thereby eliminating the need for the Price Anderson Act (which was originally intended to be only a temporary measure until the industry matured). If, on the other hand, the industry is not mature enough to convince the insurers that offsite damage from reactor accidents can be covered in the normal way, then the NRC would be, in our opinion, irresponsible to allow such reactors to be built within striking distance of large metropolitan areas or beside irreplaceable bodies of water. These considerations are particularly important since the events of 9/11 which have demonstrated the enormous damage that can be done by a small band of dedicated terrorists who have no regard for their own survival. (**0048-7** [Edwards, Gordon])

Comment: Taxpayer and ratepayer subsidies for Fermi 3 represent opportunity costs lost to safer, cheaper, and cleaner alternatives such as efficiency and renewable sources of electricity. The nuclear power industry has enjoyed over half a trillion dollars in public support over the past half century. DTE's Fermi Nuclear Power Plant has already benefitted for decades from federal research and development, as well as liability insurance against major accidents. The federal 2005 Energy Policy Act provided yet another $13 billion in subsidies, tax incentives, and additional support for new reactors. The industry has already successfully lobbied for $18.5 billion for new reactor federal loan guarantees, approved in Dec. 2007, making taxpayers co-signors on financially risky nuclear construction projects. Now DTE as well as Nuclear Energy Institute lobbyists are seeking additional tens of billions of dollars in nuclear loan guarantees as part of the federal economic stimulus bill, even though Fermi 3 cannot even break ground in the next two years. At the state level, DTE has received approval to charge electric ratepayers hundreds of millions of dollars to pay off its construction debt for Fermi 2. It recently applied to the Michigan Public Service Commission for tens of millions of dollars from ratepayers to fund its application to NRC for Fermi 3. Such public funds would be much better invested in energy efficiency, which is seven to ten times more cost effective than a new atomic reactor at reducing greenhouse gas emissions, or in wind power, so plentiful in Michigan and twice as cost effective as nuclear power at carbon reductions. (**0050-23** [Kamps, Kevin])

Comment: as I live within the ten mile radius of the Fermi II plant, I have always tried to keep abreast of the issues surrounding nuclear energy in Monroe, MI where I reside. I am particularly troubled about the proposed Fermi III plant because I do not think it is economically feasible. I think it will cost too much to produce nuclear energy and we will soon learn of better, cleaner less expensive ways to produce the energy we need. (**0052-1** [Fedorowicz, Meg])

Comment: Almost every article I read mentioned the skyrocketing costs of building new nuclear power plants. Quoting from an article in Time Magazine in December or 2008 ". . . rain has fallen on the nuclear parade. It turns out that new plants would be not just extremely expensive but spectacularly expensive". According to the article, the nuclear industry has a history of 250% cost overruns.

A leading expert in power plant costs, Craig A. Severance, who is a practicing CPA has written copiously about the cost of nuclear. Quoting him: "Generation costs per kilowatt hour for new nuclear plants (not including distribution to customers) are likely to be from 25 - 30 cents/kWh."

Such high cost may destroy the very demand the plant was built to serve. High electric rates may seriously impact utility customers and make nuclear utilities' service areas noncompetitive for businesses with other regions of the U.S. which are developing lower-cost electricity. This is a situation Michigan can ill afford. High electric rates will also encourage people to be even more energy-efficient in their homes and businesses, thus reducing demand even further.

Again quoting Mr. Severance - "Given the myriad low-carbon, much-lower-cost alternatives to nuclear power available today -- such as efficiency, wind, solar thermal baseload, solar PV, geothermal, and recycled energy the burden is on the nuclear industry to provide its own detailed, public cost estimates that it is prepared to stand behind in public utility commission hearings." (**0053-5** [Nordness, Dorothy])

Comment: Who will pay, and are they willing to pay?? Pulling again from the Time Magazine article, the answer is Ratepayers would take the main hit, but Taxpayers could be on the hook for billions in loan guarantees, tax breaks, insurance benefits and direct subsidies. This is because banks and bond-rating agencies are skeptical of backing the costs. In 2007 renewables attracted $71 billion globally in private capital during 2007 while nuclear got zip -- zero. The reactors under construction around the world are all government-financed, and ratepayers and taxpayers who will ultimately bear the burden are left out of the decision loop and not given the information they need to make a rational decision. (**0053-6** [Nordness, Dorothy])

Comment: Nuclear power has taken most of federal energy research and development dollars for over 50 years. Yet no private utility would consider investing in a nuclear plant without additional taxpayer backing as in France. Further, the Price/Anderson Act burdens the taxpayers with liability for major nuclear accidents.

A group of concerned Harvard/Boston doctors created the organization Physicians for Social Responsibility (PSR). PSR spread across the country and expanded into the International Physicians for the Prevention of Nuclear War, recipient of the 1985 Nobel Peace Prize. PSR published a definitive work on nuclear power entitled "Dirty, Dangerous, and Expensive: The Truth about Nuclear Power." The full text can be obtained at www.psr.org.

In the January 12, 2009 issue of Time magazine, Michael Grunwald wrote "It turns out that new plants would not just be extremely expensive but spectacularly expensive...sky high costs and uncertain financing could sink nukes again." (**0054-4** [Drake, Gerald A.])

Comment: I am concerned about the larger financial risks associated with the new nuclear power plant in our community.

The distinguished physicist and chief scientist of Rocky Mountain Institute, Amory Lovins, and research analyst, Imran Sheikh, published a report last year entitled, The Nuclear Illusion. The authors price electricity from a new nuclear power plant at cents per kilowatt hour, and then from a wind farm at cents per kilowatt hour. Both include the cost of fuel, capital, operations, maintenance, transmission and distribution. But in addition to its 14 cents per kilowatt hour, nuclear power requires funding for disposing of radioactive waste for ensuring plants against an accident, and for decommissioning plants when they wear out. These added costs are shouldered by taxpayers.

The Price-Anderson Act guarantees utilities protection against 98 percent of nuclear accident liability. All U.S. utilities refuse to generate nuclear power until the government provided this liability limit. Lester Brown, the founder of Earth Policy Institute, and prolific author, calls the economics of nuclear power flawed. He writes: The collective cap on nuclear operator liability is $10.2 billion. This compares with an estimate by SANDIA, a national laboratory, that a worse case accident could cost $700 billion. $10.2 billion, $700 billion. Anything above the $10.2 billion would be covered by taxpayers. If utilities need this kind of protection, shouldn't taxpayers have it as well?

According to Kristin Schrader-Frechette, O'Neill Family Professor in the Department of Biological Sciences and Department of Philosophy at the University of Notre Dame, Standard and Poor's downgrades the rating of any utility that wants a nuclear plant. Forbes Magazine recently called nuclear investment the largest managerial disaster in business history, something pursued only by the blind or the biased.

The Nuclear Energy Institute reported to the U.S. Department of Energy that 100 percent loan coverage by taxpayers is essential. Wall Street refuses to invest in nuclear power because the plants are assumed to have a 50 percent default rate. The only way that Wall Street will put their money behind these plants is if American taxpayers underwrite the risks.

Of 132 nuclear power plants built in the U.S., about one-half of the 253 originally ordered, 21 percent were permanently and prematurely closed due to reliability or cost problems. Another 20 percent have completely failed, for a year or more, at least once.

Michael Toddy writes in the June 30th, 2008 issue of the Wall Street Journal: The entire nuclear power industry is vulnerable to the safety standards of its worst performers because an accident anywhere in the world would stoke another anti-nuclear backlash among the public and investors.

Cost of the Yucca Mountain Nuclear Waste Repository was estimated to be $58 billion in 2001. In 2008, the estimate had soared to $96 billion. Because of escalating costs, the longer the construction lead time the greater the business risk that a proposed facility will exceed its estimated cost. Solar, wind, and gas have much shorter lead times than nuclear.

Investment in misguided attempts to stimulate the nuclear industry is money that could have gone to cheap, renewable electricity, like wind, solar, and geothermal, not to mention conservation and efficiency efforts. Besides their lower cost for construction and operation, investments in conservation efficiency and renewable energy provide ongoing jobs for solar panel installation, retrofitting buildings that are leaking, waste water reclamation, materials reuse, and recycling, and much more. (**0058-18** [Seubert, Nancy])

Comment: They are in a rush for finances. They are in a rush to get federal loan guarantees; they are in a rush to get ratepayers money. They are quite willing to spend ratepayer's money up front, during construction phase, and quite willing to spend federal taxpayer monies. But the utility is not willing to put forward the stockholder monies. So what this amounts to is public risk financially and private profit. Once they turn the key on that thing, you can bet the profit's going to go to Detroit Edison. (**0058-63** [Keegan, Michael])

Comment: the enormous financial investment in another nuclear power plant is not justified when the energy needs can be addressed first and foremost by focusing on efficiency and conservation. This isn't rocket science, it's not a secret. We all know that the best bargain for the buck in energy is conservation and efficiency.

Investment in high cost energy sources, such as nuclear power, must be the very last resort. Any application for a new nuclear plant must be considered in light of the applicant's investment in alternatives, beginning with efficiency and conservation, and then consideration of the mix of alternative energy option. Investment in multiple sources, not solely one or mega project is responsible. What is invested in nuclear power cannot be invested in wind, solar, geothermal, efficiency and conservation. The cost of nuclear energy is akin to putting too many eggs in one basket. It is foolish and too risky for us all; ratepayers, investors, and citizen taxpayers. (**0058-69** [Weber, Margaret])

Comment: There is also financial angle to this story, and again, I am reiterating some of what previous speakers talked about. New technologies that are being proposed are not tested, and maybe no more than theories put forth by nuclear proponents who want to profit from uninformed taxpayers by convincing them to pay the bills for the new facilities.

Let me explain. Given that the risk of default on loan repayments by most new reactor projects was assessed as very high. Wall Street and investment firms have stayed away from financing the new projects. The industry then turned to Congress, which pressured by the industry, agreed to authorize federal loan guarantees in 2005. So, if new reactors default, taxpayers will be held liable to repay the loans to the tune of many billions for each defaulted reactor.

However, this won't work for the financing of the ESBWR reactor, which is, as I understand, will not receive any of the 18.5 billion already approved by Congress in nuclear loan guarantees. DTE has yet to explain how it will finance Fermi 3 without those loan guarantees. But in the meantime the utility has applied to the Michigan Public Service Commission, to allow tens of millions of dollars to be charged on ratepayer electricity bills to cover its expenses in fighting paperwork with the NRC for the Fermi reactor proposal. (**0058-89** [Fischer, Lydia])

Comment: My understanding of the NEPA process, which was described earlier, is that there is a burden on the part of a proposal for a permit for anything affecting the environment, any possible impact on the environmental parts of air, water, people, flora, fauna, et cetera, is to look at alternative sources and make a solid case that there's no better alternative to supply whatever product it is that is being permitted.

Now, in this case I say that we should have a very rigorous examination of what are the benefits of alternative energy produced as opposed to the Fermi 3 plant. Because I think we will find out - we've certainly seen a lot of evidence to that already -- that if you compare the risk of Fermi 3 to the risk of alternative sources, which would be wind power, solar power, geothermal, and energy efficiency, conservation, that if you look very rigorously at the impact on people and their health, on public health, on the ecology, on the amount of economic opportunities that are available to people, job creation, that you will find that you cannot get the same benefits from the expanded tour that's being proposed from the taxpayer and from the ratepayers, for the Fermi 3 plant as opposed to what would be a comparable investment and alternative renewable sources.

And I agree with one of the previous speakers, that there is a great risk of undermining the development of renewable energy by going ahead with plans for a major power plant of the scope of Fermi 3. (**0058-98** [Holden, Anna])

Comment: What type of electricity generating equipment should we, the utility customers of DTE, invest in? We must consider both the costs and the benefits of the proposal before us, and alternatives to it.

Let's start with the costs. In the case of the proposed Fermi 3 nuclear power plant, the true costs include not only the very large financial costs of constructing, operating, decommissioning, and storing the radioactive waste from the plant, but also very significant safety, environmental, and health consequences. These costs should be compared to the costs of solar and wind alternatives.

What about the benefits? The benefits include not only the electricity produced, but also jobs and profits associated with the project. Nuclear power may be better for profits, but solar and wind will provide more jobs in Michigan. (**0059-47** [Wolfe, Joan])

Comment: Should we, the customers of DTE, assume the responsibility of paying for the costs of construction, operation, decommissioning, and long term storage of nuclear waste associated with the proposed Fermi 3 nuclear power plant? Can the residents and neighbors of Southeast Michigan afford to reap the environmental and health consequences of nuclear power in their backyards? We need to assess how the same funds could be instead used to develop and build a distributed wind and solar electricity generation, storage, and grid distribution system. That could meet our electricity use needs with far less damaging environmental and health costs. We need to ask whether there are less costly ways than the proposed Fermi 3 nuclear power plant to meet the electricity needs of the people of Southeast Michigan. And we must assess who will bear the costs and who will reap the benefits. (**0059-54** [Wolfe, Joan])

Comment: There are new solutions which will work better than the failed solutions of the past. The up to date knowledge and scientific materials presented by other speakers today here about alternative energy sources, demonstrates that the best option for meeting Michigan's energy needs, will be found not with expensive, untested, job stealing environmental unsafe nuclear power. That sounds contradictory to some things that other people said. But remember, I'm the statistician who says, Compared to what, job stealing? I thought it gave us jobs. It did, but fewer jobs than we would have gotten by the alternative of alternative energy sources.

Instead Michigan's energy needs can be met with safe, proven, cost effective alternative energy technology that is available today, built by Michigan workers and maintained by Michigan workers throughout the State. Development of alternative energy sources would provide many more jobs for Michigan and provide a larger tax base and would be much less environmentally risky than would the taxpayer subsidies needed to build an untested nuclear reactor design.

Nuclear power generation required massive tax subsidies from plants that were to last built 90 years ago. Today the economic advantages of alternative energy sources makes nuclear power even less economically feasible than it was even decades ago when it failed. (**0059-59** [Wolfe, Robert])

Comment: The proponents of Fermi 3 keep talking about the future, but I don't think they can see any farther than the dollar signs in their eyes. What they think would be good for Monroe would definitely be bad for Michigan, the Country, and the world. If you look at the entire nuclear cycle, Fermi 3 will be the most expensive electricity produced which will destroy the potential for long term jobs in the State. (**0059-66** [Farris, Mark])

Comment: Decommissioning of all the nukes is nearing the end of their operational lives. There will be a financial burden on the national economy in our lifetimes. DTE doesn't really have a solution for Fermi 1 and Fermi 2 decommissioning, and that cost will be dumped on citizens. About 20 years ago the shipping port reactor was decommissioned at a cost of over $100 million. Fermi 2 is about 20 times the size of Fermi 1, and Fermi 3 is projected to be about 25 times larger than Fermi 1. It will cost billions to decommission those three nukes. We'll pay coming and going for expensive electricity. (**0059-69** [Farris, Mark])

Comment: So, regarding taxpayer loan guarantees that's been mentioned today. The only way that DTE can finance the construction of its proposed Fermi reactor is for US taxpayers to bear all the financial risks. In 2003 the Congressional Budget Office warned that over half of all new reactor projects would likely default on their loan repayments.

Wall Street and investment firms are not interested in shouldering such risks. Thus, the nuclear power industry pressured the US Congress in 2005 to authorize federal loan guarantees. Now if new reactors default, taxpayers will be held liable to repay the loans, to the tune of many billions of dollars for each defaulted reactor. However, the US Department of Energy recently decided that the General Electric Hitachi's so-called Economic Simplified Boiling Water Reactor Design proposed at Fermi 3, will not receive any of the $18.5 billion already approved by Congress in nuclear loan guarantees a year ago.

Because of this the biggest nuclear utility in the United States, Exelon of Chicago, announced last November that it would not pursue ESBWRs at its new twin reactor project in Victoria County Station, Texas. Upon announcing its rejection of the ESBWR design, Exxon told NRC that another reactor design would enhance Exxon's ability to obtain federal loan guarantees, which are essential for financing a new nuclear development project. DTE has yet to explain how it will finance Fermi 3 absent taxpayer loan guarantees. The nuclear power industry has already enjoyed over $500 billion in public subsidies over the past 50 years. The giveaways have included $145 billion in federal research and development, tens of billions of dollars from ratepayers poured into the nuclear waste fund for irradiated nuclear fuel disposal. Hundreds of millions to billions of dollars per year in the form of insurance premiums that the nuclear power industry does not have to pay, because the federal Price-Anderson Act puts liability risks from major accidents onto the backs of US taxpayers. $125 billion in household and business payments on electricity bills to pay off nuclear utilities construction debts on the last generation of reactors. The list goes on and on.

DTE has even applied to the Michigan Public Service Commission to allow additional tens of millions of dollars to be charged on ratepayer electricity bills to cover its expenses, in filing paperwork with the US NRC for the Fermi 3 reactor proposal. After 50 years of receiving the lion's share of public support in the electricity sector, while only providing 20 percent or less of our electricity, none of our transport and none of our heating, the nuclear power industry should be required to stand on its own two feet in the marketplace. (**0059-73** [Kamps, Kevin])

Comment: My concern is the enormous cost for the Fermi 3 facility. In addition to the 14 cents per kilowatt hour price of electricity from a new nuclear power plant, the tax-payer must shoulder the cost for disposing of radioactive waste, for insuring plants against an accident, and for the decommissioning of plants. The over-all cost of Fermi III would be $7 billion, plus over-run costs. (**0062-1** [Henige, Margaret Ann])

Comment: As a concerned citizen I am worried about the building of Fermi 3 nuclear power plant and would like to address some of my concerns to your office. I am troubled by the high costs of building and operating such a plant and am wondering if other alternative means to acquire energy have been explored.

According to Amory Loving and Imran Shaikh of the Rocky Mountain Institute the cost to produce the same amount of energy produced by a wind farm, at 7 cents per kilowatt hour, is half of that to produce the same amount of energy that a nuclear power plant would, at 14 cents per kilowatt hour (The Nuclear Illusion).

The cost of building these plants is also of some concern to me. With $18.5 billion dollars in loans approved by the federal government, I was troubled to learn that out of roughly half of the 253 plants originally ordered, about 132 plants, 21 percent were permanently closed due to cost problems and another 27 percent have completely failed for a year or more at least once. These numbers are very alarming. (**0064-1** [Davis, Gary])

Comment: Much debate has been given to whether or not nuclear energy is a clean energy source. However, not much is ever discussed about the monetary value attached to the nuclear industry. In The Nuclear Illusion, Amory Lovins and Imran Sheikh priced nuclear electricity at 14 cents per kilowatt hour compared to wind power at 7 cents per hour. In addition to the

14 cents per kilowatt hour, there is the added expense of disposing of radioactive waste, for insuring plants against an accident and decommissioning plants when they wear out. (**0066-1** [Tinnirello, Nicole])

Comment: The expense of building at this time is prohibitive in this time of recession (**0070-2** [Karas, Josephine])

Comment: Investment: the enormous financial investment in another nuclear power plant is not justified, when the energy needs can be addressed first and foremost by focusing on energy efficiency and conservation. This is not a secret or rocket science: the best bargain for the dollar in energy is conservation and efficiency. Investment in high-cost energy sources such as nuclear power must be the very last resort. Any application for a new nuclear plant must be considered in light of the applicant's investment in the alternatives: beginning with efficiency and conservation and then consideration of the mix of alternative renewable energy options. Investment in multiple sources of renewables, not solely one or the other, is responsible. Diversity of energy sources allows for flexibility. Investment in a nuclear power plant is a poor environmental investment: there are limited financial resources, public or private. What is invested in a nuclear plant cannot be invested in wind, solar, geo-thermal, efficiency, conservation, etc. The cost of nuclear is akin to putting too many eggs in one basket: it is foolish and too risky for us all, ratepayers, taxpayers, and shareholders alike. (**0082-35** [Weber, Margaret])

Comment: Background: Public Act 286 (Oct. 6, 2008) passed after heavy lobbying by DTE Energy. The bill severely limits choice (to 10%) and allows Energy Providers (i.e., DTE & CMS) to bill--via rate hikes--based on anticipated future expenses, rather than traditional rate-setting tied to current costs. Ron A. May just spoke on plan to get tax credit. He and other Execs are paid for this ("incentivized type of strategy").

Questions:

1. May Det. Edison (or DTE) begin increasing rates for these anticipated capital expenditures?

2. MPSC's investigation into Detroit Edison's A&G expenditures (Admin & General Expenses) identified extraordinary costs passed onto consumers at Nov. 2004 (see Case No. U-14666 and U-13808). Why would we expect responsible "anticipation of costs"? Det. Edison employees told me the Corp. Execs....

Note: Among DTE/MCN entities per SEC filings show Caymen Island entities (which may heed "avoid" taxes). (**0082-40** [B., M. J.])

Comment: What type of electricity generating equipment should we the utility customers of DTE invest in? We must consider both the costs and the benefits of the proposal before us and alternatives to it. Let's start with the costs. In the case of the proposed Fermi 3 nuclear power plant, the true costs include not only the very large financial costs of constructing , operating, decommissioning, and storing the radioactive waste from the plant, but also significant safety, environmental, and health consequences. These costs should be compared to the costs of solar and wind alternatives.

What about the benefits? The benefits include not only the electricity produced, but also the jobs and the profits associated with this project. Nuclear power may be better for profits, but solar and wind will provide more jobs in Michigan. (**0083-1** [Wolfe, Joan])

Comment: The USA is in deep recession. Many have lost their homes and jobs. Who will pay for Fermi? Will Detroit Edison pay for it all? I doubt it. Every nuclear facility that exists has been subsidized by taxpayers. The reactor of Fermi 3 is planned on being built in France. i.e. more job outsourcing. (**0083-33** [Barnes, Kathryn])

Comment: I am concerned about the larger financial risks associated with a new nuclear power plant in our community. The distinguished physicist and chief scientist of Rocky Mountain Institute, Amory Lovins, and research analyst Imran Sheikh published a report last year entitled The Nuclear Illusion. The authors price electricity from a new nuclear power plant at 14 cents per kilowatt hour and that from a wind farm at 7 cents per kilowatt hour. Both include the costs of fuel, capital, operations, maintenance, transmission and distribution. But in addition to its 14 cents per kilowatt hour, nuclear power requires funding for disposing of radioactive waste, for insuring plants against an accident, and for decommissioning plants when they wear out. These added costs are shouldered by taxpayers.

The Price-Anderson Act guarantees utilities protection against 98 percent of nuclear-accident liability. All U.S. utilities refused to generate nuclear power until the government provided this liability limit.

Lester Brown, the founder of Earth Policy Institute and prolific author, calls the economics of nuclear power flawed. The collective cap on nuclear operator liability is $10.2 billion, he writes. This compares with an estimate by Sandia National Laboratory that a worst-case accident could cost $700 billion. Anything above $10.2 billion would be covered by taxpayers. If utilities need this kind of protection, shouldn't taxpayers have it as well?

According to Kristin Shrader-Frechette, O'Neill Family Professor in the Department of Biological Sciences and Department of Philosophy at the University of Notre Dame, Standard and Poor's downgrades the rating of any utility that wants a nuclear plant. Forbes magazine recently called nuclear investment 'the largest managerial disaster in business history,' something pursued only by the 'blind' or the 'biased'.

The Nuclear Energy Institute reported to the US Department of Energy that 100 percent loan coverage by taxpayers is essential. Wall Street refuses to invest in nuclear power because the plants are assumed to have a 50 percent default rate. The only way that Wall Street will put their money behind these plants is if American taxpayers underwrite the risks. (**0083-35** [Seubert, Nancy])

Comment: Should we the customers of DTE assume the responsibility of paying for the costs of construction, operation, decommissioning, and long term storage of nuclear waste associated with the proposed Fermi 3 nuclear power plant? Can the residents and neighbors of southeast Michigan afford to reap the environmental and health consequences of nuclear power in their back yards?

We need to assess how the same funds could instead be used to develop and build a distributed wind and solar electricity generation, storage, and grid distribution system that could meet our electricity use needs with far less damaging environmental and health costs.

We need to ask whether there are less costly ways than the proposed Fermi 3 nuclear power plant to meet the electricity needs of the people of southeast Michigan, and we must assess who will bear the costs and who will reap the benefits. (**0083-7** [Wolfe, Joan])

Response: *The costs and benefits of construction and operation of the proposed Fermi 3 nuclear plant will be addressed in Chapter 10 of the EIS. NRC does not have authority or responsibility by law or regulation to ensure that the proposed plant is the least costly alternative to provide energy services under any particular set of assumptions concerning future circumstances. The EIS will consider (in Chapter 9) the potential for alternative non-nuclear technologies to provide the electricity that could be generated by the proposed plant and the environmental impacts of those alternatives. NRC is not involved in establishing energy policy. Rather, it regulates the nuclear industry to protect the public health and safety and the environment within existing policy. Therefore, issues such as the potential effect of a particular nuclear power investment on the future development and implementation of alternative technologies, subsidies for nuclear power, and characterization of financial risks associated with such projects are not within the scope of the NRC environmental review and will not be considered further in the EIS. The sufficiency of decommissioning funding is also outside the scope of environmental review; however, 10 CFR 50.75 requires licensees to provide reasonable assurance that funds will be available for the decommissioning process.*

Comment: Up until a few years ago, there had been no new nuclear power reactors ordered in North America since 1978. Reactor orders on this continent dried up for many reasons.

Reactors proved to be far more expensive than previously thought, and the costs proved notoriously difficult to control.

Construction times were so long that the building of each nuclear reactor simply added to the energy demand for a decade or more before useful energy could be produced, often too late to respond to the demand that had been perceived 10 or 15 years earlier.

The problem of safely guarding high-level radioactive wastes in perpetuity had not been properly appreciated or satisfactorily addressed.

The accumulation of over 200 million tons of radioactive tailings from uranium mining operations in the USA posed what the Wall Street Journal once described as an economic and environmental time-bomb.

The catastrophic potential of reactor accidents had not yet received the public attention that ensued from the Three Mile Island and Chernobyl reactor accidents.

The perilous link between Atoms for Peace and Atoms for War had not yet been demonstrated with the Indian atomic bomb explosion in 1974 (brought about using peaceful nuclear technology provided by Canada and the USA).

The enormous potential for meeting our energy needs through efficiency measures and through renewable sources of energy was not as evident as it is today.

We at CCNR believe that the Environmental Impact Statement prepared for a new reactor today should be required to address all these issues quite thoroughly and explicitly. (**0048-1** [Edwards, Gordon])

Response: *The impacts of construction and operation of the proposed Fermi 3 nuclear plant will be presented in Chapters 4 and 5 of the EIS. The impacts of accidents will be discussed in Chapter 5 of the EIS. The impacts of the uranium fuel cycle will be discussed in Chapter 6 of the EIS. Alternatives to the proposed action, including renewable energy sources and demand-side management, will be evaluated in Chapter 9 of the EIS. Benefit-cost balance will be discussed in Chapter 10 of the EIS.*

Comment: Where do you recognize that THERE IS NO NET GAIN OF ENERGY IN NUCLEAR POWER? (**0004-8** [Carey, Corinne])

Comment: As the NRC proceeds with the environmental impact analysis for this proposed plant, I implore you to include a comprehensive analysis of the potential economic benefits it will generate for MI and our region. This is clearly an essential component to assure balance in your final conclusions on the costs and benefits of the proposed plant. (**0010-5** [Mahoney, Charlie])

Comment: Fourth point: And the reason for moratorium is very high construction expenses. I heard that it would be costing DTE $1 billion to construct this Fermi 3 nuclear reactor. (**0058-30** [Pfeiffer, Jelica B.])

Comment: I'm here to address costs, both long term and short term. With the various subsidies, it's costing about to 30 cents per kilowatt hour out the gate. This is wholesale, not retail. (**0058-32** [Yascolt, Stas])

Comment: These serious environmental and health costs outweigh any potential benefits of building Fermi 3. (**0059-52** [Wolfe, Joan])

Comment: As the NRC proceeds with the environmental impact analysis for this proposed plant, I implore you to include a comprehensive analysis of the potential economic benefits it will generate for MI and our region. This is clearly an essential component to assure balance in your final conclusions on the costs and benefits of the proposed plant. (**0083-21** [Pitoniak, Gregory])

Comment: To help sell the idea of a new nuclear plant to the Monroe County public it stands to reason that DTE would draw on any perceived benefits the plant would have for the local area - one of these being that of the jobs created by the construction and operation of the plant. In this county, hard hit by layoffs and plant closings related to the automobile slump, the prospect of lots of new jobs would certainly peek public anticipation of a better economy. At first glance it would seem that DTE's promise of thousands of temporary construction jobs and many hundreds of permanent operational jobs should be taken as a great positive. But closer examination reveals a much less attractive picture. Competing for the same public support and financial resources is the renewable energy industry (solar, wind, etc.). In these tough economic times it must be asked, Which area of energy generation will benefit us most? Which will give the most bang for the buck?

One study (see www.environmentamerica.org/reports/election-2008-reports2/election-20008reports/john-mccain-nuclear-plans) used the example of the largest currently planned (2008) new nuclear plant, the Calvert Cliffs Unit 3 in Maryland. It is expected to generate 4000 temporary construction jobs and 360 permanent jobs. Assuming a typical cost for a nuclear plant to -be $7 billion, each of those construction jobs comes at a cost of $1.75 million, with the permanent ones at a whopping $19 million per job!

Another study (see reference in previous paragraph) states: According to the Nuclear Energy Institute, a 1000 MW nuclear plant creates 400-700 permanent jobs. Building a nuclear reactor would result in the creation of 1,400 -1,800 jobs during construction. Using the best of these numbers together, this works out to be almost $2.5 million per job.

DTEs own figures (as found in Ch. 4 of the NRC environmental report), indicate an estimated maximum of 2900 construction jobs and up to 700 permanent jobs during operation, for a total of 3,600 jobs. DTE estimates the cost of construction at $10 billion. This works out to be about $2.8 million per job, most of which would be temporary (less than 8 yrs). And who would pay for these very expensive nuclear jobs? DTE electrical customers through higher utility rates, of course.

By contrast, another study (see reference in paragraph two above) indicates that investing $100 billion in energy efficiency and renewable energy over two years would create 2 million jobs -that works out to be only $50,000 per job (or only $0.05 million per job). Still another study (see www.tarsandswatch.org, and find their Jan16, 2008 report) says: ...study after study has confirmed that a renewable energy sector produces many more jobs. Wind like solar, produces five times as much employment as nuclear per amount invested.

And what about those Monroe County automotive job losses-could those unemployed folks count on stepping into the nuclear construction jobs building a Fermi III? Not likely, unless they are experienced carpenters, iron workers, equipment operators, mechanical workers, electrical workers, boiler makers, pipe fitters, sheet metal workers, insulators, painters, or millwrights. How many would fit into one of these categories??

From what I've studied so far, it sure sounds like the construction and operation of Fermi III would be a real economic boondoggle! We'd be much better off to invest our resources in energy efficiency and renewable energy sources such as solar and wind. (**0083-36** [Mantai, Frank])

Response: *Costs and benefits of construction and operation of the proposed Fermi 3 nuclear plant will be presented in Chapter 10 of the EIS. Consideration will be given to the availability of various job skills in the region rather than assuming all skills are available in the local workforce.*

Comment: We also -- affordability remains an essential issue as well, and we understand as we transfer some of the responsibility for payments, more from corporations and financiers to citizens, the necessity to protect our most vulnerable citizens from some of the economic impact of these cost shifts. We understand that there are some programs that help the low income population to assure that they can -- affordability. And we serve as an advocate for a little bit of expansion of those, breaking the ties of assistance in the definition of the indigent who need help in purchasing needed energy, from the poverty level to a higher level of standard. That represents about 300 percent of the SSI level, which is the test that we're using more and more to really, truly, define those who have the greatest needs for the life sustaining supports and the technology needed to help people maintain their independence in this State. (**0058-136** [McGuire, Jim])

Response: *NRC's responsibility is to regulate the nuclear industry to protect the public health and safety and the environment. NRC is not involved in establishing and administering energy policy. This comment is outside the scope of the staff's environmental review and will not be considered further in the EIS.*

Comment: As a company who can lead the charge in even better energy production, I ask that you internalize the full environmental and social cost in the selling price so that consumers can identify choices that meet the highest social and environmental standards. (**0027-3** [Askwith, Annemarie])

Response: *The comment requests Detroit Edison to internalize environmental and social costs in the selling price of energy. As this is not within NRC's authority, the comment is outside the scope of the environmental review and will not be considered further. Costs and benefits of construction and operation of the proposed Fermi 3 nuclear plant will be presented in Chapter 10 of the EIS.*

Comment: One horsepower is 746 watts. When you consider how valuable electricity is. When I was young there was farm areas where my folks came from that were just getting the benefits of the rural electrification, and what a wonderment that is. And we have people who complain about the price of electricity. When you consider a horsepower hour is costing you about 9 cents, I don't think it's too much to complain about. (**0058-130** [Meyer, Richard])

Response: *This comment provides general support for the cost of nuclear power. The comment provides no new or significant information relevant to the staff's environmental review and will not be considered further in the EIS.*

Comment: I'd just like to say in conclusion, that I am greatly opposed as a taxpayer and as a ratepayer with the proposal that the burden of paying for this Fermi 3 plant should be on our shoulders as opposed to being funded by the stockholders. It's a very profitable company, and those who have stock, I would think, probably want profits. But I think we should put these other factors above profit, and that we should not have this come out the ratepayers. (**0058-102** [Holden, Anna])

Comment: USA is in deep recession. Many have lost their homes and jobs. Who will pay for Fermi? Will Detroit Edison pay for it all? I doubt it. Every nuclear facility that exists has been subsidized by taxpayers. The reactor of Fermi 3 is planned on being built in France. That is more job outsourcing. (**0059-19** [Barnes, Kathryn])

Response: *The comments relate to the costs of power generation that are passed on to customers. NRC's responsibility is to regulate the nuclear industry to protect the public health and safety within existing policy. NRC is not involved in establishing the rates paid by customers.*

Comment: I would like to ask you to let me and the citizens of Monroe, MI know how we are going to pay for the building of another plant, how we are going to pay the high costs of producing this form of energy (**0052-3** [Fedorowicz, Meg] [Fedorowicz, Meg])

Response: *The purpose of the EIS is to disclose potential environmental impacts of building and operating the proposed nuclear power plant. Neither the determination of the impact of building and operating a nuclear power plant on retail power rates, nor the impacts such potential rate changes may cause are under NRC's regulatory purview; therefore, these comments will not be considered further.*