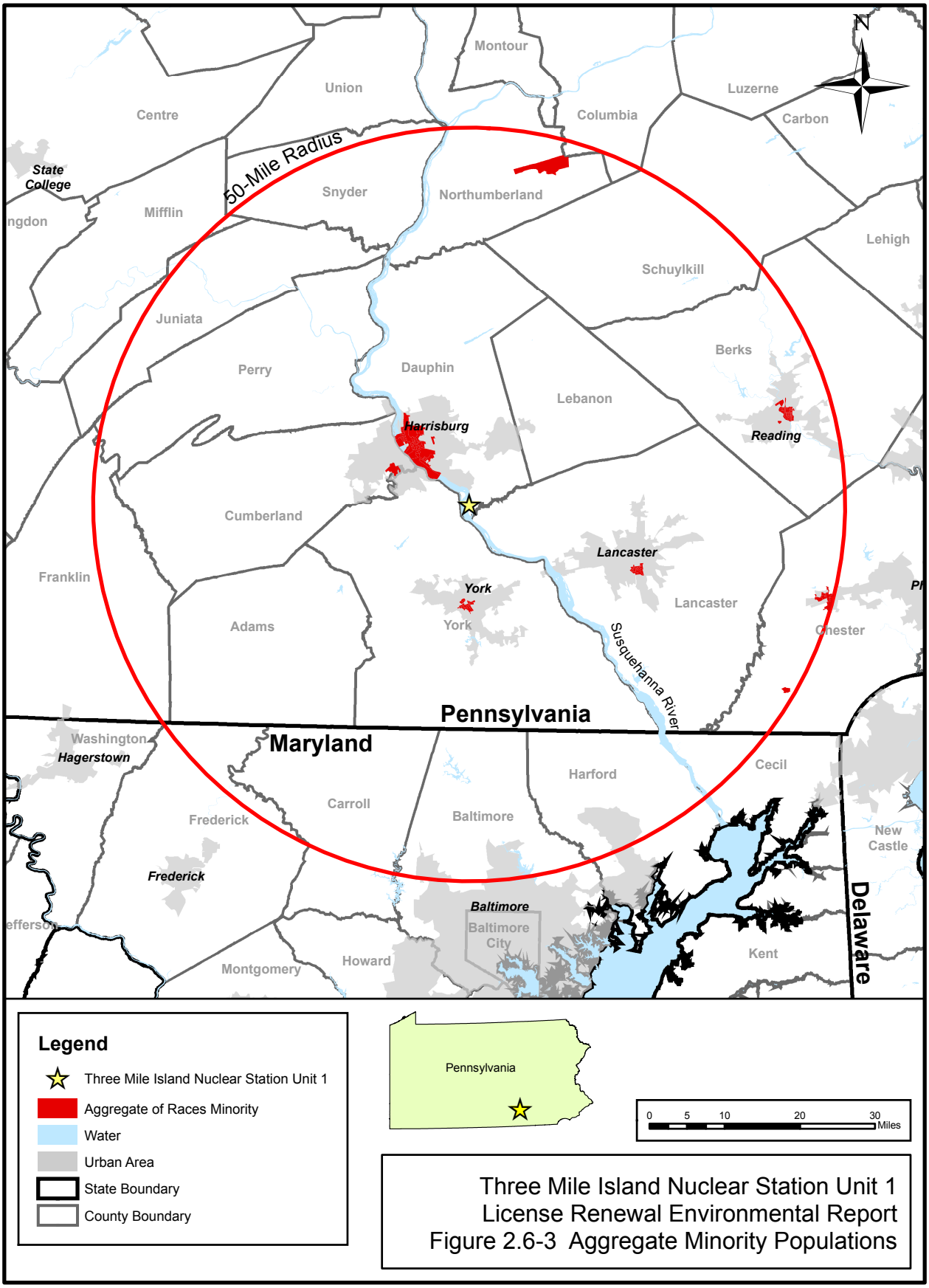
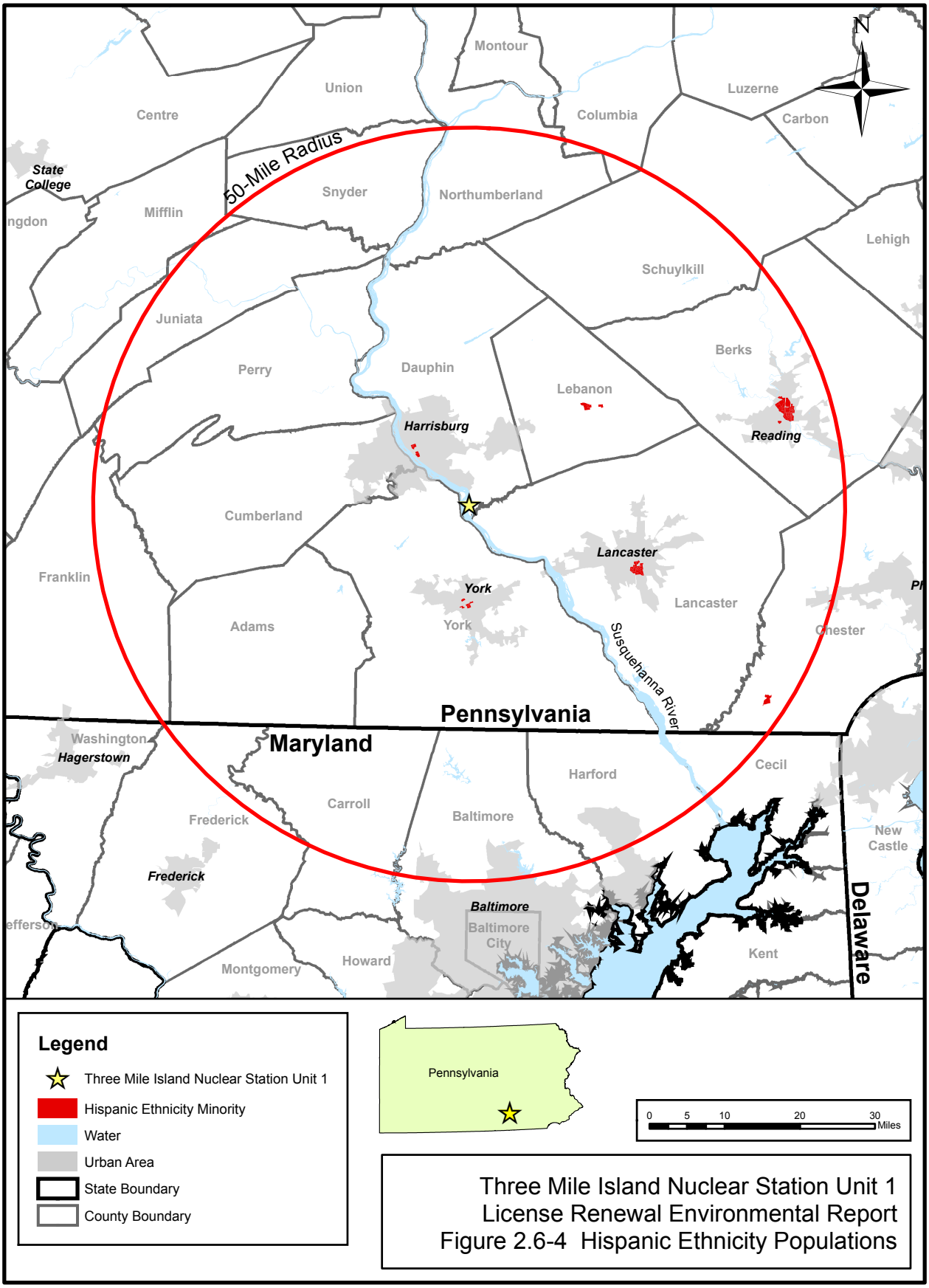
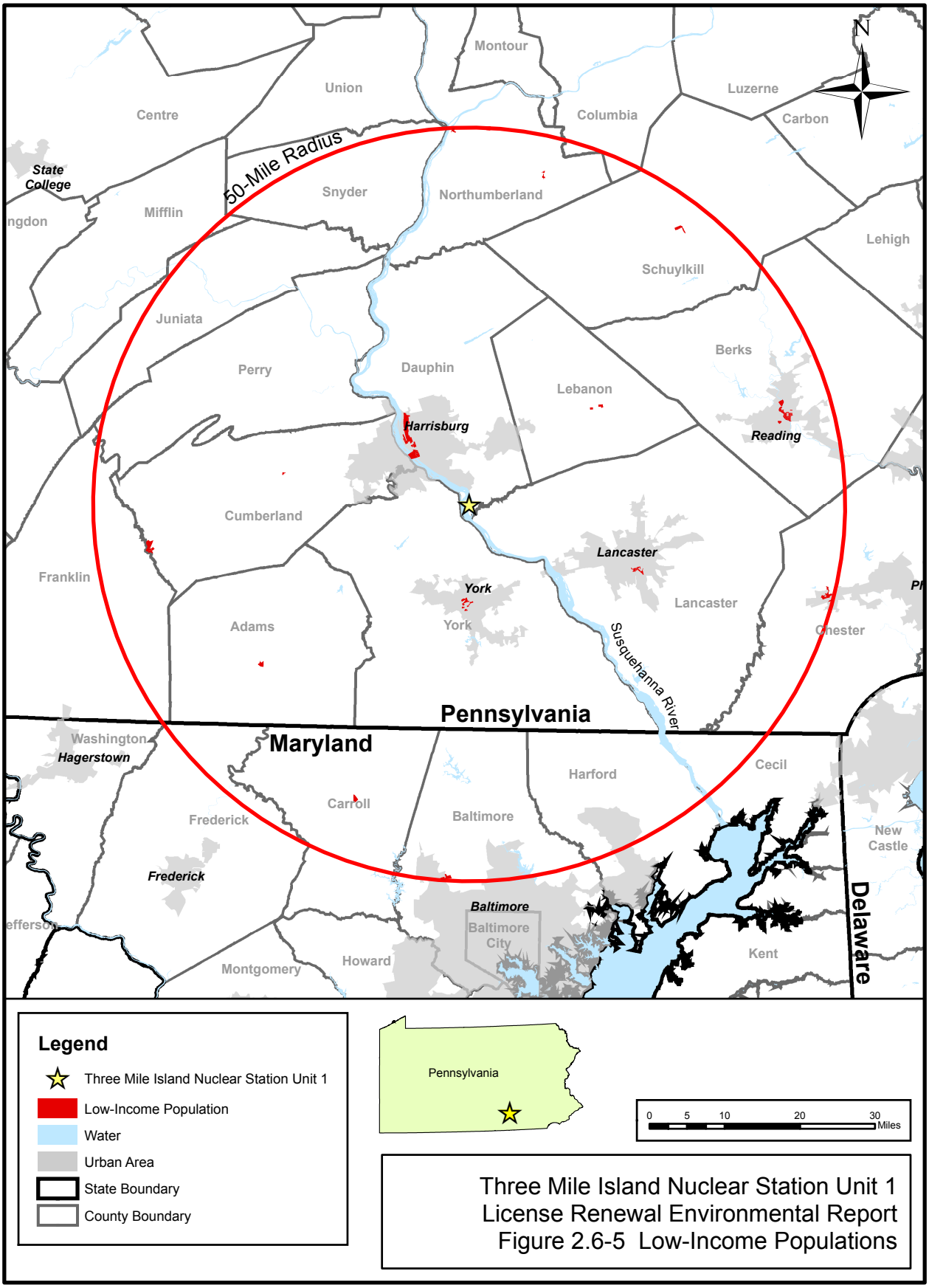

N
50-Mile Radius
Montour
Union
Centre
Columbia
Luzerne
Carbon
State College
Snyder
Northumberland
Mifflin
Lehigh
Schuylkill
Juniata
Berks
Perry
Dauphin
Lebanon
Harrisburg
Reading
Cumberland
Lancaster
Franklin
York
Lancaster
Adams
York
Susquehanna River
Pennsylvania
Maryland
Washington
Hagerstown
Harford
Cecil
Carroll
Baltimore
Frederick
New Castle
Frederick
Baltimore
Baltimore City
Delaware
Kent
Montgomery
Howard
Legend
Three Mile Island Nuclear Station Unit 1
Aggregate of Races Minority
Water
Urban Area
State Boundary
County Boundary
Pennsylvania
0 5 10 20 30
Miles
Three Mile Island Nuclear Station Unit 1
License Renewal Environmental Report
Figure 2.6-3 Aggregate Minority Populations


N
50-Mile Radius
Montour
Union
Centre
Columbia
Luzerne
Carbon
State College
Snyder
Northumberland
Mifflin
Lehigh
Schuylkill
Juniata
Berks
Perry
Dauphin
Lebanon
Harrisburg
Reading
Cumberland
Lancaster
Franklin
York
Lancaster
Adams
York
Susquehanna River
Pennsylvania
Maryland
Washington
Hagerstown
Harford
Cecil
Carroll
Baltimore
Frederick
New Castle
Frederick
Baltimore
Baltimore City
Delaware
Montgomery
Howard
Kent
Legend
Three Mile Island Nuclear Station Unit 1
Hispanic Ethnicity Minority
Water
Urban Area
State Boundary
County Boundary
Pennsylvania
0 5 10 20 30
Miles
Three Mile Island Nuclear Station Unit 1
License Renewal Environmental Report
Figure 2.6-4 Hispanic Ethnicity Populations


N
50-Mile Radius
Montour
Union
Centre
Columbia
Luzerne
Carbon
State College
Snyder
Northumberland
Mifflin
Lehigh
Schuylkill
Juniata
Berks
Perry
Dauphin
Lebanon
Harrisburg
Reading
Cumberland
Lancaster
Franklin
York
Lancaster
Adams
York
Susquehanna River
Pennsylvania
Maryland
Washington
Hagerstown
Harford
Cecil
Carroll
Baltimore
Frederick
New Castle
Frederick
Baltimore
Baltimore City
Delaware
Howard
Montgomery
Kent
Legend
Three Mile Island Nuclear Station Unit 1
Low-Income Population
Water
Urban Area
State Boundary
County Boundary
Pennsylvania
0 5 10 20 30
Miles
Three Mile Island Nuclear Station Unit 1
License Renewal Environmental Report
Figure 2.6-5 Low-Income Populations

2.13 REFERENCES

Note to reader: Some web pages cited in this document are no longer available, or are no longer available through the original URL addresses. Hard copies of cited web pages are available in AmerGen files. Some sites, for example the census data, cannot be accessed through their given URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by AmerGen have been given for these pages, even though they may not be directly accessible. Also, all references are specific to respective chapter.

AEC (U.S. Atomic Energy Commission). 1972. Final Environmental Statement related to the operation of Three Mile Island Nuclear Station, Units 1 and 2. Metropolitan Edison Company, et al. Docket Nos. 50-289 and 50-320. December.

Alliance for the Chesapeake Bay. undated. "Susquehanna River Fact Sheet." The Susquehanna and the Chesapeake Bay. Available at http://www.acb-online.org/pubs.cfm. Accessed July 22, 2004.

AmerGen (AmerGen Energy Company, LLC). 2004. Three Mile Island 2003 Annual Report, Record of Well Pumpage and Water Levels, Susquehanna River Basin Commission Permit No. 19961102.

AmerGen (AmerGen Energy Company, LLC). 2005. Three Mile Island 2004 Annual Report, Record of Well Pumpage and Water Levels, Susquehanna River Basin Commission Permit No. 19961102.

AmerGen (AmerGen Energy Company, LLC). 2006a. Three Mile Island 2005 Annual Report, Record of Well Pumpage and Water Levels, Susquehanna River Basin Commission Permit No. 19961102.

AmerGen (AmerGen Energy Company, LLC). 2006b. "Three Mile Island Updated Safety Analysis Report, Update 18." April.

AmerGen (AmerGen Energy Company, LLC). 2007a. Three Mile Island Nuclear Station Units 1 and 2 Annual Radiological Environmental Operating Report, 1 January Through 31 December 2006, Appendix F, "Annual Radiological Groundwater Protection Program Report, 1 January Through 31 December 2006." Middletown, Pennsylvania. April.

AmerGen (AmerGen Energy Company, LLC). 2007b. Automatic temperature monitoring data from TMI-1 Intake Screen Pumphouse and Discharge Monitoring Pit from August 2005 through September 28, 2007. Compiled by Ed Fuhrer, AmerGen, September 28.

ASME (American Society Mechanical Engineers). Undated. "#57 Kaplan Turbine (1929)." Available online at http://www.asme.org/communities/History/Landmarks_Kaplan_ Turbine_1929.cfm. Accessed February 1, 2007.

Backwoods Angler. 2006. "Waters We Fish." Available on line at http://www.backwoodsangler.com/The%20River's.htm.

BLM (Bureau of Land Management). 2007. Update on Bald Eagle protection requirements Under Applicable Laws and Regulations Post Endangered Species Act Delisting. August 30.

CAI (Commonwealth Associates, Inc.). 1981. Archeological Investigations at the Susquehanna Steam Electric Station. The Susquehanna SES Floodplain. Management Summary. R-2282B. Pennsylvania Power and Light Company. March 26.

Conestoga-Rovers (Conestoga-Rovers & Associates). 2006. Hydrogeologic Investigation Report, Fleetwide Assessment, Three Mile Island Generating Station, Middletown, Pennsylvania. September.

Conestoga-Rovers (Conestoga-Rovers & Associates). 2007. Estimated Mass Flux of Tritiated Groundwater to the Susquehanna River, Three Mile Island Generating Station, Middletown, Pennsylvania. October.

Dauphin County (Dauphin County Planning Commission). 2007. Draft Dauphin County Comprehensive Plan. Prepared by the Dauphin County Planning Commission, 2007 available at www.tcrpc-pa.org/dccompplan.asp. Accessed October 19, 2007.

DU (Ducks Unlimited). 2006. Pennsylvania, "Lower Susquehanna Focus Area". Available at www.ducks.org/Pennsylvania/PennsylvaniaProjects. Accessed on October 13, 2006.

Durlin and Schaffstall (Durlin, R.R. and W.P. Schaffstall). 2005. Water Resources Data Pennsylvania Water Year 2004, Water-Data Report PA-04-2, U.S. Geological Survey. May.

Exelon. 2004. Three Mile Island 2003 Annual Report, Record of Well Pumpage and Water Levels, Susquehanna River Basin Commission Permit No. 19961102.

Exelon. 2005. Three Mile Island 2004 Annual Report, Record of Well Pumpage and Water Levels, Susquehanna River Basin Commission Permit No. 19961102.

Exelon. 2006a. Three Mile Island 2005 Annual Report, Record of Well Pumpage and Water Levels, Susquehanna River Basin Commission Permit No. 19961102.

Exelon. 2006b. Radiological Groundwater Protection Program. CY-AA-170-400. December 16.

Exelon. 2007. TMI Radiological Groundwater Protection Program (RGPP) Sample Point Data and Standard Control Limits. CY-TM-170-4180, Revision 1. October 9.

Frederick, John. 2007. "Susquehanna River & Lower Juniata River, Angler Survey and Smallmouth Bass Tag Study". Available at http://www.fish.state.pa.us/images/fisheries/afm/2007/7x06_29tag.htm. Accessed October 12, 2007.

FWS (U.S. Fish and Wildlife Service). 2006. "Species Information, Threatened and Endangered Animals and Plants". Available at http://www.fws.gov/endangered/wildlife.html#Species. Accessed September 8, 2006.

Global Security. 2005. "Defense Depot Susquehanna, Pennsylvania (DDSP)." Available online at http://www.globalsecurity.org/military/facility/susquehanna.htm. Accessed October 11, 2007.

Hartman, L. 2000. "Susquehanna River for Muskie." Available on line at http://www.muskyamerica.com/.

Hoffman, J. 2006. "Susquehanna Large River Assessment Project" Publication 245, Watershed Assessment and Protection Division, Susquehanna River Basin Commission. August.

IA (Ichthyological Associates, Inc.). 1979. "An Ecological Study of the Susquehanna River Near the Three Mile Island Nuclear Station" Annual Report for 1978.

IA (Ichthyological Associates, Inc.). 1983. "An Ecological Study of the Susquehanna River Near the Three Mile Island Nuclear Station" Annual Report for 1982.

Jaworoski, E. Undated1. "The Susquehanna's Fabulous Smallmouth." Fly Fisherman. Available on line at http://www.flyfisherman.com/northeast/ejsusquehanna/index.html.

Jaworoski, E. Undated2. "Susky Smallmouth." Available on line at http://www.outdoors.net/site/features/feature.aspx+Forum+FlyFishing+ArticleCode+577.

Kleinschmidt. Undated. "York Haven Fish Passage Project." Available on line at: http://www.kleinschmidtusa.com/pds/fish_passage/yorkhaven.htm.

Lancaster County (Lancaster County Planning Commission). 1996. Lancaster County Water Resources Plan. Adopted November 20, 1996. Available online at http://www.co.lancaster.pa.us/planning/ cwp/view.asp?a=476&Q=387355. Accessed July 31, 2006.

Lancaster County (Lancaster County Planning Commission). 2005. Lancaster County 2005-2030 Long-Range Transportation Plan. Adopted by the Lancaster County Transportation Coordinating Committee on June 28, 2004, and the Lancaster County Board of County Commissioners on March 23, 2005. Available online at http://www.co.lancaster.pa.us/planning/cwp/ view.asp?a=478&Q=388860&PM=1. Accessed July 27, 2006.

Lancaster County (Lancaster County Planning Commission). 2006. The Growth Management Element of The Comprehensive Plan for Lancaster County, Pennsylvania prepared by the Lancaster County Planning Commission and Lancaster County Growth Management Update Task Force, April 2006, available at www.co.lancaster.pa.us/planning/lib/planning/balance_full_report.pdf. Accessed October 5, 2006.

Lindsey et al. (Lindsey, Bruce D., Kevin J. Breen, Michael D. Bilger, and Robin A. Brightbill). 1998. "Water Quality in the Lower Susquehanna River Basin, Pennsylvania and Maryland, 1992-95." U.S. Geological Survey Circular 1168.

Mangold, W. and Grace, T. 1987. "The Other Side of the Island: Additional Data on the Prehistoric Occupations of Three Mile Island." Presented at the Mid Atlantic Archaeological Conference Annual Meeting, Lancaster, Pennsylvania. April.

McLaren/Hart. 1998a. Confirmatory Sampling Soil and Groundwater Investigation, Three Mile Island Nuclear Station, Route 441, Londonderry Township, Pennsylvania. McLaren/Hart, Inc., September 24.

McLaren/Hart. 1998b. Facility Assessment Report, Three Mile Island Nuclear Station, Route 441, Londonderry Township, Pennsylvania. McLaren/Hart, Inc., September 9.

McNally, B. 1997. "Small Times on the Susquehanna." Available on line at http://www.boats.com/content/boat-articles.jsp?contentid=2284.

Nicewonger, R. 2002. "Susquehanna Smallmouth." Available on line at http://globalflyfisher.com/patterns/susquehanna/.

Normandeau Associates, Inc. 2007. Summary of Environmental Studies Near The Three Mile Island Nuclear Station. October.

NRC (U.S. Nuclear Regulatory Commission). 1989. "Programmatic Environmental Impact Statement related to decontamination and disposal of radioactive waste resulting from March 28, 1979 accident Three Mile Island Nuclear Station, Unit 2". NUREG-0683, Supplement No. 3, Docket No. 50-320. Washington D.C. August.

NRC (U.S. Nuclear Regulatory Commission). 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS). Volumes 1 and 2. NUREG-1437. Washington, DC. May.

NRC (U.S. Nuclear Regulatory Commission). 2001. "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues." Appendix D. NRR Office Instruction No. LIC-203. June 21.

NRC (U.S. Nuclear Regulatory Commission). 2005. Fact Sheet on the Accident at Three Mile Island, Available at: http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.pdf. Accessed September 28, 2006.

PADEP (Pennsylvania Department of Environmental Protection). Undated. Source Water Assessment Summaries for Luzerne and Columbia Counties 2002-2003. Available online at http://164.156.71.80/WXOD.aspx?fs=6f84d840f80b0000800000cf000000cf&ft=1 . Accessed March 29, 2005.

PADEP (Pennsylvania Department of Environmental Protection). 2005. "Survey Information. Water Supply Data for Dauphin and Lancaster Counties." Available online at www.drinkingwater.state.pa.us/dwrs/HTM/DEP_frm.html. Accessed May 3, 2006.

PADEP (Pennsylvania Department of Environmental Protection). 2007. "Pennsylvania's Peregrine DEP Falcon Page." Available online at http://www.dep.state.pa.us/dep/falcon/. Accessed on February 1, 2007.

PENNDOT (Pennsylvania Department of Transportation). 2004. PENNDOT Traffic Count Maps. Available online at http://www.dot.state.pa.us/Internet/Bureaus/pdPlanRes.nsf/infoBPRTrafficInfoTrafficVolumeMap. Accessed July 27, 2006.

Pennsylvania Fish & Boat Commission. Undated. Smallmouth Bass and Walleye Passage at Susquehanna River Dams 1997-2005. Available online at http://www.fish.state.pa.us/shad01/reports/2005/fish2005.htm.

Pennsylvania Power & Light Company. Undated. "PPL Brunner Island." Available online at http://www.pplweb.com/ppl+generatiion/coal+plants/ppl+brunner+island.htm. Accessed on November 3, 2006.

PGA (Pennsylvania General Assembly). Undated. "Pennsylvania History." Available online at http://www.legis.state.pa.us/WU01/VC/visitor_info/pa_history/pa_history.htm. Accessed August 19, 2004.

PHMC (Pennsylvania Historical and Museum Commission). Undated. "PA History." Available online at http://www.phmc.state.pa.us/bah/pahist/overview.asp?secid=31. Accessed August 19, 2004.

PHMC (Pennsylvania Historical and Museum Commission). 1977. "Early and Middle Woodland Campsites on Three Mile Island, Dauphin County, Pennyslvania." Pennsylvania Historical and Museum Commission, William Penn Memorial Museum. Harrisburg, Pennsylvania. January.

PHMC (Pennsylvania Historical and Museum Commission). 1999. "News Release. TMI 20th Anniversary Event to Feature Federal, State, and Local Officials. Historical marker to be unveiled." Available online at http://www.phmc.state.pa.us/news/phmcnews1999_10.htm. Accessed August 2, 2006.

PNHP (Pennsylvania Natural Heritage Program). 2006. "State Species List, Updated August 2006, All Species by Dauphin and York Counties". Available at http://www.naturalheritage.state.pa.us/AllSpecies.aspx. Accessed September 25, 2006.

PNHP (Pennsylvania Natural Heritage Program). 2007. "State Species List, updated December 2006, All Species by Lancaster County." Available at http://www.Naturalheritage.state.pa.us/ALLSpecies.aspx. Accessed on January 8, 2007.

Rand McNally. 2006. "Driving distance from Middletown, PA to Mystic Island, NJ". Available at www.randmcnally.com/rmc/directions. Accessed August 18, 2006.

RMC (RMC Environmental Services). 1990. An ecological study of the Susquehanna River near the Three Mile Island Nuclear Station. Annual Report for 1989. March.

RMC (RMC Environmental Services). 1991. An ecological study of the Susquehanna River near the Three Mile Island Nuclear Station. Annual Report for 1990. March.

Smithsonian Environmental Research Center. 2003. "Susquehanna River." Available at http://www.serc.si.edu/watershed/december2001/susquehannariver.htm. Accessed July 22, 2004.

SRBC (Susquehanna River Basin Commission). 1999. GPU Nuclear, Inc. Application 19961102 (Revised), January 14.

USCB (U.S. Census Bureau). 1990. H005. Vacancy Status – Universe: Occupied Housing Units. Data Set: 1990 Summary Tape File 1 (STF 1) 100-Percent Data. Available online at http://factfinder.census.gov/. Accessed July 3, 2006.

USCB (U.S. Census Bureau). 1995. Population of Counties by Decennial Census 1900 to 1990, March 27, 1995, U.S. Census Bureau available at www.census.gov, accessed October 5, 2006.

USCB (U.S. Census Bureau). 2000a. "P1. Total Population [1] – Universe: Total Population. Data Set: Census 2000 Summary File 1 (SF1) 100-Percent Data." Available online at http://factfinder.census.gov/. Accessed May 2, 2006.

USCB (U.S. Census Bureau). 2000b. QT-H1, General Housing Characteristics: 2000. Data Set: Census 2000 Summary File 1 (SF 1) 100-Percent Data. Available online at http://factfinder.census.gov/. Accessed July 5, 2006.

USCB (U.S. Census Bureau). 2003. "Table 3b. Population in Metropolitan and Micropolitan Statistical Areas Ranked Separately by 2000 Population for the United States and Puerto Rico: 1990 and 2000." Available online at http://www.census.gov/. Accessed May 2, 2006.

USCB (U.S. Census Bureau). 2005. State and County Quick Facts, People Quick Facts, Dauphin and Lancaster Counties, July 1, 2005, U.S. Census Bureau available at www.census.gov, accessed October 5, 2006.

USCB (U.S. Census Bureau). 2006. State and County Quickfacts. Dauphin and Lancaster Counties, Pennsylvania. Available online at http://www.census.gov/. Accessed July 7, 2006.

USDOI (U.S. Department of the Interior). 2006. National Register of Historic Places. Available online at http://www.nr.nps.gov/. Accessed April 24, 2006.

USEPA (U. S. Environmental Protection Agency). 2006. EPA – Envirofacts Warehouse – Quick Start. Dauphin, Lancaster, and York Counties, PA. Available online at http://oaspub.epa.gov/enviro/ef_home3.html?p_zipcode=Dauphin%2C+PA&p_type=county&x=9&y=8. Accessed August 10, 2006.

WHC (Wildlife Habitat Council). 2005. "Site Assessment and Wildlife Management Opportunities Report for Exelon Corporation's Three Mile Island Generating Station." October.

York County (York County Planning Commission). 2006. "York County Growth Management Plan". Available at www.ycpc.org. Accessed on October 13, 2006.

Chapter 3

The Proposed Action

NRC

"…The report must contain a description of the proposed action, including the applicant's plans to modify the facility or its administrative control procedures…. This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment…." 10 CFR 51.53(c)(2)

AmerGen Energy Company, LLC (AmerGen) proposes that the Nuclear Regulatory Commission (NRC) renew the operating license for Three Mile Island Nuclear Station Unit 1 (TMI-1) for an additional 20 years. Renewal would give AmerGen and the Commonwealth of Pennsylvania the option of relying on TMI-1 to meet future electricity needs. Section 3.1 discusses the plant in general. Sections 3.2 through 3.4 address potential changes that could occur as a result of license renewal.

3.1 GENERAL PLANT INFORMATION

General information about TMI-1 is available in several documents. In 1972, the U.S. Atomic Energy Commission published the Final Environmental Statement (FES) related to the operation of Three Mile Island Nuclear Station Units 1 and 2 (AEC 1972). The Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (NRC 1996) describes TMI-1 features and, in accordance with NRC requirements, AmerGen maintains the Final Safety Analysis Report for TMI-1 (AmerGen 2006a). AmerGen has referred to each of these and additional documents while preparing this environmental report for license renewal. Refer to Figure 3.1-1 for the general plant layout.

3.1.1 REACTOR AND CONTAINMENT SYSTEMS

TMI-1 is a pressurized water reactor (PWR) plant with a once through steam generator system. United Engineers and Constructors were the original plant construction contractors and Gilbert Associates was the architect-engineer. The nuclear steam supply system was supplied by Babcock and Wilcox. Commercial operation for TMI-1 began on September 2, 1974 (AmerGen 2006a). The initial core thermal power was 2,535 megawatts-thermal (MWt). The power rate was increased in July 1988 to 2,568 MWt following the seventh refueling outage (AmerGen 2006b).

The TMI-1 nuclear steam supply system consists of the reactor vessel, two vertical once through steam generators, four reactor coolant pumps, an electrically heated pressurizer, and interconnected piping. The steam generators are vertical, straight-tube-and-shell heat exchangers that produce superheated steam on their shell sides at a constant pressure over the power range. This design prevents fission products and activated corrosion products, which may be present in the reactor coolant water, from entering the steam used to drive the plant's turbines. Reactor coolant flows downward through the tubes and transfers heat to generate steam on the shell side. Within the shell, the tube bundle is surrounded by a cylindrical baffle. There are openings in the baffle at the feedwater inlet nozzle to afford contact feedwater heating. Emergency feedwater is supplied through an auxiliary feedwater ring located at the top of the steam generator to assure natural circulation of the reactor coolant following the unlikely event of the loss of all reactor coolant circulating pumps (AmerGen 2006a).

The primary containment is the reactor building and its associated isolation systems. The reactor building consists of a reinforced concrete slab and structure with cylindrical wall, a flat foundation mat, and a shallow dome roof. The 3-foot concrete cylindrical wall is prestressed with a post-tensioning system in the vertical and horizontal directions. The dome roof is prestressed using a three way post-tensioning system. The inside surface of the reactor building is lined with a carbon steel liner ¾ inch thick for the cylinder and dome and ¼ inch thick for the base (AmerGen 2006a).

The reactor fuel is sintered low-enriched uranium dioxide cylindrical pellets. The pellets are sealed in zirconium-based alloy tubing and caps. All fuel rods are internally prepressurized with helium (AmerGen 2006a).

The containment systems and their engineered safeguards are designed to ensure that offsite doses resulting from postulated accidents are well below the guidelines in 10 CFR 100, *Reactor Site Criteria*.

3.1.2 COOLING AND AUXILIARY WATER SYSTEMS

At TMI-1, the Circulating Water System and service water systems draw from the Susquehanna River and cooling tower blowdown is discharged to the same river downstream from the intake structure. Onsite groundwater wells are also utilized for cooling water makeup, domestic water consumption, and other industrial purposes. The following subsections describe the water systems at TMI-1.

3.1.2.1 Surface Water

TMI-1 has a permit with the Susquehanna River Basin Commission for consumptive use of river water up to 18 million gallons per day, on a 30 day average, for electric generation. To comply with permit requirements, TMI-1 participates in the Cowanesque Reservoir water allocation project, which will allow discharge of stored water in the event of a drought condition protecting TMI-1 from a shutdown during a drought emergency in the Susquehanna River (McLaren/Hart 1998).

The TMI-1 Intake Screen and Pump House (ISPH) structure is located on the western bank of the island. The ISPH structure houses plant river water pumps that take suction from the Susquehanna River (AEC 1972).

3.1.2.2 Circulating Water System

TMI-1 utilizes two hyperbolic natural draft cooling towers for dissipating the heat rejected from the plant steam cycle. In addition to this major heat load, there are several other cooling systems that dissipate heat from other portions of the plant. The condensing equipment consists of a single-pass main condenser and two-pass units for the auxiliary condensers. Makeup water for cooling tower evaporation, wind loss, and blowdown are obtained from the Open Cycle Cooling Water System. River water used in the Circulating Water System enters the intake structure, passes under a skimmer wall, through automated trash racks with 1-inch vertical bar spacing, through traveling screens with 3/8-inch mesh, through the river water pumps, and finally through strainers of 1/8-inch mesh before passing to the heat exchangers. The intake structure is also equipped with a deicing line for operation during subfreezing weather. After passing through the secondary services coolers, river water is mixed with circulating water in the circulating pumps. The flow velocity at the Intake Structure under normal operating conditions is 0.2 feet per second. The maximum withdrawal of makeup water for cooling tower losses is 15,250 gallons per minute (gpm). Under normal operations, approximately 12,250 gpm is withdrawn. The circulating water pump building contains six circulating water pumps that are arranged so three pumps discharge water into each of the 102-inch-diameter mains. The Circulating Water System is equipped with a chemical injection system for controlling bacterial and algae growth and corrosion. Cooling tower blowdown at a normal rate of 3,000 gpm (maximum of 6,000 gpm) is combined with the Open Cycle Cooling Water and discharged to the Susquehanna River through a 48-inch-diameter river discharge line. The intake water pumping systems are designed to pump under three river conditions: (1) loss of the York Haven Dam; (2) the normal river elevation of 278 foot; and (3) flood levels. (AmerGen 2006a, 2007).

3.1.2.3 Groundwater Resources

To reduce operations and maintenance costs at TMI-1 associated with clarifying river water in the Pre-Treatment System, three groundwater service wells, (A, B, and C), were installed in 1996 to supplement industrial water withdrawn from the Susquehanna River (Figure 3.1-1). The groundwater is used for station fire service, makeup to the demineralized water system, bearing lubrication for the screen house

pumps, and service water for other buildings and equipment (McLaren/Hart 1998).

There are two drinking water wells, (OSF and 48S), located north of the TMI-1 reactor building. The drinking water treatment system is permitted by the Pennsylvania Department of Environmental Protection. Dilute orthophosphate solution can be added to the drinking water by an automatic pump system at each well house. Zinc orthophosphate solution is added to the system to control corrosion and reduce concentrations of lead and copper. Sodium hypochlorite solution is periodically added as a biocide. If it is not needed to supply drinking water, the OSF well may be used to augment the supply of service water from wells A, B, and C (McLaren/Hart 1998).

AmerGen operates a sanitary wastewater treatment facility with a design capacity of 80,000 gpd (gallons per day). The typical daily flow at the facility is between 10,000 and 15,000 gpd. However, during outages the maximum flow approaches 40,000 gpd. The facility is adequately sized to meet all projected outages.

3.1.3 TRANSMISSION FACILITIES

The Updated Final Safety Analysis Report (AmerGen 2006a) identifies four 230-kilovolt (kV) transmission lines that connect TMI-1 to the electric grid. Two of these lines connect the plant with the existing substation at Middletown Junction, east of the Susquehanna River. Each of these lines extends for 1.5 miles. A third line extends for 4.1 miles to the west side of the Susquehanna River, where it connects to a 230-kV line terminating into Jackson Substation.

The fourth 230-kV line extends to the TMI-1 500-kV Substation. Inside the substation the voltage is converted to 500-kV with a 230/500-kV autotransformer, which is connected to the FirstEnergy 500-kV grid.

Figure 3.1-2 is a map of the TM-1I transmission system.

- Line No. 1091 – TMI-1 to Middletown Junction – This 230-kV line operated by FirstEnergy Corporation extends northeast for 1.5 miles in a 150-foot wide corridor to the Middletown Junction Substation near Middletown.

- Line No. 1092 – TMI-1 to Middletown Junction – This 230-kV line operated by FirstEnergy Corporation extends northeast for 1.5 miles in a 150-foot wide corridor to the Middletown Junction Substation near Middletown.

- Line No. 1051 – TMI-1 to Jackson Substation – This 230-kV line operated by FirstEnergy Corporation extends southward for 4.1 miles in a 150-foot wide, arcing corridor to the Jackson Substation near Jackson, west of the Susquehanna River.

- Line from TMI-1 to the 500-kV Substation – This 230-kV line shares the first four towers with the TMI-1 to Jackson Substation line. The line extends southeast for 0.7 miles and connects to the 500-kV Substation.

In total, the transmission lines of interest to Section 4.13 are contained in approximately 5.6 miles of corridor that occupy approximately 142 acres. The TMI-1 to Middletown Junction lines has adjacent corridors. The corridors pass through land that is primarily agricultural or forested, but also pass over residential and urban areas. The areas are mostly remote with low population densities. Corridors that pass through pastures generally continue to be used as pastures. Each of the lines crosses State Route 441 after leaving the switchyard. The TMI-1 to Jackson Substation Line also crosses several smaller roads. FirstEnergy Corporation owns and operates these transmission lines, which connect TMI-1 to the PJM regional transmission system. These

transmission lines would remain under FirstEnergy's ownership and would most likely stay in service after TMI-1 is decommissioned.

The transmission lines were designed and constructed in accordance with the National Electrical Safety Code (for example, IEEE 1997) and other industry guidance that was current when the lines were built. Ongoing surveillance and maintenance of these transmission facilities ensure continued conformance to design standards. These maintenance practices are described in Section 4.13.

3.1.4 WASTE MANAGEMENT AND EFFLUENT CONTROL SYSTEMS

3.1.4.1 Radioactive Waste

TMI-1 radioactive waste (radwaste) systems are designed and constructed to contain, control, and release or dispose of radioactive byproducts generated as a result of normal and emergency operation of the plant. The byproducts are activation products resulting from the irradiation of reactor cooling water and impurities therein (principally metallic corrosion products) and fission products resulting from defective fuel cladding or uranium contamination within the reactor coolant system. Table 3.1-1 contains a list of the radwaste systems at TMI-1.

The liquid waste disposal system, the waste gas system, and the solid waste disposal and packaging system are described more fully below. These descriptions, unless otherwise specified, are derived from Chapter 11, "Radioactive Waste and Radiation Protection," in the TMI-1 *Updated Final Safety Analysis Report* (i.e., AmerGen 2006a).

Radioactive Liquid Waste Disposal System

The radioactive liquid waste disposal system provides operating service functions to the reactor coolant system and spent fuel pool, allowing recovery of concentrated boric acid and purified water from the reactor coolant, the refueling water, and the spent fuel pool water. In addition, the radioactive liquid waste disposal system collects, contains, and processes miscellaneous wastes for reuse and disposal. Such wastes include wastes from laboratory drains, wastes from building drains and sumps, wastes from equipment drains and sumps, wastes from regeneration of deborating resins, spent resins from demineralizers, used precoat from precoat filters, potentially radioactive wastes from showers and the laundry, and potentially radioactive oil.

The major equipment components of the liquid waste disposal system are tanks, pumps, precoat filters, demineralizers, evaporators, coolers, and floor and equipment drains with associated sumps and piping. Except for potentially radioactive oil, radioactive liquid wastes are (1) routed through evaporators and demineralizers, (2) collected in the waste evaporator condensate storage tanks, and (3) either reused or discharged into the effluent from the cooling water basin, which is released to the Susquehanna River pursuant to the TMI-1 technical specifications and NPDES permit. Releases of liquid radwaste to the river are on a batch basis with activity analyses (including an isotopic breakdown) being performed for each batch prior to release. A minimum cooling water effluent flow rate of 5,000 gpm is maintained from the open-cycle cooling water system during releases. The actual cooling water flow rate during each individual batch release is determined based on the activity analyses for the liquid radwaste in the batch. The flow rate during a batch release is controlled to ensure that the activity in the discharge does not

exceed the specifications in the TMI *Offsite Dose Calculation Manual* (AmerGen 2006c).

Discharges of liquid radwaste to the Susquehanna River are initiated in accordance with strict administrative procedures. The liquid radwaste is combined with open-cycle cooling water in a mixing chamber before being discharged to the river. The mixture enters the river approximately 600 feet downstream from the river water intake structure.

Concentrated wastes are collected in storage tanks and managed in the solid waste packaging and disposal system.

Potentially radioactive oil is collected in a 700-gallon tank. Depending on the results of tank sampling, the oil may be drained from the tank, solidified (see the discussion below describing the solid waste packaging and disposal system), and managed as low-level radioactive waste. Alternatively, it may be managed as non-radioactive waste oil.

Waste Gas System

The radioactive waste gas system collects and stores gases that emanate from reactor coolant water in tanks and equipment where such gases may accumulate. The system design provides a blanket of inert nitrogen gas in which to collect such gases. These gases consist primarily of hydrogen with small amounts of gaseous fission products and activated dissolved gases. The gas mixture (i.e., nitrogen, hydrogen, and radioactive gases, including isotopes of krypton, xenon, and iodine) collected in the radioactive waste gas system is compressed and stored for decay of the radioactive components prior to release to the atmosphere.

During normal operation, three waste gas decay tanks each provide a 30-day minimum storage period for radioactive decay before the gases they contain are released to the atmosphere. Each tank is filled until it reaches 80 psig, which is the design discharge pressure for the waste gas system compressors. At 80 pounds per square inch (psig), an automatic sequencing system preferentially selects a new waste gas decay tank for filling based on tank pressures and whether gases are discharging from other available tanks at that time. The tanks are each equipped with a relief valve that activates if tank pressure exceeds 85 psig. The design pressure of the high-pressure waste gas system piping and other components is 150 psig. Consequently, rupture and major failure resulting from overpressure of piping and other components of the high-pressure portion of the waste gas system are not considered credible. Accidental discharges resulting from the relieving of a waste gas decay tank or compressor relief valve also are not considered credible because the operator would have approximately 8 minutes between receipt of the alarm that the automatic sequencer had not transferred waste gas flow to a fresh tank and activation of the relief valve on the overfilled tank. This time is considered sufficient for the operator to either bring an alternative tank on-line or terminate gas flow into the vent header system.

Shortly after a tank is full (i.e., it has been filled to 80 psig), the compressed waste gases within the tank are sampled and analyzed. Administrative approval, based on the results of such analyses, is required before initiating release to the atmosphere of the waste gases stored in the tank. When stored gas is to be released, double monitoring prior to the release is required to assure compliance with the exposure limits at the site boundary, as established in 10 CFR 20, “Standards For Protection Against Radiation,” and to verify compliance with 10 CFR 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 Solid Waste Packaging and Disposal System

Radioactive solid wastes being shipped off-site from TMI-1 fall into five general categories:

- Concentrated liquid waste (evaporator bottoms)
- Used precoat (spent powdered resin)
- Spent resin (bead type)
- Dry compactable trash
- Dry non-compactable trash

Dry compactable trash is either compacted on site (to reduce volume), or shipped to an offsite processor for decontamination and/or compaction prior to recycle or disposal.

An on-site radioactive waste solidification system using cement is available to solidify concentrated liquid wastes. The solidification is accomplished by pumping the quantity of waste to be solidified into a lined shipping container that has an internal mixer associated with the liner. The mixer is started and cement is added. Mixing continues until the mixer motor current increases, which indicates that the mixture is beginning to set. Following visual and tactile verification of solidification, the liner and container are closed and either temporarily stored or transported to a licensed low-level radioactive waste disposal facility. The U.S. Department of Transportation (DOT) has approved pre-shielded containers of this type for shipping low-level radioactive wastes.

Depending on applicable regulatory requirements, used precoat and spent resins may also be solidified using the radioactive waste solidification system. Like the concentrated liquid wastes, these solidified wastes are also packaged in pre-shielded DOT-approved containers, temporarily stored on site until being shipped to a licensed low-level radioactive waste disposal facility.

When the regulations do not require that evaporator bottoms, used precoat, or spent resin be solidified, such wastes are properly dewatered, packaged directly into DOT-approved containers (without solidification), and temporarily stored until transported to a licensed, off-site processor for volume reduction and/or disposal in low-level radioactive waste disposal facility.

If waste oil is sufficiently contaminated with radioactive material, it too is managed in the radioactive waste solidification facility.

3.1.4.2 Nonradioactive Waste

Nonradioactive waste is produced from plant maintenance, cleaning and operational processes. The majority of the nonradioactive waste generated at TMI-1 consists of process wastewater and nonhazardous plant trash. Other nonradioactive industrial wastes generated at TMI-1 include discarded surface coatings, glycols/antifreeze, spent oil filters, grease, oil-contaminated soil and debris, nonhazardous waste oil, and other chemical wastes. Universal wastes, such as spent fluorescent bulbs and batteries common to any industrial facility are also generated at TMI-1.

Nonradioactive wastes classified as hazardous under Subtitle C of the Resource Conservation and Recovery Act routinely make up a very small percentage of the total wastes generated at TMI-1. Such wastes include spent and off-specification (e.g., shelf life expired) chemicals, laboratory chemical wastes, and occasional project-specific wastes. Because it generates less than 100 kilograms per month of these wastes, TMI-1 is categorized as a small quantity generator of hazardous waste under federal and state regulations (40 CFR 62, “Standards Applicable to Generators of Hazardous Waste”; 25 PA Code 262a).

3.2 REFURBISHMENT ACTIVITIES

NRC

"The report must contain a description of … the applicant's plans to modify the facility or its administrative control procedures as described in accordance with § 54.21...This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment…." 10 CFR 51.53(c)(2)

"The environmental report must contain analyses of …refurbishment activities, if any, associated with license renewal…" 10CFR51.53(c)(3)(ii)

"…The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories…(2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item...." (NRC 1996, Section 2.6.3.1)

NRC regulations at 10 CFR 51 do not define a "refurbishment activity," but Section 2.6.2.6 in the GEIS explains that, for the purpose of license renewal, refurbishment activities encompass actions that typically take place only once in the life of a nuclear plant, if at all (NRC 1996). Examples of refurbishment activities provided in this GEIS section include pressurized water reactor steam generator replacement, if it would not have to be performed during the current license term, but is elected by the licensee to enable safe and economic operation for the incremental term allowed with license renewal. Because the situation at TMI-1 is consistent with this example, AmerGen is analyzing steam generator replacement in this environmental report as a refurbishment activity, pursuant to 10 CFR 51.53(c)(3)(ii).

AmerGen plans to replace the two TMI-1 steam generators with enhanced once-through steam generators. Replacement activities are expected to last approximately 70 days and be conducted sometime between October 2009 and date on which the existing operating license expires.

Each steam generator consists of straight-tube heat exchangers that convert heat from the reactor coolant system into steam to drive the turbine generators and produce electricity. The straight-tubes in the original steam generators are made of alloy 600MA. This alloy degrades over time as a result of a variety of corrosion and mechanical factors. Alloy 600MA degradation affects both of the steam generators at TMI-1. Accordingly, AmerGen has determined that they should be replaced with steam generators that use alloy 690TT tubing material, which has improved resistance to stress corrosion cracking.

The replacement steam generators will be dimensionally equivalent to the original steam generators, with the incorporation of numerous design enhancements that will minimize the number of pressure vessel welds, thereby improving inspectability. In conjunction with the steam generator replacement, the hot leg elbows, portions of the piping, and all existing steam generator insulation will be replaced. The steam generator blowdown system capacity also will be increased. Most of these activities

would be performed inside existing structures.

The replacement steam generators will be manufactured in Chalon/St Marcel, France by Areva NP and transported to TMI-1. The transport is expected to involve the following steps:

- River transport from the Areva NP St Marcel plant to Fos S/Mer harbor (near Marseille).
- Ocean transport from Fos S/Mer harbor to a U.S. port of call, which may be Baltimore, Newark, or Philadelphia.
- A combination of barge, rail, and/or road transport from the U.S. port of call to TMI-1, using one of the following options:
  - Barge from Baltimore, MD through the Chesapeake Bay and up the Susquehanna River to Port Deposit, MD. Then, rail or road to TMI-1;
  - Rail and/or road from Baltimore, MD to TMI-1;
  - Rail and/or road from Philadelphia, PA to TMI-1;
  - Rail and/or road from Newark, NJ to TMI-1.

A vendor will be selected to perform a detailed transportation study that will be the basis for establishing the final transportation plan in June 2008. Regardless of which option is selected for transporting the replacement steam generators within the U.S., all federal, state, and local requirements would be met for associated activities, which may include any or all of the following:

- Dredge or fill activities;
- Temporary or permanent removal of interferences, such as narrow tunnels and low-hanging overhead lines; and
- Movement of wide and heavy loads over railways and roadways.

Once the replacement steam generators arrive at TMI-1, they will be transported on-site by a self-propelled modular transporter. Each replacement steam generator would be loaded onto a heavy-duty self-propelled modular transporter and moved to a steam generator storage facility (described below) that will be constructed at TMI-1 (Figure 3.1-1).

To perform the steam generator replacement, a temporary opening approximately 26 feet by 25 feet will be created in the containment building directly above the existing equipment hatch. The containment building is composed of reinforced concrete walls over three feet thick with an interior steel liner and is tensioned with horizontal and vertical tendons (AmerGen 2006a). The process of creating the opening will include activities such as de-tensioning and removing tendons, removing concrete, cutting rebar, and cutting and removing a section of the steel liner. A hydro-demolition (high pressure water) process and other mechanical methods will be used to remove the concrete and cut the liner. After steam generator replacement, the opening will be sealed and the containment building returned to its original configuration and integrity.

The two original steam generators will be removed from the containment building through the temporary opening. First, however, they must be drained and cut away from existing piping and supports. Steel covers would be seal-welded to the nozzles of main coolant, steam, and feedwater piping openings of the original steam generators to seal off internal sections. Loose contamination would be removed from the exterior of each original

steam generator and a coating would be applied to affix any remaining contamination.

Once removed from the containment building, the original steam generators will be transported to the new steam generator storage facility. Meanwhile, the replacement steam generators will be removed from the storage facility and moved to the vicinity of the TMI-1 containment building. Installation would include construction of supports, connection of piping, and testing of system integrity.

Site planning, construction of facilities, modification of existing buildings, and other preparation activities will occur at TMI-1 prior to removal of the original steam generators from the TMI-1 containment building. The only new permanent facility will be the new steam generator storage facility. Temporary facilities for offices, fabrication activities, mock-up activities, weld testing, warehouse areas, and lay down areas will be used. A 4,500 square foot fabrication/weld test shop would be erected between the south flood dike and the vehicle barriers east of the gas bottle storage building. While the building would be removed following the project, the concrete floor slab at grade will remain. A 6,000 square foot decontamination facility will be located across the road from the TMI-1 intake structure. A slab will not be poured for this building so it will be removed in its entirety after the steam generators have been replaced. All other temporary facilities will either use portions of existing TMI-1 structures and facilities or will consist of temporary structures located within the developed industrial area of the site.

AmerGen estimates that the total area disturbed by construction, decontamination, and laydown activities would be less than 10 acres, all of which would be previously disturbed property within the bounds of the TMI-1 flood protection dike. The small amount of disturbed area and implementation of best management practices (e.g., watering, silt fences, covering soil piles, hydro-demolition, etc.) would minimize the amount of fugitive dust generated by refurbishment activities.

Construction activities would result in noise levels (primarily from hydro demolition) greater than those associated with normal TMI-1 operation. Noise from construction activities would be intermittent and temporary in nature, and would decrease as the distance from the source increases.

The peak period of activity would occur when the actual removal and replacement of the steam generators take place. AmerGen anticipates that up to 900 additional workers would be on site at that time. In comparison, 1,400 additional workers are required for a regular refueling outage.

AmerGen has determined that the most cost effective method for managing the original steam generators is to store them on site in a dedicated storage facility and then disposition them along with the remaining plant equipment when TMI-1 is decommissioned. The steam generator storage facility would consist of a 6,000 square foot building with approximate dimensions of 100 feet long by 60 feet wide by 30 feet high. The building would be located within the flood dike, which is part of the previously disturbed, developed industrial area of the site (Figure 3.1-1).

The steam generator storage facility would be designed in accordance with State and Local building codes, and would consist of a reinforced concrete structure constructed on a reinforced concrete mat foundation. The design would include a watertight roof membrane or equivalent roofing system. Design and construction would preclude moisture intrusion through construction joints, the roof membrane, and wall closures. The front wall would consist of precast concrete panels installed after the original steam generators have been placed inside the building. The building materials

will provide sufficient shielding to ensure dose rates remain within acceptable regulatory limits in accordance with 10 CFR 20, *Standards for Protection Against Radiation.* Construction of the steam generator storage facility will include the following activities:

- Obtaining required permits and approvals;
- Excavation for the structure and utilities;
- Installation of utilities and construction of the foundation slab, walls, and roof; and
- Backfill, grading, and paving around the completed structure.

AmerGen anticipates that up to 50 workers would be required for construction of the facility.

3.3 PROGRAMS AND ACTIVITIES FOR MANAGING THE EFFECTS OF AGING

NRC

"…The report must contain a description of … the applicant's plans to modify the facility or its administrative control procedures…. This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment…." 10 CFR 51.53(c)(2)

"…The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40 year license term will be from one of two broad categories: (1) SMITTR actions, most of which are repeated at regular intervals …." NRC 1996 (SMITTR is defined in NRC 1996 as surveillance, monitoring, inspections, testing, trending, and recordkeeping.)

In accordance with 10 CFR 54.21, programs and inspections for managing aging effects at TMI-1 are described in the Three Mile Island Nuclear Station License Renewal Application, Appendix B, Aging Management Programs and Activities.

Other than implementation of these programs and inspections, there are no planned modifications of TMI-1 administrative control procedures associated with license renewal.

3.4 EMPLOYMENT

Current Work force

AmerGen employs approximately 525 permanent employees and 170 long-term contract employees at TMI-1. The permanent staff at a nuclear plant with one reactor normally ranges between 600 and 800 employees (NRC 1996). Approximately 71 percent of the employees live in Dauphin and Lancaster Counties, Pennsylvania. The remaining employees are distributed across 14 counties in Pennsylvania, with numbers ranging from 1 to 57 employees per county. There are about five employees that live outside of Pennsylvania (see Table 2.6-1).

TMI-1 is on a 24-month refueling cycle. During refueling outages, site employment increases above the permanent work force by as many as 1,400 workers for approximately 20 to 30 days of temporary duty. This number of outage workers falls outside of the range (200 to 900 workers per reactor unit) reported in the GEIS for additional maintenance workers (NRC 1996), but for a relatively short period of time (approximately three weeks).

Refurbishment Increment

Performing the refurbishment activities described in Section 3.2 would necessitate increasing the TMI-1 staff workload by some increment. The size of this increment would be a function of the schedule within which AmerGen must accomplish the work and the amount of work involved.

In the GEIS (NRC 1996), NRC analyzed seven case study sites (including TMI-1) with respect to typical refurbishment scenarios. NRC selected a variety of nuclear plant sites that would represent the range of plant types in the United States. Then, NRC based its analyses on bounding work force estimates derived from these typical refurbishment scenarios at the case study sites. In the GEIS, NRC estimates that the most additional personnel needed to perform refurbishment activities at a pressurized water reactor would typically be 2,273 persons during a 9-month major refurbishment outage immediately before the expiration of the initial operating license. NRC also estimates that, after the refurbishment workforce has reached its peak, refueling would be undertaken to prepare for continued operation of the plant. In an effort to account for uncertainty surrounding workforce numbers, NRC performed a sensitivity analysis where socioeconomic impacts were predicted in response to a work force roughly 50 percent larger than the projected bounding case for a pressurized water reactor work force, or 3,400 workers. Having established this upper value for what would be a single event in the remainder of the life of the plant, the GEIS uses this number as the expected number of additional permanent workers needed per unit attributable to refurbishment.

AmerGen has identified one refurbishment project for TMI-1. This project qualifies for inclusion in this environmental report and will be analyzed in Chapter 4. AmerGen has determined that the GEIS work force size and scheduling assumptions amply bound the TMI-1 refurbishment work force size and scheduling. AmerGen estimates that refurbishment activities would last no longer than 70 days. Construction activities for the long-term storage facility for the original steam generators will require approximately 50 workers and will occur first. Steam generator replacement will follow and will require approximately 900 workers.

In Chapter 4, for analyses based on employment numbers, the steam generator replacement employment numbers are expected to bound the employment-related impacts of all steam generator replacement activities. Therefore, a peak refurbishment work force of 900 workers will be assumed for analyzing refurbishment impacts. For analyses based on other criteria, such as

land-disturbance, the steam generator replacement activities and the long-term storage facility construction will be analyzed separately.

License Renewal Increment

Performing the license renewal activities described in Section 3.3 would necessitate increasing the TMI-1 staff workload by some increment. The size of this increment would be a function of the schedule within which AmerGen must accomplish the work and the amount of work involved. The analysis of license renewal employment increment focuses on programs and activities for managing the effects of aging.

The GEIS (NRC 1996) assumes that NRC would renew a nuclear power plant license for a 20-year period beyond the term of its initial license, and that NRC would issue the renewal approximately 10 years before the initial license expires. In other words, the renewed license would be in effect for approximately 30 years. The GEIS further assumes that the utility would initiate surveillance, monitoring, inspections, testing, trending, and recordkeeping (SMITTR) activities at the time of issuance of the new license and would conduct license renewal SMITTR activities throughout the remaining 30-year life of the plant, sometimes during full-power operation (NRC 1996), but mostly during normal refueling and the 5- and 10-year in-service inspection and refueling outages (NRC 1996).

AmerGen has determined that the GEIS scheduling assumptions are reasonably representative of TMI-1 incremental, license renewal, workload scheduling. Many TMI-1 license renewal SMITTR activities would have to be performed during outages. Although some TMI-1 license renewal SMITTR activities would be one-time efforts, others would be recurring periodic activities that would continue for the life of the plant.

The GEIS estimates that the most additional personnel needed to perform license renewal SMITTR activities would typically be 60 persons during the 3-month duration of a 10-year in-service inspection and refueling outage. Having established this upper value for what would be a single event in 20 years, the GEIS uses this number as the expected number of additional permanent workers needed per unit attributable to license renewal. GEIS Section C.3.1.2 uses this approach in order to "...provide a realistic upper bound to potential population-driven impacts…."

AmerGen expects that its existing capability for temporarily supplementing the workforce for routine activities, such as outages, will most likely enable AmerGen to perform the increased SMITTR workload without adding workers to the TMI-1 staff. However, for purposes of analysis in this environmental report, AmerGen conservatively assumes that TMI-1 would require 60 additional permanent workers to perform all license renewal SMITTR activities and that all 60 employees would migrate into the 50-mile radius. Adding 60 full-time employees to the plant work force for the period of extended operation would have the indirect effect of creating additional jobs. Considering the size of the 50-mile radius population (2,546,479) and the fact that most indirect jobs would be service-related, AmerGen assumes that the majority of indirect workers would already be residing within the 50-mile radius.

Table 3.1-1 List of Radioactive Waste Systems at TMI-1

Radioactive Waste Systems
Spent fuel and control rod handling and packaging
Incore detector removal and packaging
Out-of-core detector removal and packaging
Purification filter removal and packaging
Liquid waste disposal system
Waste gas system
Solid waste disposal and packaging

Source: AmerGen 2006a

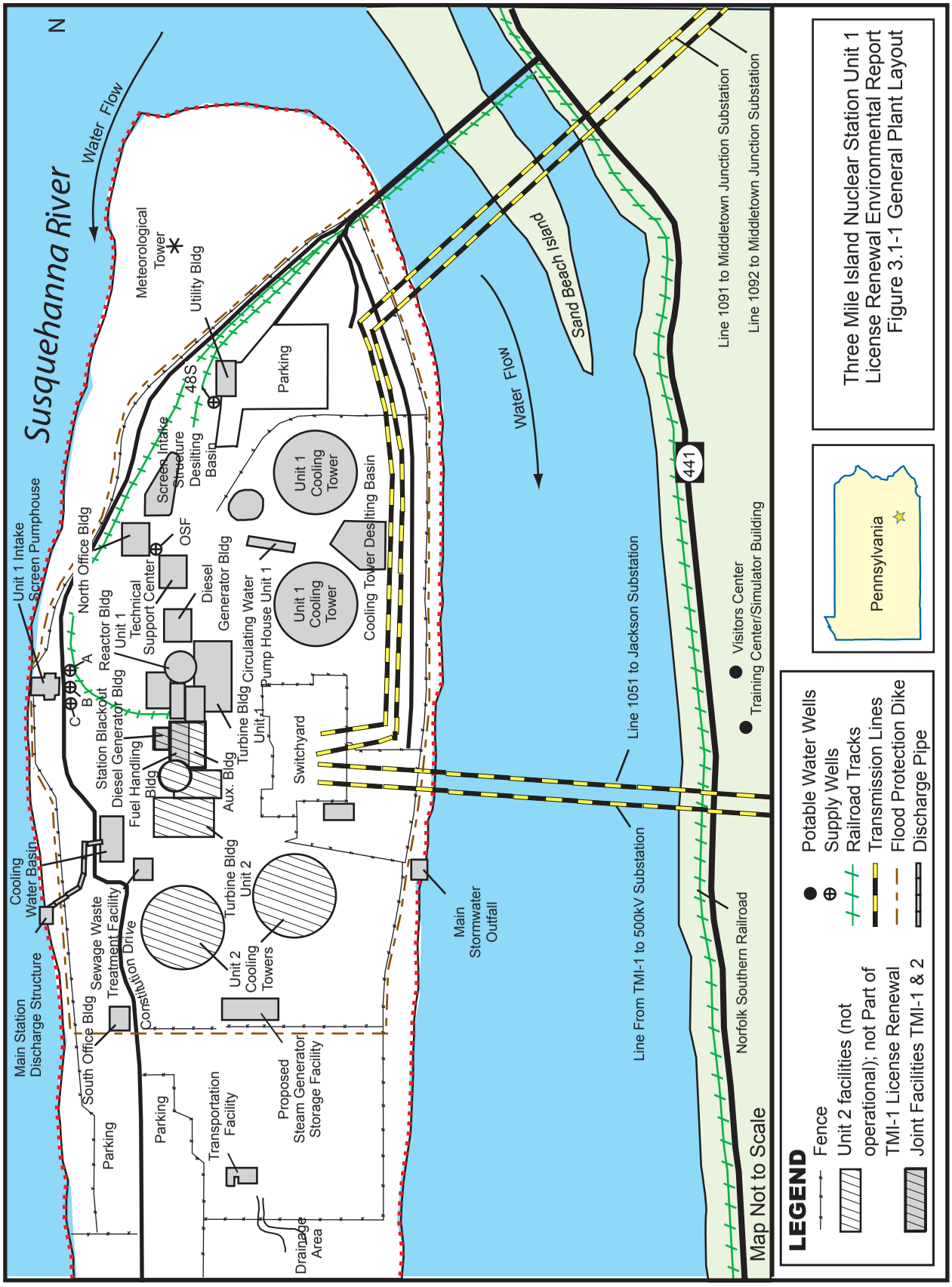
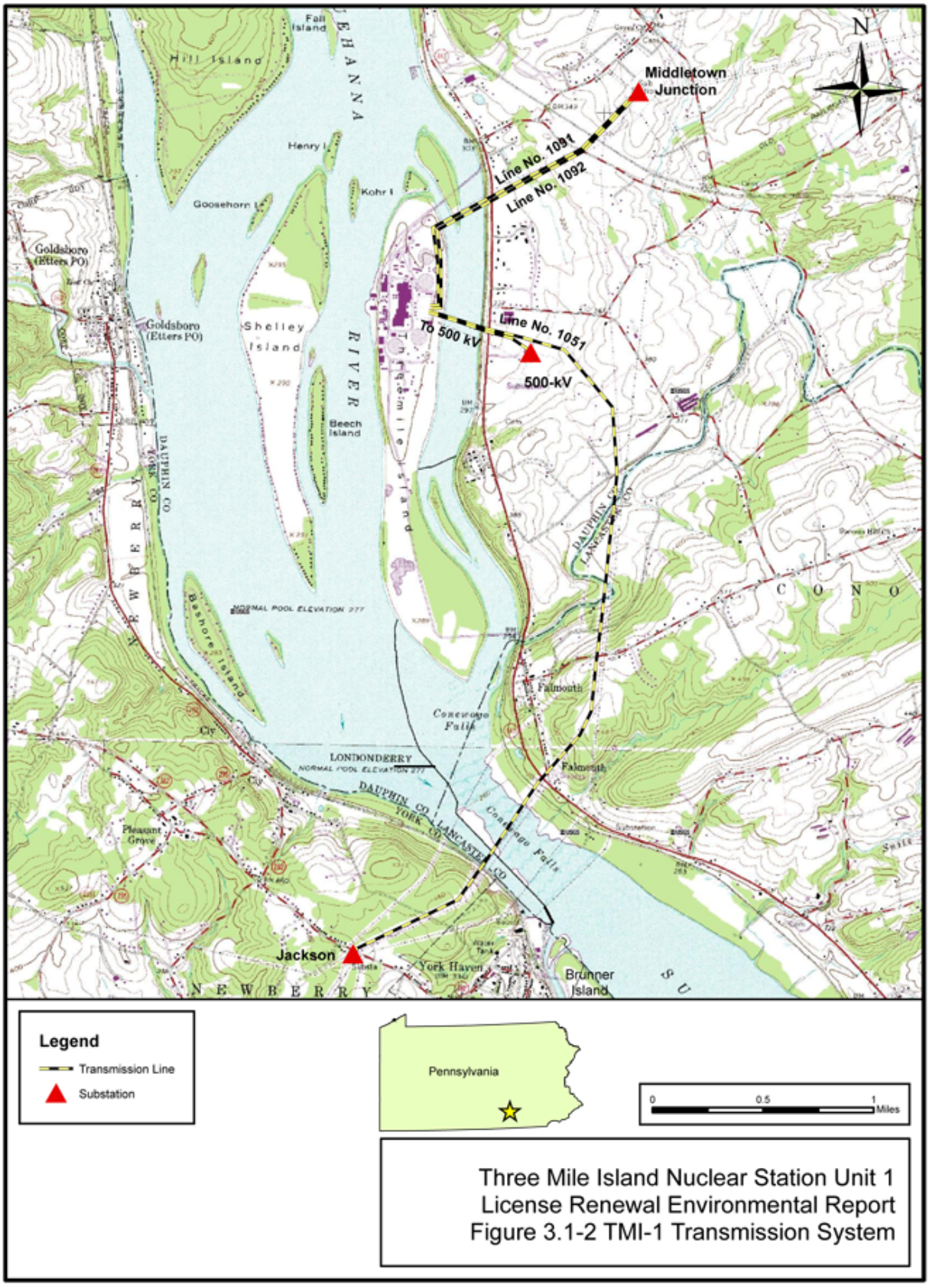

Susquehanna River
Water Flow
N
Meteorological Tower
Utility Bldg
48S
Parking
Screen Intake Structure
Desilting Basin
Unit 1 Cooling Tower
Unit 1 Intake Screen Pumphouse
North Office Bldg
OSF
Unit 1 Technical Support Center
Diesel Generator Bldg
Reactor Bldg
Unit 1 Circulating Water Pump House
Cooling Tower Desilting Basin
Station Blackout Diesel Generator Bldg
Fuel Handling Bldg
Turbine Bldg Unit 1
Aux. Bldg
Switchyard
Cooling Water Basin
Main Station Discharge Structure
Sewage Waste Treatment Facility
Constitution Drive
Turbine Bldg Unit 2
Unit 2 Cooling Towers
South Office Bldg
Parking
Parking
Transportation Facility
Proposed Steam Generator Storage Facility
Drainage Area
Main Stormwater Outfall
Water Flow
Sand Beach Island
Line 1091 to Middletown Junction Substation
Line 1092 to Middletown Junction Substation
441
Visitors Center
Training Center/Simulator Building
Line 1051 to Jackson Substation
Line From TMI-1 to 500kV Substation
Norfolk Southern Railroad
Map Not to Scale
LEGEND
Fence
Unit 2 facilities (not operational); not Part of TMI-1 License Renewal
Joint Facilities TMI-1 & 2
Potable Water Wells
Supply Wells
Railroad Tracks
Transmission Lines
Flood Protection Dike
Discharge Pipe
Pennsylvania
Three Mile Island Nuclear Station Unit 1
License Renewal Environmental Report
Figure 3.1-1 General Plant Layout

Figure 3.1-2 TMI Transmission System



3.5 REFERENCES

Note to reader: Some web pages cited in this document are no longer available, or are no longer available through the original URL addresses. Hard copies of cited web pages are available in AmerGen files. Some sites, for example the census data, cannot be accessed through their given URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by AmerGen have been given for these pages, even though they may not be directly accessible. Also, all references are specific to respective chapter.

AEC (Atomic Energy Commission). 1972. "Final Environmental Statement Related to Operation of Three Mile Island Nuclear Station Units 1 and 2." December.

AmerGen (AmerGen Energy Company, LLC). 2006a. "Three Mile Island Updated Safety Analysis Report, Update 18." April.

AmerGen (AmerGen Energy Company, LLC). 2006b. "Plant Fact Sheet, Three Mile Island Generating Station." Accessed at http://www.AmerGencorp.com/ourcompanies/powergen/nuclear/three_mile_island_unit_-_1.htm. Accessed on August 25.

AmerGen (AmerGen Energy Company, LLC). 2006c. "Offsite Dose Calculation Manual." Procedure 6610-PLN-4200.01, Revision 25. August 9.

IEEE (Institute of Electrical and Electronics Engineers). 1997. National Electrical Safety Code, 1997 Edition, New York, New York.

McLaren/Hart. 1998. Facility Assessment Report, Three Mile Island Nuclear Station, Route 441, Londonderry Township, Pennsylvania. McLaren/Hart, Inc., September 9.

NRC (U.S. Nuclear Regulatory Commission). 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants. Volumes 1 and 2. NUREG-1437. Washington, DC. May.

Chapter 4

Environmental Consequences of the Proposed Action and Mitigating Actions

NRC

The report must contain a consideration of alternatives for reducing impacts…for all Category 2 license renewal issues….” 10 CFR 51.53(c)(3)(iii)

“The environmental report shall include an analysis that considers…the environmental effects of the proposed action…and alternatives available for reducing or avoiding adverse environmental effects.” 10 CFR 51.45(c) as adopted by 10 CFR 51.53(c)(2)

The environmental report shall discuss the “…impact of the proposed action on the environment. Impacts shall be discussed in proportion to their significance….” 10 CFR 51.45(b)(1) as adopted by 10 CFR 51.53(c)(2)

“The information submitted…should not be confined to information supporting the proposed action but should also include adverse information.” 10 CFR 51.45(e) as adopted by 10 CFR 51.53(c)(2)

Chapter 4 presents an assessment of the environmental consequences associated with the renewal of the Three Mile Island Nuclear Station Unit 1 (TMI-1) operating license. The U.S. Nuclear Regulatory Commission (NRC) has identified and analyzed 92 environmental issues that it considers to be associated with nuclear power plant license renewal and has designated the issues as Category 1, Category 2, or NA (not applicable). NRC designated an issue as Category 1 if, based on the result of its analysis, the following criteria were met:

- the environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic;
- a single significance level (i.e., small, moderate, or large) has been assigned to the impacts that would occur at any plant, regardless of which plant is being evaluated (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent-fuel disposal); and
- mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely to be not sufficiently beneficial to warrant implementation.

If the NRC analysis concluded that one or more of the Category 1 criteria could not be met, NRC designated the issue as Category 2. NRC requires plant-specific analyses for Category 2 issues.

Finally, NRC designated two issues as NA, signifying that the categorization and impact definitions do not apply to these issues.

NRC rules do not require analyses of Category 1 issues that NRC resolved using generic findings (10 Code of Federal Regulations (CFR) 51) as described in the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (NRC 1996). An applicant may reference the generic findings or GEIS

analyses for Category 1 issues. Of the 92 total issues, NRC designated 69 as Category 1 and 21 as Category 2.

Appendix A of this report lists the 92 issues and identifies the environmental report section that addresses each issue.

CATEGORY 1 AND NA LICENSE RENEWAL ISSUES

NRC

"The environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in Appendix B to subpart A of this part." 10 CFR 51.53(c)(3)(i)

"…[A]bsent new and significant information, the analyses for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant's environmental report for license renewal…." (NRC 1996b, pg. 28483)

Category 1 License Renewal Issues

AmerGen Energy Company, LLC (AmerGen) has determined that 10 of the 69 Category 1 issues do not apply to TMI-1 because they are specific to design or operational features that are not found at the facility. Appendix Table A-1 lists the 69 Category 1 issues, indicates whether or not each issue is applicable to TMI-1, and if inapplicable provides AmerGen's basis for this determination. Appendix Table A-1 also includes references to supporting analyses in the GEIS where appropriate.

AmerGen has reviewed the NRC findings at Table B-1 in Appendix B to 10 CFR 51 and has not identified any new and significant information that would make the NRC findings, with respect to Category 1 issues, inapplicable to TMI-1. Therefore, AmerGen adopts by reference the NRC findings for these Category 1 issues. AmerGen will undertake refurbishment activities associated with license renewal and has included evaluation of the impacts, as indicated in the GEIS. AmerGen has determined that no refurbishment activities would change the conclusions identified in the GEIS and therefore, AmerGen adopts by reference the NRC conclusions regarding those Category 1 issues relative to refurbishment.

"NA" License Renewal Issues

NRC determined that its categorization and impact-finding definitions did not apply to Issues 60 and 92; however, AmerGen included these issues in Table A-1. NRC noted that applicants currently do not need to submit information on Issue 60, chronic effects from electromagnetic fields (10 CFR 51). For Issue 92, environmental justice, NRC does not require information from applicants, but noted that it will be addressed in individual license renewal reviews (10 CFR 51). AmerGen has included environmental justice demographic information in Section 2.6.2.

CATEGORY 2 LICENSE RENEWAL ISSUES

NRC

"The environmental report must contain analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for those issues identified as Category 2 issues in Appendix B to subpart A of this part." 10 CFR 51.53(c)(3)(ii)

"The report must contain a consideration of alternatives for reducing adverse impacts, as required by § 51.45(c), for all Category 2 license renewal issues…." 10 CFR 51.53(c)(3)(iii)

NRC designated 21 issues as Category 2. Sections 4.1 through 4.20 (Section 4.17 addresses 2 issues) address the Category 2 issues, beginning with a statement of the issue. Five Category 2 issues apply to operational features that TMI-1 does not have. If the issue does not apply to TMI-1, the section explains the basis for inapplicability.

For the 16 Category 2 issues that AmerGen has determined to be applicable to TMI-1, the appropriate sections contain the required analyses. These analyses include conclusions regarding the significance of the impacts relative to the renewal of the operating license and refurbishment activities for TMI-1 and, if applicable, discuss potential mitigative alternatives to the extent required. AmerGen has identified the significance of the impacts associated with each issue as either small, moderate, or large, consistent with the criteria that NRC established in 10 CFR 51, Appendix B, Table B-1, Footnote 3 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. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.
>
> MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource.
>
> LARGE - Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

In accordance with National Environmental Policy Act practice, AmerGen considered ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are small receive less mitigative consideration than impacts that are large).

4.1 WATER USE CONFLICTS

NRC

"If the applicant's plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than 3.15×10^{12} ft^3 / year (9×10^{10} m^3/year), an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided. The applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow." 10 CFR 51.53(c)(3)(ii)(A)

"…The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 13

The NRC made surface water use conflicts a Category 2 issue because consultations with regulatory agencies indicate that water use conflicts are already a concern at two closed-cycle plants and may be a problem in the future at other plants. In the GEIS, NRC notes two factors that may cause water use and availability issues to become important for some nuclear power plants that use cooling towers. First, some plants equipped with cooling towers are located on small rivers that are susceptible to droughts or competing water uses. Second, consumptive water loss associated with closed-cycle cooling systems may represent a substantial proportion of the flows in small rivers (NRC 1996, Section 4.3.2.1).

As discussed in Section 3.1, TMI-1 has a cooling tower-based heat dissipation system. Cooling water lost to cooling tower evaporation is replaced by make-up water pumped from the Susquehanna River at a permitted consumptive average rate of 18 million gallons per day (gpd) (SRBC 1995). Based on data from water years 1891 to 2004, the annual mean flow of the Susquehanna River at Harrisburg, approximately 11 miles upstream of TMI-1, is 34,450 cubic feet per second [(cfs) ($1.09\text{x}10^{12}$ cubic feet per year)] (Durlin and Schaffstall 2005), which means that the Susquehanna River meets the NRC definition of a small river. Therefore, this issue applies to TMI-1.

The lowest annual mean flow at the Harrisburg gauging Station is 16,940 cfs ($1.098\text{x}10^{10}$ gpd). The lowest daily mean at the station is 1,700 cfs ($1.10\text{x}10^{9}$ gpd). (Durlin and Schaffstall 2005) River flow at Three Mile Island is directly controlled by the York Haven Dam (York Haven Hydroelectric Station) which is immediately downstream of the plant, across the main channel of the river. A smaller dam (Red Hill) is located across the east channel of the river adjacent to the site. Together these dams form Lake Frederick (York Haven Pond). The York Haven Hydroelectric Station is operated on a run-of-river basis and its power output is dependent upon river flow. The reservoir is used for limited peaking operation during periods of low river flow (AmerGen 2006). At TMI-1, the circulating water system can withdraw water from the Susquehanna River for consumptive use up to 18 million gpd (SRBC 1995). The average estimated withdrawal of surface water at the Unit 1

intake structure is 24,000 gallons per minute (gpm) (AmerGen 2007a). TMI-1 withdrawals from the Susquehanna River represent less than 1.6 percent of the river flow during typical drought periods (lowest daily mean), less than 0.2 percent of the lowest annual mean flow, and less than 0.1 percent of average annual flow. TMI-1 also participates in the Cowanesque Lake water storage project. TMI-1 has sponsored a total of 8,274 acre-feet of compliance storage at the Cowanesque project, of which 4,250 acre-feet of water could be released to help mitigate any impact to the Susquehanna River caused by plant operations during a drought of record (SRBC 1995). The Susquehanna River Basin Commission (SRBC) monitors water flows of the Susquehanna River. When the SRBC determines that flows in the river have reached a critical level, the SRBC directs the Army Corps of Engineers to release quantities of water identified in a separate, predetermined plan (SRBC 2005). Based on the low percentages of water use as compared to stream flow discussed above and the potential of releasing water into the system during periods of drought, AmerGen has determined that any impacts to instream and riparian communities and to alluvial water bearing material (aquifers) caused by TMI-1 make-up water withdrawal from the Susquehanna River would be SMALL and would not warrant additional mitigation.

4.2 ENTRAINMENT OF FISH AND SHELLFISH IN EARLY LIFE STAGES

NRC

"If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations…or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from…entrainment." 10 CFR 51.53(c)(3)(ii)(B)

"...The impacts of entrainment are small in early life stages at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid..." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 25

The issue of entrainment of fish and shellfish in early life stages does not apply to TMI-1 because condenser cooling at the unit does not utilize a once-through cooling water system or a cooling pond heat dissipation system.

4.3 IMPINGEMENT OF FISH AND SHELLFISH

NRC

"If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations…or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from…impingement…." 10 CFR 51.53(c)(3)(ii)(B)

"…The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems…." 10 CFR 51, Subpart A, Appendix B, Table B 1, Issue 26

The issue of impingement of fish and shellfish does not apply to TMI-1 because condenser cooling at the unit does not utilize a once-through cooling water system or a cooling pond heat dissipation system.

4.4 HEAT SHOCK

NRC

"If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act… 316(a) variance in accordance with 40 CFR Part 125, or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock …." 10 CFR 51.53(c)(3)(ii)(B)

"…Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 27

The issue of heat shock does not apply to TMI-1 because condenser cooling at the unit does not utilize a once-through cooling water system or a cooling pond heat dissipation system.

4.5 GROUNDWATER USE CONFLICTS (PLANTS USING >100 GPM OF GROUNDWATER)

NRC

"If the applicant's plant…pumps more than 100 gallons (total onsite) of groundwater per minute, an assessment of the impact of the proposed action on groundwater use must be provided." 10 CFR 51.53(c)(3)(ii)(C)

"Plants that use more than 100 gpm may cause groundwater use conflicts with nearby groundwater users." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 33

NRC made groundwater use conflicts a Category 2 issue because, at a withdrawal rate of more than 100 gpm, a cone of depression could extend offsite. This could deplete the groundwater supply available to offsite users, an impact that could warrant mitigation. Information to be ascertained includes: (1) TMI-1 groundwater withdrawal rate (whether greater than 100 gpm), (2) drawdown at offsite location, and (3) impact on neighboring wells.

Based on information presented in Section 2.3, TMI-1 used an average of between 95 to 115 gpm of groundwater from the seven facility wells for the period of 2003 through 2005. Therefore, the issue of groundwater use conflicts does apply.

In 1998, TMI-1 applied to the SRBC to increase its groundwater withdrawal from Wells A, B, and C, to 225,000 gpd. As part of the original SRBC groundwater use approval process simultaneous pump tests were performed in 1996. The pumping rate for the test was 75 percent of the requested 225,000 gpd or 168,750 gpd (117 gpm). No impacts to the operation of the on-site OSF well or the 48S well were observed and the SRBC determined that no other wells on Three Mile Island or along the eastern shore of the river had been affected by the site production well operations (Wells A, B, and C) (SRBC 1999). Subsequently in 1999, the SRBC approved the new 30-day average flow of 225,000 gpd for Wells A, B, and C. As discussed in Section 2.3, recharge to the site's groundwater pumping area is primarily along subcrops of the bedrock aquifer in the Susquehanna River and not along bedding planes or joints supplying water to off-site users.

Based on the results of the pump test performed in 1996 on Wells A, B, and C production, which indicated no effect on nearby wells, AmerGen concludes there will be SMALL to no impacts to nearby groundwater users during the period of relicensing operations.

4.6 GROUNDWATER USE CONFLICTS (PLANTS USING COOLING TOWERS WITHDRAWING MAKEUP WATER FROM A SMALL RIVER)

NRC

"If the applicant's plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than 3.15×10^{12} ft^3 / year...[t]he applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow." 10 CFR 51.53(3)(ii)(A)

"…Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other groundwater or upstream surface water users come on line before the time of license renewal…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 34

NRC made this groundwater use conflict a Category 2 issue because surface water withdrawals from small rivers could adversely impact aquatic life, downstream users of a small river, and groundwater-aquifer recharge. This is a particular concern during low-flow conditions and could create a cumulative impact due to upstream consumptive use. Cooling towers and cooling ponds lose flow by evaporation, which is necessary to cool the heated water before it is discharged to the environment.

The issue of potential groundwater use conflicts applies because TMI-1 withdraws makeup water from a small river, the Susquehanna River, which as discussed in Section 4.1, has an annual flow of 34,450 cubic feet per second ($1.09\text{x}10^{12}$ cubic feet per year) at the Harrisburg gauging station located approximately 11 miles upstream of TMI-1. As discussed in Section 3.1, TMI-1 has a natural-draft cooling tower heat dissipation system. Circulated cooling water lost to cooling tower evaporation is replaced by make-up water pumped from the Susquehanna River. TMI-1 is located on Lake Frederick, created by the damming of the Susquehanna River by the Red Hill Dam and the York Haven Dam (York Haven Hydroelectric Station) which is immediately downstream of TMI-1 across the main channel of the river.

As discussed in Section 4.1, TMI-1 withdraws surface water at a rate approximately 1.6 percent of the lowest daily mean, less than 0.2 percent of the lowest annual mean flow, and less than 0.1 percent of average annual flow of the Susquehanna River. As discussed in Section 4.1, TMI-1 participates in the Cowanesque Lake water storage project which allows TMI-1 a sponsored total of 8,274 acre-feet of compliance storage at the Cowanesque project. SRBC can direct the Army Corps of Engineers to release water during periods of drought. Of the 8,274 acre-feet sponsored by TMI-1, approximately 4,250 acre-feet of water would mitigate any impact to the Susquehanna River caused by plant operations during a drought of record, thus allowing continued operations. AmerGen concludes that impacts of withdrawing water

from the river on the alluvial water bearing unit (aquifer) would be SMALL and that additional mitigation measures would not be warranted.

4.7 GROUNDWATER USE CONFLICTS (PLANTS USING RANNEY WELLS)

NRC

"If the applicant's plant uses Ranney wells…an assessment of the impact of the proposed action on groundwater use must be provided." 10 CFR 51.53(c)(3)(ii)(C)

"…Ranney wells can result in potential ground-water depression beyond the site boundary. Impacts of large ground-water withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 35

NRC made this groundwater use conflict a Category 2 issue because large quantities of groundwater withdrawn from Ranney wells could degrade groundwater quality at river sites by induced infiltration of poor-quality river water into an aquifer.

The issue of groundwater use conflicts does not apply to TMI-1 because the plant does not use Ranney wells. As Section 3.1 describes, TMI-1 uses a closed cycle cooling system with cooling towers that removes make-up water from the Susquehanna River and discharges blowdown to the Susquehanna River.

4.8 DEGRADATION OF GROUNDWATER QUALITY

NRC

"If the applicant's plant is located at an inland site and utilizes cooling ponds, an assessment of the impact of the proposed action on groundwater quality must be provided." 10 CFR 51.53(c)(3)(ii)(D)

"…Sites with closed-cycle cooling ponds may degrade ground-water quality. For plants located inland, the quality of the ground water in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses…." 10 CFR 51, Subpart A, Appendix B, Table B 1, Issue 39

NRC made degradation of groundwater quality a Category 2 issue because evaporation from closed-cycle cooling ponds concentrates dissolved solids in the water and settles suspended solids. In turn, seepage into the water table aquifer could degrade groundwater quality.

The issue of groundwater degradation does not apply to TMI-1 because the plant does not use cooling ponds. As Section 3.1 describes, TMI-1 uses a closed cycle cooling system with natural draft cooling towers that withdraws make-up water from and discharges blowdown to the Susquehanna River.

4.9 IMPACTS OF REFURBISHMENT ON TERRESTRIAL RESOURCES

NRC

The environmental report must contain an assessment of "…the impact of refurbishment and other license-renewal-related construction activities on important plant and animal habitats…." 10 CFR 51.53(c)(3)(ii)(E)

"…Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 40

"…If no important resource would be affected, the impacts would be considered minor and of small significance. If important resources could be affected by refurbishment activities, the impacts would be potentially significant…." (NRC 1996a, Section 3.6, pg. 3-6)

NRC made impacts to terrestrial resources from refurbishment a Category 2 issue, because the significance of ecological impacts cannot be determined without considering site- and project-specific details (NRC 1996). Aspects of the site and project to be ascertained are: (1) the identification of important ecological resources, (2) the nature of refurbishment activities, and (3) the extent of impacts to plant and animal habitats.

Activities associated with refurbishment at TMI-1 are described in Section 3.2. Most of the refurbishment activities would be performed on equipment inside existing buildings. However, laydown areas, a permanent steam generator storage facility, and several temporary facilities would be needed to support the refurbishment activities. All new permanent facilities and temporary structures would be located in previously disturbed areas. AmerGen anticipates that the amount of land utilized would be less than 10 acres.

As discussed in Section 2.4, the portion of Three Mile Island that is occupied by the station is a developed industrial area that is devoid of important plant and animal habitats. The southern portion of the island is largely undeveloped and contains wetlands that provide nesting and foraging habitat for migratory waterfowl. The southern portion of the island also contains fallow field areas that are surrounded by a woodland buffer. Riparian buffer areas around the perimeter of the island are intact. Forested riparian areas are isolated to the southern part of the Island. Animal species that inhabit these natural areas could be temporarily displaced by noise and vibration from machinery and personnel associated with refurbishment activities, but such disturbances would be temporary and minor.

As stated in Section 3.2, the replacement steam generators will be manufactured in France and transported to TMI-1. The exact mode and route of transportation once the steam generator arrives in a U. S. port (e.g., Baltimore, Newark, Philadelphia) is

undecided at this time. Potential impacts to the terrestrial resources from either a rail or road option would meet the necessary federal, state, and local regulatory requirements prior to transport. Some of these activities could involve dredging or fill activities or temporary removal of interferences along routes, which could have temporary impacts on terrestrial resources.

Table 2.5-1 identifies a number of threatened or endangered species that have been recorded in counties within which TMI-1 and its associated transmission lines are located. As stated in Section 2.5, the only listed species that have been known to occur at TMI-1 are American holly (state-listed as threatened), bald eagle (state-listed as threatened), peregrine falcon (state-listed as endangered), and osprey (state-listed as threatened). The American holly is not known to be present in the industrial or paved areas of the site. Peregrine falcons have nested on the Unit 1 Reactor Building every year since 2002. Ospreys have nested on the meteorological tower every year since 2004. Bald eagles have become relatively common along the Susquehanna River and are occasionally observed at Three Mile Island. However, no bald eagle nests are known to occur on the island. Refurbishment activities could startle peregrine falcons and ospreys or other birds at TMI-1, but these birds have presumably become habituated to industrial activities at the site, including movement of personnel and machinery and loud noise. The steam generator replacement is planned for fall of 2009 to coincide with a planned outage, and these activities would create significant disturbances at and around the Unit 1 containment dome; however, the peregrine falcon nestlings have historically fledged the nest by late summer and the adult birds have migrated to their wintering ranges (PDEP 2007). In addition, the peregrine falcon nest is not near the ground but is instead high atop the containment, which serves to mitigate potential disturbances that might occur if the nest were lower and birds were late vacating the nest. As further evidenced from AmerGen's consultations with the Pennsylvania Game Commission, the conclusion that "adverse impacts to any special concern species of birds or mammals is not expected". Copies of correspondences with all state and federal agencies concerning terrestrial resources are presented in Appendix C. In summary, AmerGen concludes that impacts to important terrestrial resources from refurbishment activities would be SMALL and do not warrant mitigation.

4.10 THREATENED OR ENDANGERED SPECIES

NRC

"Additionally, the applicant shall assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act." 10 CFR 51.53(c)(3)(ii)(E)

"Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 49

NRC made impacts to threatened and endangered species a Category 2 issue because the status of many species is being reviewed, and site-specific assessment is required to determine whether any identified species could be affected by refurbishment activities or continued plant operations through the renewal period. In addition, compliance with the Endangered Species Act requires consultation with the appropriate federal agency (NRC 1996a, Sections 3.9 and 4.1).

Section 2.2 of this Environmental Report describes the aquatic communities of the Susquehanna River. Section 2.4 describes important terrestrial habitats at TMI-1 and along the associated transmission corridors. Section 2.5 discusses threatened or endangered species that may occur in the vicinity of TMI-1 or its associated transmission corridors.

Except as discussed in Section 2.5, AmerGen is not aware of any threatened or endangered species that could occur at TMI-1 or along the associated transmission corridors. Current operation of TMI-1 and vegetation management practices along the transmission line rights-of-way do not adversely affect any listed species or its habitat (see Section 2.5). Furthermore, plant operations and transmission line maintenance practices are not expected to change significantly during the license renewal term. Therefore, no adverse impacts to threatened or endangered terrestrial species from current or future operations are anticipated.

AmerGen contacted the Pennsylvania Department of Conservation and Natural Resources, the Pennsylvania Game Commission, the Pennsylvania Fish and Boat Commission, and the U.S. Fish and Wildlife Service requesting information on any listed species or critical habitats that might occur on the TMI-1 site or along the associated transmission corridors, with particular emphasis on species that might be adversely affected by continued operation over the license renewal period. Agency responses are provided in Appendix C. All four agencies indicated that license renewal is unlikely to affect any listed species.

As discussed in Section 3.2, AmerGen plans refurbishment in the form of steam generator replacement, including construction of a long term storage facility for the original steam generators. No refurbishment-related impacts to special status species are expected to occur. The steam generator replacement is planned for the fall of 2009, and adult peregrine falcons

and their chicks have historically vacated the nest on the Reactor Building of Unit 1 by August (PDEP 2007).

As stated in Section 4.9, the exact route over which the replacement steam generators will be transported from the port of call to TMI-1 has not been established. The route will depend on the mode of transportation to be used (e.g., barge, rail, road). Options being considered are discussed in Section 3.2. It is possible that endangered or threatened species or their habitats would be present along the route, regardless of which option is chosen. Even so, unless dredge or fill activities are necessary to implement an option, effects caused by steam generator transport on threatened or endangered species in the vicinity of the route are not expected to differ from or add measurably to the existing effects of other vehicles and materials already transported along the routes. In any event, AmerGen will comply with applicable federal, state, and local regulatory requirements for the selected option.

If an option were to involve dredge or fill activities, the potential for impacts on threatened and endangered species would be reviewed (and mitigation measures identified) in the context of seeking regulatory consents for the dredge or fill activity. Potentially applicable requirements are listed in Table 9.1-3.

Because AmerGen has no plan to alter operations after license renewal, has committed to comply with applicable regulatory requirements related to refurbishment activities, and resource agencies evidenced no serious concerns about license renewal impacts, AmerGen concludes that impacts to threatened or endangered species from license renewal would be SMALL and do not warrant mitigation. License renewal of TMI-1 is not expected to result in taking of any threatened or endangered species. Renewal of the TMI-1 license also is not likely to jeopardize the continued existence for any threatened or endangered species or result in the destruction or adverse modifications of any critical habitat.

4.11 AIR QUALITY DURING REFURBISHMENT (NON-ATTAINMENT OR MAINTENANCE AREAS)

NRC

"If the applicant's plant is located in or near a nonattainment or maintenance area, an assessment of vehicle exhaust emissions anticipated at the time of peak refurbishment workforce must be provided in accordance with the Clean Air Act as amended." 10 CFR 51.53(c)(3)(ii)(F)

"…Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the numbers of workers expected to be employed during the outage…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 50

NRC made impacts to air quality during refurbishment a Category 2 issue because vehicle exhaust emissions could be cause for some concern, and a general conclusion about the significance of the potential impact could not be drawn without considering the compliance status of each site and the number of workers expected to be employed during an outage (NRC 1996).

Activities associated with refurbishment at TMI-1 are discussed in Section 3.2. Most of the refurbishment activities would be performed on equipment inside existing buildings and would not generate atmospheric emissions. However, laydown areas, a permanent steam generator storage facility, and several temporary facilities would be needed to support the refurbishment activities. AmerGen estimates indicate that the disturbed area for construction and laydown areas would be less than 10 acres. The small amount of disturbed area and implementation of best management practices (e.g., watering, silt fences, covering soil piles, etc.) would minimize the amount of fugitive dust generated during construction. Also, particulate matter in the form of fugitive dust consists primarily of large particles that settle quickly and thus have minimal adverse public health effects.

During refurbishment, temporary and localized increases in atmospheric concentrations of nitrogen oxides (NOx), carbon monoxide, sulfur dioxide (SO2), volatile organic compounds (VOC), ammonia and particulate matter (PM) would result from exhaust emissions of workers' vehicles, heavy construction vehicles, diesel generators, and other machinery and tools. As discussed in Section 3.3 of the GEIS (NRC 1996a), air quality impacts from these sources would be minor and of short duration. The amount of pollutants emitted from construction vehicles and equipment and construction worker commute traffic would be small compared to total vehicular emissions in the region.

As discussed in Section 2.10, the U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for six common pollutants and has designated all areas of the United States as having air quality either better than (attainment) or worse than

(non-attainment) the NAAQS. TMI-1 is located in the Harrisburg-Lebanon-Carlisle, Pennsylvania metropolitan statistical area (MSA), which is designated as a subpart 1 non-attainment area under the 8-hour ozone NAAQS and a non-attainment area under the $PM_{2.5}$ (fine particulate matter with an aerodynamic diameter of 2.5 microns or less) NAAQS. The MSA is designated as an attainment area for all other NAAQS.

As noted in Section 3.3 of the GEIS (NRC 1996a), a conformity analysis is required for each pollutant where the total of direct and indirect emissions caused by a proposed federal action would exceed established threshold emission levels in a non-attainment or maintenance area. Federal conformity rules are defined in 40 CFR Parts 51 and 93. Due to Dauphin County's ozone non-attainment status, the generation of NOx and VOC, which combine in the presence of heat and sunlight to create ozone, are a source of concern. Fine particulates ($PM_{2.5}$) can result from both direct and indirect sources. Gasoline and diesel fueled vehicles emit both direct $PM_{2.5}$ and gases (NOx, SO2, VOC, ammonia) that react in the air to form $PM_{2.5}$. The EPA requires NOx and SO2 emissions to be considered in $PM_{2.5}$ conformity assessments, but consideration of VOC and ammonia emissions is only required if the EPA or the state air agency determine that one or more of these precursors are significant (71 Federal Register (FR) 40420). No such determination has been made for Dauphin County. Consequently, direct generation of $PM_{2.5}$ and the generation of SO2 and NOx emissions are sources of concern due to the county's status as a $PM_{2.5}$ non-attainment area.

For ozone, the threshold emissions levels are 100 tons per year (tpy) for NOx and 50 tpy for VOC. For $PM_{2.5}$, the threshold emissions levels are 100 tpy for direct $PM_{2.5}$ emissions and 100 tpy for each of the $PM_{2.5}$ precursors, NOx and SO2 (71 FR 40420).

As discussed in Section 3.2, the refurbishment activities would begin with the commencement of construction activities for the steam generator storage facility. The peak period of activity would occur when the actual removal and replacement of the steam generators take place during a 70-day outage between fall 2009 and the date on which the TMI-1 license expires. Assuming carpooling by some workers and that all passenger vehicles and all construction equipment will not be in simultaneous use, the following vehicle numbers have been analyzed. During site preparation, an average of about 60 vehicles per day ranging from passenger vehicles to earthmovers would be used for construction activities, with a peak of approximately 100 vehicles. During the 70-day steam generator replacement outage, an average of 800 vehicles ranging from passenger vehicles to earthmovers would be used for construction activities, with a peak of approximately 850 vehicles. Construction vehicles and machinery would be equipped with standard pollution-control devices to minimize emissions. These emissions would be small compared to regulatory thresholds and a conformity determination for this project pursuant to the Clean Air Act would not be required.

4.12 MICROBIOLOGICAL ORGANISMS

NRC

"If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river having an annual average flowrate of less than 3.15×10^{12} ft^3/year (9×10^{10} m^3/year), an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided." 10 CFR 51.53(c)(3)(ii)(G)

"These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically." 10 CFR 51,Subpart A, Appendix B, Table B-1, Issue 57

Due to the lack of sufficient data from facilities using cooling ponds, lakes, or canals or discharging to small rivers, NRC designated impacts on public health from thermophilic organisms a Category 2 issue. Information to be determined is: (1) whether the plant discharges to a small river, and (2) whether discharge characteristics (particularly temperature) are favorable to the survival of thermophilic organisms.

This issue is applicable to TMI-1 because the plant discharges to the Susquehanna River, which has an annual mean flow of 1.09×10^{12} cubic feet per year at the U.S. Geological Survey gauging station in Harrisburg, approximately 11 miles upstream of TMI-1 (Durlin and Schaffstall 2005). It is also relevant because the Susquehanna River in the vicinity of TMI-1 is used by the public for recreation, including boating, fishing, and swimming.

Organisms of concern include the enteric pathogens Salmonella and Shigella, the *Pseudomonas aeruginosa* bacterium, thermophilic Actinomycetes ("fungi"), the many species of Legionella bacteria, and pathogenic strains of the free-living Naegleria amoeba.

Bacteria pathogenic to humans have evolved to survive in the digestive tracts of mammals and accordingly have optimum temperatures of around 99°F (Joklik and Smith 1972). Many of these pathogenic microorganisms (e.g., *Pseudomonas*, *Salmonella*, and *Shigella*) are ubiquitous in nature, occurring in the digestive tracts of wild mammals and birds (and thus in natural waters), but are usually only a problem when the host is immunologically compromised. Thermophilic bacteria generally occur at temperatures from 77°F to 176°F, with maximum growth at 122°F to 140°F (Joklik and Smith 1972).

TMI-1 uses two natural draft cooling towers to transfer waste heat from the circulating water system which cools the main condensers to the atmosphere (see Section 3.1 for detailed description of condenser cooling system). Thermal modeling conducted for the Final Environmental Statement (FES) for operation of TMI-1 indicated that the station's discharge would have a modest rise in downstream river temperature in summer (AEC 1972). The TMI-1 National Pollutant Discharge Elimination System (NPDES) permit requires continuous temperature monitoring of the circulating cooling water system's effluent before discharge into the Susquehanna River.

Temperatures measured in the Susquehanna River during thermal plume mapping conducted in May, June, July, and August 1978, when Unit 1 was operating at 100 percent, showed that the delta T (ΔT) at the discharge ranged from 0.5˚ F below to 1.4˚ F above the ambient river temperature. In general, the heated effluent was confined to an area of approximately 16 feet offshore and 82 feet downstream of the discharge. The maximum measured discharge temperature occurred during August 1978 (77.9˚ F); when the ambient river temperature was 77˚ F (Ichthyological Associates 1979). Therefore, during this thermal plume mapping the station's discharge to the Susquehanna River exhibited temperatures indistinguishable from those measured upstream (ambient location) of the plant's intake.

Recent temperature data from an automatic temperature sensor at the station's intake screen pump house and at the discharge monitoring pit (before the water is mixed with Susquehanna River water) from August 2005 through September 2007 indicate that the 24-hr average maximum discharge temperature occurred on August 4 in 2006 (100.2° F) and on September 11 in 2007 (101.1° F) (AmerGen 2007b).

Water at these temperatures could, in theory, allow limited survival of thermophilic microorganisms, but is well below the optimal temperature range (122° F - 140° F) for growth and reproduction of thermophilic microorganisms.

Another factor controlling the survival and growth of thermophilic microorganisms in the Susquehanna River is the disinfection of TMI-1 sewage treatment plant effluent. This reduces the likelihood that a seed source or inoculant will be introduced into the Susquehanna River via the TMI-1 discharge. Wastewater, whether from domestic sewage or industrial sources, is frequently a source of pathogens in natural waters.

Fecal coliform bacteria are regarded as indicators of other pathogenic microorganisms, and are the organisms normally monitored by state health agencies. The present NPDES permit for TMI-1 requires monitoring of fecal coliforms in sewage treatment plant effluent (Outfall 101). Samples are collected once per quarter for fecal coliform analysis and other parameters. The TMI-1 NPDES permit calls for "effective disinfection" to control disease-producing organisms during the swimming season (May 1 through September 30) and imposes a limit of 200 fecal coliform colonies (geometric average value) per 100 ml sample. The NPDES permit also stipulates that no more than 10 percent of samples tested may contain 1,000 colonies/100ml sample.

Given the thermal characteristics of the Susquehanna River at the TMI-1 thermal discharge and disinfection of sewage treatment plant effluent, AmerGen does not expect station operations to stimulate growth or reproduction of thermophilic microorganisms.

AmerGen has written the Bureau of Water Supply and Wastewater Management of the Pennsylvania Department of Environmental Protection (PADEP), requesting information on any studies that may have been conducted on thermophilic microorganisms in the Susquehanna River and any concerns PADEP may have relative to these organisms. PADEP responded to AmerGen's informational request and concurred that the continued "operation of TMI-1 over the license renewal term would not stimulate growth of thermophilic pathogens." Copies of the correspondence are included in Appendix C of this environmental report. AmerGen is not aware of reported cases of illness caused by Naegleria or Legionella at, in the vicinity, or downstream of the plant. Therefore, AmerGen concludes that the impact of thermophilic organisms is SMALL and does not warrant mitigation.

4.13 ELECTRIC SHOCK FROM TRANSMISSION-LINE-INDUCED CURRENTS

NRC

The environmental report must contain an assessment of the impact of the proposed action on the potential shock hazard from transmission lines "...[i]f the applicant's transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the National Electric Safety Code for preventing electric shock from induced currents…" 10 CFR 51.53(c)(3)(ii)(H)

"…Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and generally are not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential at the site…." 10 CFR 51, Subpart A, Table B 1, Issue 59

NRC made impacts of electric shock from transmission lines a Category 2 issue because, without a review of each plant's transmission line conformance with the National Electrical Safety Code (NESC) criteria (IEEE 1997), NRC could not determine the significance of the electric shock potential. This section provides an analysis of the TMI-1 transmission lines in conforming with the NESC standard.

Production of Induced Currents

Objects located near transmission lines can become electrically charged due to their immersion in the lines' electric field. This charge results in a current that flows through the object to the ground. The current is called "induced" because there is no direct connection between the line and the object. The induced current can also flow to the ground through the body of a person who touches the object. An object that is insulated from the ground can actually store an electrical charge, becoming what is called "capacitively charged." A person standing on the ground and touching a vehicle or a fence receives an electrical shock due to the sudden discharge of the capacitive charge through the person's body to the ground. After the initial discharge, a steady-state current can develop, the magnitude of which depends on several factors, including the following:

- the strength of the electric field which, in turn, depends on the voltage of the transmission line as well as its height and geometry;
- the size of the object on the ground; and
- the extent to which the object is grounded.

In 1977, the NESC adopted a provision that describes how to establish minimum vertical clearances to the ground for electric lines having voltages exceeding 98-kilovolt alternating current to ground. The clearance must limit the induced current due to electrostatic effects to 5 milliamperes if the largest anticipated truck, vehicle, or equipment were short-circuited to ground.

By way of comparison, the setting of ground fault circuit interrupters used in residential wiring (special breakers for outside circuits or those with outlets around water pipes) is 4 to 6 milliamperes.

TMI-1 Transmission Lines

As described in Section 3.1.3, there are four 230-kilovolt lines specifically constructed to distribute power from TMI-1 to the electric grid:

- Line No. 1051 – TMI-1 Plant to Jackson Substation
- Line No. 1091 - TMI-1 Plant to Middletown Junction
- Line No. 1092 – TMI-1 Plant to Middletown Junction
- Line from TMI-1 Plant to the 500-kV Substation

Induced Current Analysis

This analysis of the TMI-1 transmission lines is based on computer modeling of induced current under the line. The initial step of the analysis was identification of the line/road crossings to be analyzed. Only paved roads and highways were considered in the analysis; minor roads, i.e., “dirt” or service road crossings, were not included. The electric field strength and subsequently the induced current were then calculated for the transmission line at each location.

The electric field strength and induced current were calculated using a computer code called ACDCLINE, produced by the Electric Power Research Institute. The results of this computer program have been field-verified through actual electric field measurements by several utilities. The input parameters included design features of the limiting-case scenario and the NESC requirement that line sag be determined at a minimum conductor temperature of 120°F. The conductor sag measurements were taken from plan-and-profile drawings for the four lines, and the sag dimensions had been determined at a conservative temperature of 212°F. For analysis purposes, the maximum vehicle size under the lines is considered to be a tractor-trailer of 8.5 feet wide, 12 feet average height, and 65 feet long.

Analysis Results

The analytical results for each line are summarized in Table 4.13-1. The analysis determined that the maximum values for the four transmission lines are in compliance with the NESC limit and well below the NESC limit of 5 milliamperes. As shown in the table, the highest induced current was calculated to be 2.09 millamperes for Line No. 1092.

FirstEnergy Corporation, owners and operators of the transmission lines, conduct surveillance and maintenance to assure that design ground clearances will not change. These procedures include routine inspection by aircraft on a regular basis. The aerial patrols of all corridors include checks for encroachments, broken conductors, broken or leaning structures, and signs of burnt trees, any of which would be evidence of clearance problems. Ground inspections include examination for clearance at questionable locations, integrity of structures, and surveillance for dead or diseased trees that might fall on the transmission line. Problems noted during any inspection are brought to the attention of the appropriate organizations for corrective action.

As a result of this analysis performed in accordance with the requirements of 10 CFR 51, AmerGen concludes that electric shock is of SMALL significance for the TMI-1 transmission lines because the magnitude of the induced currents does not exceed the NESC standard. Mitigation measures are not warranted because there is adequate clearance between energized conductors and the ground. The conclusions on this

issue will remain valid into the future, provided there are no changes in line use, voltage, and maintenance practices and no changes in land use under the line.

4.14 HOUSING IMPACTS

4.14.1 HOUSING – REFURBISHMENT

NRC

The environmental report must contain "...[a]n assessment of the impact of the proposed action on housing availability…" 10 CFR 51.53(c)(3)(ii)(l)

"…Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or areas with growth control measures that limit housing development…." 10 CFR 51, Subpart A, Table B-1, Issue 63

"The impacts on housing are considered to be of small significance when a small and not easily discernible change in housing availability occurs, generally as a result of a very small demand increase or a very large housing market. Increases in rental rates or housing values in these areas would be expected to equal or slightly exceed the statewide inflation rate. No extraordinary construction or conversion of housing would occur where small impacts are foreseen." (NRC 1996)

NRC made housing impacts a Category 2 issue because impact magnitude depends on local conditions that NRC could not predict for all plants at the time of GEIS publication (NRC 1996). Local conditions that need to be ascertained are: (1) population categorization as small, medium, or high, (2) applicability of growth control measures, (3) the size and growth rate of the housing market.

In the GEIS, Section 3.7.2 (NRC 1996), NRC states that the potential for refurbishment-related impacts to housing would be caused by increased staffing. Further, NRC states that impacts on housing would be considered to be of small significance when a small and not easily discernible change in housing availability occurs, generally as a result of a very small demand increase or a very large housing market.

In 10 CFR 51, Subpart A, Appendix B, Table B-1, NRC concluded that impacts to housing are expected to be of small significance at plants located in high population areas where growth control measures are not in effect.

The maximum impact to area housing was assessed using the following assumptions: (1) all direct jobs would be filled by in-migrating residents, (2) the residential distribution of the workers would resemble that of the original construction workforce, Dauphin and Lancaster Counties, (3) refurbishment workers that could not find temporary housing within Dauphin and Lancaster Counties would find temporary housing in other counties within the 50-mile radius, and (4) each new direct job created would represent one housing unit. AmerGen's estimate of 900 refurbishment employees (Section 3.4) could generate the demand for 900 housing units.

As described in Section 2.6, TMI-1 is located in a high population area. As noted in Section 2.8, the two counties surrounding the plant are not subject to growth control measures that limit housing development. Additionally, the 2000 population of the 50-mile radius was 2,546,479 and the state had an average of 2.48 persons per household (USCB 2000), suggesting the existence of approximately 1 million housing units. Hotels and motels in the vicinity, especially within the Harrisburg-Carlisle, PA MSA, provide temporary housing opportunities.

With the amount of temporary and permanent housing available and the absence of growth control measures, this demand would not create a discernible change in housing availability, rental rates or housing values, or spur housing construction or conversion in the plant vicinity or region. Therefore, AmerGen concludes that impacts to housing availability resulting from refurbishment-related population growth would be SMALL and would not warrant mitigation.

4.14.2 HOUSING – LICENSE RENEWAL TERM

NRC

The environmental report must contain "...[a]n assessment of the impact of the proposed action on housing availability…" 10 CFR 51.53(c)(3)(ii)(I)

"…Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or areas with growth control measures that limit housing development…." 10 CFR 51, Subpart A, Table B-1, Issue 63

"...[S]mall impacts result when no discernible change in housing availability occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversion occurs…." (NRC 1996)

NRC made housing impacts a Category 2 issue because impact magnitude depends on local conditions that NRC could not predict for all plants at the time of GEIS publication (NRC 1996). Local conditions that need to be ascertained are: (1) population categorization as small, medium, or high and (2) applicability of growth control measures.

In 10 CFR 51, Subpart A, Appendix B, Table B-1, NRC concluded that impacts to housing are expected to be of small significance at plants located in high population areas where growth control measures are not in effect.

The maximum impact to area housing was calculated using the following assumptions: (1) all direct jobs would be filled by in-migrating residents; (2) the residential distribution of new residents would be similar to current operations worker distribution; and (3) each new direct job created would represent one housing unit. AmerGen's estimate of 60 license renewal employees (Section 3.4) could generate the demand for 60 housing units.

As described in Section 2.6, TMI-1 is located in a high population area. As noted in Section 2.8, Dauphin and Lancaster Counties are not subject to growth control measures that limit housing development. Additionally, in an area which has a population within a 50-mile radius of approximately 2,546,479 and a state average of 2.48 persons per household (USCB 2000), suggesting the existence of approximately one million housing units, it is reasonable to conclude that this demand would not create a discernible change in housing availability, rental rates or housing values, or spur housing construction or conversion. AmerGen concludes that impacts to housing availability resulting from plant-related population growth would be SMALL and would not warrant mitigation.

4.15 PUBLIC WATER SUPPLY

4.15.1 PUBLIC WATER SUPPLY – REFURBISHMENT

NRC

The environmental report must contain "…an assessment of the impact of population increases attributable to the proposed project on the public water supply." 10 CFR 51.53(c)(3)(ii)(l)

"…An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 65

"Impacts on public utility services are considered small if little or no change occurs in the ability to respond to the level of demand and thus there is no need to add capital facilities. Impacts are considered moderate if overtaxing of facilities during peak demand periods occurs. Impacts are considered large if existing service levels (such as quality of water and sewage treatment) are substantially degraded and additional capacity is needed to meet ongoing demands for services." (NRC 1996)

NRC made public utility impacts a Category 2 issue because an increased problem with water availability, resulting from pre-existing water shortages, could occur in conjunction with plant demand and plant-related population growth (NRC 1996). Local information needed would include: (1) a description of water shortages experienced in the area, and (2) an assessment of the public water supply system's available capacity.

NRC's analysis of impacts to the public water supply system considered both plant demand and plant-related population growth demands on local water resources. As stated in Section 2.3, the plant does not use water from a public water system. Therefore, there would be no plant demand-related impacts to the public water supply.

As such, the following discussion focuses on impacts of refurbishment on local public utilities, and the assumption that TMI-1 would add up to 900 employees during a 70-day period for refurbishment activities, as indicated in Section 3.4. Section 2.6 describes the TMI-1 regional demography. Section 2.9 describes the public water supply systems in the area, their permitted capacities, and current demands.

The maximum impact to area public water supplies was calculated using the following assumptions: (1) all direct jobs would be filled by in-migrating residents, (2) the residential distribution of the majority of the refurbishment work force would be similar to that of the original construction work force, Dauphin and Lancaster Counties, (3) refurbishment-related workers that could not find temporary housing within Dauphin and Lancaster Counties would find temporary housing in other counties within the 50-mile radius; and (4) refurbishment-related workers would not bring families due to the temporary nature of the refurbishment projects (i.e. 70 days or less).

The impact to the local water supply systems from plant-related population growth can be determined by calculating the

amount of water that would be required by these individuals. The average American uses about 90 gpd for personal use (USEPA 2003). As described in Section 3.4, AmerGen estimates an additional 900 employees. The plant-related population increase could require an additional 81,000 gpd (900 people multiplied by 90 gpd) in an area where the excess public water supply capacity is approximately 21 million gallons per day from the Harrisburg Municipal Water Authority and the City of Lancaster, alone (see Tables 2.9-1 and 2.9-2). Of the 6 major water suppliers in Dauphin and Lancaster Counties, there are no suppliers for which demand exceeds supply.

Additionally, TMI-1 operates an on-site sewage treatment facility with adequate capacity to accommodate the temporary increase of refurbishment employees. If it is assumed that this increase in population would be consistent with original construction work force trends (i.e., temporarily residing in Dauphin and Lancaster Counties), the increase in water demand would not create shortages in capacity of the water supply systems in these communities. AmerGen concludes that impacts resulting from plant-related population growth to public water supplies would be SMALL, requiring no additional capacity and not warranting mitigation.

4.15.2 PUBLIC WATER SUPPLY – LICENSE RENEWAL TERM

NRC

The environmental report must contain "…an assessment of the impact of population increases attributable to the proposed project on the public water supply." 10 CFR 51.53(c)(3)(ii)(l)

"…An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 65

"Impacts on public utility services are considered small if little or no change occurs in the ability to respond to the level of demand and thus there is no need to add capital facilities. Impacts are considered moderate if overtaxing of facilities during peak demand periods occurs. Impacts are considered large if existing service levels (such as quality of water and sewage treatment) are substantially degraded and additional capacity is needed to meet ongoing demands for services." (NRC 1996)

NRC made public utility impacts a Category 2 issue because an increased problem with water availability, resulting from pre-existing water shortages, could occur in conjunction with plant demand and plant-related population growth (NRC 1996). Local information needed would include: (1) a description of water shortages experienced in the area, and (2) an assessment of the public water supply system's available capacity.

NRC's analysis of impacts to the public water supply system considered both plant demand and plant-related population growth demands on local water resources. As stated in Section 2.3, the plant does not use water from a public water system. Therefore, there would be no plant demand-related impacts to the public water supply.

As such, the following discussion focuses on impacts of continued operations on local public utilities and the assumption that TMI-1 would add up to 60 additional employees during the period of extended operation for license renewal activities. As Section 3.4 indicates, AmerGen analyzed a hypothetical 60-person increase in TMI-1 employment attributable to license renewal. Section 2.6 describes the TMI-1 regional demography. Section 2.9 describes the public water supply systems in the area, their permitted capacities, and current demands.

The maximum impact to local water supply systems was assessed using the following assumptions: (1) all direct jobs would be filled by in-migrating residents and (2) the residential distribution of the workers would resemble that of the current operations workforce. The impact can be determined by calculating the amount of water that would be required by these individuals. The average American uses about 90 gpd for personal use (USEPA 2003). As described in Section 3.4, TMI-1 estimates an additional 60 employees, which could result in a population increase of 149 in the area (60 jobs multiplied by 2.48, which is the average number of persons per household in Pennsylvania [USCB 2000]). Using this consumption rate, the plant-related population increase could require an approximate additional 13,410 gpd

(149 people multiplied by 90 gpd) in an area where the excess public water supply capacity is approximately 21 million gallons per day from the Harrisburg Municipal Water Authority and the City of Lancaster (see Tables 2.9-1 and 2.9-2). Of the 6 major water suppliers in Dauphin and Lancaster Counties, there are no suppliers for which demand exceeds supply. If it is assumed that this increase in population would be consistent with current employee trends (i.e., 71 percent in Dauphin and Lancaster Counties), the increase in water demand would not create shortages in capacity of the water supply systems in these communities. AmerGen concludes that impacts resulting from plant-related population growth to public water supplies would be SMALL, requiring no additional capacity and not warranting mitigation.

4.16 EDUCATION

4.16.1 EDUCATION – REFURBISHMENT

NRC

The environmental report must contain "…[a]n assessment of the impact of the proposed action on…public schools (impacts from refurbishment activities only) within the vicinity of the plant…." 10 CFR 51.53(c)(3)(ii)(l)

"…Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors…." 10 CFR 51, Subpart A, Table B-1, Issue 66

"…[S]mall impacts are associated with project-related enrollment increases of 3 percent or less. Impacts are considered small if there is no change in the school systems' abilities to provide educational services and if no additional teaching staff or classroom space is needed. Moderate impacts are generally associated with 4 to 8 percent increases in enrollment. Impacts are considered moderate if a school system must increase its teaching staff or classroom space even slightly to preserve its pre-project level of service….Large impacts are associated with project-related enrollment increases above 8 percent…." (NRC 1996)

NRC made refurbishment-related impacts to education a Category 2 issue because site- and project-specific factors determine the significance of impacts (NRC 1996). Local factors to be ascertained include: (1) project-related enrollment increases and (2) status of the student/teacher ratio.

As stated in Section 3.4, AmerGen estimates that a maximum of 900 construction workers would be required for a maximum of 70 days for a steam generator replacement. This number of construction workers resembles an outage workforce, as it falls near the range (200 to 900 workers per reactor unit) reported in the GEIS for additional maintenance workers during a normal refueling outage (NRC 1996). The duration of the construction project would be within the range of a refueling outage. Anecdotal evidence from refueling outages at many plants in the U.S. suggests that outage workforces of this size and duration generally do not relocate families to the plant site region. Therefore, AmerGen estimates that few to no children would relocate to the region and that impacts on public schools would be SMALL and mitigation would not be warranted.

4.16.2 EDUCATION – LICENSE RENEWAL TERM

NRC made license renewal-related impacts to education a Category 1 issue. Therefore, an analysis is not needed.

4.17 OFFSITE LAND USE

4.17.1 OFFSITE LAND USE - REFURBISHMENT

NRC

The environmental report must contain "…an assessment of the impact of the proposed action on... land-use... (impacts from refurbishment activities only) within the vicinity of the plant…." 10 CFR 51.53(c)(3)(ii)(l)

"…Impacts may be of moderate significance at plants in low population areas…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 68

"…[I]f plant-related population growth is less than 5 percent of the study area's total population, off-site land-use changes would be small, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 persons per square mile, and at least one urban area with a population of 100,000 or more within 50 miles…." (NRC 1996)

NRC made impacts to offsite land use as a result of refurbishment activities a Category 2 issue because land-use changes could be considered beneficial by some community members and adverse by others. Local conditions to be ascertained include: (1) plant-related population growth, (2) patterns of residential and commercial development, and (3) proximity to an urban area with a population of at least 100,000 (NRC 1996).

In the GEIS, Section 3.7.5 (NRC 1996), NRC stated that, if refurbishment-related population growth is less than 5 percent of the study area's total population, off-site land-use changes would be small, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 persons per square mile, and at least one urban area with a population of 100,000 or more within 50 miles.

As stated in Section 2.6.1, Demography, the 2000 population of the 50-mile radius was 2,546,479, the population density was 325 persons per square mile within the 20-mile radius, and the 2000 population of Dauphin County was 251,798. The Harrisburg-Carlisle, PA MSA, Lancaster, PA MSA, York-Hanover, PA MSA and Reading, PA MSA are the largest urban areas within a 50-mile radius of the plant, and had 2000 populations of 509,074; 470,658; 381,751; and 373,638, respectively.

A refurbishment workforce of 900 would represent 0.4 percent increase in the population of Dauphin County and an even smaller percent increase (0.2 percent or less) in the populations of any one of the largest urban areas within the 50-mile region. As stated in Section 2.8, Land Use Planning, Dauphin and Lancaster counties are not subject to growth control measures that limit housing development. Therefore, AmerGen concludes that impacts to off-site land use resulting from refurbishment would be SMALL and would not warrant mitigation.

4.17.2 OFFSITE LAND USE - LICENSE RENEWAL TERM

NRC

The environmental report must contain "…[a]n assessment of the impact of the proposed action on…land-use…." 10 CFR 51.53(c)(3)(ii)(l)

"Significant changes in land use may be associated with population and tax revenue changes resulting from license renewal." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 69

"…[I]f plant-related population growth is less than five percent of the study area's total population, off-site land-use changes would be small…." (NRC 1996, Section 3.7.5)

"…[I]f the plant's tax payments are projected to be small relative to the community's total revenue, new tax-driven land-use changes during the plant's license renewal term would be small, especially where the community has preestablished patterns of development and has provided adequate public services to support and guide development." (NRC 1996, Section 4.7.4.1)

NRC made impacts to offsite land use during the license renewal term a Category 2 issue, because land-use changes may be perceived as beneficial by some community members and detrimental by others. Therefore, NRC could not assess the potential significance of site-specific offsite land-use impacts (NRC 1996, Section 4.7.4.2). Site-specific factors to consider in an assessment of land-use impacts include: (1) the size of plant-related population growth compared to the area's total population, (2) the size of the plant's tax payments relative to the community's total revenue, (3) the nature of the community's existing land-use pattern, and (4) the extent to which the community already has public services in place to support and guide development.

The GEIS presents an analysis of offsite land use for the renewal term that is characterized by two components: population-driven and tax-driven impacts (NRC 1996, Section 4.7.4.1).

Population-Related Impacts

Based on the GEIS case-study analysis, NRC concluded that all new population-driven land-use changes during the license renewal term at all nuclear plants would be small. Population growth caused by license renewal would represent a much smaller percentage of the local area's total population than the percent change represented by operations-related growth (NRC 1996, Section 3.7.3).

Tax-Revenue-Related Impacts

Determining tax-revenue-related land use impacts is a two-step process. First, the significance of the plant's tax payments on taxing jurisdictions' tax revenues is evaluated. Then, the impact of the tax contribution on land use within the taxing jurisdiction's boundaries is assessed.

Tax Payment Significance

NRC has determined that the significance of tax payments as a source of local

government revenue would be large if the payments are greater than 20 percent of revenue, moderate if the payments are between 10 and 20 percent of revenue, and small if the payments are less than 10 percent of revenue (NRC 1996).

Land Use Significance

NRC defined the magnitude of land-use changes as follows (NRC 1996):

SMALL - very little new development and minimal changes to an area's land-use pattern.

MODERATE - considerable new development and some changes to land-use pattern.

LARGE - large-scale new development and major changes in land-use pattern.

NRC further determined that, "…[I]f the plant's tax payments are projected to be medium to large relative to the community's total revenue, new tax-driven land-use changes would be moderate. This is most likely to be true where the community has no preestablished patterns of development (i.e., land use plans or controls) or has not provided adequate public services to support and guide development in the past, especially infrastructure that would allow industrial development (NRC 1996).

Tax Impacts

Table 2.7-1 provides a comparison of the 2000 through 2005 tax payments made by AmerGen to Dauphin County, Lower Dauphin School District and Londonderry Township and the tax revenues for each of these taxing bodies. Using NRC's criteria, Amergen's property tax payments were of small significance to Dauphin County (0.2 percent), Lower Dauphin School District (1.7 percent) and Londonderry Township (0.3 percent).

Land Use Impacts

As stated in Sections 2.6 and 2.9, Dauphin County experienced significant growth over the last several decades. From 1980 to 1990, the county's growth rate of 2 percent outpaced the State of Pennsylvania growth rate that was relatively stagnant at 0.2 percent. From 1990 to 2000, the population growth of the county remained positive at 5.9 percent. During the same period, the state population grew at a rate of 3.4 percent.

Dauphin County's growth can be attributed to the development of the southwest and southeast sections of the county.

Dauphin County, Lower Dauphin School District and Londonderry Township receive TMI-1 property tax payments. Although the county has experienced growth over the last three decades, the majority of land use remains rural (87 percent). Dauphin County uses comprehensive land use plans and zoning and subdivision ordinances to guide development. These plans and ordinances have been in place for several decades. The ordinances promote the public health, safety, and general welfare of residents; protect agricultural land from urban sprawl; and provide a basis for the orderly development. The ordinances require building permits, conditional use permits, plat development, zoning district controls, and variance requests. In the early 1990s, the county adopted formal growth control measures to promote growth in areas with existing infrastructure and development.

Conclusion

The TMI-1's property taxes are of small significance to Dauphin County and the land use changes in the county have been minimal with less than 13 percent of the county developed. Population growth has been attributed to the larger influence of the surrounding metropolitan areas and advancements in the transportation network. The county has a preestablished

pattern of development with controls for future development and has been able to provide the infrastructure needed to accommodate this growth. The nuclear plant's presence is not expected to directly attract support industries and commercial development or to encourage or deter residential development. Because population growth related to the license renewal of TMI-1 is expected to be small and there would be no new tax impacts to Dauphin County, the renewal of AmerGen's license would have a continued SMALL but financially beneficial impact on land use in Dauphin County. Therefore, mitigation would not be warranted.

4.18 TRANSPORTATION

4.18.1 TRANSPORTATION – REFURBISHMENT

NRC

The environmental report must "...assess the impact of highway traffic generated by the proposed project on the level of service of local highways during periods of license renewal refurbishment activities and during the term of the renewed license." 10 CFR 51.53(c)(3)(ii)(J)

"…Transportation impacts…are generally expected to be of small significance. However, the increase in traffic associated with additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 70

Small impacts would be associated with U.S. Transportation Research Board Level of Service A, having the following condition: "…Free flow of the traffic stream; users are unaffected by the presence of others." and Level of Service B, having the following condition: "…Stable flow in which the freedom to select speed is unaffected but the freedom to maneuver is slightly diminished…." (NRC 1996)

NRC made impacts to transportation a Category 2 issue, because impact significance is determined primarily by road conditions existing at the time of refurbishment, which NRC could not forecast for all facilities (NRC 1996). Local road conditions to be ascertained are: (1) level of service conditions and (2) incremental increases in traffic associated with the refurbishment work force.

The following discussion focuses primarily on transportation impacts from the addition during the 70-day steam generator replacement outage of up to 900 additional employees. However, transportation impacts also may occur at some locations along the transfer route of the replacement steam generators from the U.S. port of call (i.e., Baltimore, Philadelphia, or Newark) to the TMI-1 site. As section 3.2 explains, a final option has not been selected for the transfer activities. Notwithstanding, some options being considered may involve temporary removal from the route of interferences, such as low-hanging overhead lines. Movement of wide and heavy loads over roadways are also possible. Such activities may result in temporary, localized, slowing of traffic, or detours. In any case, applicable prior approvals (see Table 9.1-3) would be obtained at the appropriate time from federal, state, and local agencies.

The maximum impact to transportation in the area of the TMI-1 site as a result of additional employees during the 70-day outage was analyzed using the following assumptions: (1) all direct jobs would be filled by in-migrating residents, (2) the residential distribution of the majority of the refurbishment work force would be similar to that of the original construction work force (Dauphin and Lancaster Counties), (3) refurbishment-related workers that could not find temporary housing within Dauphin and Lancaster Counties would find temporary housing in other counties within

the 50-mile radius; and (4) each new direct job created would represent one additional vehicle on area roadways.

In the GEIS, NRC used the Transportation Research Board's level of service (LOS) definitions to assess significance levels of transportation impacts. LOS is a qualitative measure describing operational conditions within a traffic stream and their perception by motorists (NRC 1996). AmerGen employed the same definitions to analyze transportation impacts. According to NRC criteria, LOS A and B are associated with small impacts because the operation of individual users is not substantially affected by the presence of other users (NRC 1996, Section 3.7.4.2). LOS data are available for select roads in Dauphin County, specifically State Highway (SH)-441 (Table 2.9-3, Roadway Information). The greatest concentration of refurbishment-related workforce traffic would be found on SH-441 between Interstate 76 and SH-241. Dauphin County has determined that the LOS determinations for SH-441 on either side of the TMI-1 site entrances are either A or B. Traffic counts on SH-441, south of TMI-1's southern entrance in Lancaster County, are similar to those reported in Dauphin County. Therefore, AmerGen reasonably assumes that LOS determinations on this portion of SH-441 may be similar to those in Dauphin County.

As stated previously, the TMI-1 site has two entrances. The entrance to the north is used by the operating work force. The entrance to the south is used by a limited number of operational employees working on the southern portion of the station and construction and outage workforces. During the refurbishment projects, construction workers would use the southern entrance to the site. This would alleviate potential congestion problems at the northern site entrance.

The addition of 900 workers on SH-441 would not create discernible change in traffic flows because the LOS determinations for SH-441, both directly north and south of the plant, are either A or B. Given these employment projections, the average number of vehicles per day currently using the surrounding roads to TMI-1, and the LOS determinations of A and B on SH-441 in Dauphin County (Table 2.9-3), AmerGen concludes that impacts to transportation would be SMALL and mitigative measures would be unwarranted.

4.18.2 TRANSPORTATION – LICENSE RENEWAL TERM

NRC

The environmental report must "...assess the impact of highway traffic generated by the proposed project on the level of service of local highways during periods of license renewal refurbishment activities and during the term of the renewed license." 10 CFR 51.53(c)(3)(ii)(J)

"…Transportation impacts…are generally expected to be of small significance. However, the increase in traffic associated with additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 70

Small impacts would be associated with U.S. Transportation Research Board Level of Service A, having the following condition: "…Free flow of the traffic stream; users are unaffected by the presence of others." and Level of Service B, having the following condition: "…Stable flow in which the freedom to select speed is unaffected but the freedom to maneuver is slightly diminished…." (NRC 1996)

NRC made impacts to transportation a Category 2 issue, because impact significance is determined primarily by road conditions existing at the time of license renewal, which NRC could not forecast for all facilities (NRC 1996). Local road conditions to be ascertained are: (1) level of service conditions and (2) incremental increases in traffic associated license renewal staff.

The following discussion focuses on impacts of continued operations on transportation and the assumption that TMI-1 would add up to 60 additional employees during the period of extended operations. AmerGen's TMI-1 workforce includes approximately 526 permanent and 170 contract employees. On a 24-month cycle, as many as 1,400 additional workers join the permanent workforce during a refueling outage, which typically lasts approximately 20 to 30 days. AmerGen's projection of 60 additional employees associated with license renewal for TMI-1 represents an 8.7 percent increase in the current number of permanent and contract employees and an even smaller percentage of employees present onsite during a refueling outage.

In the GEIS, NRC used the Transportation Research Board's LOS definitions to assess significance levels of transportation impacts. LOS is a qualitative measure describing operational conditions within a traffic stream and their perception by motorists (NRC 1996). AmerGen employed the same definitions to analyze transportation impacts. According to NRC criteria, LOS A and B are associated with small impacts because the operation of individual users is not substantially affected by the presence of other users (NRC 1996, Section 3.7.4.2). LOS data are available for select roads in Dauphin County, specifically SH-441 (Table 2.9-3, Roadway Information). The greatest concentration of operations-related workforce traffic would be found on SH-441 between Interstate 76 and SH-241. Dauphin County has determined that the LOS determinations for SH-441 on either side of the TMI-1 site entrances are either A or B. Traffic counts on SH-441, south of TMI-1's southern entrance in Lancaster

County are similar to those reported in Dauphin County. Therefore, AmerGen reasonably assumes that LOS determinations on this portion of SH-441 may be similar to those in Dauphin County.

As stated previously, the TMI-1 site has two entrances. The entrance to the north is used by the operating work force. The entrance to the south is used by a limited number of operational employees working on the southern portion of the station and construction and outage workforces. During the outages and refurbishment projects, construction and outage workers would use the southern entrance to the plant. The 60 additional license renewal workers would use the northern entrance. This would alleviate any potential congestion problems at the northern site entrance.

The addition of 60 workers on SH-441 would not create discernible change in traffic flows because the LOS determinations for SH-441, both directly north and south of the plant, are either A or B. Given these employment projections, the average number of vehicles per day currently using the surrounding roads to TMI-1, and the LOS determinations of A and B on SH-441 in Dauphin County (Table 2.9-3), AmerGen concludes that impacts to transportation would be SMALL and mitigative measures would be unwarranted.

4.19 HISTORIC AND ARCHAEOLOGICAL RESOURCES

4.19.1 HISTORIC AND ARCHAEOLOGICAL RESOURCES – REFURBISHMENT

NRC

The environmental report must contain an assessment of "…whether any historic or archaeological properties will be affected by the proposed project." 10 CFR 51.53(c)(3)(ii)(K)

"Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 71

"Sites are considered to have small impacts to historic and archaeological resources if (1) the State Historic Preservation Officer (SHPO) identifies no significant resources on or near the site; or (2) the SHPO identifies (or has previously identified) significant historic resources but determines they would not be affected by plant refurbishment, transmission lines, and license-renewal term operations and there are no complaints from the affected public about altered historic character; and (3) if the conditions associated with moderate impacts do not occur." (NRC 1996)

NRC made impacts to historic and archaeological resources a Category 2 issue, because determinations of impacts to historic and archaeological resources are site-specific in nature and the National Historic Preservation Act mandates that impacts must be determined through consultation with the State Historic Preservation Officer (SHPO) (NRC 1996).

The Final Environmental Statement (FES) related to operation of the Three Mile Island Nuclear Station, Units 1 and 2 reports that the Advisory Council on Historic Preservation, the United States Department of the Interior, and the Pennsylvania Historical and Museum Commission (PHMC) were consulted by the US Atomic Energy Commission (AEC) regarding issuance of the initial operating licenses for the units. Comments from those agencies were included in the FES and indicated that the operation of TMI-1 would have no significant adverse effect on cultural resources in the area (AEC 1972).

Several cultural resource investigations have been conducted on the Island, including an archaeological survey and excavation by the Pennsylvania Historical and Museum Commission in 1967 (PHMC 1977). Results of those investigations indicate that Three Mile Island has had a long history of occupation and utilization. Cultures from the prehistoric Early Archaic through the historic Susquehannock have used the island.

AmerGen has identified sites currently listed on the National Register and determined eligible for listing on the National Register within the site vicinity (see Table 2.11-1).

Also, AmerGen has corporate procedures that protect cultural resources on all AmerGen plant sites and has instituted those procedures at TMI-1, as well.

Currently, AmerGen is not aware of any historic or archaeological resources that have been affected by TMI-1 activities. For the steam generator replacement project, AmerGen has no plans to construct permanent additional facilities or infrastructure except for the steam generator storage facility. This facility will be constructed in a previously disturbed area on site. Construction activities will be governed by AmerGen's corporate procedure that ensure the protection of cultural resources (Exelon 2007). Additional refurbishment traffic on area roadways is not expected to affect cultural resources. Therefore, AmerGen concludes that impacts from refurbishment activities would be SMALL, and no mitigation would be warranted.

Through correspondence with the Pennsylvania SHPO, AmerGen has obtained the Pennsylvania Bureau of Historic Preservation's concurrence that refurbishment activities would have no effect on historic and archaeological resources. Copies of the correspondence are presented in Appendix D.

4.19.2 HISTORIC AND ARCHAEOLOGICAL RESOURCES – LICENSE RENEWAL TERM

NRC

The environmental report must contain an assessment of "…whether any historic or archaeological properties will be affected by the proposed project." 10 CFR 51.53(c)(3)(ii)(K)

"Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 71

"Sites are considered to have small impacts to historic and archaeological resources if (1) the State Historic Preservation Officer (SHPO) identifies no significant resources on or near the site; or (2) the SHPO identifies (or has previously identified) significant historic resources but determines they would not be affected by plant refurbishment, transmission lines, and license-renewal term operations and there are no complaints from the affected public about altered historic character; and (3) if the conditions associated with moderate impacts do not occur." (NRC 1996)

NRC made impacts to historic and archaeological resources a Category 2 issue, because determinations of impacts to historic and archaeological resources are site-specific in nature and the National Historic Preservation Act mandates that impacts must be determined through consultation with the State Historic Preservation Officer (NRC 1996).

In the context of the National Historic Preservation Act, the NRC has determined that the Area of Potential Effect for a license renewal action is the area at the power plant site and its immediate environs which may be impacted by post-license renewal land disturbing activities specifically related to license renewal, regardless of ownership or control of the land of interest.

The FES related to operation of the Three Mile Island Nuclear Station, Units 1 and 2 reports that the Advisory Council on Historic Preservation, the United States Department of the Interior, and the Pennsylvania Historical and Museum Commission (PHMC) were consulted by the US Atomic Energy Commission (AEC) regarding issuance of the initial operating licenses for the units. Comments from those agencies were included in the FES and indicated that the operation of TMI-1 would have no significant adverse effect on cultural resources in the area (AEC 1972).

Several cultural resource investigations have been conducted on the Island, including an archaeological survey and excavation by the Pennsylvania Historical and Museum Commission in 1967 (PHMC 1977). Results of those investigations have indicated that Three Mile Island has had a long history of occupation and utilization. Cultures from the prehistoric Early Archaic

through the historic Susquehannock have used the island.

AmerGen has identified sites currently listed on the National Register and determined eligible for listing on the National Register within the site vicinity. Also, AmerGen has corporate procedures that protect cultural resources on all AmerGen plant sites and has instituted those procedures at TMI-1 as well.

Currently, AmerGen is not aware of any historic or archaeological resources that have been affected by TMI-1 operations. Because AmerGen has no plans to construct additional facilities at TMI-1 related to license renewal and because any land-disturbing activities that would be required would be done under the auspices of AmerGen's corporate procedures that insure the protection of cultural resources (Exelon 2007), AmerGen concludes that operation of TMI-1 over the license renewal term would not impact cultural resources; hence, impacts would be SMALL, and no mitigation would be warranted.

Through correspondence with the Pennsylvania SHPO, AmerGen has obtained the Pennsylvania Bureau of Historic Preservation's concurrence that operation of TMI-1 during the term of license renewal activities would have no effect on historic and archaeological resources. Copies of the correspondence are presented in Appendix D.

4.20 SEVERE ACCIDENT MITIGATION ALTERNATIVES (SAMA)

NRC

The environmental report must contain a consideration of alternatives to mitigate severe accidents "…if the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environment assessment..." 10 CFR 51.53(c)(3)(ii)(L)

"…The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 76

Section 4.20 summarizes an analysis of alternative ways to mitigate the impacts of severe accidents at TMI-1. AmerGen prepared this severe accident mitigation alternatives (SAMA) analysis, the details of which are provided in Appendix E, with support from its parent company, Exelon. For this reason, AmerGen and Exelon are referred to interchangeably in Section 4.20 and Appendix E.

The term "accident" refers to any unintentional event (i.e., outside the normal or expected plant operation envelope) that results in the release or a potential for release of radioactive material to the environment. NRC categorizes accidents as "design basis" or "severe." Design basis accidents are those for which the risk is great enough that NRC requires plant design and construction to prevent unacceptable accident consequences. Severe accidents are those that NRC considers too unlikely to warrant design controls.

NRC concluded in its license renewal rulemaking that the unmitigated environmental impacts from severe accidents met its Category 1 criteria. However, NRC made consideration of mitigation alternatives a Category 2 issue because not all plants had completed ongoing regulatory programs related to mitigation (e.g., individual plant examinations and accident management). Site-specific information to be presented in the license renewal environmental report includes: (1) potential SAMAs; (2) benefits, costs, and net value of implementing potential SAMAs; and (3) sensitivity of analysis to changes in key underlying assumptions.

AmerGen maintains a probabilistic safety assessment (PSA) model to use in evaluating the most significant risks of radiological release from TMI-1 fuel into the reactor and from the reactor into the containment structure. For the SAMA analysis, AmerGen used the PSA model output as input to an NRC-approved consequence assessment code (MACCS2) that calculates economic costs and dose to the public from hypothesized releases from the containment structure into the environment. Then, using NRC regulatory analysis techniques, AmerGen calculated the monetary value of the unmitigated TMI-1 severe accident risk. The result represents

the monetary value of the base risk of dose to the public and workers, offsite and onsite economic costs, and replacement power. This value became a cost/benefit-screening tool for potential SAMAs; a SAMA whose cost of implementation exceeded the base cost-risk value could be rejected as being not cost-beneficial.

AmerGen used industry, NRC, and TMI-1-specific information to create a list of 33 SAMAs for consideration. AmerGen analyzed this list to screen out any SAMAs that (1) would not apply to the TMI-1 design, (2) had already been implemented at TMI-1, or (3) would achieve results that AmerGen had already achieved at TMI-1 by other means. None of the SAMAs were screened based on these criteria. Hence, AmerGen prepared cost estimates for the 33 SAMAs and used the base risk value to screen out SAMAs that would not be cost-beneficial.

AmerGen calculated the cost-risk reduction that would be attributable to each of the remaining SAMAs (assuming SAMA implementation) and re-quantified the cost-risk value. The difference between the base cost-risk value and the SAMA-reduced cost-risk value became the averted cost-risk, or the value of implementing the SAMA.

AmerGen then performed a cost/benefit comparison for these SAMAs using this averted cost-risk value and the corresponding cost estimates for implementing the specific SAMA.

AmerGen performed additional sensitivity analyses to evaluate how the SAMA analysis would change if certain key parameters were changed. The results of the sensitivity analyses are discussed in Appendix E.

During AmerGen's TMI-1 SAMA analysis, certain errors were found in an NRC-sponsored code, SECPOP2000, which supports the MACCS2 code. The effect of these errors on the analysis has been evaluated, as described in Section E.7.6 of Appendix E, and incorporated into the conclusions reported below.

Based on the results of this SAMA analysis, AmerGen concludes that fifteen potentially cost-beneficial options exist to reduce plant risk that could be examined further, but none are related to managing the effects of plant aging during the period of extended operation. The potentially cost beneficial SAMAs will be considered for implementation through the established TMI-1 work management processes.

Table 4.13-1. Results of Induced Current Analysis.

Transmission Line	Voltage (kilovolts)	Maximum Induced Current (milliamperes)
Line No. 1051 – TMI-1 Plant to Jackson Substation	230	1.09
Line No. 1091 - TMI-1 Plant to Middletown Junction	230	1.38
Line No. 1092 – TMI-1 Plant to Middletown Junction	230	2.09
Line from TMI-1 Plant to the 500-kV Substation	230	1.33

Note: The TMI-1 Plant to the 500-kV Substation transmission line was designed to operate at 500 kilovolts, but it operates at 230 kilovolts.

4.21 REFERENCES

Note to reader: Some web pages cited in this document are no longer available, or are no longer available through the original URL addresses. Hard copies of cited web pages are available in AmerGen files. Some sites, for example the census data, cannot be accessed through their given URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by AmerGen have been given for these pages, even though they may not be directly accessible. Also, all references are specific to respective chapter.

AEC (U.S. Atomic Energy Commission). 1972. Final Environmental Statement related to the operation of Three Mile Island Nuclear Station, Units 1 and 2. Metropolitan Edison Company, et al. Docket Nos. 50-289 and 50-320. December.

AmerGen (AmerGen Energy Company, LLC). 2006. Three Mile Island Updated Final Safety Analysis Report, Rev. 18. April.

AmerGen (AmerGen Energy Company, LLC). 2007a. Three Mile Island Nuclear Station Water Use Schematic, NPDES PA0009920. March 30.

AmerGen (AmerGen Energy Company, LLC). 2007b. Automatic temperature monitoring data from TMI-1 Intake Screen Pumphouse and Discharge Monitoring Pit from August 2005 through September 28, 2007. Compiled by Ed Fuhrer, AmerGen, September 28.

Durlin and Schaffstall (Durlin, R.R. and W.P. Schaffstall). 2005. Water Resources Data Pennsylvania Water Year 2004, Water-Data Report PA-04-2, U.S. Geological Survey. May.

Exelon (Exelon Nuclear). 2007. "Environmental Evaluations." Document No. EN-AA-103-0001, Revision 3. February 28

IA (Ichthyological Associates, Inc.). 1979. "An Ecological Study of the Susquehanna River Near the Three Mile Island Nuclear Station" Annual Report for 1978.

IEEE (Institute of Electrical and Electronics Engineers). 1997. National Electrical Safety Code, 1997 Edition, New York, New York.

Joklik, W. K. and D. T. Smith. 1972. *Microbiology*. 15th Edition. Meredith Corporation, New York.

NRC (U.S. Nuclear Regulatory Commission). 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants Volumes 1 and 2. NUREG-1437. Washington, DC. May.

PDEP (Pennsylvania Department of Environmental Protection). 2007. "Pennsylvania's Peregrine DEP Falcon Page." Available online at http://www.dep.state.pa.us/dep/falcon/. Accessed on February 1, 2007.

PHMC (Pennsylvania Historical and Museum Commission). 1977. "Early and Middle Woodland Campsites on Three Mile Island, Dauphin County, Pennsylvania." Pennsylvania Historical and Museum Commission, William Penn Memorial Museum. Harrisburg, Pennsylvania. January.

SRBC (Susquehanna River Basin Commission). 1995. GPU Nuclear Corporation, Three Mile Island Nuclear Station-Unit 1, Application 199550302. March 19.

SRBC (Susquehanna River Basin Commission) 1999, GPU Nuclear, Inc. Application for a Revised permit for Groundwater Withdrawal Permit 19961102 (Revised). January 14.

SRBC (Susquehanna River Basin Commission) 2005, Cowanesque Reservoir Water Storage Project Storing Water for Low Flows, Information Sheet. July 14.

USCB (U.S. Census Bureau). 2000. "State and County Quickfacts, Dauphin and Lancaster Counties, Pennsylvania." Available online at http://quickfacts.census.gov/. Accessed August 3, 2006.

USEPA (United States Environmental Protection Agency). 2003. Water on Tap: What You Need To Know. EPA 816- K-03-007. Office of Water. Washington, DC.

Chapter 5

ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION

5.1 DISCUSSION

NRC

"…The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware." 10 CFR 51.53(c)(3)(iv)

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants and provides for license renewal, requiring a license renewal application that includes an environmental report (10 Code of Federal Regulations (CFR) 54.23). NRC regulations, 10 CFR 51, prescribe the environmental report content and identify the specific analyses the applicant must perform. In an effort to streamline the environmental review, NRC has resolved most of the environmental issues generically and only requires an applicant's analysis of the remaining issues.

While NRC regulations do not require an applicant's environmental report to contain analyses of the impacts of those Category 1 environmental issues that have been generically resolved [10 CFR 51.53(c)(3)(i)], the regulations do require that an applicant identify any new and significant information of which the applicant is aware [10 CFR 51.53(c)(3)(iv)]. The purpose of this requirement is to alert NRC staff to such information, so the staff can determine whether to seek the Commission's approval to waive or suspend application of the rule with respect to the affected generic analysis. NRC has explicitly indicated, however, that an applicant is not required to perform a site-specific validation of Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) conclusions (NRC 1996).

AmerGen Energy Company, LLC (AmerGen) expects that new and significant information would include:

- Information that identifies a significant environmental issue not covered in the GEIS and codified in the regulation, or
- Information that was not covered in the GEIS analyses and that leads to an impact finding different from that codified in the regulation.

NRC does not specifically define the term "significant." For the purpose of its review, AmerGen used guidance available in Council on Environmental Quality (CEQ) regulations. The National Environmental Policy Act authorizes CEQ to establish implementing regulations for federal agency use. NRC requires license renewal applicants to provide NRC with input, in the form of an environmental report, that NRC will use to meet National Environmental Policy Act requirements as they apply to license renewal (10 CFR 51.10).

CEQ guidance provides that federal agencies should prepare environmental impact statements for actions that would significantly affect the environment (40 CFR 1502.3), focus on significant environmental issues (40 CFR 1502.1), and eliminate from detailed study issues that are not significant [40 CFR 1501.7(a)(3)]. The CEQ guidance includes a lengthy definition of "significantly" that requires consideration of the context of the action and the intensity or severity of the impact(s) (40 CFR 1508.27). AmerGen considered that MODERATE or LARGE impacts, as defined by NRC, would be significant. Chapter 4 presents the NRC definitions of SMALL, MODERATE, and LARGE impacts.

The new and significant assessment that AmerGen conducted during preparation of this license renewal application included: (1) interviews with AmerGen and First Energy subject matter experts on the validity of the conclusions in the GEIS as they relate to Three Mile Island Generating Station Unit 1 (TMI-1), (2) an extensive review of documents related to environmental issues at TMI-1, (3) a review of correspondence with state and federal agencies to determine if the agencies had concerns relevant to their resource areas that had not been addressed in the GEIS, (4) a review of the results of TMI-1 environmental monitoring and reporting, as required by regulations and oversight of plant facilities and operations by state and federal regulatory agencies (i.e., the results of ongoing routine activities that could bring significant issues to AmerGen's attention), and (5) a review for issues relevant to the TMI-1 application of certain license renewal applications that have previously been submitted to the NRC by the operators of other nuclear plants.

As part of the assessment described above for new and significant information, AmerGen evaluated information about tritium in groundwater at the Three Mile Island Nuclear Station (Section 2.3). Based on that evaluation, AmerGen has concluded that TMI-1 is not contributing to changes in groundwater quality that would preclude current or future uses of the groundwater for the following reasons:

- The Susquehanna River acts as a boundary between the groundwater on Three Mile Island and groundwater in the rock of the Gettysburg formation on either side of the river.

- Under normal Station conditions, tritium levels in the groundwater do not exceed the EPA drinking water standard of 20,000 pCi/L.

- The Radiological Groundwater Protection Program (RGPP) at the Three Mile Island Nuclear Station has been shown to provide an effective warning system for releases of tritium to the groundwater from TMI-1 operations.

- Station response to RGPP reporting illustrates that timely corrective action is effective to remediate and control tritium releases to groundwater.

Hence, the contribution of TMI-1 operations during the license renewal period to the cumulative impacts of major activities on groundwater quality would be small.

In its entirety, AmerGen's assessment did not identify any new and significant information regarding the plant's environment or operations that would make any generic conclusion codified by the NRC for Category 1 issues not applicable to TMI-1, that would alter regulatory or GEIS statements regarding Category 2 issues or that would suggest any other measure of license renewal environmental impact.

5.2 REFERENCES

NRC (U.S. Nuclear Regulatory Commission). 1996. Public Comments on the Proposed 10 CFR 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response. Volumes 1 and 2. NUREG-1529. Washington, DC. May.

Chapter 6

SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 LICENSE RENEWAL IMPACTS

AmerGen Energy Company, LLC (AmerGen) has reviewed the environmental impacts of renewing the Three Mile Island Nuclear Station Unit 1 (TMI-1) operating licenses and has concluded that impacts would be SMALL and would not require mitigation. This environmental report documents the basis for AmerGen's conclusion. Chapter 4 incorporates by reference Nuclear Regulatory Commission (NRC) findings for the 69 Category 1 issues that apply to TMI-1, all of which have impacts that are SMALL (Appendix A, Table A-1). The rest of Chapter 4 analyzes Category 2 issues, all of which are either not applicable or have impacts that are SMALL. Table 6.1-1 identifies the impacts that TMI-1 license renewal would have on resources associated with Category 2 issues.

6.2 MITIGATION

NRC

"The report must contain a consideration of alternatives for reducing adverse impacts…for all Category 2 license renewal issues…" 10 CFR 51.53(c)(3)(iii)

"The environmental report shall include an analysis that considers and balances…alternatives available for reducing or avoiding adverse environmental effects…" 10 CFR 51.45(c) as incorporated by 10 CFR 51.53(c)(2) and 10 CFR 51.45(c)

Impacts of license renewal and refurbishment activities have been predicted as SMALL and would not require mitigation. Current operations include monitoring activities that would continue during the license renewal term. AmerGen performs routine monitoring to ensure the safety of workers, the public, and the environment. These activities include gaseous and liquid radiological environmental monitoring in accordance with the TMI-1 operating license technical specifications issued by the NRC, non-radiological air emissions monitoring in accordance with air quality permits issued by the PADEP, groundwater monitoring in accordance with the TMI-1 Radiological Groundwater Protection Program, and water effluent monitoring in accordance with the National Pollutant Discharge Elimination System (NPDES) permit issued by the PADEP. These monitoring programs ensure that the plant's emissions and effluents are within regulatory limits and that unusual or off-normal emissions/discharges are quickly detected, thus mitigating potential impacts. Accordingly, AmerGen has concluded that additional mitigation measures are not warranted.

6.3 UNAVOIDABLE ADVERSE IMPACTS

NRC

The environmental report shall discuss any "...adverse environmental effects which cannot be avoided should the proposal be implemented..." 10 CFR 51.45(b)(2) as adopted by 10 CFR 51.53(c)(2)

This environmental report adopts by reference NRC findings for applicable Category 1 issues, including discussions of any unavoidable adverse impacts (Table A-1). AmerGen examined 21 Category 2 issues and identified the following unavoidable adverse impacts of license renewal and refurbishment activities:

- The Cooling Towers and their vapor plumes are visible from offsite. This visual impact will continue during the license renewal term.

- Procedures for the disposal of radioactive and nonradioactive wastes are intended to reduce adverse impacts from these sources to acceptably low levels. A small impact will occur as long as the plant is in operation. Solid radioactive wastes are a product of plant operations and permanent disposal of such materials is required.

- Operation of TMI-1 results in a very small increase in radioactivity in the air and water. However, fluctuations in natural background radiation are expected to exceed the small incremental increase in dose to the local population. Operation of TMI-1 also creates a very low probability of accidental radiation exposure to inhabitants of the area.

- Operations of TMI-1 results in consumptive use of Susquehanna River water. AmerGen is required to have plans for low-flow augmentation during drought conditions and participates in the Cowanesque Lake storage project.

- Land is required to store the old steam generator onsite pending disposal.

6.4 IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENTS

NRC

The environmental report shall discuss any "...irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented…" 10 CFR 51.45(b)(5) as adopted by 10 CFR 51.53(c)(2)

Continued operation of TMI-1 for the license renewal term will result in irreversible and irretrievable resource commitments, including the following:

- Nuclear fuel, which is used in the reactor and is converted to radioactive waste;
- Land required to permanently store or dispose of spent nuclear fuel, low-level radioactive wastes generated as a result of plant operations, and nonradioactive industrial wastes;
- Materials used for construction of the steam generator storage building;
- Elemental materials that will become radioactive; and
- Materials used for the normal industrial operations of the plant that cannot be recovered or recycled or that are consumed or reduced to unrecoverable forms.

6.5 SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

NRC

The environmental report shall discuss the "...relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity..." 10 CFR 51.45(b)(4) as adopted by 10 CFR 51.53(c)(2)

The current balance between short-term use and long-term productivity at the TMI-1 site was established with the decision to convert approximately 440 acres of farmland and woodland to industrial use. The Final Environmental Statement related to construction and operation evaluated the impacts of constructing and operating TMI-1 (AEC 1972). Natural resources that would be subjected to short-term use include land and water. Three Mile Island and the area surrounding it are largely undeveloped. Approximately 200 acres of the 370-acre island are devoted to the production of electrical energy. This includes the area occupied by TMI-1 facilities (buildings, parking lots, roadways) and landscaped areas around the facilities. Transmission line construction required about 130 acres of land that resulted in the alteration of natural wildlife habitats.

Although TMI-1 consumes water from the Susquehanna River, the impacts are minor and would cease once the reactors cease operation.

Refurbishment would result in the consumption of additional water during hydro-demolition, but the consumption would be limited in duration and would cease once the steam generators are replaced. Air emissions associated with refurbishment would add small amounts of radiological and nonradiological constituents to the air. Likewise, noise impacts would localized and of short duration. The productivity of the aquatic community in the Susquehanna River in the vicinity of TMI-1 is minimally impacted by the water use.

After decommissioning, most environmental disturbances would cease and restoration of the natural habitat could occur. Thus, the "trade-off" between the production of electricity and changes in the local environment is reversible to some extent.

Experience with other experimental, developmental, and commercial nuclear plants has demonstrated the feasibility of decommissioning and dismantling such plants sufficiently to restore a site to its former use. The degree of dismantlement will take into account the intended new use of the site and a balance among health and safety considerations, salvage values, and environmental impact. However, decisions on the ultimate disposition of these lands have not yet been made. Continued operation for an additional 20 years would not increase the short-term productivity impacts described here.

Table 6.1-1. Environmental Impacts Related to License Renewal at TMI-1

No.	Category 2 Issue	Environmental Impact
Surface Water Quality, Hydrology, and Use (for all plants)		
13	Water use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow)	**SMALL.** TMI-1 consumptive maximum water use is less than 0.1 percent of average river flow. AmerGen complies with the Susquehanna River Basin Commission's Standards for Surface Water Withdrawals in 18 CFR 803.44.
Aquatic Ecology (for plants with once-through or cooling pond heat dissipation systems)		
25	Entrainment of fish and shellfish in early life stages	**NONE.** This issue does not apply because TMI-1 does not use a once-through or cooling pond heat dissipation system.
26	Impingement of fish and shellfish	**NONE.** This issue does not apply because TMI-1 does not use a once-through or cooling pond heat dissipation system.
27	Heat shock	**NONE.** This issue does not apply because TMI-1 does not use a once-through or cooling pond heat dissipation system.
Groundwater Use and Quality		
33	Groundwater use conflicts (potable and service water, and dewatering; plants that use > 100 gpm)	**SMALL.** Based on the requirements of the Susquehanna River Basin Commission permit and results of the pumping tests, negligible impacts are expected to nearby groundwater users.
34	Groundwater use conflicts (plants using cooling towers or cooling ponds and withdrawing makeup water from a small river)	**SMALL.** TMI-1 withdraws from the Susquehanna River at a rate of approximately 1.6 percent of the lowest daily mean. Impacts to the alluvial aquifer are minuscule.
35	Groundwater use conflicts (Ranney wells)	**NONE.** This issue does not apply because TMI-1 does not use Ranney wells.
39	Groundwater quality degradation (cooling ponds at inland sites)	**NONE.** This issue does not apply because TMI-1 does not use cooling ponds.
Terrestrial Resources		
40	Refurbishment impacts	**SMALL.** Impacts are expected to be minimal because the steam generator replacement work will be conducted within the existing industrial footprint of the station, which has been previously disturbed. While peregrine falcons nest at TMI-1, they appear to have become accustomed to the activities at the plant. If it is determined that activities associated with the steam generator replacement project warrant obtaining a permit from the PA Game Commission and/or the U.S. Fish and Wildlife service, an application will be filed at the appropriate time.
Threatened or Endangered Species		
49	Threatened or endangered species	**SMALL.** Bald eagles are common on the Susquehanna River during some seasons of the year. Peregrine falcons and osprey are known to occur at TMI-1. The transmission lines cross counties that have known populations of protected species, but none has been identified in the transmission corridors.

Table 6.1-1. Environmental Impacts Related to License Renewal at TMI-1 (continued)

No.	Category 2 Issue	Environmental Impact
Air Quality		
50	Air quality during refurbishment (non-attainment and maintenance areas)	**SMALL.** Impacts are expected to be minimal because Best Management Practices would be employed during refurbishment activities.
Human Health		
57	Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	**SMALL.** The low temperatures in the Susquehanna River and the disinfection at the sewage treatment facility do not support the propagation of pathological microbes.
59	Electromagnetic fields, acute effects (electric shock)	**SMALL.** The largest modeled induced current under the TMI-1 lines is substantially less than the 5-milliampere limit. Therefore, the TMI-1 transmission lines conform to the National Electrical Safety Code provisions for preventing electric shock from induced current.
Socioeconomics		
63	Housing impacts	**SMALL.** The conceptual addition of 60 jobs would not noticeably affect a housing market of more than one million housing units. Due to the short duration of refurbishment activity, no impacts are expected.
65	Public water supply: public utilities	**SMALL.** Water suppliers in Dauphin and Lancaster Counties have excess capacity. The addition of as many as 60 jobs would not adversely affect the available water supply. Due to the short duration of refurbishment activity, no impacts are expected.
66	Public services: education (refurbishment)	**SMALL.** Due to the short duration of refurbishment activity, no impacts are expected.
68	Offsite land use (refurbishment)	**SMALL.** Due to the short duration of refurbishment activity, no impacts are expected.
69	Offsite land use (license renewal term)	**SMALL.** No plant-induced changes to offsite land use are expected from license renewal because TMI-1 taxes represent less than 3 percent of total tax revenue for the school district and Dauphin County.
70	Public services: transportation	**SMALL.** The addition of as many as 60 employees would not noticeably increase traffic or adversely affect level of service in the vicinity of TMI-1. Due to the short duration of refurbishment activity, no impacts are expected.
71	Historic and archaeological resources	**SMALL.** Continued operation of TMI-1 would require limited construction at the site, primarily for steam generator storage. Construction would occur in a previously disturbed area and therefore, license renewal would have little or no effect on historic or archaeological resources and impacts are expected to be minimal.
Postulated Accidents		
76	Severe accidents	**SMALL.** AmerGen did not identify any cost-effective SAMAs related to aging management.

6.6 REFERENCES

AEC (Atomic Energy Commission). 1972. Final Environmental Statement Related to the Operation of Three Mile Island Nuclear Station Units 1 and 2, Metropolitan Edison Company. Docket Nos. 50-289 and 50-320. December.

Chapter 7

Alternatives to the Proposed Action

NRC

The environmental report shall discuss "Alternatives to the proposed action.…" 10 CFR 51.45(b)(3), as adopted by reference at 10 CFR 51.53(c)(2).

"...The report is not required to include discussion of need for power or economic costs and benefits of ... alternatives to the proposed action except insofar as such costs and benefits are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation...." 10 CFR 51.53(c)(2).

"While many methods are available for generating electricity, and a huge number of combinations or mixes can be assimilated to meet a defined generating requirement, such expansive consideration would be too unwieldy to perform given the purposes of this analysis. Therefore, NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable…" (NRC 1996a).

"…The consideration of alternative energy sources in individual license renewal reviews will consider those alternatives that are reasonable for the region, including power purchases from outside the applicant's service area...." (NRC 1996b)

Chapter 7 evaluates alternatives to Three Mile Island Nuclear Station Unit 1 (TMI-1) license renewal. The chapter identifies actions that AmerGen Energy Company, LLC (AmerGen) might take, and associated environmental impacts, if the U.S. Nuclear Regulatory Commission (NRC) does not renew the plant's operating license. The chapter also addresses actions that AmerGen has considered, but would not take, and discusses the bases for determining that such actions would be unreasonable.

The alternatives discussed in this chapter are divided into two categories, "no-action" and "alternatives that meet system generating needs." In considering the level of detail and analysis that it should provide for each category, AmerGen relied on the NRC decision-making standard for license renewal:

> "…the NRC staff, adjudicatory officers, and Commission shall determine whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decision makers would be unreasonable." [10 Code of Federal Regulations (CFR) 51.95(c)(4)].

AmerGen has determined that the environmental report would support NRC decision making as long as the document provides sufficient information to clearly indicate whether an alternative would have a smaller, comparable, or greater environmental impact than the proposed action. Providing additional detail or analysis serves no function if it only brings to light additional adverse impacts of alternatives to license renewal. This approach is consistent with regulations of the Council on Environmental Quality, which

provide that the consideration of alternatives (including the proposed action) should enable reviewers to evaluate their comparative merits (40 CFR 1500-1508). AmerGen believes that Chapter 7 provides sufficient detail about alternatives to establish the basis for necessary comparisons to the Chapter 4 discussion of impacts from the proposed action.

In characterizing environmental impacts from alternatives, the same definitions of "small," "moderate," and "large" presented in the introduction to Chapter 4 are used in this chapter.

7.1 NO-ACTION ALTERNATIVE

The "no-action alternative" refers to a scenario in which NRC does not renew the TMI-1 operating license. Components of this alternative include replacing the generating capacity of TMI-1 and decommissioning the facility, as described below.

TMI-1 provides approximately 7 terawatt-hours of electricity annually (EIA 2006a) with 802 megawatts of base-load electrical capacity (AmerGen 2005) to residents and other consumers in the mid-Atlantic region. Replacement could be accomplished by (1) building new generating base-load capacity, (2) purchasing power from the wholesale market, or (3) reducing power requirements through demand reduction. Section 7.2.1 describes each of these possibilities in detail, and Section 7.2.2 describes environmental impacts from feasible alternatives.

The Generic Environmental Impact Statement (GEIS) (NRC 1996a, pg. 7-1) defines decommissioning as the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license. One of the NRC-evaluated decommissioning options is immediate decontamination and dismantlement, and safe storage of the stabilized and defueled facility for a period of time, followed by additional decontamination and dismantlement. Regardless of the option chosen, decommissioning must be completed within a 60-year period. Under the no-action alternative, AmerGen would continue operating TMI-1 until the existing license expires, then initiate decommissioning activities in accordance with NRC requirements. The GEIS describes decommissioning activities based on an evaluation of a larger reactor (the "reference" pressurized-water reactor is the 1,175-megawatt-electric [MWe] Trojan Nuclear Plant). This description is applicable to decommissioning activities that AmerGen would conduct at TMI-1.

As the GEIS notes, NRC has evaluated environmental impacts from decommissioning. NRC-evaluated impacts include impacts of occupational and public radiation dose; impacts of waste management; impacts to air and water quality; and ecological, economic, and socioeconomic impacts. NRC indicated in the Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities; Supplement 1 (NRC 2002a, Section 4.3.8) that the environmental effects of greatest concern (i.e., radiation dose and releases to the environment) are substantially less than the same effects resulting from reactor operations. AmerGen adopts by reference the NRC conclusions regarding environmental impacts of decommissioning.

AmerGen notes that decommissioning activities and their impacts are not discriminators between the proposed action and the no-action alternative. TMI-1 will have to be decommissioned regardless of the NRC decision on license renewal; license renewal would only postpone decommissioning for another 20 years. NRC has established in the GEIS that the timing of decommissioning operations does not substantially influence the environmental impacts of decommissioning. AmerGen adopts by reference the NRC findings (10 CFR 51, Appendix B, Table B 1, Decommissioning) to the effect that delaying decommissioning until after the renewal term would have small environmental impacts. The discriminators between the proposed action and the no-action alternative lie within the choice of generation replacement options to be part of the no-action alternative. Section 7.2.2 analyzes the impacts from these options.

AmerGen concludes that the decommissioning impacts under the no-

action alternative would not be substantially different from those occurring following license renewal, as identified in the GEIS (NRC 1996a) and in the decommissioning generic environmental impact statement (NRC 2002a). These impacts would be temporary and would occur at the same time as the impacts from meeting system generating needs.

7.2 ALTERNATIVES THAT MEET SYSTEM GENERATING NEEDS

TMI-1 has a maximum net capacity of 802 MWe (AmerGen 2005) and generated approximately 7.3 terawatt-hours of electricity in 2004 and 6.8 terawatt-hours in 2005 (EIA 2006a). This power is sufficient to supply the electricity used by over 300,000 homes (Exelon 2006), and would be unavailable to customers in the event the TMI-1 operating license is not renewed.

The power consumed in Pennsylvania is not limited to electricity generated within the Commonwealth. Pennsylvania relies on electricity drawn from the PJM Interconnection, a regional network that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia. One consequence of the network is that electric power consumers in Pennsylvania are not specifically dependent on electricity generated within the Commonwealth. The current mix of power generation options within the PJM region is one indicator of what AmerGen considers to be feasible alternatives. In 2005, electric generators connected to the PJM network had a total generating capacity of 164,634 MWe (PJM 2006a). This capacity includes units fueled by coal (41.5 percent), nuclear (19.1 percent), oil (7.2 percent), natural gas (27.5 percent), hydroelectric (4.5 percent), and renewable sources (0.3 percent) (PJM 2006b). In 2005, the electric industry in the PJM region provided 728 terawatt-hours of electricity (PJM 2006a). Power generation in the PJM region was dominated by coal (66.6 percent), followed by nuclear (25.2 percent), natural gas (5.6 percent), hydroelectric (1.3 percent), oil (0.9 percent) and renewable sources (0.5 percent) (PJM 2006b). Figures 7.2-1 and 7.2-2 illustrate the electric industry generating capacity and energy output by fuel type for the PJM region.

Comparison of generating capacity with actual utilization of this capacity indicates that coal and nuclear are used by PJM substantially more relative to their PJM capacity than either oil-fired or gas-fired generation. This condition reflects the relatively low fuel cost and base-load suitability for nuclear power and coal-fired plants, and relatively higher use of gas- and oil-fired units to meet peak loads. Comparison of capability and energy production for petroleum and gas-fired facilities indicates a strong preference for gas firing over oil firing, indicative of the higher cost and greater air emissions associated with oil firing. Energy production from hydroelectric sources is similarly preferred from a cost standpoint, but capacity is limited and utilization can vary substantially depending on water availability.

7.2.1 ALTERNATIVES CONSIDERED

Technology Choices

For the purposes of this environmental report, alternative generating technologies were evaluated to identify candidate technologies that would be capable of replacing TMI-1's base-load capacity of 802 MWe.

Based on these evaluations, it was determined that new plant systems capable of replacing the capacity of the TMI-1 nuclear unit are limited to pulverized-coal and gas-fired combined-cycle units for base-load operation. This conclusion is borne out by the generation information presented above that identifies coal as the most heavily used non-nuclear generating fuel type in the region. AmerGen would use natural gas as the primary fuel in its combined-cycle turbines because of the economic and environmental advantages of

gas over oil. Manufacturers now have large standard sizes of combined-cycle gas turbines that are economically attractive and suitable for high-capacity base-load operation. For the purposes of the TMI-1 license renewal environmental report, AmerGen has limited its analysis of new generating capacity alternatives to the technologies it considers feasible: pulverized coal- and gas-fired units. AmerGen chose to evaluate combined-cycle turbines in lieu of simple-cycle turbines because the combined-cycle option is more economical. The benefits of lower operating costs for the combined-cycle option outweigh its higher capital costs.

Effects of Restructuring

Nationally, the electric power industry has been undergoing a transition from a regulated industry to a competitive market environment. Efforts to deregulate the electric utility industry began with passage of the National Energy Policy Act of 1992. Provisions of this act required electric utilities to allow open access to their transmission lines and encouraged development of a competitive wholesale market for electricity. The Act did not mandate competition in the retail market, leaving that decision to the states (NEI 2000). Over the past few years, states within the PJM region have transitioned to competitive wholesale and retail markets.

In 1996, Pennsylvania enacted the "Electricity Generation Customer Choice and Competition Act." Provisions of the Act opened Pennsylvania's retail electric power market to competition. The Pennsylvania Public Utility Commission (PPUC) provides strategic direction and policy guidance for oversight of the electric power industry in the Commonwealth, including the restructuring initiative (Pennsylvania General Assembly 1996).

In 2004, Pennsylvania adopted the Alternative Energy Portfolio Standards Act (AEPS), which requires all suppliers selling retail electricity in Pennsylvania (retail electric suppliers) to include alternative energy sources in the mix of energy that they sell. Eligible resources may be located anywhere within the PJM region (Pennsylvania General Assembly 2004).

The AEPS established two tiers of alternative energy sources and set minimum requirements for each tier. By 2007 at least 1.5 percent of the electricity sold by a retail electric supplier must come from Tier I sources. Tier I sources include wind, solar photovoltaic energy, low-impact hydropower, geothermal sources, biologically-derived methane gas, fuel cells, biomass, and coal mine methane. The Tier I percentage increases by 0.5 percent each year, and by the year 2020, at least 8 percent of the retail electric energy sold in Pennsylvania must be generated from Tier I sources. The AEPS also requires that a very small percentage of Tier I generation be from solar photovoltaic technologies.

In addition, a certain percentage of electricity sold by retail electric suppliers must be generated from Tier II alternative energy sources. Tier II sources include energy derived from waste coal, distributed generation systems, demand side management (DSM), large-scale hydropower, municipal solid waste generation, utilizing the byproducts of pulping or wood-manufacturing processes, and integrated combined coal gasification technology. The AEPS requires 4.2 percent of energy sold each year through 2009 to be generated using Tier II resources. The percentage increases incrementally until the year 2020 when at least 10 percent of the retail electric energy sold in Pennsylvania must be supplied from Tier II sources.

As mentioned above, the AEPS includes provisions for DSM measures to reduce electricity demand within the Commonwealth. Eligible measures include energy efficiency measures undertaken by residential, commercial, institutional, or governmental customers; load management

and demand response approaches that shift electric load from periods of higher to lower demand; and the reuse of energy from exhaust gases or other manufacturing by-products or useful thermal energy for electricity production by industrial and manufacturing customers. These measures also enable electricity customers to benefit from the energy credit market created by the portfolio standard. Retail customers who reduce their electricity demand through energy efficiency and load management, or who generate electricity by reusing energy, will earn alternative energy credits that they can sell to utility companies (Pennsylvania General Assembly 2004).

Alternatives

The following sections present fossil-fuel-fired generation (Section 7.2.1.1) and purchased power (Section 7.2.1.2) as reasonable alternatives to license renewal. Section 7.2.1.3 discusses reduced demand and presents the basis for concluding that it is not a reasonable alternative to license renewal. Section 7.2.1.4 discusses other alternatives that AmerGen has determined are not reasonable and the bases for these determinations.

7.2.1.1 Construct and Operate Fossil-Fuel-Fired Generation

Construction of a hypothetical new power station at the present TMI-1 site or another existing power station would be preferable to construction at a new green field site. This approach would minimize environmental impacts by building on previously disturbed land and by making the most use possible of existing facilities, such as transmission lines, roads and parking areas, office buildings, and components of the cooling system. However, there is insufficient area at the existing TMI-1 site to construct a new coal- or gas-fired unit, thus a new plant would have to be located elsewhere. AmerGen's parent company, Exelon, owns or co-owns numerous fossil power plants in the mid-Atlantic region and would look to site a replacement for TMI-1 at an existing fossil plant site in this region, however, this may not be feasible. As mentioned above, locating the new plant at an existing plant site would benefit from the existing infrastructure and minimize the environmental impact which would occur at a new green field location. Consequently, to avoid overstating the impacts associated with new coal- and gas-fired unit construction scenarios, AmerGen has elected to assume that any hypothetical new power station would be constructed at an existing fossil plant site.

To compare gas- and coal-fired units on an equal basis, AmerGen set the net electrical generating capacities of the alternative hypothetical gas- and coal-fired units at the same values. For comparability, the net power of the coal-fired unit was set equal to that of the gas-fired plant (793 MWe). Although this provides less capacity than the existing unit, it ensures against overestimating environmental impacts from the alternatives.

It must be emphasized, however, that these are hypothetical scenarios. AmerGen does not have plans to construct one of these units.

Gas-Fired Generation

For purposes of this analysis, AmerGen assumed development of a modern natural gas-fired combined-cycle plant with design characteristics similar to those being developed elsewhere in the PJM region, and with a generating capacity similar to TMI-1. The hypothetical plant would be composed of two pre-engineered natural gas-fired systems producing 263 MWe and 530 MWe of net plant power for a total of 793 MWe (Chase and Kehoe 2000). The characteristics of this plant and other relevant resources were used to define the gas-fired alternative. Table 7.2-1 presents

the basic characteristics for the gas-fired alternative.

Coal-Fired Generation

NRC has routinely evaluated coal-fired generation alternatives for nuclear plant license renewal. In defining the coal-fired alternative to TMI-1, site- and Pennsylvania-specific input has been applied for direct comparison with a gas-fired plant producing 793 MWe.

Table 7.2-2 presents the basic coal-fired alternative emission control characteristics. The emissions control assumptions are based on the technologies recognized by Environmental Protection Agency (EPA) for minimizing emissions and calculated emissions based upon the EPA published removal efficiencies (EPA 1998a). AmerGen assumes that the representative plant would be located at an unidentified green field site, which will require new infrastructure (e.g., rail spur, cooling water system, transmission, roads, and technical and administrative support facilities).

7.2.1.2 Purchased Power

AmerGen has evaluated conventional and prospective power supply options that could be reasonably implemented before the existing TMI-1 license expires. As noted in Section 7.2.1, electric industry restructuring initiatives in the Commonwealth of Pennsylvania and other states in the PJM region are designed to promote competition in energy supply markets by facilitating participation by non-utility suppliers. PJM has implemented market rules to appropriately anticipate and meet electricity demands in the resulting wholesale electricity market. As an additional facet of this restructuring effort, retail customers in the region now may choose among any company with electric generation to supply their power, resulting in uncertainty with regard to future AmerGen load obligations. In view of these conditions, AmerGen assumes for purposes of this analysis that adequate supplies of electricity would be available, and that purchased power would be a reasonable alternative to meet the Station's load requirements in the event the existing operating license for TMI-1 is not renewed.

The source of this purchased power may reasonably include new generating facilities developed elsewhere in the Commonwealth or neighboring states in the PJM region. The technologies that would be used to generate this purchased power are similarly speculative. AmerGen assumes that the generating technology used to produce purchased power would be one of those that NRC analyzed in the GEIS. For this reason, AmerGen is adopting by reference the GEIS description of the alternative generating technologies as representative of the purchase power alternative. Of these technologies, facilities fueled by coal and combined-cycle facilities fueled by natural gas are the most cost effective for providing base-load capacity.

AmerGen anticipates that additional transmission infrastructure would be needed in the event purchased power must replace TMI-1 capacity. From a local perspective, loss of TMI-1 could require construction of new transmission lines to ensure local system stability. From a regional perspective, PJM's inter-connected transmission system is highly reliable, and the market-driven process for adding capacity in the region is expected to have a positive impact on overall system reliability.

7.2.1.3 Demand Side Management

As discussed in Section 7.2.1, Pennsylvania has adopted Alternative Energy Portfolio Standards that include provisions for market–based DSM measures to reduce electricity demand within the Commonwealth.

Prior to adopting the AEPS, Pennsylvania had developed a comprehensive program to promote and advance DSM in the retail

electric market through individual settlements with the Commonwealth's major distribution companies. The Pennsylvania Sustainable Energy Board worked in partnership with regional sustainable energy boards, other commonwealth agencies, electric utilities, business organizations and environmental organizations to develop and implement "tools" to save energy. Pennsylvania's DSM offerings under this program included from load curtailment incentives during periods of peak demand to rebates; financial incentives for commercial, industrial, and residential customers for installation of energy-efficient appliances and equipment; and educational programs and demonstration projects (PSEB 2004).

Since 1997, Pennsylvania's DSM programs have saved Pennsylvania residents and businesses over 56 terawatt-hours in avoided electricity use, and additional demand reductions are projected to result from these efforts (Pinero 2001). However, it is expected that projected energy efficiencies would be anticipated by the market. As a practical matter, it would be impossible to increase those energy savings by an additional 802 MWe to replace the TMI-1 generating capability. For these reasons, AmerGen does not consider energy conservation to represent a reasonable alternative to renewal of the TMI-1 operating licenses.

7.2.1.4 Other Alternatives

This section identifies alternatives that AmerGen has determined are not reasonable for replacing TMI-1 and the bases for these determinations. AmerGen accounted for the fact that TMI-1 is a base-load generator and that any feasible alternative to TMI-1 would also need to be able to generate base-load power. For purposes of analysis, AmerGen assumed that the states of Pennsylvania, New Jersey and Maryland comprise the PJM region. In performing this evaluation, AmerGen relied heavily upon NRC's GEIS (NRC 1996a).

Wind

Wind power, due to its intermittent nature, is not suitable for base-load generation. As discussed in Section 8.3.1 of the GEIS, wind power systems produce power only when the wind is blowing at a sufficient velocity and duration (McGowan and Connors 2000). While recent advances in technology have improved wind turbine capacity, average annual capacity factors for wind power systems are relatively low (25 to 40 percent) (McGowan and Connors 2000) compared to 90 to 95 percent industry average for a base-load plant such as a nuclear plant.

The energy potential in the wind is expressed by wind generation classes ranging from 1 (least energetic) to 7 (most energetic). Current wind technology can operate economically on Class 4 sites with the support of the Federal production tax credit of 1.9 cent per kWh (DOE 2006), while Class 3 wind regimes will require further technical development for utility-scale application. In the PJM region, the primary areas of good wind energy resource are the Atlantic coast, the Great Lakes, and exposed hilltops, ridge crests, and mountain summits in Pennsylvania. Areas of highest wind energy potential (Class 5 and 6) are the outer coastal areas of New Jersey, offshore areas of Lake Erie, and the higher mountain summits of the Appalachians. Offshore wind resources are abundant (NJDEP 2005) but offshore technology is not sufficiently mature (DOE 2006) for present consideration.

Based on American Wind Energy Association estimates (AWEA 2006), the PJM region has the technical potential (the upper limit of renewable electricity production and capacity that could be brought online, without regard to cost, market acceptability, or market constraints) for roughly 6,658 MWe of installed wind power capacity. The full exploitation of wind energy is constrained by a variety of factors including land availability and land-use

patterns, surface topography, infrastructure constraints, environmental constraints, wind turbine capacity factor, wind turbine availability, and grid availability. By mid-2006, a total of 171 MWe of wind energy had been developed in PJM region. Projected new capacity in various stages of planning or permit review within the PJM region includes an additional 391 MWe of wind energy (AWEA 2006).

Wind farms generally consist of 10-50 turbines in the 1-3 MWe range. Estimates based on existing installations indicate that a utility-scale wind farm would be spread over 30 to 50 acres per MWe of installed capacity (McGowan & Connors 2000). However, the actual area occupied by turbines, substations, and access roads may occupy only 3 to 5 percent of the wind farm's total acreage, thus the remaining area is available for other uses. When the wind farm is located on land already used for intensive agriculture the additional impact to wildlife and habitat will likely be minor, while disturbance caused by wind farms in more remote areas may be more significant. Therefore, replacement of TMI-1 generating capacity (802 MWe net) with wind power, assuming a capacity factor of 35 percent, would require a large green field site about 180 square miles of which 5 to 9 square miles would be disturbed and unavailable for other uses. The State of New Jersey promotes wind power as a component of its Renewable Portfolio Standard, but concludes that wind, due to its intermittent nature, is unsuitable to provide base-load power (NJDEP 2005). Similarly, AmerGen has concluded that wind power is not a reasonable alternative to TMI-1 license renewal.

Solar

By its nature, solar power is intermittent. In conjunction with energy storage mechanisms, solar power might serve as a means of providing base-load power. However, current energy storage technologies are too expensive to permit solar power to serve as a large base-load generator. Even without consideration of storage capacity, solar power technologies (photovoltaic and thermal) cannot currently compete with conventional fossil-fueled technologies in grid-connected applications due to high costs per kilowatt of capacity (EERE 2006a).

Solar power is not a technically feasible alternative for base-load capacity in the PJM region. The PJM region receives 3.5 to 5.5 kilowatt hours of solar radiation per square meter per day compared with 4.5 to 7.5 kilowatt hours per square meter per day in areas of the West, such as California, which are most promising for solar technologies (NREL 2004).

Finally, land requirements for solar plants are high. Estimates based on existing installations indicate that utility-scale plants would occupy about 3.8 acres per MWe for photovoltaic and 8 acres per MWe for solar thermal systems (DOE 2004). Utility-scale solar plants have only been used in regions such as the western U.S. that receive high concentrations (5 to 7.2 kilowatt hours per square meter per day) of solar radiation. AmerGen believes that a utility-scale solar plant located in the PJM region, which receives 2.8 to 3.9 kilowatt hours of solar radiation per square meter per day, would occupy about 16 acres per MWe for photovoltaic and 25 acres per MWe for solar thermal systems. Therefore, replacement of TMI-1 generating capacity with solar power would require dedication of about 20 square miles for photovoltaic and 31 square miles for solar thermal systems, and both would have large environmental impacts at a green field site.

AmerGen has concluded that, due to the high cost, limited availability of sufficient incident solar radiation, and the amount of land needed (approximately 20 to 31 square miles), solar power is not a reasonable alternative to TMI-1 license renewal.

Hydropower

About 7,440 MWe of utility generating capacity in the PJM region is hydroelectric (PJM 2006c). As the GEIS points out in Section 8.3.4, hydropower's percentage of United States generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern over flooding, destruction of natural habitat, and alteration of natural river courses. A small number of hydropower projects, the largest of which is 2.15 MWe, are being considered in the PJM region (FERC 2006). These small hydropower projects could not replace the 802 MWe generated at TMI-1. According to the U.S. Hydropower Resource Assessment (INEEL 1998), there are no remaining sites in the PJM region that would be environmentally suitable for a large hydroelectric facility.

The GEIS estimates land use of 1,600 square miles per 1,000 MWe for hydroelectric power. Based on this estimate, replacement of TMI-1 generating capacity would require flooding approximately 1,270 square miles, resulting in a large impact on land use. Further, operation of a hydroelectric facility would alter aquatic habitats above and below the dam, which would impact existing aquatic communities.

AmerGen has concluded that, due to the lack of suitable sites in the PJM region for a large hydroelectric facility and the amount of land needed (approximately 1,270 square miles), hydropower is not a reasonable alternative to TMI-1 license renewal.

Geothermal

Geothermal energy is a proven resource for power generation. Geothermal power plants use naturally heated fluids as an energy source for electricity production. To produce electric power, underground high-temperature reservoirs of steam or hot water are tapped by wells and the steam rotates turbines that generate electricity. Typically, water is then returned to the ground to recharge the reservoir (NREL 1997).

Geothermal energy can achieve average capacity factors of 95 percent and can be used for base-load power where this type of energy source is available (NREL 1997). Widespread application of geothermal energy is constrained by the geographic availability of the resource. In the U.S., high-temperature hydrothermal reservoirs are located in the western continental U.S., Alaska, and Hawaii. There are no known high-temperature geothermal sites in Pennsylvania.

Pennsylvania has low to moderate temperature resources that can be tapped for direct heat or geothermal heat pumps, but electricity generation is not feasible with these resources (EERE 2006b).

Wood Energy

As discussed in the GEIS (NRC 1996a), the use of wood waste to generate electricity is largely limited to those states with significant wood resources. The pulp, paper, and paperboard industries in states with adequate wood resources generate electric power by consuming wood and wood waste for energy, benefiting from the use of waste materials that could otherwise represent a disposal problem. According to the U.S. Department of Energy, Pennsylvania is the only state in the PJM region that is considered to have adequate wood resources (Walsh et al. 2000). However, the largest wood waste power plants are 40 to 50 MWe in size.

Further, as discussed in Section 8.3.6 of the GEIS (NRC 1996a), construction of a wood-fired plant would have an environmental impact that would be similar to that for a coal-fired plant, although facilities using wood waste for fuel would be built on smaller scales. Like coal-fired plants, wood-waste plants require large areas for fuel

storage, processing, and waste (i.e., ash) disposal. Additionally, operation of wood-fired plants has environmental impacts, including impacts on the aquatic environment and air. Wood has a low heat content that makes it unattractive for base-load applications. It is also difficult to handle and has high transportation costs.

While some wood resources are available in the PJM region, AmerGen has concluded that, due to the lack of an environmental advantage, low heat content, handling difficulties, and high transportation costs, wood energy is not a reasonable alternative to TMI-1 license renewal.

Municipal Solid Waste

As discussed in Section 8.3.7 of the GEIS (NRC 1996a), the initial capital costs for municipal solid waste plants are greater than for comparable steam turbine technology at wood-waste facilities. This is due to the need for specialized waste separation and handling equipment.

The decision to burn municipal solid waste 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; however, it is unlikely that many landfills will begin converting waste to energy because of unfavorable economics.

Estimates in the GEIS suggest that the overall level of construction impacts from a waste-fired plant should be approximately the same as that for a coal-fired plant. Additionally, waste-fired plants have the same or greater operational impacts (including impacts on the aquatic environment, air, and waste disposal). Some of these impacts would be moderate, but still larger than the environmental effects of TMI-1 license renewal.

AmerGen has concluded that, due to the high costs and lack of environmental advantages, burning municipal solid waste to generate electricity is not a reasonable alternative to TMI-1 license renewal.

Other Biomass-Derived Fuels

In addition to wood and municipal solid waste fuels, there are several other concepts for fueling electric generators, including burning energy crops, converting crops to a liquid fuel such as ethanol (ethanol is primarily used as a gasoline additive), and gasifying energy crops (including wood waste). As discussed in the GEIS, none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a base-load plant such as TMI-1.

Further, estimates in the GEIS suggest that the overall level of construction impacts from a crop-fired plant should be approximately the same as that for a wood-fired plant. Additionally, crop-fired plants would have similar operational impacts (including impacts on the aquatic environment and air). These systems also have large impacts on land use, due to the acreage needed to grow the energy crops.

AmerGen has concluded that, due to the high costs and lack of environmental advantage, burning other biomass-derived fuels is not a reasonable alternative to TMI-1 license renewal.

Petroleum

The PJM region has several petroleum (oil)-fired power plants; however, they produce less than 1 percent of the total power generated in the region (PJM 2006c). From 1990 to 2004, utilities in the PJM region reduced the proportion of power produced by oil-fired generating plants by 34 percent (EIA 2006c). Oil-fired operation is more expensive than nuclear or coal-fired operation, and future increases in petroleum prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation.

Also, construction and operation of an oil-fired plant would have environmental impacts. For example, Section 8.3.11 of the GEIS (NRC 1996a) estimates that construction of a 1,000-MWe oil-fired plant would require about 120 acres. Additionally, operation of oil-fired plants would have environmental impacts (including impacts on the aquatic environment and air) that would be similar to those from a coal-fired plant.

AmerGen has concluded that, due to the high costs and lack of obvious environmental advantage, oil-fired generation is not a reasonable alternative to TMI-1 license renewal.

Fuel Cells

Fuel cell power plants are in the initial stages of commercialization. While more than 650 large stationary fuel cell systems have been built and operated worldwide, the global stationary fuel cell electricity generating capacity in 2003 was only 125 MWe. In addition, the largest stationary fuel cell power plant is only 11 MWe (Fuel Cell Today 2003). Recent estimates suggest that a company would have to produce about 100 MWe of fuel cell stacks annually to achieve a price of $1,000 to $1,500 per kilowatt (Kenergy 2000). However, the production capability of the largest stationary fuel cell manufacturer is 50 MWe per year (CSFCC 2002). AmerGen believes that this technology has not matured sufficiently to support production for a facility the size of TMI-1, and AmerGen has concluded that, due to cost and production limitations, fuel cell technology is not a reasonable alternative to TMI-1 license renewal.

Advanced Nuclear Reactor

Increased interest in the development of advanced nuclear power plants has been expressed recently by members of both industry and government. However, AmerGen considers it unlikely that a replacement for TMI-1 could be sited, planned, licensed, constructed, and brought online by the time the existing operating license expires in 2014.

Delayed Retirement

As the NRC noted in the GEIS (NRC 1996a, Section 8.3.13), extending the lives of existing non-nuclear generating plants beyond the time they were originally scheduled to be retired represents another potential alternative to license renewal. AmerGen does not own any non-nuclear power plants and AmerGen's parent company, Exelon, has no plans to retire any of its base-load fossil units in the PJM region (PJM 2006c). Thus delayed retirement of the above generation sources could not replace the 802 MWe generated at TMI-1.

New generation capacity within the PJM will likely not be available to replace TMI-1's capacity. Power generating utilities within the PJM have retired a large number of generation retirements totaling 5,700 MWe over the last two years and this has resulted in multiple reliability criteria violations. The problem has been magnified by steady load growth and sluggish generation additions (PJM 2006b). Some potential reliability issues have been forestalled through a combination of short lead-time transmission upgrades, voluntary deactivation deferrals, and implementation of a process that compensates generators that remain online beyond announced retirement dates. However, the Federal Energy Regulatory Commission recently determined that PJM cannot compel the owners of units scheduled for retirement to remain in service. For these reasons, the delayed retirement of non-nuclear generating units is not considered a reasonable alternative to TMI-1 license renewal (PJM 2006b).

Combination of Alternatives

NRC indicated in the GEIS that, while many methods are available for generating

electricity and a huge number of combinations or mixes can be assimilated to meet system needs, such expansive consideration would be too unwieldy, given the purposes of the alternatives analysis. Therefore, NRC determined that a reasonable set of alternatives should be limited to the analysis of single discrete electrical generation sources and only those electric generation technologies that are technically reasonable and commercially viable (NRC 1996a, pg. 8-1). Nevertheless, for the purpose of comparison, AmerGen has assumed that a 100 MWe wind farm, along with a 530 MWe natural gas combined-cycle unit and 272 MWe of power purchased from the wholesale electricity market could replace the TMI-1 generating capacity (802 MWe net). When operating, the combined cycle plant can "follow" the wind load by ramping up and down quickly. When the wind is blowing hard, the combined cycle plant can be ramped down; when the wind is not blowing or is blowing too softly to turn the wind turbines, the combined cycle plant can be ramped up. Power purchased from other generators in the PJM market would provide the balance of electricity needed.

Operation of the new natural gas-fired power plant would result in increased air emissions and other impacts. The impacts associated with the wind portion of the alternative – land use impacts, noise impacts, visual impacts, impacts on wildlife, etc. – would be more than the stand alone natural gas alternative. The environmental impacts associated with power purchased from other generators would be similar to the impacts associated with the coal and gas-fired alternatives, but would be located elsewhere within the PJM region.

AmerGen concludes that it is very unlikely that the environmental impacts of any combination of generating and conservation options would be reduced to the level of impacts associated with renewal of the TMI-1 operating license. Therefore, a combination of alternatives is not considered a reasonable alternative to TMI-1 license renewal.

7.2.2 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

This section evaluates the environmental impacts of alternatives that AmerGen has determined to be reasonable alternatives to TMI-1 license renewal: gas-fired generation, coal-fired generation, and purchased power.

7.2.2.1 Gas-Fired Generation

NRC evaluated environmental impacts from gas-fired generation alternatives in the GEIS, focusing on combined-cycle plants. Section 7.2.1.1 presents AmerGen's reasons for defining the gas-fired generation alternative as a 2-unit combined-cycle plant on an existing fossil plant site. Construction of a gas-fired unit would have impacts on land-use and could impact ecological, aesthetic, and cultural resources. Human health effects associated with air emissions would be of concern. Aquatic biota losses due to cooling water withdrawals would be offset by the concurrent shutdown of the nuclear generator.

Air Quality

Natural gas is a relatively clean-burning fossil fuel that primarily emits nitrogen oxides (NOx), a regulated pollutant, during combustion. A natural gas-fired plant would also emit small quantities of sulfur oxides (SOx), particulate matter, and carbon monoxide (CO), all of which are regulated pollutants. Control technology for gas-fired turbines focuses on NOx emissions. From data published by EPA (EPA 2000), the emissions from the natural gas-fired plant are calculated to be:

SOx = 64 tons per year

NOx = 168 tons per year

Carbon monoxide = 1,123 tons per year

Filterable Particulates = 36 tons per year [all particulates are particulates with diameters less than 2.5 microns ($PM_{2.5}$)]

In 2004, Pennsylvania was ranked 2nd nationally in sulfur dioxide (SO_2) emissions and 5th nationally in NOx emissions from electric power plants (EIA 2006c). The ranking was based on quantity emitted. For example, the electric power plants in only 1 state emitted more SO_2 than those located in Pennsylvania. The acid rain requirements of the Clean Air Act Amendments capped the nation's SO_2 emissions from power plants. Each company with fossil-fuel-fired units was allocated SO_2 allowances. To be in compliance with the Act, the companies must hold enough allowances to cover their annual SO_2 emissions. AmerGen would need to obtain SO_2 credits to operate a fossil-fuel-fired plant. In 1998, the EPA promulgated the NOx SIP (State Implementation Plan) Call regulation that required 22 states, including Pennsylvania, to reduce their NOx emissions by over 30 percent to address regional transport of ground-level ozone across state lines (EPA 1998b). In 2005 EPA issued the Clean Air Interstate Rule (CAIR), which will permanently cap emissions of SO_2 and NOx in 28 eastern states and the District of Columbia using a cap and trade program. The NOx and SO_2 programs commence in 2009 and 2010, respectively. To operate a new fossil-fuel-fired plant, AmerGen would need to obtain enough NOx credits to cover annual emissions either from the set-aside pool or by buying NOx credits from other sources. Additionally, because all of Pennsylvania is treated as a non-attainment area for ozone, a fossil-fuel-fired plant would need to obtain NOx emission reduction credits in the amount of 1.15 tons of NOx for every ton of NOx emitted.

NOx effects on ozone levels, SO_2 allowances, and NOx credits could all be issues of concern for gas-fired combustion. While gas-fired turbine emissions are less than coal-fired boiler emissions, the emissions are still substantial. AmerGen concludes that emissions from the gas-fired alternative would noticeably alter local air quality, but would not cause or contribute to violations of National Ambient Air Quality Standards in the region. Air quality impacts would therefore be MODERATE.

Waste Management

The solid waste generated from this type of facility would be minimal. The only noteworthy waste would be from spent selective catalytic reduction (SCR) used for NOx control. The SCR process for a 793 MWe plant would generate approximately 500 ft^3 of spent catalyst per year (NRC 2002b). AmerGen concludes that gas-fired generation waste management impacts would be SMALL.

Other Impacts

Construction of the gas-fired alternative on an existing plant site would impact the construction site and the supporting utility corridors. A new gas pipeline would likely be required for the gas turbine generators in this alternative. To the extent practicable, AmerGen would route the pipeline along existing, previously disturbed, right-of-way to minimize impacts. A new pipeline of approximately 10-inch diameter would require a 50-foot-wide corridor. This new construction may also necessitate an upgrade of the Statewide pipeline network. AmerGen estimates that 32 acres would be needed for a plant site, resulting in the loss of terrestrial habitat. Aesthetic impacts, erosion and sedimentation, fugitive dust, and construction debris impacts would be noticeable but MODERATE with appropriate controls. AmerGen estimates a peak construction workforce of 483 thus socioeconomic impacts of construction would be SMALL. However, AmerGen estimates a significantly reduced workforce of 27 for gas operations, resulting in adverse socioeconomic impacts due to the loss of 600-800 personnel responsible for operational activities at TMI-1 and the 200

to 1,400 additional personnel employed during TMI-1 refueling outages. Loss of the operational and temporary personnel would impact various aspects of the local community including employment, taxes, housing, offsite land use, economic structure, and public services (NRC 1996a). AmerGen believes these impacts would be MODERATE.

Impacts to aquatic resources and water quality would be similar to, but smaller than, the impacts of TMI-1 due to the replacement plant's use of the cooling water withdrawals from and discharges to the Susquehanna River or other naturally occurring body of water. These impacts would be offset by the concurrent shutdown of TMI-1. The stacks and boilers of the new gas-fired unit may add visual impacts at the existing power plant site where it is constructed, but these should be minimal because of the presence of existing plant structures. Impacts to cultural resources would be possible, but if surveys for archaeological and cultural resources were not already done at the time the existing plant at the selected site was constructed, site surveys would be conducted to identify these resources and mitigate any impacts.

7.2.2.2 Coal-Fired Generation

NRC evaluated environmental impacts from coal-fired generation alternatives in the GEIS (NRC 1996a). NRC concluded that construction impacts could be substantial, due in part to the large land area required (which can result in natural habitat loss) and the large workforce needed. NRC identified major adverse impacts from operations as human health concerns associated with air emissions, waste generation, and losses of aquatic biota due to cooling water withdrawals and discharges.

The coal-fired alternative that AmerGen has defined in Section 7.2.1.1 would be located at an existing plant site.

Air Quality

A coal-fired plant would emit SO_2, NOx, particulate matter, mercury, and carbon monoxide, all of which are regulated pollutants. As Section 7.2.1.1 indicates, AmerGen has assumed a plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. Using data published by the Energy Information Administration (EIA 2002, EIA 2006b) and the EPA (EPA 1998a), the coal-fired alternative emissions are calculated to be as follows:

SO_2 = 5,241 tons per year

NOx = 690 tons per year

Carbon monoxide = 690 tons per year

Mercury = 0.11 tons per year

Particulates:

PM_{10} (particulates having a diameter of less than 10 microns) = 49 tons per year

$PM_{2.5}$ (particulates having a diameter of less than 2.5 microns) = 0.21 tons per year

The discussion in Section 7.2.2.1 of regional air quality is applicable to the coal-fired generation alternative. In addition, NRC noted in the GEIS that adverse human health effects from coal combustion have led to important federal legislation in recent years and that public health risks, such as cancer and emphysema, have been associated with coal combustion. NRC also mentioned global warming and acid rain as potential impacts. AmerGen concludes that federal legislation and large-scale concerns, such as global warming and acid rain, are indications of concerns about destabilizing important attributes of air resources. However, SO_2 emission allowances, NOx credits, low NOx burners, overfire air, fabric filters or electrostatic precipitators, and scrubbers are regulatorily-imposed

mitigation measures. As such, AmerGen concludes that the coal-fired alternative would have MODERATE impacts on air quality; the impacts would be noticeable and greater than those of the gas-fired alternative, but would not destabilize air quality in the area.

Waste Management

AmerGen concurs with the GEIS assessment that the coal-fired alternative would generate substantial solid waste. The coal-fired plant would annually consume approximately 2,760,000 tons of coal having an ash content of 15.55 percent. After combustion, 90 percent of this ash, approximately 321,000 tons per year, would be marketed for beneficial reuse. The remaining ash, approximately 107,000 tons per year, would be collected and disposed of onsite, if space were available. In addition, if space were available, approximately 205,000 tons of scrubber sludge would be disposed of on site each year (based on annual limestone usage of about 172,000 tons). AmerGen estimates that ash and scrubber waste disposal over a 40-year plant life would require approximately 188 acres. If this acreage is not available at the existing power plant site where the new coal-fired unit would be sited, offsite disposal may be necessary, which would increase disposal impacts.

AmerGen believes that proper siting, current waste management practices, and current waste monitoring practices would prevent waste disposal from destabilizing any resources. After closure of the waste site and revegetation, the land would be available for other uses. For these reasons, AmerGen believes that waste disposal for the coal-fired alternative would have MODERATE impacts; the impacts of increased waste disposal would be noticeable, but would not destabilize any important resource, and further mitigation would be unwarranted.

Other Impacts

AmerGen estimates that construction of the power block and coal storage area would affect 129 acres of land and associated terrestrial habitat. Because much of this construction would be on previously disturbed land, impacts would be SMALL to MODERATE. Installation of a new rail spur or expansion of an existing spur would likely be required for coal and limestone deliveries under this alternative. Visual impacts would be consistent with the industrial nature of the site. As with any large construction project, some erosion and sedimentation and fugitive dust emissions could be anticipated, but would be minimized by using best management practices. Debris from clearing and grubbing could be disposed of onsite. AmerGen estimates a peak construction work force of 1,328. Socioeconomic impacts from the construction workforce would be minimal, if worker relocation is not required with a site located near a large metropolitan area. AmerGen estimates an operational workforce of 92 for the coal-fired alternative. This is a sizable reduction in operating personnel compared to TMI-1's 600-800 personnel, and the impact on the local community employment, taxes, housing, off-site land use, and public services could be significant. Thus, reduction in workforce would result in adverse socioeconomic impacts characterized as MODERATE.

Impacts to aquatic resources and water quality would be similar to impacts of TMI-1, due to the new plant's use of the cooling water from and discharge to the Susquehanna River or other natural water body, and would be offset by the concurrent shutdown of TMI-1. The stacks, boilers, and rail deliveries would increase the visual impact to the new site. Impacts to cultural resources would also be possible, but site surveys would be conducted to identify these resources and mitigate any impacts.

7.2.2.3 Purchased Power

As discussed in Section 7.2.1.2, AmerGen assumes that the generating technology used under the purchased power alternative would be one of those that NRC analyzed in the GEIS. AmerGen is also adopting by reference the NRC analysis of the environmental impacts from those technologies. Under the purchased power alternative, therefore, environmental impacts would still occur, but they would likely originate from a power plant located elsewhere in the PJM region. AmerGen believes that imports from outside the PJM region would not be required.

The existing transmission lines would be expected to transmit power to the south-central region of Pennsylvania, thus new lines would not be required. As a result, the impact would be SMALL. As indicated in the introduction to Section 7.2.1.1, the environmental impacts of construction and operation of new coal- or gas-fired generating capacity for purchased power at a previously undisturbed green field site would exceed those of a coal- or gas-fired alternative located at an existing power station.

Table 7.2-1. Gas-Fired Alternative

Characteristic	Basis
Unit size = 793 MWe ISO rating net combined cycle consisting of 263 MWe and 530 MWe systems with heat recovery steam generators (HRSGs)	Manufacturer's standard size gas-fired combined-cycle plant (≤ TMI-1 net capacity of 802 MWe)
Unit size = 826 MWe ISO rating gross	Based on 4 percent onsite power usage
Number of units = 1	Assumed
Fuel type = natural gas	Assumed
Fuel heating value = 1,033 Btu/ft^3	2004 value for gas used in Pennsylvania (EIA 2006b, Table 14.A)
Fuel SOx content = 0.0034 lb/MMBtu	EPA 2000, Table 3.1-2a
NOx control = selective catalytic reduction (SCR) with steam/water injection	Best available for minimizing NOx emissions (EPA 2000)
Fuel NOx content = 0.0090 lb/MMBtu	Typical for large SCR-controlled gas fired units with water injection (EPA 2000, Table 3.1 Database)
Fuel CO content = 0.0600 lb/MMBtu	Typical for large SCR-controlled gas fired units (EPA 2000, Table 3.1 Database)
Fuel PM_{10} content = 0.0019 lb/MMBtu	EPA 2000, Table 3.1-2a
Heat rate = 6,090 Btu/kWh	Chase and Kehoe 2000
Capacity factor = 0.85	Assumed based on performance of modern plants

Note: The difference between "net" and "gross" is electricity consumed onsite.
Note: The HRSG does not contribute to air emissions.
Btu = British thermal unit
ft^3 = cubic foot
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh = kilowatt hour
MM = million
MWe = megawatt electrical
NOx = nitrogen oxides
PM^{10} = particulates having diameter of 10 microns or less
≤ = less than or equal to

Table 7.2-2. Coal-Fired Alternative

Characteristic	Basis
Unit size = 793 MWe ISO rating net	Size set = to gas-fired alternative (≤ TMI-1 net capacity of 802 MWe)
Unit size = 844 MWe ISO rating gross	Based on 6 percent onsite power usage
Number of units = 1	Assumed
Boiler type = tangentially fired, dry-bottom	Minimizes nitrogen oxides emissions (EPA 1998a)
Fuel type = bituminous, pulverized coal	Typical for coal used in Pennsylvania
Fuel heating value = 11,615 Btu/lb	2004 value for coal used in Pennsylvania (EIA 2006b, Table 15.A)
Fuel ash content by weight = 15.55 percent	2004 value for coal used in Pennsylvania (EIA 2006b, Table 15.A)
Fuel sulfur content by weight = 2.00 percent	2004 value for coal used in Pennsylvania (EIA 2006b, Table 15.A)
Uncontrolled NOx emission = 10 lb/ton	Typical for pulverized coal, tangentially fired, dry-bottom, NSPS (EPA 1998a)
Uncontrolled CO emission = 0.5 lb/ton	Typical for pulverized coal, tangentially fired, dry-bottom, NSPS (EPA 1998a)
Heat rate = 10,200 Btu/kWh	Typical for coal-fired boilers (EIA 2002)
Capacity factor = 0.85	Typical for large coal-fired units
NOx control = low NOx burners, over-fire air and selective catalytic reduction (95 percent reduction)	Best available and widely demonstrated for minimizing NOx emissions (EPA 1998a)
Particulate control = fabric filters (baghouse-99.9 percent removal efficiency)	Best available for minimizing particulate emissions (EPA 1998a)
SOx control = Wet scrubber - limestone (95 percent removal efficiency)	Best available for minimizing SOx emissions (EPA 1998a)

Note: The difference between “net” and “gross” is electricity consumed onsite.

Btu = British thermal unit

ISO rating = International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch

kWh = kilowatt hour

NSPS = New Source Performance Standard

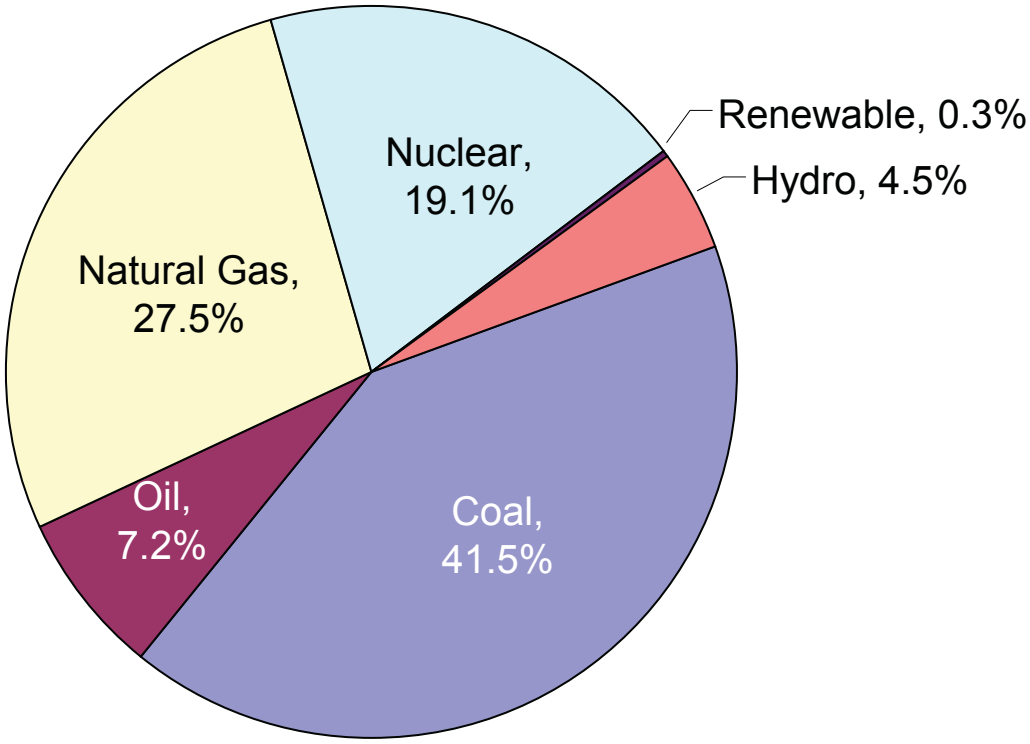
lb = pound

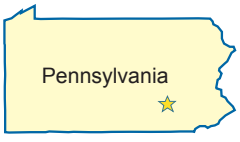
MWe = megawatt electrical

NOx = nitrogen oxides

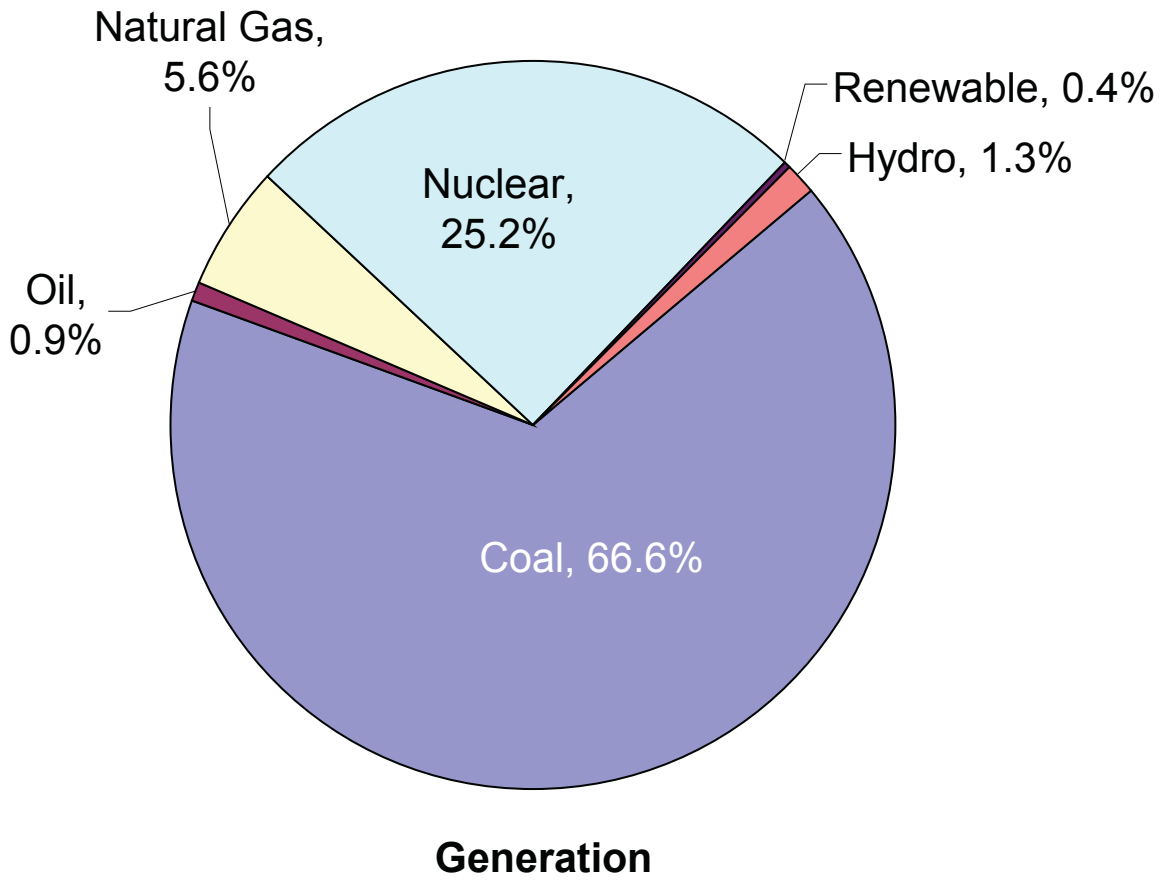
SOx = oxides of sulfur

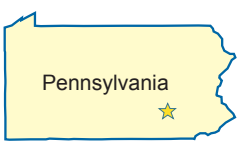
≤ = less than or equal to





Three Mile Island Nuclear Station Unit 1
License Renewal Environmental Report
Figure 7.2-1 PJM Regional Generating Capacity (2005)





Three Mile Island Nuclear Station Unit 1
License Renewal Environmental Report
Figure 7.2-2 PJM Regional Energy Output by Fuel Type (2005)

7.3 REFERENCES

Note to reader: Some web pages cited in this document are no longer available, or are no longer available through the original URL addresses. Hard copies of cited web pages are available in AmerGen files. Some sites, for example the census data, cannot be accessed through their given URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by AmerGen have been given for these pages, even though they may not be directly accessible. Also, all references are specific to respective chapter.

AmerGen (AmerGen Energy Company, LLC). 2005. "Monthly Operating Reports" for the months of January through June 2005. Available at http://adamswebsearch.nrc.gov/scripts/rwisapi.dll/@pip1.env. Accessed September 29, 2006.

AWEA (American Wind Energy Association). 2006. "Wind Energy Projects throughout the United States of America." Available at http://www.awea.org/projects/index.html. Accessed October 19, 2006.

Chase, D.L and Kehoe, P.T. 2000. GE Combined-Cycle Product Line and Performance. GER-3574G. GE Power Systems, Schenectady, NY. October. Available at http://www.gepower.com/prod_serv/products/tech_docs/en/downloads/ger3574g.pdf. Accessed October 30, 2006.

CSFCC (California Stationary Fuel Cell Collaborative). 2002. "White Paper Summary of Interviews with Stationary Fuel Cell Manufacturers." Available at http://stationaryfuelcells.org/DOCUMENTS/PDFdocs/Summary_InterviewsAug2002.pdf. Accessed October 30, 2006.

DOE (U.S. Department of Energy). 2004. "PV FAQs - How much land will PV need to supply our electricity?". DOE/GO-102004-1835. Office of Energy Efficiency and Renewable Energy Washington, DC. February. Available at http://www.nrel.gov/ncpv/pdfs/land_faq.pdf. Accessed October 30, 2006.

DOE (U.S. Department of Energy, Energy Efficiency and Renewable Energy). 2006. "Wind Power Today." DOE/GO-102006-2319. May. Available at http://www.nrel.gov/docs/fy06osti/39479.pdf. Accessed October 30, 2006.

EERE (Energy Efficiency and Renewable Energy, Solar Energy Technologies Program). 2006a. "Technology Improvement Opportunities." Technology Pathway Partnership Technical Exchange Meeting, Chicago, IL, April 18-19. Available at http://www1.eere.energy.gov/solar/solar_america/pdfs/breakout_atios-041706pdf. Accessed January 23, 2007.

EERE (Energy Efficiency and Renewable Energy, Solar Energy Technologies Program). 2006b. "Alternative Energy Resources in Pennsylvania." Available at http://www.eere.energy.gov/states/alternatives/resources_pa.cfm. Accessed January 23, 2007.

EIA (Energy Information Administration). 2002. Electric Power Annual 2000, Volume II. DOE/EIA-0348(00)/2. November. Available at http://tonto.eia.doe.gov/FTPROOT/electricity/0348002.pdf. Accessed October 30, 2006.

EIA (Energy Information Administration). 2006a. Pennsylvania Nuclear Industry. Updated August 18, 2006. Available at http://www.eia.doe.gov/cneaf/nuclear/page/at_a_glance/states/statespa.html. Accessed September 25, 2006.

EIA (Energy Information Administration). 2006b. DOE/EIA-0191(2006). Cost and Quality of Fuels for Electric Utility Plants 2003 and 2004. Tables 11.A, 11.B, 14.A, 14.B, 15.A, 15.B. June 30. Available at http://www.eia.doe.gov/cneaf/electricity/cq/cqa2004.pdf. Accessed October 30, 2006.

EIA (Energy Information Administration). 2006c. State Electricity Profiles, 2004 Edition. DOE/EIA-0629(2004). June. Available at http://www.eia.doe.gov/cneaf/electricity/st_profiles/e_profiles_sum.html. Accessed October 4, 2006.

EPA (U.S. Environmental Protection Agency). 1998a. Air Pollutant Emission Factors. Vol. 1, Stationary Point Sources and Area Sources. Section 1.1, "Bituminous and Subbituminous Coal Combustion." AP-42. September. Available at http://www.epa.gov/ttn/chief/ap42/ch01/index.html. Accessed October 30, 2006.

EPA (U.S. Environmental Protection Agency). 1998b. Finding of Significant Contribution and Rulemaking for Certain States in the Ozone Transport Assessment Group Region for Purposes of Reducing Regional Transport of Ozone. Federal Register. Vol. 63, No. 207. October 27.

EPA (U.S. Environmental Protection Agency). 2000. Air Pollutant Emission Factors. Vol. 1, Stationary Point Sources and Area Sources. Section 3.1, "Stationary Gas Turbines." AP-42. April. Available at http://www.epa.gov/ttn/chief/ap42/ch03/index.html. Accessed October 30, 2006.

Exelon Corporation. 2006. "Power Generation, Three Mile Island Generating - 1". Available at http://www.exeloncorp.com/ourcompanies/powergen/nuclear/three_mile_island_unit__1.htm. Accessed September 26, 2006.

FERC (Federal Energy Regulatory Commission). 2006. "Issued Preliminary Permits as of 10/05/2006." Available at http://www.ferc.gov/industries/hydropower/gen-info/licensing/pre-permits.xls. Accessed October 30, 2006.

FHA (Federal Highway Administration). 1997. "User Guidelines for Waste and Byproduct Materials in Pavement Construction." Available at http://www.fhwa.dot.gov/pavement/pub_details.cfm?id=384. Accessed October 30, 2006.

Fuel Cell Today. 2003. "Fuel Cells Market Survey: Large Stationary Applications." Available at http://www.fuelcelltoday.com/FuelCellToday/FCTFiles/FCTArticleFiles/Article_667_LgeStatSurvey0903.pdf. Accessed on October 30, 2006.

INEEL (Idaho National Engineering and Environmental Laboratory). 1998. U.S. Hydropower Resource Assessment Final Report. DOE/ID-10430.2. Available at http://hydropower.inel.gov/resourceassessment/pdfs/doeid-10430.pdf. Accessed on October 30, 2006.

Kenergy Corporation. 2000. "Fuel Cell Technology – Its Role in the 21st Century." Commercial & Industrial News 4th Quarter 2000. Available at http://www.kenergycorp.com/ci/cinews/qtr4ci2000/technology.htm. Accessed on June 19, 2002.

McGowan, J.G. and S. Connors. 2000. Windpower: A Turn of the Century Review. Annual Review of Energy and the Environment, Volume 25, pages 147-197. Available at http://arjournals.annualreviews.org/doi/abs/10.1146/annurev.energy.25.1.147?cookieSet=1&journalCode=energy. Accessed October 30, 2006.

Milligan, M. 2006. "Tackling Climate Change in the United States: The Potential Contribution from Wind Power." NREL (National Renewable Energy Laboratory). NREL/CP-500-4030. July.

NEI (Nuclear Energy Institute). 2000. "Restructuring the U.S. Electric Power Industry." Available at http://www.nei.org/doc.asp?catnum=3&catid=621&docid=&format=print. Accessed October 30, 2006.

NJDEP (New Jersey Department of Environmental Protection). 2005. "What Wind Turbine Development Can, and Cannot Do, for the State of New Jersey." April. Available at www.njwindpanel.org. Accessed October 20, 2006.

NRC (U.S. Nuclear Regulatory Commission). 1996a. Generic Environmental Impact Statement for License Renewal of Nuclear Plants. Volumes 1 and 2. NUREG 1437. Washington, DC. May.

NRC (U.S. Nuclear Regulatory Commission). 1996b. Supplementary Information to Final Rule. Federal Register. Vol. 61, No. 244. December 18.

NRC (U.S. Nuclear Regulatory Commission). 2002a. Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities; Supplement 1; Regarding the Decommissioning of Nuclear Power Reactors. NUREG-0586 Supplement 1. Washington, DC. November.

NRC (U.S. Nuclear Regulatory Commission). 2002b. Generic Environmental Impact Statement for License Renewal of Nuclear Plants Regarding McGuire Nuclear Station, Units 1 and 2. NUREG-1437, Supplement 8, Final. Office of Nuclear Reactor Regulation. Washington, DC. December.

NREL (National Renewable Energy Laboratory) 1994. Solar Radiation Data Manual for Flat Plate and Concentrating Collectors. NREL/TP-463-5607. Golden, Colorado. April. Available at http://rredc.nrel.gov/solar/pubs/redbook/. Accessed October 19, 2006.

NREL (National Renewable Energy Laboratory) 1997. "Geothermal Resource Information Clearinghouse." Available at http://rredc.nrel.gov/geothermal. Accessed October 2006.

NREL (National Renewable Energy Laboratory) 2004. "PV Solar Radiation (Flat Plate, Facing South , Latitude Tilt." Available at http://www.nrel.gov/gis/images/us_pv_annual_may2004.jpg. Accessed January 23, 2007.

Pennsylvania General Assembly. 1996. House Bill No. 1509, Electricity Generation Customer Choice and Competition Act, as Amended. Available at http://www.puc.state.pa.us/electric/pdf/HB1509P4282.pdf. Accessed October 30, 2006.

Pennsylvania General Assembly. 2004. Senate Bill No. 1030, Alternative Energy Portfolio Standards Act, as Amended. Available at http://www2.legis.state.pa.us/WU01/LI/BI/BT/2003/0/SB1030P1973.pdf. Accessed October 30, 2006.

Pinero, E. 2001. Testimony Summary: The House Committee on Energy and Commerce, Subcommittee on Energy and Air Quality Hearing, March 14, 2001. Available at. http://energycommerce.house.gov/107/Hearings/03142001hearing94/Pinero127.htm. Accessed October 30, 2006.

PJM (PJM Interconnection, LLC). 2006a. "PJM 2006 Annual Report." Available at http://www.pjm.com/about/annual-report.html. Accessed September 27, 2006

PJM (PJM Interconnection, LLC). 2006b. "Section 2: Developing an Expansion Plan." Available at http://www.pjm.com/planning/downloads/20060410-rtep-sec-2.pdf. Accessed September 27, 2006.

PJM (PJM Interconnection, LLC). 2006c. "2005 PJM Load, Capacity and Transmission Report (Draft)." August 16, 2006. Available at http://www.pjm.com/documents/downloads/reports/draft-2006-pjm-411.pdf. Accessed September 30, 2006.

PSEB (Pennsylvania Sustainable Energy Board). 2004. "Pennsylvania Sustainable Energy Board 2003 Annual Report." May 11, 2004. Available at http://www.puc.state.pa.us/electric/pdf/PASustainable_Energy_Board_2003AR.pdf. Accessed October 30, 2006.

Walsh M. E., R. L. Perlack, A. Turhollow, D. de la Torre Ugarte, D. A. Becker, R. L. Graham, S. E. Slinsky, and D. E. Ray. 2000. "Biomass Feedstock Availability in the United States: 1999 State Level Analysis." Oak Ridge National Laboratory. Oak Ridge, TN. April 30, 1999. Updated January, 2000. Available at http://bioenergy.ornl.gov/resourcedata/index.html. Accessed October 30, 2006.

Chapter 8

COMPARISON OF ENVIRONMENTAL IMPACT OF LICENSE RENEWAL WITH THE ALTERNATIVES

NRC

"To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form..." 10 CFR 51.45(b)(3) as adopted by 51.53(c)(2)

Chapter 4 analyzes environmental impacts of the Three Mile Island Nuclear Station Unit 1 (TMI-1) license renewal and Chapter 7 analyzes impacts from renewal alternatives. Table 8.0-1 summarizes environmental impacts of the proposed action (license renewal) and the alternatives, for comparison purposes. The environmental impacts compared in Table 8.0-1 are those that are either Category 2 issues that apply to the proposed action or are issues that the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (NRC 1996) identified as major considerations in an alternatives analysis. For example, although the U.S. Nuclear Regulatory Commission (NRC) concluded that air quality impacts from the proposed action would be small (Category 1), the GEIS identified major human health concerns associated with air emissions from alternatives (Section 7.2.2). Therefore, Table 8.0-1 includes a comparison of the air impacts from the proposed action to those of the alternatives. Table 8.0-2 is a more detailed comparison of the alternatives.

Table 8.0-1. Impacts Comparison Summary

Impact	Proposed Action (License Renewal)	No-Action Alternatives			
		Base (Decommissioning)	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Land Use	SMALL	SMALL	MODERATE	SMALL to MODERATE	MODERATE
Water Quality	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	MODERATE	MODERATE	SMALL to MODERATE
Ecological Resources	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Threatened or Endangered Species	SMALL	SMALL	SMALL	SMALL	SMALL
Human Health	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Socioeconomics	SMALL	SMALL	SMALL	MODERATE	SMALL to MODERATE
Waste Management	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Aesthetics	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE
Cultural Resources	SMALL	SMALL	SMALL	SMALL	SMALL

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, any important attribute of the resource. 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3.

Table 8.0-2. Impacts Comparison Detail

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Alternative Descriptions				
TMI-1 license renewal for 20 years, followed by decommissioning	Decommissioning following expiration of current TMI-1 license. Adopting by reference, as bounding TMI-1 decommissioning, GEIS description (NRC 1996, Section 7.1)	New construction at an existing power plant site	New construction at an existing power plant site	Would involve construction of new generation capacity in the PJM region. Adopting by reference GEIS description of alternate technologies (Section 7.2.1.2)
		Installation of a new rail spur	Construct 10-inch-diameter gas pipeline in a 50-foot-wide corridor. May require upgrades to existing pipelines	
		Construction of switchyard and transmission lines	Construction of switchyard and transmission lines	Construct new transmission lines to interconnect to the PJM region
		Single unit 793-MWe tangentially-fired, dry bottom units; capacity factor 0.85	Two pre-engineered natural gas fired systems, with heat recovery steam generators, producing combined total of 793 MWe; capacity factor 0.85	

Table 8.0-2. Impacts Comparison Detail (Continued).

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
		Construct intake/ discharge canal system	Construct intake/ discharge canal system	
		Pulverized bituminous coal, 11,615 Btu/lb; 10,200 Btu/kWh; 15.55% ash; 2.0% sulfur; 10 lb/ton nitrogen oxides; 2,758,159 tons coal/yr	Natural gas, 1,033 Btu/ft3; 6,090 Btu/kWh; 0.0034 lb sulfur/MMBtu; 0.0090 lb NOx/MMBtu; 36,238,318,762 ft3 gas/yr	
		Low NOx burners, over-fire air and selective catalytic reduction (95% NOx reduction efficiency)	Selective catalytic reduction with steam/water injection	
		Wet scrubber – lime/limestone desulphurization system (95% SOx removal efficiency); 172, 030 tons lime/yr		
		Fabric filters or electrostatic precipitators (99.9% particulate removal efficiency)		

Table 8.0-2. Impacts Comparison Detail (Continued).

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
525 permanent and 170 long-term contract workers		92 workers (Section 7.2.2.2)	27 workers (Section 7.2.2.1)	
Land Use Impacts				
SMALL – Adopting by reference Category 1 issue findings (Attachment A, Table A-1, Issues 52, 53)	SMALL – Not an impact evaluated by GEIS (NRC 1996)	MODERATE – 129 acres required for the power block and associated facilities; 188 acres for ash disposal (Section 7.2.2.2)	SMALL to MODERATE – 32 acres for facility at TMI-1 location (Section 7.2.2.1). New gas pipeline would be built to connect with existing gas pipeline corridor	MODERATE – most transmission facilities could be constructed along existing transmission corridors (Section 7.2.2.3). Adopting by reference GEIS description of land use impacts from alternate technologies (NRC 1996)
Water Quality Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 1-3, 6-11, and 31). Three Category 2 groundwater issues apply (Section 4.1, Issue 13; and Section 4.5, Issue 33; Section 4.6, Issue 34). Two Category 2 groundwater issues don't apply (Section 4.7, Issue 35; and Section 4.8, Issue 39).	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 89).	SMALL – Construction impacts minimized by use of best management practices. Operational impacts similar to TMI-1 by using cooling water and discharge to the Susquehanna River. (Section 7.2.2.2)	SMALL – Reduced cooling water demands, inherent in combined-cycle design (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of water quality impacts from alternate technologies (NRC 1996)

Table 8.0-2. Impacts Comparison Detail (Continued).

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Air Quality Impacts				
SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 51). Category 2 issue finding (Section 4.11, Issue 50).	SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issue 88)	MODERATE – 5,241 tons SOx/yr 690 tons NOx/yr 690 tons CO/yr 214 tons TSP/yr 0.21 tons PM-2.5/yr 49 tons PM-10/yr (Section 7.2.2.2)	MODERATE – 64 tons SOx/yr 168 tons NOx/yr 1,123 tons CO/yr 36 tons PM-2.5/yra (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of air quality impacts from alternate technologies (NRC 1996)
Ecological Resource Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 14-24, 28-30, 43, and 45-48). One Category 2 issues findings (Section 4.9, Issue 40). Three Category 2 issues not applicable (Section 4.2, Issue 25; Section 4.3, Issue 26; and Section 4.4, Issue 27)	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 90)	MODERATE – 188 acres of undisturbed land could be required for ash/sludge disposal over 20-year license renewal term. (Section 7.2.2.2)	SMALL – Construction of pipeline could alter the terrestrial habitat. (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of ecological resource impacts from alternate technologies (NRC 1996)

Table 8.0-2. Impacts Comparison Detail (Continued).

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Threatened or Endangered Species Impacts				
SMALL – No Federally threatened or endangered species are known residents at the site or along the transmission corridors. (Section 4.10, Issue 49)	SMALL – Not an impact evaluated by GEIS (NRC 1996)	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats
Human Health Impacts				
SMALL – Adopting by reference Category 1 issues (Table A-1, Issues 54-56, 58, 61, 62). One Category 2 issue does apply (Section 4.12, Issue 57). Risk due to transmission-line induced currents minimal due to conformance with consensus code (Section 4.13, Issue 59)	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 86)	MODERATE – Adopting by reference GEIS conclusion that risks such as cancer and emphysema from emissions are likely (NRC 1996)	SMALL – Adopting by reference GEIS conclusion that some risk of cancer and emphysema exists from emissions (NRC 1996)	SMALL to MODERATE – Adopting by reference GEIS description of human health impacts from alternate technologies (NRC 1996)

Table 8.0-2. Impacts Comparison Detail (Continued).

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Socioeconomic Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 64, 67). Two Category 2 issues findings (Section 4.16, Issue 66 and Section 4.17, Issue 68). Location in high population area with no growth controls minimizes potential for housing impacts. Section 4.14, Issue 63). Plant property tax payment represents less than 1 percent of county's total tax revenues (Section 4.17, Issues 68 and 69). Capacity of public water supply and transportation infrastructure minimizes potential for related impacts (Section 4.15, Issue 65; Section 4.16, Issue 66 and Section 4.18, Issue 70)	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 91)	SMALL – Reduction in permanent work force at TMI-1 could adversely affect surrounding counties, but would be mitigated by TMI-1's proximity to several metropolitan areas (Section 7.2.2.2)	SMALL to MODERATE – Reduction in permanent work force at TMI-1 could adversely affect surrounding counties, but would be mitigated by TMI-1's proximity to several metropolitan areas (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of socioeconomic impacts from alternate technologies (NRC 1996)

Table 8.0-2. Impacts Comparison Detail (Continued).

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Waste Management Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 77-85)	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 87)	MODERATE – 107,000 tons of coal ash and 205,000 tons of scrubber sludge annually would require 188 acres over 20-year license renewal term. (Section 7.2.2.2)	SMALL – Approximately 500 ft3 spent SCR catalyst per year (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of waste management impacts from alternate technologies (NRC 1996)
Aesthetic Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 73, 74)	SMALL – Not an impact evaluated by GEIS (NRC 1996)	SMALL to MODERATE – The coal-fired power blocks and the exhaust stacks would be visible from offsite, in an industrial setting (Section 7.2.2.2)	SMALL– Steam turbines and stacks would create visual impacts comparable to those from existing TMI-1 facilities (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of aesthetic impacts from alternate technologies (NRC 1996)
Cultural Resource Impacts				
SMALL – SHPO consultation minimizes potential for impact (Section 4.19, Issue 71)	SMALL – Not an impact evaluated by GEIS (NRC 1996)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site (Section 7.2.2.2)	SMALL – Construction in previously disturbed soil would be unlikely to affect cultural resources (Section 7.2.2.1)	SMALL – Adopting by reference GEIS description of cultural resource impacts from alternate technologies (NRC 1996)

Table 8.0-2. Impacts Comparison Detail (Continued).

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternatives		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
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, any important attribute of the resource. (10 CFR 51, Subpart A, Appendix B, Table B 1, Footnote 3).				
[a]. All TSP for gas-fired alternative is PM-2.5.				

Btu	=	British thermal unit	NOx	=	nitrogen oxide
ft3	=	cubic foot	PJM	=	regional electric distribution network
gal	=	gallon	PM-2.5	=	particulates having diameter less than 2.5 microns
GEIS	=	Generic Environmental Impact Statement (NRC 1996)	SHPO	=	State Historic Preservation Officer
kWh	=	kilowatt hour	SOx	=	sulfur dioxide
lb	=	pound	TSP	=	total suspended particulates
MM	=	million	yr	=	year
MW	=	megawatt			

8.1 REFERENCES

NRC (U.S. Nuclear Regulatory Commission). 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants. Volumes 1 and 2. NUREG-1437. Washington, DC. May.

Chapter 9

Status of Compliance

9.1 PROPOSED ACTION

NRC

"The environmental report shall list all federal permits, licenses, approvals and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The environmental report shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements which have been imposed by Federal, State, regional, and local agencies having responsibility for environmental protection." 10 CFR 51.45(d), as adopted by 10 CFR 51.53(c)(2)

9.1.1 GENERAL

Table 9.1-1 lists environmental authorizations that AmerGen Energy Company, LLC (AmerGen) has obtained for current Three Mile Island Nuclear Station Unit 1 (TMI-1) operations. In this context, AmerGen uses "authorizations" to include any permits, licenses, approvals, or other entitlements. AmerGen expects to continue renewing these authorizations during the current license period and throughout the period of extended operation under the renewed U.S. Nuclear Regulatory Commission (NRC) license. Because the NRC regulatory focus is prospective, Table 9.1-1 does not include authorizations that AmerGen obtained for past activities that did not include continuing obligations.

To support its application for renewal of the TMI-1 license to operate, AmerGen assessed whether new and significant environmental information exists relative to the information considered by the NRC in preparing the *Generic Environmental Impact Statement For License Renewal* (see Chapter 5). The assessment included interviews with subject matter experts at TMI-1, a review of TMI-1 environmental documentation, and communications with state and federal environmental protection agencies. Based on this assessment, AmerGen concludes that TMI-1 is in compliance with applicable environmental standards and requirements.

Table 9.1-2 lists additional environmental authorizations and consultations related specifically to renewal by the NRC of the TMI-1 license to operate. As indicated, AmerGen anticipates needing relatively few such authorizations and consultations. Sections 9.1.2 through 9.1.4 discuss some of these items in more detail.

Table 9.1-3 lists potentially required authorizations associated with conducting refurbishment activities.

9.1.2 THREATENED OR ENDANGERED SPECIES

Section 7 of the Endangered Species Act (16 USC 1531 et seq.) requires federal agencies to ensure that agency action is not likely to jeopardize any species that is listed, or proposed for listing as endangered, or threatened. Depending on the agency action involved, the Act requires consultation either with the U.S. Fish and Wildlife Service (FWS) (regarding effects on non-marine species), or the National Marine Fisheries Service (NMFS) (regarding effects

on marine species), or both. FWS and NMFS have issued joint procedural regulations at 50 Code of Federal Regulations (CFR) 402, Subpart B, that address consultation, and FWS maintains the joint list of threatened and endangered species at 50 CFR 17.

Although not required of an applicant by federal law or NRC regulation, AmerGen has chosen to invite comment from federal and state agencies regarding potential effects that renewal of the TMI-1 license might have. Appendix C includes copies of AmerGen correspondence with FWS, Pennsylvania Department of Conservation and Natural Resources, the Pennsylvania Game Commission, and the Pennsylvania Fish and Boat Commission.

9.1.3 HISTORIC PRESERVATION

Section 106 of the National Historic Preservation Act (16 USC 470 et seq.) requires federal agencies having the authority to license any undertaking to, prior to issuing the license, take into account the effect of the undertaking on historic properties and to afford the Advisory Council on Historic Preservation an opportunity to comment on the undertaking. Council regulations provide for the State Historic Preservation Officer (SHPO) to have a consulting role (35 CFR 800.2). Although not required of an applicant by federal law or NRC regulation, AmerGen has chosen to invite comment by the Pennsylvania SHPO. Appendix D contains a copy of AmerGen's letter to the Pennsylvania SHPO and the SHPO's response. The SHPO stated, "in our opinion the activities described in your proposal should have no effect on these resources." Therefore, the SHPO agrees that license renewal will have no adverse effect on significant cultural resources within the project area.

9.1.4 WATER QUALITY (401) CERTIFICATION

Federal Clean Water Act Section 401 requires an applicant seeking a federal license for an activity that may result in a discharge to navigable waters to provide the licensing agency with a certification by the state where the discharge would originate indicating that applicable state water quality standards will not be violated as a result of the discharge (33 USC 1341). The Commonwealth of Pennsylvania issued a Section 401 State Water Quality Certification for the TMI nuclear station on November 9, 1977 (included in Appendix B). Now, AmerGen is applying for NRC approval to extend TMI-1 operations under a renewed license.

The NRC has indicated in its Generic Environmental Impact Statement for License Renewal that issuance of an NPDES permit by a state implies continued Section 401 certification by the state (NRC 1996, Section 4.2.1.1). The Commonwealth of Pennsylvania has EPA authorization to implement the NPDES permitting program. In addition, guidance published by the Pennsylvania Department of Environmental Protection (PADEP) states that water quality certifications have been integrated with other required permits and that individual water quality certifications will be issued only for activities that are not regulated by other water quality approvals or permits. Accordingly, as evidence of continued Section 401 certification by Pennsylvania, AmerGen is providing the existing TMI-1 NPDES permit (PA0009920) (included in Appendix B).

9.2 ALTERNATIVES

NRC

"The discussion of alternatives in the report shall include a discussion of whether the alternatives will comply with such applicable environmental quality standards and requirements." 10 CFR 51.45(d), as required by 10 CFR 51.53(c)(2)

The coal, gas, and purchased power alternatives discussed in Section 7.2 probably could be constructed and operated to comply with applicable environmental quality standards and requirements. AmerGen notes that increasingly stringent air quality protection requirements could make the construction of a large fossil-fueled power plant infeasible in many locations. AmerGen also notes that the U.S. Environmental Protection Agency is in the process of revising requirements for design and operation of cooling water intake structures at new and existing facilities (40 CFR 125 Subparts I and J). The new requirements could necessitate construction of cooling towers for the coal- and gas-fired alternatives.

Table 9.1-1. Existing Environmental Authorizations for TMI-1 Operations

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Federal and State Requirements					
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011, et seq.), 10 CFR 50.10	License to operate	Docket 50-289	Issued: 4/19/74 Expires: 4/19/14	Operation of TMI-1
Susquehanna River Basin Commission	Susquehanna River Basin Compact, P.L. 91-575, Article 3, Section 3.10, P.L. 91-575, and Commission Regulation 803.61	Consumptive Water Use Permit	Docket 19950302	Issued: 3/14/80 Expires: 3/14/10	Consumptive Water Use of up to 18,000,000 gpd (on a 30-day average) for electric power generation
Susquehanna River Basin Commission	Susquehanna River Basin Compact, P.L. 91-575, Article 3, Section 3.10, P.L. 91-575, and Commission Regulation 803.43	Groundwater Withdrawal Permit	Docket 19961102	Issued: 1/26/99 Expires: 11/26/21	Groundwater Withdrawal of up to 225,000 gpd (on a 30-day average) for industrial use
Pennsylvania Department of Environmental Protection	Air Pollution Control Act, P.L. 2119 and 25 Pa. Code Chapter 127	Synthetic Minor Operating Permit	22-05029	Issued:1/1/07 Expires:12/31/11	All air emission sources at TMI-1
Pennsylvania Department of Environmental Protection	Clean Water Act, 33 U.S.C. Section 1251 et seq. and Pennsylvania's Clean Streams Law, as amended, 35 P.S. Section 691.1 et seq.	NPDES permit	PA 0009920	Issued: 10/30/07 Expires: 10/31/12 (Administratively Extended Pending New Permit Issuance)	Authorization to discharge into the Susquehanna River

Table 9.1-1. Existing Environmental Authorizations for TMI-1 Operations (continued)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Federal and State Requirements					
U.S. Army Corps of Engineers	Pennsylvania Public Laws 834, 204, 851, 1987, etc.	Maintenance dredging permit	CENAB-OP-RPA (AmerGen Energy Company, LLC) 197500083-4	Issued: 1/3/06 Expires: 12/31/15	Maintenance dredging of the TMI-1 Intake Bay in the Susquehanna River
Pennsylvania Department of Environmental Protection	P.L. 555, as amended	Maintenance Dredging Permit	21275724	Issued: 01/13/76 Expires: No Date Listed on Permit	Maintenance dredging of the intake bay in the Susquehanna River
Pennsylvania Department of Environmental Protection	Pennsylvania Safe Drinking Water Act (P.L. 206, No. 43)	Public Water Supply Permit	22296501-T1	Issued: 01/20/00 Expires: No Date Listed on Permit	Operation of TMI-1 Plant Site Drinking Water System
Pennsylvania Department of Environmental Protection	Pennsylvania Safe Drinking Water Act (P.L. 206, No. 43)	Public Water Supply Permit	22295502-T1	Issued: 01/20/00 Expires: No Date Listed on Permit	Operation of TMI-1 Training Center Drinking Water System
U.S. Environmental Protection Agency	RCRA Section 310	Acknowledgement of Notification of Regulated Waste Activity	PAR 000037861	Issued: 3/22/99 Expires: No Date Listed on Permit	Generation and transportation of hazardous waste
Pennsylvania Department of Environmental Protection	Pennsylvania Storage Tank and Spill Prevention Act and 25 PA Code 245	Storage Tank Registration/Permit Certificate	22-60170	Issued: 6/4/07 Expires: 6/4/08 (Annual Renewal)	Registration of storage tanks

Table 9.1-1. Existing Environmental Authorizations for TMI-1 Operations (continued)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Federal and State Requirements					
U.S. Department of Transportation	49 CFR Part 107, Subpart G and 49 U.S.C. 5108	Hazardous Materials Certificate of Registration	022307-701-002PR	Issued: 5/16/07 Expires: 6/30/10	Hazardous Materials transportation
Pennsylvania Department of Labor and Industry, Boiler Section	Pennsylvania Fire Marshall	Flammable and Combustible Liquid Storage Tank Approval	168,466	Issued: 6/12/70 Expires: No Date Listed on Permit	Construction and Operation of TMI-1 50,000-gallon aboveground diesel fuel oil tank.
Pennsylvania Department of Labor and Industry, Boiler Section	Pennsylvania Fire Marshall	Flammable and Combustible Liquid Storage Tank Approval	168,465	Issued: 6/12/70 Expires: No Date Listed on Permit	Construction and Operation of TMI-1 30,000-gallon underground diesel fuel oil tank.
Pennsylvania Department of Labor and Industry, Boiler Section	Pennsylvania Fire Marshall	Flammable and Combustible Liquid Storage Tank Approval	187,165	Issued: 11/17/77 Expires: No Date Listed on Permit	Construction and Operation of TMI-1 200,000-gallon aboveground diesel fuel oil tank.
Pennsylvania Department of Labor and Industry, Boiler Section	Pennsylvania Fire Marshall	Flammable and Combustible Liquid Storage Tank Approval	203,271-B	Issued: 8/4/89 Expires: No Date Listed on Permit	Construction and Operation of TMI-1 Fire Training Facility 285-gallon aboveground diesel fuel oil tank.

Table 9.1-1. Existing Environmental Authorizations for TMI-1 Operations (continued)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Federal and State Requirements					
Pennsylvania Department of Labor and Industry, Boiler Section	Pennsylvania Fire Marshall	Flammable and Combustible Liquid Storage Tank Approval	122-203,393	Issued: 9/22/89 Expires: None	Construction and Operation of TMI-1 Transportation Department USTs (4,000-gallon diesel and 10,000 gallon gasoline)
Pennsylvania Department of Environmental Protection	Londonderry Township	Sewage Disposal System Permit Modification	C179678 and C21434	Issued: 1/1/95 Expires: No Date Listed on Permit	Approval of additional flows to Visitors Center and Training Center elevated sand mounds.
Pennsylvania Department of Environmental Protection	Water Quality Management Division	Sewage Sludge Disposal Agreement	Letter Agreement	Issued: 6/20/00 Expires: No Date Listed on Permit	Disposal of sewage sludge.
Pennsylvania Department of Environmental Protection	Bureau of Laboratory Certification	Environmental Laboratory Accreditation Certification	Reg. No. 22-00649	Issued: 04/17/07 Expires: 04/30/08	TMI-1 Chemistry Laboratory is certified to perform accredited analyses for NPDES reporting
Pennsylvania Department of Environmental Protection	Londonderry Township	On Lot Sewage Disposal System Permit	U003282	Issued: 08/10/07 Expires: No Date Listed on Permit	New Sand Mound System for TMI-1 Training Center

Table 9.1-2. Environmental Authorizations Needed to Continue TMI-1 Operation During the Period of License Renewal

Agency	Authority	Requirement	Remarks
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011 et seq.)	License renewal	Environmental Report submitted in support of license renewal application
U.S. Fish and Wildlife Service (FWS)	Endangered Species Act Section 7 (16 USC 1536)	Consultation	Requires federal agency issuing a license to consult with the FWS (Attachment C)
Pennsylvania Department of Environmental Protection	Clean Water Act Section 401 (33 USC 1341)	Certification	State issuance of NPDES permit (Attachment B) constitutes 401 certification (1977 certification included in Attachment B) (Section 9.1.4)
Pennsylvania Historical and Museum Commission	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with State Historic Preservation Officer (SHPO). SHPO must concur that license renewal will not affect any sites listed or eligible for listing (Attachment D)

Note: No renewal-related requirements identified for local or other agencies.

Table 9.1-3 Environmental Authorizations Potentially Needed for TMI-1 Refurbishment Activities

Responsible Agency	Authority	Requirement	Status
		AIR QUALITY PROTECTION	
Pennsylvania Department of Environmental Protection (PADEP)	CAA, Title V, Sections 501-507 (42 U.S.C. 7661-7661f); PA Code Chapter 127	Requires approval (operating permit) by the PADEP for construction or modification of an air pollutant source.	TMI-1 currently holds a *Synthetic Minor Operating Permit* (No. 22-05029), which allows the emission of air pollutants from the TMI-1 site, provided that federally enforceable restrictions are placed on the emissions such that total site emissions will not exceed the threshold for becoming a major source. AmerGen is reviewing the need to modify the existing permit or apply for a new permit for temporary emissions associated with the following steam generator replacement project air pollutant emission sources: concrete batch plant; fuel oil delivery and storage; painting; sandblasting; generator and truck exhausts; fugitive dust; nitrogen purge release. If permitting action is determined to be required, AmerGen will file an application at the appropriate time.
		PROTECTION OF WATER RESOURCES	
PADEP	Clean Water Act of 1977 (CWA) (33 U.S.C. 1251 et seq.); 25 PA Code Chapter 92	Requires a National Pollutant Discharge Elimination System (NPDES) permit prior to any discharge of pollutants from a point source into surface waters.	TMI-1 currently holds an *NPDES Permit* (No. PA 0009920), which authorizes pollutant discharges into the Susquehanna River. AmerGen is reviewing the need to modify the existing NPDES permit, or otherwise obtain authorization for the following temporary discharges to surface waters associated with steam generator replacement project activities: discharge of treated water from hydro demolition (used to cut the opening through the outside concrete wall of the reactor containment building); discharge of storm water from disturbed area during construction; and discharge of concrete truck washout water. If permitting action is determined to be required, AmerGen will file an application at the appropriate time.
PADEP	Clean Streams Law (35 P.S. 691.201, 691.202, 691.207 and 691.402); 25 PA Code Chapter 72	Requires permits for large volume, on lot sewage systems.	TMI-1 currently holds an *On Lot Sewage Disposal System Permit* (No. U003282). AmerGen has determined that no permit modification is needed to support the steam generator replacement project. The existing system is adequately sized to meet the demands of the steam generator replacement project. In addition, a service contract for portable toilets may be implemented at the site during the steam generator replacement project.

Table 9.1-3 Environmental Authorizations Potentially Needed for TMI-1 Refurbishment Activities (continued)

Responsible Agency	Authority	Requirement	Status
U.S. Environmental Protection Agency (EPA)	CWA (33 U.S.C. 1251 et seq.); 40 CFR Part 112	Requires a Spill Prevention Control and Countermeasures (SPCC) Plan for any facility that could discharge oil in harmful quantities into navigable waters.	AmerGen is reviewing the existing TMI-1 SPCC Plan and will, as appropriate, modify it or develop a separate SPCC Plan for activities associated with steam generator replacement project activities.
Susquehanna River Basin Commission (SRBC)	Susquehanna River Basin Compact, P.L. 91-575, Article 3, Section 3.10; 18 CFR Part 806; 25 PA Code Chapter 806	Requires review and approval of any project that will result in consumptive use of water from the Susquehanna River.	TMI-1 holds a *Consumptive Water Use Permit* (Docket 19950302) for up to 18,000,000 gpd (on a 30-day average) for electric power generation. AmerGen is reviewing whether a modification to this permit is necessary to supply water for steam generator replacement project activities, especially hydro-demolition. If permitting action is determined to be necessary, Amergen will file an application at the appropriate time.
Susquehanna River Basin Commission	Susquehanna River Basin Compact, P.L. 91-575, Article 3, Section 3.10; 18 CFR Part 807; 25 PA Code Chapter 807	Requires any person withdrawing or diverting in excess of an average of 10,000 gpd for any consecutive 30-day period, from ground or surface Susquehanna River water sources to register the amount of withdrawal.	TMI-1 holds a *Water Withdrawal Permit* (Docket 19961102) for groundwater withdrawal of up to 225,000 gpd (on a 30-day average) for industrial use. AmerGen is reviewing whether the steam generator replacement project activities will require additional groundwater or surface water withdrawal. If so, an application will be filed with the SRBC at the appropriate time.
U.S. Army Corps of Engineers	CWA (33 U.S.C. 1251 et seq.)	Requires that a *CWA Section 404 Permit* be issued for the discharge of dredge or fill material into waters of the U.S., including wetlands.	AmerGen is reviewing options for transport of the new steam generators from a U.S. port of call to TMI-1. If the selected option, or any other activity associated with the steam generator replacement project, would involve dredge or fill activities, AmerGen or its contractor will apply for the required approval at the appropriate time.
PADEP	Flood Plain Management Act (32 P. S. 679.101—679.601); 25 PA Code Chapter 106	Requires that a permit be obtained before construction, modification, removal, destruction or abandonment of an obstruction in a floodplain.	AmerGen is reviewing flood plain elevations and will avoid steam generator replacement activities within the flood plain to the extent practicable. If avoidance is not practicable, AmerGen will obtain the necessary permits at the appropriate time.

Table 9.1-3 Environmental Authorizations Potentially Needed for TMI-1 Refurbishment Activities (continued)

Responsible Agency	Authority	Requirement	Status
		WASTE MANAGEMENT AND POLLUTION PREVENTION	
PADEP	Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA) (42 U.S.C. 6901 et seq.), Subtitle I; Storage Tank and Spill Prevention Act (35 P. S. 6021.101—6021.2104); 25 PA Code Chapter 245	Requires that a permit be obtained before operating or installing certain aboveground and underground storage tanks.	AmerGen is reviewing the contents and sizes of proposed aboveground and underground storage tanks associated with steam generator replacement activities. If any tanks are identified that are not covered by an exemption or permit-by-rule, AmerGen will apply for a storage tank permit at the appropriate time.
PADEP	RCRA, as amended by HSWA (42 U.S.C. 6901 et seq.), Subtitle C; Solid Waste Management Act (35 P. S. 6018.105, 6018.401—6018.403 and 6018.501); 25 PA Code Articles VII (Hazardous Waste Management) and IX (Residual Waste Management)	Requires that waste generators characterize their wastes and ensure compliance with applicable requirements for treatment, storage, disposal, and transportation.	AmerGen will characterize all wastes generated by steam generator replacement activities to determine applicable requirements for treatment, storage, disposal, and transportation of the wastes. Possible waste categories include low-level radioactive waste, nonradioactive hazardous waste, mixed waste, nonradioactive nonhazardous solid waste, and residual waste. All wastes will be treated, stored, disposed, and transported in accordance with applicable requirements, based on characterization results. Permits, if required, will be obtained at the appropriate time.

Table 9.1-3 Environmental Authorizations Potentially Needed for TMI-1 Refurbishment Activities (continued)

Responsible Agency	Authority	Requirement	Status
		BIOTIC RESOURCES	
U.S. Fish and Wildlife Service; PA Game Commission	Bald and Golden Eagle Protection Act (16 USC 668 – 668d); Endangered Species Act Section 7 (16 USC 1536); 34 PA Game and Wildlife Code Sec. 2924	Prohibits taking of bald eagles and other birds or animals classified by the U.S. Fish and Wildlife Service or the PA Game Commission as endangered or threatened species, and prohibits interfering with or destroying the active nest or eggs of a protected bird, unless a permit has been issued for such activity.	AmerGen is reviewing nest locations and activities of peregrine falcons, osprey, and bald eagles in the vicinity of the TMI-1 reactor containment building. If it is determined that activities associated with the steam generator replacement project warrant obtaining a permit from the PA Game Commission and/or the U.S. Fish and Wildlife service, an application will be filed at the appropriate time.
		OTHER	
Federal Aviation Administration	14 CFR Part 77	Requires notice to the FAA of proposed construction that could obstruct air navigation	AmerGen will evaluate the height of cranes and structures associated with the steam generator replacement project. If it is determined that a notice to the FAA is required, the notice will be filed at the appropriate time.
Pennsylvania Department of Transportation	67 PA Code Chapter 179	Requires a permit for movement on a Pennsylvania highway of an oversize or overweight vehicle, including the load.	AmerGen is reviewing options for transport of the new steam generators from a U.S. port of call to TMI-1. If the selected option would involve moving the steam generators or other oversize or overweight loads over Pennsylvania highways or the highways of other states, AmerGen or its contractor will apply for the required approval at the appropriate time.

9.3 REFERENCES

NRC (U.S. Nuclear Regulatory Commission). 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants. Volumes 1 and 2. NUREG-1437. Washington, DC. May.

Appendix A

NRC NEPA Issues for License Renewal of Nuclear Power Plants

AmerGen has prepared this environmental report in accordance with the requirements of U.S. Nuclear Regulatory Commission (NRC) regulation 10 CFR 51.53. NRC included in the regulation a list of National Environmental Policy Act (NEPA) issues for license renewal of nuclear power plants.

Table A-1 lists these 92 issues and identifies the section in which AmerGen addressed each applicable issue in this environmental report. For organization and clarity, AmerGen has assigned a number to each issue and uses the issue numbers throughout the environmental report.

Table A-1. TMI-1 Environmental Report Discussion of License Renewal NEPA Issues[a]

Issue	Category	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
Surface Water Quality, Hydrology, and Use (for all plants)			
1. Impacts of refurbishment on surface water quality	1	4.0	3.4.1/3-4
2. Impacts of refurbishment on surface water use	1	4.0	3.4.1/3-4
3. Altered current patterns at intake and discharge structures	1	4.0	4.2.1.2.1/4-5
4. Altered salinity gradients	1	NA	Issue applies to an activity, discharge to saltwater, which TMI-1 does not do.
5. Altered thermal stratification of lakes	1	NA	Issue applies to an activity, discharge to a lake, which TMI-1 does not do.
6. Temperature effects on sediment transport capacity	1	4.0	4.2.1.2.3/4-8
7. Scouring caused by discharged cooling water	1	4.0	4.2.1.2.3/4-6
8. Eutrophication	1	4.0	4.2.1.2.3/4-9
9. Discharge of chlorine or other biocides	1	4.0	4.2.1.2.4/4-10
10. Discharge of sanitary wastes and minor chemical spills	1	4.0	4.2.1.2.4/4-10
11. Discharge of other metals in waste water	1	4.0	4.2.1.2.4/4-10
12. Water use conflicts (plants with once-through cooling systems)	1	NA	Issue applies to a plant feature, once-through cooling, which TMI-1 does not have.
13. Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	2	4.1	4.3.2.1/4-29
Aquatic Ecology (for all plants)			
14. Refurbishment impacts to aquatic resources	1	4.0	3.5/3-5
15. Accumulation of contaminants in sediments or biota	1	4.0	4.2.1.2.4/4-10
16. Entrainment of phytoplankton and zooplankton	1	4.0	4.2.2.1.1/4-15
17. Cold shock	1	4.0	4.2.2.1.5/4-18
18. Thermal plume barrier to migrating fish	1	4.0	4.2.2.1.6/4-19

Table A-1. TMI-1 Environmental Report Discussion of License Renewal NEPA Issues[a] (continued)

Issue		Category	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
19.	Distribution of aquatic organisms	1	4.0	4.2.2.1.6/4-19
20.	Premature emergence of aquatic insects	1	4.0	4.2.2.1.7/4-20
21.	Gas supersaturation (gas bubble disease)	1	4.0	4.2.2.1.8/4-21
22.	Low dissolved oxygen in the discharge	1	4.0	4.2.2.1.9/4-23
23.	Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	1	4.0	4.2.2.1.10/4-24
24.	Stimulation of nuisance organisms (e.g., shipworms)	1	4.0	4.2.2.1.11/4-25
Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)				
25.	Entrainment of fish and shellfish in early life stages for plants with once-through and cooling pond heat dissipation systems	2	NA	Issue applies to a heat dissipation system, once-through cooling, that TMI-1 does not have.
26.	Impingement of fish and shellfish for plants with once-through and cooling pond heat dissipation systems	2	NA	Issue applies to a heat dissipation system, once-through cooling, that TMI-1 does not have.
27.	Heat shock for plants with once-through and cooling pond heat dissipation systems	2	NA	Issue applies to a heat dissipation system, once-through cooling, that TMI-1 does not have.
Aquatic Ecology (for plants with cooling-tower-based heat dissipation systems)				
28.	Entrainment of fish and shellfish in early life stages for plants with cooling-tower-based heat dissipation systems	1	4.2	4.3.3/4-33
29.	Impingement of fish and shellfish for plants with cooling-tower-based heat dissipation systems	1	4.3	4.3.3/4-33
30.	Heat shock for plants with cooling-tower-based heat dissipation systems	1	4.4	4.3.3/4-33
Groundwater Use and Quality				
31.	Impacts of refurbishment on groundwater use and quality	1	4.0	3.4.2/3-5

Table A-1. TMI-1 Environmental Report Discussion of License Renewal NEPA Issues[a] (continued)

Issue		Category	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
32.	Groundwater use conflicts (potable and service water; plants that use < 100 gpm)	1	NA	Issue applies to an activity, using < 100 gpm or more of groundwater, TMI-1 usage is > 100 gpm.
33.	Groundwater use conflicts (potable, service water, and dewatering; plants that use > 100 gpm)	2	4.5	4.8.1.1/4-115 and 4.8.1.2/4-117
34.	Groundwater use conflicts (plants using cooling towers withdrawing make-up water from a small river)	2	4.6	4.8.1.3/4-117
35.	Groundwater use conflicts (Ranney wells)	2	NA	Issue applies to a plant feature, Ranney wells, which TMI-1 does not have.
36.	Groundwater quality degradation (Ranney wells)	1	NA	Issue applies to a feature, Ranney wells, which TMI-1 does not have.
37.	Groundwater quality degradation (saltwater intrusion)	1	NA	Issue applies to a feature, location at an ocean or estuary site, which TMI-1 does not have.
38.	Groundwater quality degradation (cooling ponds in salt marshes)	1	NA	Issue applies to a feature, location in a salt marsh, which TMI-1 does not have.
39.	Groundwater quality degradation (cooling ponds at inland sites)	2	NA	Issue applies to a feature, cooling ponds, which TMI-1 does not have.
	Terrestrial Resources			
40.	Refurbishment impacts to terrestrial resources	2	4.9	3.6/3-6
41.	Cooling tower impacts on crops and ornamental vegetation	1	NA	Issue applies to a feature, mechanical draft cooling towers, which TMI-1 does not have.
42.	Cooling tower impacts on native plants	1	NA	Issue applies to a feature, mechanical draft cooling towers, which TMI-1 does not have.
43.	Bird collisions with cooling towers	1	4.0	4.3.5.2/4-45
44.	Cooling pond impacts on terrestrial resources	1	NA	Issue applies to a feature, cooling ponds, which TMI-1 does not have.

Table A-1. TMI-1 Environmental Report Discussion of License Renewal NEPA Issues[a] (continued)

Issue		Category	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
45.	Power line right-of-way management (cutting and herbicide application)	1	4.0	4.5.6.1/4-71
46.	Bird collisions with power lines	1	4.0	4.5.6.2/4-74
47.	Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	1	4.0	4.5.6.3/4-77
48.	Floodplains and wetlands on power line right-of-way	1	4.0	4.5.7.7/4-81
	Threatened or Endangered Species (for all plants)			
49.	Threatened or endangered species	2	4.10	Refurbishment 3.9/3-48 Renewal Term 4.1/4-1
	Air Quality			
50.	Air quality during refurbishment (non-attainment and maintenance areas)	2	4.11	3.3/3-2
51.	Air quality effects of transmission lines	1	4.0	4.5.2/4-62
	Land Use			
52.	Onsite land use	1	4.0	3.2/3-1
53.	Power line right-of-way land use impacts	1	4.0	4.5.3/4-62
	Human Health			
54.	Radiation exposures to the public during refurbishment	1	4.0	3.8.1/3-27
55.	Occupational radiation exposures during refurbishment	1	4.0	3.8.2/3-42
56.	Microbiological organisms (occupational health)	1	4.0	4.3.6/4-48
57.	Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	2	4.12	4.3.6/4-48
58.	Noise	1	4.0	4.3.7/4-49
59.	Electromagnetic fields, acute effects	2	4.13	4.5.4.1/4-66
60.	Electromagnetic fields, chronic effects	NA	4.0	4.5.4.2/4-67

Table A-1. TMI-1 Environmental Report Discussion of License Renewal NEPA Issues[a] (continued)

Issue		Category	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
61.	Radiation exposures to public (license renewal term)	1	4.0	4.6.2/4-87
62.	Occupational radiation exposures (license renewal term)	1	4.0	4.6.3/4-95
	Socioeconomics			
63.	Housing impacts	2	4.14	Refurbishment 3.7.2/3-10 Renewal Term 4.7.1/4-101
64.	Public services: public safety, social services, and tourism and recreation	1	4.0	Refurbishment 3.7.4/3-14 (public service) 3.7.4.3/3-18 (safety) 3.7.4.4/3-19 (social) 3.7.4.6/3-20 (tour, rec.) Renewal Term 4.7.3/4-104 (public safety) 4.7.3.3/4-106 (safety) 4.7.3.44-107 (social) 4.7.3.6/4-107 (tour, rec.)
65.	Public services: public utilities	2	4.15	Refurbishment 3.7.4.5/3-19 Renewal Term 4.7.3/4-104
66.	Public services: education (refurbishment)	2	4.16	3.7.4.1/3-15
67.	Public services: education (license renewal term)	1	4.0 and 4.16.1	4.7.3.1/4-106
68.	Offsite land use (refurbishment)	2	4.17.1	3.7.5/3-20
69.	Offsite land use (license renewal term)	2	4.17.2	4.7.4/4-107
70.	Public services: transportation	2	4.18	Refurbishment 3.7.4.2/3-17 Renewal Term 4.7.3.2/4-106
71.	Historic and archaeological resources	2	4.19	Refurbishment 3.7.7/3-23 Renewal Term 4.7.7/4-114

Table A-1. TMI-1 Environmental Report Discussion of License Renewal NEPA Issues[a] (continued)

Issue		Category	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
72.	Aesthetic impacts (refurbishment)	1	4.0	3.7.8/3-24
73.	Aesthetic impacts (license renewal term)	1	4.0	4.7.6/4-111
74.	Aesthetic impacts of transmission lines (license renewal term)	1	4.0	4.5.8/4-83
	Postulated Accidents			
75.	Design basis accidents	1	4.0	5.3.2/5-11 (design basis) 5.5.1/5-114 (summary)
76.	Severe accidents	2	4.20	5.3.3/5-12 (probabilistic analysis) 5.3.3.2/5-19 (air dose) 5.3.3.3/5-49 (water) 5.3.3.4/5-65 (groundwater) 5.3.3.5/5-95 (economic) 5.4/5-106 (mitigation) 5.5.2/5-114 (summary)
	Uranium Fuel Cycle and Waste Management			
77.	Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste)	1	4.0	6.2/6-8
78.	Offsite radiological impacts (collective effects)	1	4.0	Not in GEIS.
79.	Offsite radiological impacts (spent fuel and high-level waste disposal)	1	4.0	Not in GEIS.
80.	Nonradiological impacts of the uranium fuel cycle	1	4.0	6.2.2.6/6-20 (land use) 6.2.2.7/6-20 (water use) 6.2.2.8/6-21 (fossil fuel) 6.2.2.9/6-21 (chemical)
81.	Low-level waste storage and disposal	1	4.0	6.4.2/6-36 (low-level def) 6.4.3/6-37 (low-level volume) 6.4.4/6-48 (renewal effects)
82.	Mixed waste storage and disposal	1	4.0	6.4.5/6-63
83.	Onsite spent fuel	1	4.0	6.4.6/6-70
84.	Nonradiological waste	1	4.0	6.5/6-86
85.	Transportation	1	4.0	6.3/6-31, as revised by Addendum 1, August 1999.

Table A-1. TMI-1 Environmental Report Discussion of License Renewal NEPA Issues[a] (continued)

Issue		Category	Section of this Environmental Report	GEIS Cross Reference[b] (Section/Page)
Decommissioning				
86.	Radiation doses (decommissioning)	1	4.0	7.3.1/7-15
87.	Waste management (decommissioning)	1	4.0	7.3.2/7-19 (impacts) 7.4/7-25 (conclusions)
88.	Air quality (decommissioning)	1	4.0	7.3.3/7-21 (air) 7.4/7-25 (conclusions)
89.	Water quality (decommissioning)	1	4.0	7.3.4/7-21 (water) 7.4/7-25 (conclusions)
90.	Ecological resources (decommissioning)	1	4.0	7.3.5/7-21 (ecological) 7.4/7-25 (conclusions)
91.	Socioeconomic impacts (decommissioning)	1	4.0	7.3.7/7-19 (socioeconomic) 7.4/7-24 (conclusions)
Environmental Justice				
92.	Environmental justice	NA	2.6.2	Not in GEIS.

a. Source: 10 CFR 51, Subpart A, Appendix A, Table B-1. (Issue numbers added to facilitate discussion.)
b. Source: Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437).