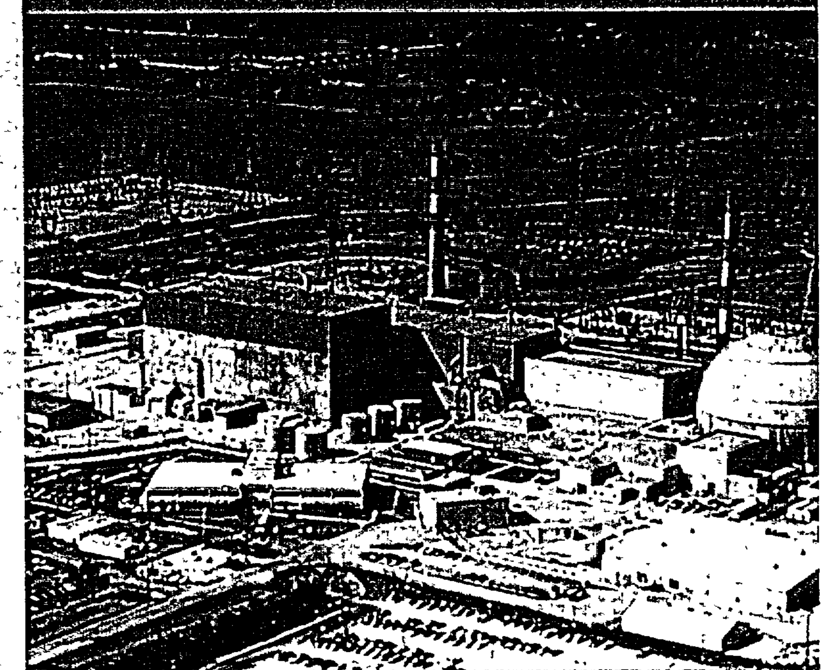
Applicant's Environmental Report
Operating License Renewal Stage
Dresden Nuclear Power Station
Units 2 and 3



Exelon

Appendix E

Applicant's Environmental Report –
Operating License Renewal Stage
Dresden Nuclear Power Station Units 2 and 3

Exelon Generation Company, LLC

License Nos. DPR-19 and DPR-25

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ACRONYMS AND ABBREVIATIONS

AQCR	Air Quality Control Region
BWR	boiling water reactor
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CMSA	Consolidated Metropolitan Statistical Area
ComEd	Commonwealth Edison
CWA	Clean Water Act
DNPS	Dresden Nuclear Power Station
DSM	Demand-side management
EGC	Exelon Generation Company
EPA	U.S. Environmental Protection Agency
Exelon	Exelon Generation Company, LLC
°F	degrees Fahrenheit
FES	Final Environmental Statement
FESOP	Federally Enforceable State Operating Permit
FWS	U.S. Fish and Wildlife Service
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants
gpm	gallons per minute
IEPA	Illinois Environmental Protection Agency
IPA	integrated plant assessment
kV	kilovolt
msl	mean sea level
MW	megawatt
MWe	megawatts-electrical
NESC®	National Electrical Safety Code®
NMFS	National Marine Fisheries Service
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
PMSA	(Chicago) Primary Metropolitan Statistical Area
RM	River mile
ROW	right-of-way
SAMA	Severe Accident Mitigation Alternatives
SHPO	State Historic Preservation Officer
SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping
SO_2	sulfur dioxide
SO_x	sulfur oxides

Chapter 1

Introduction

Appendix E - Dresden Nuclear Power Station Environmental Report

1.1 Purpose of and Need for Action

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. Exelon Generation Company (EGC), LLC operates Dresden Nuclear Power Station Units 2 and 3 (DNPS) pursuant to NRC Operating Licenses DPR-19 and DPR-25, respectively (NRC 1969; NRC 1971). The Unit 2 license will expire December 22, 2009, and the Unit 3 license will expire January 12, 2011.

EGC has prepared this environmental report in conjunction with its application to NRC to renew the DNPS Units 2 and 3 operating licenses, as provided by the following NRC regulations:

- Title 10, Energy, Code of Federal Regulations (CFR), Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Section 54.23, Contents of Application-Environmental Information (10 CFR 54.23) and Title 10, Energy, CFR, Part 51, Environmental Protection Requirements for Domestic Licensing and Related Regulatory Functions, Section 51.53, Postconstruction Environmental Reports, Subsection 51.53(c), Operating License Renewal Stage [10 CFR 51.53(c)].

NRC has defined the purpose and need for the proposed action, the renewal of the operating licenses for nuclear power plants such as DNPS, as follows:

> "...The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decision makers...." (NRC 1996a)

The renewed operating licenses would allow for an additional 20 years of Station operation beyond the current DNPS licensed operating period of 40 years.

1.2 Environmental Report Scope and Methodology

NRC regulations for domestic licensing of nuclear power plants require environmental review of applications to renew operating licenses. The NRC regulation 10 CFR 51.53(c) requires that an applicant for license renewal submit with its application a separate document entitled *Applicant's Environmental Report - Operating License Renewal Stage*. In determining what information to include in the DNPS Environmental Report, EGC has relied on NRC regulations and the following supporting documents that provide additional insight into the regulatory requirements:

- NRC supplemental information in the *Federal Register* (NRC 1996a,b,c; NRC 1999a)
- *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996d and NRC 1999b)
- *Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses* (NRC 1996e)
- Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response (NRC 1996f)

EGC has prepared Table 1-1 to verify conformance with regulatory requirements. Table 1-1 indicates where the environmental report responds to each requirement of 10 CFR 51.53(c). In addition, each responsive section is prefaced by a boxed quote of the regulatory language and applicable supporting document language.

1.3 Dresden Nuclear Power Station Licensee and Ownership

EGC is a subsidiary of Exelon Corporation. Exelon owns and operates DNPS. Commonwealth Edison (ComEd), another Exelon Corporation subsidiary, owns and operates the DNPS transmission lines. Section 3.1 describes the Station, and Section 3.1.3 describes the transmission facilities.

EGC has ownership in 11, and operates 10, nuclear power plants in Illinois, Pennsylvania, and New Jersey. This includes three plants owned by AmerGen Energy Company, a joint venture with British Energy. Exelon Corporation was formed in 2000 by the merger of Unicom Corporation and PECO Energy Company. Prior to that time, ComEd, a Unicom subsidiary, owned and operated DNPS. For this reason, the DNPS license renewal environmental report makes frequent reference to ComEd and documentation that ComEd prepared.

Table 1-1. Environmental Report Responses to License Renewal Environmental Regulatory Requirements.

Regulatory Requirement	Responsive Environmental Report Section(s)	
10 CFR 51.53(c)(1)	Entire Document	
10 CFR 51.53(c)(2), Sentences 1 and 2	3.0	Proposed Action
10 CFR 51.53(c)(2), Sentence 3	7.2.2	Environmental Impacts of Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(1)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(2)	6.3	Unavoidable Adverse Impacts
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(3)	7.0	Alternatives to the Proposed Action
	8.0	Comparison of Environmental Impacts of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(4)	6.5	Short-term Use Versus Long-term Productivity of the Environment
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(5)	6.4	Irreversible and Irretrievable Resource Commitments
10 CFR 51.53(c)(2) and 10 CFR 51.45(c)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.2	Mitigation
	7.2.2	Environmental Impacts of Alternatives
	8.0	Comparison of Environmental Impact of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(d)	9.0	Status of Compliance
10 CFR 51.53(c)(2) and 10 CFR 51.45(e)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.3	Unavoidable Adverse Impacts
10 CFR 51.53(c)(3)(ii)(A)	4.1	Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a Small River with Low Flow)
	4.6	Groundwater Use Conflicts (Plants Using Cooling Towers or Cooling Ponds that Withdraw Makeup Water from a Small River)
10 CFR 51.53(c)(3)(ii)(B)	4.2	Entrainment of Fish and Shellfish in Early Life Stages
	4.3	Impingement of Fish and Shellfish
	4.4	Heat Shock
10 CFR 51.53(c)(3)(ii)(C)	4.5	Groundwater Use Conflicts (Plants Using >100 gpm of Groundwater)
	4.7	Groundwater Use Conflicts (Plants Using Ranney Wells)

Table 1-1. Environmental Report Responses to License Renewal Environmental Regulatory Requirements (Continued).

Regulatory Requirement	Responsive Environmental Report Section(s)	
10 CFR 51.53(c)(3)(ii)(D)	4.8	Degradation of Groundwater Quality
10 CFR 51.53(c)(3)(ii)(E)	4.9	Impacts of Refurbishment on Terrestrial Resources
	4.10	Threatened or Endangered Species
10 CFR 51.53(c)(3)(ii)(F)	4.11	Air Quality During Refurbishment (Non-Attainment and Maintenance Areas)
10 CFR 51.53(c)(3)(ii)(G)	4.12	Impacts on Public Health of Microbiological Organisms
10 CFR 51.53(c)(3)(ii)(H)	4.13	Electromagnetic Fields – Acute Effects
10 CFR 51.53(c)(3)(ii)(I)	4.14	Housing Impacts
	4.15	Public Utilities Public Water Supply Availability
	4.16	Education Impacts from Refurbishment
	4.17	Offsite Land Use
10 CFR 51.53(c)(3)(ii)(J)	4.18	Transportation
10 CFR 51.53(c)(3)(ii)(K)	4.19	Historic and Archaeological Resources
10 CFR 51.53(c)(3)(ii)(L)	4.20	Severe Accident Mitigation Alternatives
10 CFR 51.53(c)(3)(iii)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.2	Mitigation
10 CFR 51.53(c)(3)(iv)	5.0	Assessment of New and Significant Information
10 CFR 51, Appendix B, Table B-1, Footnote 6	2.6.2	Minority and Low-Income Populations

1.4 References

NRC (U.S. Nuclear Regulatory Commission), 1969. Dresden Nuclear Power Station Operating License Issued by Nuclear Regulatory Commission, DPR-19 for Unit 2, Expiration Date December 22, 2009.

NRC (U.S. Nuclear Regulatory Commission), 1971. Dresden Nuclear Power Station Operating License Issued by Nuclear Regulatory Commission, DPR-25 for Unit 3, Expiration Date January 12, 2011.

NRC (U.S. Nuclear Regulatory Commission), 1996a. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses," *Federal Register*, Vol. 61, No. 109, June 5.

NRC (U.S. Nuclear Regulatory Commission), 1996b. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Correction," *Federal Register*, Vol. 61, No. 147, July 30.

NRC (U.S. Nuclear Regulatory Commission), 1996c. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses," *Federal Register*, Vol. 61, No. 244, December 18.

NRC (U.S. Nuclear Regulatory Commission), 1996d. *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), 1996e. *Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses*, NUREG-1440, Washington, DC, May.

NRC (U.S. Nuclear Regulatory Commission), 1996f. *Public Comments on the Proposed 10 CFR Part 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.

NRC (U.S. Nuclear Regulatory Commission), 1999a. "Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rules," *Federal Register*, Vol. 64, No. 171, September 3.

NRC (U.S. Nuclear Regulatory Commission), 1999b. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)*, Section 6.3, "Transportation" and Table 91, "Summary of findings on NEPA issues for license renewal of nuclear power plants," NUREG-1437, Volume 1, Addendum 1, Washington, DC, August.

Chapter 2

Site and Environmental Interfaces

2.1 Location and Features

DNPS is located in Goose Lake Township, Grundy County, Illinois, on the south shoreline of the Illinois River at the confluence of the Des Plaines and Kankakee Rivers (immediately below the junction of the Kankakee and Des Plaines Rivers at river mile 272.4) (Figures 2-1 and 2-2).

The DNPS site consists of approximately 2,500 acres owned by EGC with an additional 17 acres of river frontage leased from the State of Illinois (Figure 2-3). In addition to the two nuclear reactors and their turbine building, intake and discharge canals, cooling pond and canals, and auxiliary buildings, the site includes switchyards and DNPS Unit 1 (retired August 31, 1984) (ComEd 1995a). Approximately one-half of the cooling pond is in Wilmington Township, Will County, and the other half is in Goose Lake Township, Grundy County, Illinois (see Figure 2-2).

No major metropolitan areas occur within six miles of DNPS. The nearest town is Channahon, approximately three miles northeast. The site is approximately 8 miles east of Morris, Illinois, 15 miles southwest of Joliet, Illinois, and 50 miles southwest of downtown Chicago (Figure 2-1). The area within six miles of the site includes parts of both Grundy and Will Counties. The local terrain is level to gently undulating, except for the Kankakee Bluffs just northeast of DNPS on the north bank of the Illinois River. The area around DNPS is largely rural, characterized by farm land, woods, and small residential communities.

The Goose Lake Prairie State Natural Area is located approximately one-mile southwest of the DNPS turbine building. This 2,537-acre preserve contains the largest remnant of prairie left in Illinois and includes open grasslands and prairie marshes (Illinois Department of Natural Resources [IDNR 2002a]). Directly across the Kankakee River from DNPS is the Des Plaines Fish and Wildlife Area. This 500-acre park offers a variety of recreational facilities, including the largest pheasant hunting facility in the state (IDNR undated). To the east of the Des Plaines Fish and Wildlife Area is the Midewin National Tallgrass Prairie, a 16,000-acre site formerly used as the Joliet Army Ammunition Plant. This area was transferred to the U.S. Forest Service in 1997 and will be managed to restore, maintain, and enhance the prairie ecosystem (USDA 2001). Figure 2-2 shows the location of these natural areas.

Industrial sites located near the Station include the General Electric Morris Operation and the Midwest Generation Collins Station (GE Nuclear Energy 2000). Approximately five miles southwest of DNPS is Heidecke Lake (a cooling pond for the Collins Station), and the Goose Lake Prairie Natural Area which provide fishing and hunting opportunities (ComEd 1995b). Figure 2-2 shows the locations of these sites. Section 2.13 provides additional information about the Morris and Collins sites and Section 3.1 describes key features of DNPS.

2.2 Aquatic and Riparian Ecological Communities

2.2.1 HYDROLOGY AND WATER QUALITY

Hydrology

The Illinois River, formed by the confluence of the Des Plaines and Kankakee Rivers, is a major drainage system for the State of Illinois. DNPS is located at the headwaters of the Illinois River where the Des Plaines and Kankakee Rivers join (Figure 2-2). This area is part of the Upper Illinois River Basin (Figure 2-4), which includes that area upstream from Ottawa, Illinois. The Upper Illinois River Basin includes parts of 16 counties in northeastern Illinois, 13 counties in northwestern Indiana, 7 counties in southeastern Wisconsin, and 1 county in southwestern Michigan. The drainage area of the basin is 7,007,360 acres with 62 percent of the basin occurring in Illinois, 28 percent in Indiana, 10 percent in Wisconsin, and less than 0.1 percent in Michigan. Major tributaries of the Upper Illinois River Basin include the Illinois, Kankakee, Des Plaines, Iroquois, Fox, and Chicago Rivers (USGS 1999).

Since the late 1800s, the Illinois River has undergone extensive changes. In 1871, the flow of the Chicago River was reversed in order to divert sanitary wastes from the City of Chicago away from Lake Michigan to protect the drinking water source for the City. The polluted water of the Chicago River was directed through the Illinois and Michigan (I&M) Canal into the Des Plaines River and subsequently into the Illinois River. The Chicago Sanitary & Ship Canal was opened in 1900, adding several thousand cubic feet per second (cfs) of diverted Lake Michigan water. The new canal was cut into the channels of the South Branch of the Chicago River and the I&M Canal through the Chicago Portage area. At that point, it becomes a separate third channel parallel to the Des Plaines River and the old I&M Canal. About 40 miles downstream, it enters the Des Plaines River between Lockport and Joliet (ComEd 1996).

In 1919, the State began constructing the Illinois Waterway, which created a new, larger channel through the Chicago River, the Chicago Sanitary & Ship Canal, the Des Plaines River, and the Illinois River, shaping them into a continuous navigation route at least 9 feet deep and at least 300 feet wide from Lake Michigan to the Mississippi River. The waterway project required construction of seven major locks and a new set of higher dams. Three of these locks and dams were constructed in the vicinity of or upstream of DNPS. There is a 22-foot-high dam at Dresden Island, approximately 2 miles downstream from the confluence of the Kankakee and Des Plaines Rivers, a 34-foot-high dam just south of Joliet at Brandon Road, and a 40-foot-high dam on the Des Plaines River just south of Lockport (ComEd 1996). Construction of these dams has resulted in a series of reservoirs maintained principally to facilitate barge traffic. Pool elevations are controlled, eliminating natural seasonal flushing events, and are manipulated frequently (ComEd 1996).

Mean annual flow of the Illinois River at Marseilles, Illinois, approximately 26.5 miles below DNPS was 10,820 cfs (ranging from 7,568 to 16,380 cfs) over the 1920 to 1999 time period. Flows tend to be highest in spring (March, April, and May), when the Upper Illinois River Basin receives snowmelt and runoff from spring rains, and lowest during late summer and early fall (August, September, and October) when precipitation in the region is lowest (USGS 2000).

The dam at Dresden Island creates the Dresden Pool which has a normal pool elevation of 505 feet mean sea level (msl) and can vary from 503.0 to 506.5 feet msl. The pool level below the Dresden dam is 483.4 feet msl (ComEd 1995a). Dresden

Pool has a fair amount of "natural" shoreline area and a number of natural tributaries. The two upper pools at Lockport and Brandon (Figure 2-4) have altered the Des Plaines River significantly over time and are mostly artificial, straight-dredged channels with nearly vertical sides, augmented by flow diverted from Lake Michigan. There are a wide variety of historical and current sources of pollutants to these pools. As a result, the water column and sediments have been contaminated by the numerous industries along the river and its tributaries (ComEd 1996).

Extensive shallow water areas with patches of rubble and macrophytic vegetation characterize the habitat of the Dresden Pool in the vicinity of DNPS; fallen trees also provide extensive cover in some areas. Silt substrate characterizes the majority of the area; however, there are some areas with sand substrate. Much of the area is classified as lentic (i.e., standing water, such as a reservoir) due to the influence of the Dresden Lock and Dam. The exception is the discharge canal from DNPS, which is characterized as more lotic (i.e., flowing water, such as a stream) in nature and consists of a dredged canal having a rip-rapped substrate colonized with periphytic algae and a swift current (ComEd 1993).

The Kankakee River Basin drains the largest part (27.6 percent or approximately 1,934,031 acres) of the Upper Illinois River Basin (Figure 2-4). The Kankakee River flows from its headwaters in northeast Indiana toward Illinois in a general northeast to southwest trend and turns northwest at its confluence with the Iroquois River, about 4.8 miles upstream from Kankakee, Illinois (USGS 1999). The mean annual flow of the Kankakee River near Wilmington, Illinois from 1934 to 1999 was 4,739 cfs (ranging from 1,965 to 8,153 cfs); seasonal flows parallel those of the Illinois River (USGS 2000). The Kankakee River flows 57 miles before joining the Des Plaines River to form the Illinois River near the Grundy and Will County line in Illinois (Figure 2-4).

The Des Plaines River originates just south of Union Grove, Wisconsin, and enters Illinois near Russell, Illinois. The river flows 157 miles and drains approximately 13.3 percent (931,978 acres) of the Upper Illinois River Basin. It flows north to south from Wisconsin into Lake and Cook Counties, Illinois, turns southwest at Lyons, Illinois, follows the Chicago Sanitary & Ship Canal, and joins the Kankakee River (USGS 1999). The mean annual flow of the Des Plaines River just above its confluence with the Kankakee River is approximately 6,080 cfs; seasonal flows parallel those of the Illinois River (USGS 1999, 2000). The Des Plaines River drainage area includes 430,720 acres that originally drained to Lake Michigan through the Chicago and Calumet Rivers. The Des Plaines River is the primary drainage system for the greater Chicago/Cook County area (USGS 1999).

Water Quality

During the 1999 aquatic monitoring program (May through October), water temperatures, dissolved oxygen, specific conductivity, and transparency were measured at locations in the Dresden Pool, both above and below the discharge of DNPS (ComEd 2000). During this sampling program, water temperatures ranged from 14.1° to 35.9°C with the warmest temperatures occurring at the DNPS discharge canal and the coolest occurring at either the upstream Des Plaines or Kankakee River stations. Warmest temperatures generally occurred during late July or August and coolest in late October. Mean temperatures at most locations during the 1999 monitoring period were between 24° and 29°C. Mean temperatures within the discharge canal were slightly to moderately higher (2.0°-6.3°C) than at other locations. Compared to recent years, mean summertime (i.e., June 15 to September 30) temperatures in the Dresden Pool were similar in 1995 (28.5°C), 1998 (29.3°C), 1999 (29.8°C), but lower in 1994 (26.4°C) and 1997 (27.6°C), (ComEd 2000).

During 1999, dissolved oxygen concentrations ranged from 5.8 to 16.6 parts per million (ppm). Generally, dissolved oxygen values were the highest in the Kankakee River, with similar values at all other locations within the Dresden Pool (mean range of 7.9 to 8.2 ppm). The highest dissolved oxygen values were generally observed in July and the lowest in June. Specific conductance values ranged from 597 to 1075 micromhos per centimeter (μmhos/cm), with mean values highest in May and late October and lowest from July to August. Transparency values (using Secchi disk) ranged from 35 to 79 cm, with the Kankakee River location exhibiting the lowest values and the DNPS discharge canal exhibiting the highest (ComEd 2000).

Dresden Pool is part of a water body that has been heavily impacted by channelization of the Des Plaines River, construction of locks and dams, periodic dredging, stormwater runoff from continued expansion of upstream urban areas, and its use as a conduit for sanitary and industrial discharges from metropolitan areas (1998 population of 8.9 million) within the Upper Illinois River Basin for almost 100 years. However, during the past 50 years, water-quality improvements in the Basin were numerous because of advances in municipal and industrial waste treatment. Numerous ongoing research and management programs, such as implementation of Total Maximum Daily Loads, Best Management Practices, Wetland Restoration, Pesticide Management and Monitoring have been initiated to address point and nonpoint source pollution (USGS 1998). Overall, the water quality of the Dresden Pool is classified by the Illinois Environmental Protection Agency as General Use and is on the State of Illinois list of impaired waters. The pollutants identified as causing impairment are priority organics, metals, nutrients, and siltation. Flow alteration is also a contributing factor (IEPA 2000).

2.2.2 AQUATIC COMMUNITIES

The aquatic communities of the DNPS cooling pond and intake and discharge areas have been studied extensively since the late 1960s. Many of these studies were funded and conducted by ComEd or its contractors and were directly related to studying the potential environmental impacts of DNPS operations (ComEd 1993, 1995b, 1996, and 2000). Studies of phytoplankton, zooplankton, periphyton, benthic invertebrates, and fish indicate that operation of DNPS has not had a measurable impact on the ecology of the Illinois River or the Dresden Pool area (ComEd 1993, 2000).

The benthic community in the vicinity of the Dresden Pool is primarily composed of Oligochaeta (aquatic worms), Chironomidae (fly larvae), and Ephemeroptera (mayfly nymphs). However, there have been some differences in taxa richness between collections made in 1992 and 1999. For example, during 1999 relative abundance of Oligochaetes was considerably higher and Chironomids was generally lower. Also during 1999, Ephemeroptera abundance was noticeably higher at locations above the intake canal on the Kankakee River compared to a station just below the discharge canal (ComEd 2000). In general, the benthic data indicate that a less diverse benthic community exists in the Dresden Pool and appears to be dominated by more pollution tolerant taxa. It is possible that naturally occurring higher temperatures and variability in sampling methods contributed to the temporal, spatial, and differences observed between 1992 and 1999 (ComEd 2000).

Surveys of the fish community in the vicinity of the DNPS have been conducted since 1971. These studies were initiated by ComEd to monitor the fish populations near the confluence of the lower Kankakee and lower Des Plaines Rivers and in the Illinois River within the Dresden Pool and just below Dresden Lock and Dam. The Dresden Pool area included sampling stations near the intake and discharge areas of DNPS. Fish sampling methods included electrofishing, gillnetting, and seining (ComEd 1993).

Results of the 1992 sampling program indicated that 55 species (and 4 hybrids) of fish were collected, with the most common species being bluegill, gizzard shad, bluntnose minnow, emerald shiner, green sunfish, spotfin shiner, and bullhead minnow. Fish biomass was dominated by carp, carp goldfish hybrid, gizzard shad, and channel catfish (ComEd 1993). One greater redhorse, an Illinois state-listed endangered species was collected below the Dresden Lock and Dam in 1992 (ComEd 1993). During 1999, a total of 36 species and 2 hybrids were collected, with gizzard shad, emerald shiner, bluegill, and green sunfish dominating the catch. By weight, the catch was dominated by common carp and gizzard shad. (ComEd 2000). The species compositions for 1992 and 1999 are representative of the historical fishery in the vicinity of DNPS.

Results of the long-term monitoring studies have shown that the fish community in the area of DNPS has become more diverse since the studies began. For example, the number of species collected by various collection methods increased from the 1970s through the early to mid-1980s and leveled off in the early 1990s (ComEd 1993). The increases in species richness that occurred during the 1980s were primarily the result of more cyprinid (i.e., minnow) and sunfish species. Since the 1970s, water quality has also improved in the Kankakee and lower Des Plaines Rivers and the increases in species richness could be related to that improvement (ComEd 1993). Based on the extensive fishery studies of the Upper Illinois Waterway, it is apparent that the fish community in the Dresden Pool area (i.e., that area above and below the Dresden Lock and Dam) is characterized by higher catch rates, higher species richness, and is less dominated by pollution-tolerant species than those up-stream of Brandon Lock and Dam (ComEd 1996). Further, it appears that the operation of DNPS has not had a measurable detrimental environ-mental impact on the Dresden Pool fishery community (ComEd 1993, 2000).

Provisional Variances - During some years, DNPS discharges above NPDES permit thermal limits may occur. EGC received one provisional variance from NPDES permit thermal limits in 2001 and two provisional variances from thermal limits in 1999 from thermal limitations from the Illinois Pollution Control Board. The 2001 provisional variance was provided to allow restoration efforts in the DNPS cooling towers to proceed. One of the 1999 provisional variances allowed additional hours to discharge water at temperatures between 90° and 93°F. The other 1999 provisional variance allowed extension of indirect open cycle operation for 21 days. Both provisional variances in 1999 were the result of an extended heat wave and drought. EGC conducted biological studies to characterize the response of fish and other aquatic life to the thermal conditions resulting from the provisional variances. Results of these studies indicated that the fish community near DNPS was not adversely impacted by the thermal conditions resulting from the provisional variances. No fish kills or beds of dead or dying aquatic macrophytes were observed. As expected, there was a change in fish distribution during the higher temperature periods. For example, temperature-tolerant fish remained in the warmer areas, while less tolerant species moved to other areas. As the temperatures decreased, fish diversity and abundance increased (ComEd 2000).

Non-Indigenous Aquatic Species

Over the past 20 years, a large number of non-indigenous aquatic species have invaded the Upper Illinois River Basin. Recent invaders include the round goby [*Neogobius melanostomus* (Pallas)] and the zebra mussel (*Dreissena polymorpha*). Many of these species disrupt the balance of inland ecosystems by competing with native species for food, living space, and spawning areas.

2.3 Groundwater Resources

DNPS is located within the Central Lowland Province that consists of a glaciated lowland stretching from the Appalachian Plateau on the east to the Great Plains on the west. DNPS is situated in a subdivision called the Kankakee Plain, a level to gently undulating plain that occupies the position of a basin between areas of higher moraine to the east and west (AEC 1973). The site lies on the plain near the intersection of the Kankakee and Des Plaines Rivers. The geology in the vicinity of the site consists of topsoil comprised of black silt and some sand and clay (Battelle 1972). Below the topsoil are dense, cohesive glacial till soils consisting of sandy silts with clay and clay silts with sand. This glacial till extends to the top of bed at depths of 12 to 31 feet below ground surface. Underlying this are rocks known as the Coal Measures that consist of interbeds of sandstone, clay, shale, and one or more seams of coal; these are Pennsylvanian in age (AEC 1973).

Groundwater resources in the region are developed from four aquifer systems. These consist of the glacial drift aquifer (i.e., the alluvial aquifer), the shallow dolomite aquifer located mainly in Silurian rock, the Cambrian-Ordovician aquifer, and the Mt. Simon aquifer (AEC 1973). The alluvial aquifer is hydraulically connected to the cooling pond, but is isolated from the Cambrian-Ordovician aquifer from which the plant withdraws water (AEC 1973). DNPS has three groundwater wells. Two are installed to depths of approximately 1,500 feet below ground surface within the Cambrian-Ordovician aquifer (AEC 1973). The third well is installed to a depth of approximately 160 feet in the shallow dolomite aquifer. The Cambrian-Ordovician aquifer is used almost exclusively as the groundwater supply for municipal and industrial use in the area (Battelle 1972).

2.4 Critical and Important Terrestrial Habitats

Most of the DNPS site consists of generation and maintenance facilities, laydown areas, parking lots, roads, a large pond, and areas of maintained vegetation. The Goose Lake Prairie State Natural Area is approximately one mile southwest of the DNPS site and is traversed by the Pontiac-Midpoint transmission corridor (see Section 3.1.3 for discussion of transmission lines). Natural habitats within the Goose Lake Prairie State Natural Area include tall grass prairie and marshes, which are utilized by a variety of wildlife. The Powerton and Goodings Grove transmission corridors traverse the Des Plaines Conservation Area, approximately two miles east of the DNPS site. Natural habitats within the Des Plaines Conservation Area include river shorelines, lakes, swamps, marshes, and prairie. The Midewin National Tallgrass Prairie is immediately east of the Des Plaines Conservation Area and is crossed by a short segment of the Goodings Grove transmission corridor. The Midewin National Tallgrass Prairie was established in 1996 and is the first nationally designated tallgrass prairie (The Conservation Fund 2001). A portion of the Collins transmission corridor is located on the periphery of the Heidecke Lake State Fish and Wildlife Area, approximately five miles southwest of DNPS. This Fish and Wildlife Area consists largely of a Midwest Generation cooling lake which is leased to the Illinois Department of Natural Resources for hunting and fishing.

With the exception of the four designated areas previously mentioned, the DNPS transmission lines traverse land-use categories typical of northeastern Illinois, such as industry, residential, and agricultural areas. No areas designated by the U.S. Fish and Wildlife Service as "critical habitat" for threatened or endangered species exist at DNPS or on the associated transmission lines.

Exelon maintains the transmission corridors by trimming and mowing, and by the use of approved herbicides. Unless otherwise needed, vegetation management on the corridor follows a five-year cycle. The preferred method of vegetation management is low-volume foliar herbicides. This allows the elimination of undesirable species while preserving grasses, herbs, shrubs, and other low-growing vegetation. Herbicide application is performed by certified applicators according to label specifications.

Exelon participates in American Cynamid's "Project Habitat". This program emphasizes management practices that are compatible with wildlife and improves habitat for various game and non-game species, as well as for rare species. The use of low-volume foliar herbicide application techniques creates and maintains native grass prairie habitats. Each year, Exelon converts areas of corridors to native prairie grass species.

2.5 Threatened or Endangered Species

Terrestrial Species

Table 2-1 presents the federally listed threatened or endangered species that are known to occur in DuPage, Grundy, Kendall, LaSalle, Livingston, Tazewell, Will, and Woodford Counties, Illinois (FWS 2002). Table 2-1 also includes the Illinois threatened or endangered species reported by the Illinois Department of Natural Resources (IDNR 2002b,c).

The transmission corridors are managed to prevent woody growth from reaching the transmission lines. The removal of woody growth can provide outstanding grassland habitat for rare plant and animal species that depend on open conditions.

Aquatic Species

As stated in Section 2.2, fish surveys of the fish populations in the vicinity of the Station have been conducted since 1971 and neither EGC nor its contractors have collected a federal-listed fish species (ComEd 1993, 2000). The Pallid Sturgeon (*Scaphirynchus albus*) is the only federally listed (threatened or endangered) fish species in Illinois. This species occurs in the Mississippi River downstream of its confluence with the Missouri River and the potential to occur in the Upper Illinois River Basin is remote (FWS 2002).

Table 2-2 contains a list of the number and location of Illinois-listed threatened or endangered fish species that have been collected in the vicinity of DNPS. There are three different species that have been collected; the greater redhorse (*Moxostoma volenciennesi*) listed as endangered, the pallid shiner (*Notropis amnis*) listed as endangered, and the river redhorse (*Moxostoma corinatum*) listed as threatened (ComEd 1993, 2000).

No federal- or state-listed mussels have been found in the vicinity of DNPS by EGC or its contractors.

2.6 Regional Demography

The *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants* (GEIS) presents a population characterization method that is based on two factors: "sparseness" and "proximity" (NRC 1996). "Sparseness" measures population density and city size within 20 miles of a site and categorizes the demographic information as follows:

Demographic Categories Based on Sparseness

		Category
Most sparse	1.	Less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles
	2.	40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles
	3.	60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles
Least sparse	4.	Greater than or equal to 120 persons per square mile within 20 miles
Source: NRC 1996.		

1

"Proximity" measures population density and city size within 50 miles and categorizes the demographic information as follows:

Demographic Categories Based on Proximity

		Category
Not in close proximity	1.	No city with 100,000 or more persons and less than 50 persons per square mile within 50 miles
	2.	No city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles
	3.	One or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles
In close proximity	4.	Greater than or equal to 190 persons per square mile within 50 miles
Source NRC 1996.		

1

The GEIS then uses the following matrix to rank the population category as low, medium, or high.

GEIS Sparseness and Proximity Matrix

		Proximity			
		1	2	3	4
Sparseness	1	1.1	1.2	1.3	1.4
	2	2.1	2.2	2.3	2.4
	3	3.1	3.2	3.3	3.4
	4	4.1	4.2	4.3	4.4

Low Population Area | Medium Population Area | High Population Area

Source NRC 1996

EGC used 2000 census data from the U.S. Census Bureau (Census Bureau) website (USCB 2000a) and geographic information system software (Environmental Systems Research Institute, Inc.'s ArcView®) to determine demographic characteristics in the DNPS vicinity. The Census Bureau provides updated annual projections, in addition to decennial data, for selected portions of its demographic information. However, Section 2.6.2, Minority and Low-Income Populations, of this environmental report uses 1990 low-income population demographic information, because updated projections are not currently available.

2.6.1 GENERAL POPULATION

EGC used the ArcView® geographic information system software to combine Census Bureau block group data with the Environmental Systems Research Institute, Inc., spatial data to determine 20- and 50-mile radius populations on a block group basis. In the event that a block group fell partially within the radius, an average population density for the entire block group was calculated. Then, the average density was multiplied by the percentage of the block group's physical land area that fell within the radius to produce an estimated number of persons located within the radius.

As derived from Census Bureau information, 337,882 people live within 20 miles of DNPS. Applying the GEIS sparseness measures, DNPS has a population density of 269 persons per square mile within 20 miles and falls into the least sparse category, Category 4 (greater than or equal to 120 persons per square mile within 20 miles).

As estimated from Census Bureau information, 7,078,561 people live within 50 miles of DNPS. This equates to a population density of 901 persons per square mile within 50 miles. The largest city within 50 miles of DNPS is Chicago, with a population of 8.9 million. Applying the GEIS proximity measures, DNPS is classified as "in close proximity", Category 4 (greater than or equal to 190 persons per square mile within 50 miles). According to the GEIS sparseness and proximity matrix, the DNPS ranks of sparseness Category 4 and proximity Category 4 result in the conclusion that DNPS is located in a High Population Area.

All or parts of 21 counties (Figure 2-1) and the City of Chicago are located within 50 miles of DNPS. Approximately 72 percent of DNPS' employees live in Will and Grundy Counties. The remaining 28 percent are distributed across 17 counties with numbers ranging from 1 to 47 employees per county.

Will and Grundy Counties lie within the northeastern region of Illinois, falling approximately 40 to 60 miles southeast of the City of Chicago. They are characterized by a varied mixture of rural and metropolitan areas, with a 2000 total population of 539,801 and an average annual growth rate of 3.9 percent from 1990 to 2000 (USCB 2000a). Grundy County tends to be more rural, while Will County encompasses a more metropolitan area comprised of Joliet and its surrounding suburban settlements. Both Will and Grundy Counties are growing at faster rates than Illinois as a whole. From 1980 to 2000, Illinois' average annual population growth rate was 0.4 percent, while Will and Grundy Counties increased by 2.7 and 1.1 percent, respectively (USCB 2000a).

In 1995, Illinois reported a population count of 11.8 million people, or 4.5 percent of the nation's population, ranking 6th in population among the 50 states and the District of Columbia (USCB 1996). By the year 2030, Illinois' population is projected to be 13.5 million people and growing at an average annual rate of 0.5 percent. By the year 2030, Will and Grundy Counties are projected to have grown at average annual rates of 2.0 and 0.8 percent, respectively (Illinois Department of Commerce and Community Affairs 2001).

Table 2-3 shows estimated populations and annual growth rates for the two counties with the greatest potential to be socio-economically affected by license renewal activities. Figure 2-1 shows the locations of these areas.

2.6.2 MINORITY AND LOW-INCOME POPULATIONS

Background

In the environmental justice analyses for previous license renewal applications, NRC used a 50-mile radius as the overall area that could contain environmental impact sites and the state as the geographic area for comparative analysis. EGC has adopted this approach for identifying the DNPS minority and low-income populations that could be affected by DNPS operations.

EGC used ArcView® geographic information system software to combine Census Bureau TIGER line data with USCB 2000 census data to determine the minority characteristics on a block group level. USCB 2000 low-income census data are not available, therefore EGC used 1990 tract data for its low-income analysis. EGC included all block groups or tracts if any of their area lay within 50 miles of DNPS. The 50-mile radius includes 5503 block groups and 1693 tracts. EGC defines the geographic area for DNPS as the entire State of Illinois when the block group is contained within Illinois, and all of Indiana when the block group is contained within Indiana.

Minority Populations

The NRC Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues defines, a "minority" population as: American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; or Black races; other; multi-racial; or the aggregate of all minority races; or Hispanic ethnicity (NRC 2001). The guidance indicates that a minority population exists if either of the following two conditions exists:

1. The minority population of the census block or environmental impact site exceeds 50 percent, or

2. The minority population percentage of the environmental impact area is significantly greater (typically at least 20 points) than the minority population percentage in the geographic area chosen for comparative analysis.

NRC guidance calls for use of the most recent Census Bureau decennial census data. EGC used 2000 census data from the Census Bureau website (USCB 2000a,b) in determining the percentage of the total population within Illinois and Indiana for each minority category, and in identifying minority populations within 50 miles of DNPS.

EGC divided Census Bureau population numbers for each minority population within each block group by the total population for that block group to obtain the percent of the block group's population represented by each minority. For each of the 5,503 block groups within 50 miles of DNPS, EGC calculated the percent of the population in each minority category and compared the result to the corresponding geographic area's minority threshold percentages to determine whether minority populations exist. Census Bureau data (USCB 2000a,b) for Illinois characterizes 0.25 percent as American Indian or Alaskan Native; 3.41 percent Asian; 0.04 percent Native Hawaiian or other Pacific Islander; 15.11 percent Black races; 5.82 percent all other single minorities; 0.19 percent multi-racial; 24.82 percent aggregate of minority races; and 12.32 percent Hispanic ethnicity. Census Bureau data (USCB 2000a,b) for Indiana characterizes 0.26 percent as American Indian or Alaskan Native; 0.97 percent Asian; 0.03 percent Native Hawaiian or other Pacific Islander; 8.3 percent Black races; 1.61 percent all other single minorities; 1.24 percent multi-racial; 12.51 percent aggregate of minority races; and 3.53 percent Hispanic ethnicity.

Based on the "more than 20 percent" or the "exceeds 50 percent" criteria, no Native Hawaiian or other Pacific Islander minorities exist in the geographic area. Table 2-4 presents the numbers of block groups within each county that exceed the threshold for determining the presence of minority populations.

Based on the "more than 20 percent" criterion, American Indian or Alaskan Native minority populations exist in one block group (Table 2-4). Figure 2-5 displays the locations of this minority block group, while Table 2-4 displays the minority block group in Cook County, Illinois.

Based on the "more than 20 percent" criterion, Asian minority populations exist in 83 block groups (Table 2-4). Figure 2-6 displays the locations of these minority block groups, while Table 2-4 displays the minority block group distributions among the counties in the geographic area.

Based on the "more than 20 percent" criterion, Black Races minority populations exist in 1470 block groups (Table 2-4). Figure 2-7 displays the locations of these minority block groups, while Table 2-4 displays the minority block group distributions among the counties in the geographic area.

Based on the "more than 20 percent" criterion, All Other Single Minorities populations exist in 628 block groups (Table 2-4). Figure 2-8 displays the locations of these minority block groups, while Table 2-4 displays the minority block group distributions among the counties in the geographic area.

Based on the "more than 20 percent" criterion, Multi-racial minority populations exist in seven block groups (Table 2-4). Figure 2-9 displays the minority block group distributions among the counties in the geographic area.

Based on the "more than 20 percent" criterion, Aggregate of Minority Races populations exist in 2,023 block groups (Table 2-4). Figure 2-10 displays the locations of these block groups, while Table 2-4 displays the minority block group distributions among the counties in the geographic area.

Based on the "more than 20 percent" criterion, Hispanic Ethnicity minority populations exist in 1004 block groups (Table 2-4). Figure 2-11 displays the minority block group distributions among the counties in the geographic area.

Low-Income Populations

NRC guidance defines "low-income" using Census Bureau statistical poverty thresholds (NRC 2001). EGC divided Census Bureau "low-income" household numbers for each census tract by the total households for that tract to obtain the percentage of "low-income" households per tract. Census Bureau data characterize 11.47 percent of Illinois households as low-income, while 10.78 percent of Indiana households are classified as low-income (USCB 1990). The guidance considers a "low-income population" to be present if:

1. The low-income population of the census block or environmental impact site exceeds 50 percent, or
2. The percentage of households below the poverty level in an environmental impact area is significantly greater (typically at least 20 points) than the low-income population percentage in the geographic area chosen for comparative analysis.

Based on the "more than 20 percent" criterion, 263 census tracts contain a low-income population. Table 2-4 displays the low-income household tract distributions among the counties in the geographic area, while Figure 2-12 displays the locations of these low-income tracts among the counties in the geographic area.

2.7 Economic Base

DNPS lies in Grundy County, Illinois, adjacent to Will County and approximately 50 miles southwest of Chicago. Both Counties are components of the nine-county Chicago Primary Metropolitan Statistical Area, which boasted a regional 1998 population estimation of 8,885,919 (based on the 1990 census population of 8,008,507) and includes the City of Chicago (USCB 2000c). On a broader scale, the Bureau of Economic Analysis consolidates several other nearby Metropolitan Statistical Areas with the Chicago PMSA to form a Consolidated Metropolitan Statistical Area (CMSA) called the Chicago-Gary-Kenosha CMSA. This CMSA ranks third in the nation for population size (USCB 2000d).

The Chicago PMSA is flanked by Lake Michigan to the east and the Grand Prairie to the west. Established at a natural portage between the Great Lakes and the Mississippi River valley, the region serves as a vital link in the nation's water, rail, and aviation networks (Northeastern Illinois Planning Commission 2001). The Chicago PMSA has a transportation network of trucking and rail terminals, interstate highway access to main east-west and north-south routes, three international and a number of regional airports, and access to international seaports via the St. Lawrence Seaway System, giving the metropolitan area access to domestic and international markets (City of Chicago 1999). DNPS is situated along the Illinois Waterway System which connects to the St. Lawrence Seaway System (The Saint Lawrence Seaway Development Corporation 2000).

The Chicago metropolitan area is the economic and cultural center of the Midwest. It is home to 34 Fortune 500 corporations. Leading economic sectors include financial services, electrical machinery and equipment, insurance, pharmaceuticals, and retailing (Northeastern Illinois Planning Commission 2001). In 1995, the 5 largest industries, by employment, were manufacturing, retail trade, financial services, business services, and health-related services (City of Chicago 1996).

Grundy County is one of Illinois' commercial and agricultural centers. While the County's agriculture sector ranks high in production relative to other Illinois counties, it ranks relatively low in employment when compared to the County's other major industries (Government Information Sharing Project 1997). As of 1997, Grundy County's industrial profile was led by the services (25 percent), manufacturing (21 percent), retail trade (22 percent), and utilities/transportation (16 percent) sectors (USCB 1997). Leading employers include: Fluor Corporation, ComEd (EGC), Equistar, Morris Hospital, Brownie Products, and Equistar Chemical LP (Grundy Economic Development Council 1995).

In the late 1800s, Will County's prairie soil, soft coal, and river access spurred the emergence of a steel and manufacturing industry. When the steel industry eventually waned, the County embraced a broader base of industrial and commercial enterprise (Community Profile Network, Inc. 2000a). Today, Will County's dominant industries are services (29 percent), retail trade (22 percent), manufacturing (21 percent), and construction (10 percent) (USCB 1997). The County's leading employers include Caterpillar, Provena-St. Joseph's, Riverboat Casinos, Silver Cross Hospital, ComEd (EGC), Mobil Oil, Nicor, Ameritech, and Tellabs (Community Profile Network, Inc. 2000b). One of the newer and most rapidly growing industries in the County is riverboat gambling. The gaming industry has created 4,000 full-time jobs with an annual payroll of $100 million for Will County, alone (Community Profile Network, Inc. 2000b).

The annualized unemployment rate for the State of Illinois in 1999 was 4.3 percent. In comparison, Will and Grundy Counties had 1999 unemployment rates of 4.0 and

6.3 percent, respectively (Illinois Department of Employment Security 2000).

2.8 Taxes

In the state of Illinois, each county is divided into smaller taxing districts. Property tax collections and distributions are funneled through these districts. Every year, each district examines fiscal needs for the following year and extends a levy to the county in an amount that will cover proposed budgets. The county then issues property tax assessments and bills based on individual district budget needs and the characteristics of the properties residing within those districts. Once the tax revenues are collected, the county redistributes the revenues to the districts which, in turn, fulfill budget obligations for the oncoming fiscal year. (Note: the amounts of revenues distributed to the districts by the county may not be identical to the amounts collected. Items such as court-ordered refunds or abatements may absorb a small portion of the revenues before they are redistributed).

DNPS pays annual property taxes to Grundy and Will Counties. Taxes fund Grundy County operations which include the school system, fire districts, libraries, road maintenance, and sanitary districts (Miller 2001). For the years 1997 to 2000, DNPS' property taxes provided between 13 and 20 percent of Grundy County's total levee extension and between 13 and 21 percent of Grundy County's total collections available for distribution. DNPS-sponsored tax collections fund Will County's school districts, fire protection districts, parks, sanitary districts, libraries, road maintenance, and forest preservation (Hart 2001). For the years 1997 to 2000, DNPS' property taxes provided less than one percent of Will County's total levee extension and less than one percent of Will County's total collections available for distribution. Tables 2-5 and 2-6 compare DNPS' tax payments to Grundy and Will County levee extensions and collections for distribution.

For Grundy County, non-renewal of the DNPS operating license, followed by the decommissioning of the Station could produce significant impacts to the tax base of the surrounding communities and their economic structures, as discussed in Section 8.4.7 of the GEIS (NRC 1996).

However, EGC projects that DNPS' annual property taxes will not remain constant throughout the license renewal period. In 1997, the State of Illinois deregulated the utility industry which, in turn, changed the methods of plant value assessment. EGC is in the process of re-evaluating the utilities' tax payments to the Counties. Before deregulation, utility tax payments were derived by using depreciated book value assessments. Since deregulation, payments are derived by using fair market value assessments. Because fair market values are influenced by economic conditions and market forces, current fair market values are somewhat below depreciated book values. Therefore, both Counties' property tax revenues will most likely be lower than in the past. Because a drop in tax revenues will likely occur, EGC negotiated with Grundy County in order to develop a reduction in payments so that it will not cause dislocation to those districts by a sudden reduction in tax payments. The agreement will give the counties time to adapt to the changes.

2.9 Land Use Planning

This section focuses on Will and Grundy Counties since the majority (approximately 72 percent) of the permanent DNPS workforce lives in these Counties (see Section 3.4) and EGC's tax payments is a significant portion of Grundy County's tax base (see Section 3.4). Both Counties have experienced growth over the last several decades and their comprehensive land use plans reflect planning efforts and public involvement. Land use planning tools, such as zoning, guide growth and development. Counties' plans share the goals of encouraging growth and development in areas where public facilities, such as water and sewer systems, are planned and of discouraging strip development.

Will County, Illinois

Will County occupies 854 square miles (or 546,882 acres) of land area. Current land usage categories and rates are agricultural (57.8 percent), forest and grassland (7.8 percent), undeveloped (2.1 percent), urban/built-up (19.7 percent), conservation open space (5.4 percent), mineral extraction (0.4 percent), water (2.3 percent), wetlands (2.6 percent), and parks (1.9 percent) (Shay 2001).

Will County's land use goals are based on "planning/management areas", whereby County land is classified as one of the following eight categories: urbanized communities, contiguous growth areas, rural communities, agriculture preservation areas, environmental corridors, high-accessibility corridors, critical sensitive areas, and special facilities areas (Will County 1990). The land use plan defines goals and objectives for each category in an effort to guide County-wide development using a standardized set of criteria. Areas of special interest are the urbanized communities, contiguous growth areas, rural communities, and agriculture preservation areas. With the exception of agriculture preservation areas, these lands represent colonization of some degree and are generally contiguous with incorporated municipalities, adjacent to similarly developed areas, served by existing or planned central utilities, and developed at urban or suburban densities (Will County 1990). An urbanization trend has moved outward from Chicago along Chicago-bound transportation corridors. The majority of new development in Will County has resulted from the growing job markets of the expanding Chicago metropolitan areas.

The land use plan encourages a compact development pattern that clusters neighborhoods, villages, and towns, rather than enabling a pattern of sprawl. As the residential population expands, planned growth is promoted through the annexation of contiguous lands guided by local municipal plans (Will County 1990).

Agriculture preservation areas are designated on the basis of potential agricultural productivity and the feasibility of being protected from intrusion by urbanization. Land that has a high natural agricultural productivity, but lies within the anticipated 20 year urban growth path, may not obtain the classification of agriculture preservation area (Will County 1990).

Grundy County, Illinois

Grundy County occupies 429 square miles (or 274,534 acres) of land area. Of this total, 97 percent (265,810 acres) of the County is unincorporated. Because the majority of the developed land in the County is located within or adjacent to the incorporated communities of Morris, Coal City, Minooka, and Gardner, the remainder of the planning area has a predominantly undeveloped character (Grundy County 1996).

In the developed portion of the planning area, land is dedicated to transportation (roads, airports, railroad rights-of-way, and other terminal facilities), public and semipublic facilities, industry, utility, residential, and business/commercial uses. Developed land accounts for 10.5 percent of the total planning area (Grundy County 1996). Eastern Grundy County is now within commuting range of the growing job markets of the western and southwestern Chicago region. The population in this area is growing faster than employment. The majority of new development is occurring in an area of eastern Grundy County extending from the Will County border west to Morris, the area most able to commute into the western and southwestern suburbs of Chicago (Grundy County 1996).

The remainder of the area is classified as undeveloped and includes vacant land, water areas, and all farm land except farm residences. Agriculture is classified as the dominant land use in this category, accounting for 225,000 acres or 81 percent of the total planning area (Grundy County 1996).

Future land use in the County is based on the premise that growth is encouraged, but must occur in a controlled manner. One of the principal land use objectives of the comprehensive land use plan is the protection of prime farmland, a resource which has the greatest pressure for and the least resistance to land use conversion. The land use plan also promotes the protection of farmland because conversion to other uses tends to have a greater impact on the County's rural character and the economic stability of the agricultural community (Grundy County 1996).

The land use plan establishes that new residential development will occur within the existing municipalities as they expand toward their established growth boundaries. Such development will promote the most convenient and efficient provision of services. The infilling of vacant parcels or lots in municipalities and in existing subdivisions in unincorporated areas is strongly encouraged. Development of existing parcels is preferred to changes in zoning that create new nodes of development or expand the boundaries of existing subdivided areas. Finally, the land use plan encourages the establishment of residential and neighborhood units that are affordable to the County's population and workforce (Grundy County 1996).

2.10 Social Services and Public Facilities

2.10.1 PUBLIC WATER SUPPLY

DNPS pumps groundwater for use as potable water and is not connected to a municipal system. Because 72 percent of the permanent employees of DNPS reside in Grundy and Will Counties, discussion of public water supply systems will focus on these two areas.

At the present time, the water supply systems in Grundy and Will Counties are operating substantially below their maximum capacities (see Table 2-7 and 2-8). This level of operation demonstrates that each community could absorb new composite employees without jeopardizing their water supplies. Tables 2-7 and 2-8 identify major water supplies (those providing at least 100,000 gallons per day) in Will and Grundy counties, respectively.

2.10.2 TRANSPORTATION

Road access to DNPS is via Dresden Road, a two-lane paved road. Dresden Road intersects with Pine Bluff Road approximately two miles south of the station (see Figure 2-2). Continuing south for approximately four more miles, Dresden Road ends at the Coal City limits. Most employees from the Grundy and Will Counties areas will travel on these roads to reach the Station. Traffic count data for each of these roads is in Table 2-9 (Knutson 2001). The State of Illinois does not make Level of Service (LOS) determinations in rural, non-metropolitan areas such as at DNPS unless it is deemed necessary. Neither Dresden Road nor Pine Bluff Road has had a Level of Service determination calculated by the Illinois Department of Transportation (Bankson 2001).

2.11 Air Quality

DNPS is located in Goose Lake Township, Grundy County, Illinois which is part of the Metropolitan Chicago Interstate Air Quality Control Region (AQCR). The Metropolitan Chicago Interstate AQCR includes counties in Illinois (Cook, DuPage, Grundy, Kane, Kankakee, Kendall, Lake, McHenry, and Will) and Indiana (Lake and Porter). Within Illinois, all counties in the Metropolitan Chicago Interstate AQCR, except Kankakee County and portions of Grundy and Kendall Counties, are designated severe-17 nonattainment under the 1-hour ozone standard and parts of Cook County are designated as moderate nonattainment for particulate matter (PM-10). In Indiana, Lake and Porter Counties are designated moderate nonattainment under the 1-hour ozone standard, and portions of Lake County are designated nonattainment for PM-10, carbon monoxide and sulfur dioxide. In July 1997, the U.S. Environmental Protection Agency (EPA) issued final rules establishing a new eight-hour ozone standard that would create nonattainment areas for ozone within Illinois and Indiana. On May 14, 1999, the Circuit Court of Appeals for the District of Columbia (D.C. Circuit) remanded the revised ozone standard to EPA for reevaluation. On February 27, 2001, the U.S. Supreme Court upheld the eight-hour ozone standard, but ordered EPA to reconsider its implementation policy and remanded the case to the D.C. Circuit for proceedings consistent with its opinion. If all other legal challenges to the revised standard are overcome by EPA, portions of the Metropolitan AQCR are expected to become an eight-hour ozone nonattainment area. Except for the areas described above, the AQCR is designated as being in attainment for all criteria pollutants (40 CFR 81.14, 40 CFR 81.314 and 40 CFR 81.315).

2.12 Historic and Archaeological Resources

Area History in Brief

Historically, northeastern Illinois was inhabited by Indians drawn to the abundant supply of water and timber found in the region. Transportation was facilitated by the old Sauk Trail and the Des Plaines, DuPage, and Kankakee Rivers (Will County 2000). The first permanent settlers of Grundy and Will Counties arrived in the mid-1830s and the Rock Island and Peoria railroads spurred further development by providing access to the region for migrant settlers. Northeastern Illinois is the historic meeting point of America's East and West.

Historic records indicate that, from 10,000 to 8,000 BC, the northern Illinois region was inhabited by Paleo Indians who briefly occupied small camps in coniferous forests and subsisted on large game and wild plants. From 8,000 to 500 BC, Archaic-period Indians inhabited deciduous forests, hunted deer and small game, wove baskets, and ground seeds with stones. From 500 BC to 900 AD, Woodland culture Indians developed maize agriculture, built villages and burial mounds, invented the bow and arrow, and began making pottery. The period from 900 to 1,500 AD introduced the Indians of the Mississippian culture. These people improved agricultural methods and built temple mounds and large fortified villages. Most of these settlements were abandoned before the initiation of the historic period (State of Illinois 2001).

The Indian settlements that remained were the Illinois Indians, also known as the Illini or the Illiniwek. These tribes inhabited a roughly triangular area extending south and west from the Chicago River and reaching into what are now Iowa, Missouri, and Arkansas. In the mid-to-late 1600s, the French were the first Europeans to descend on the upper Mississippi region. The French referred to this area as the "Illinois Country" (University of Illinois undated).

Over the next 200 years, control of the region passed through the hands of the local Indians, the French, and the British. In 1818, Illinois became the 21st state, with a population of just 34,620 (State of Illinois 2001).

Today, Illinois is one of the leading industrialized states of the nation with a rich cultural history based on an agrarian past.

Pre-Operation

ComEd did not conduct any archaeological surveys or investigations prior to station construction.

The Final Environmental Statement for construction of DNPS listed one historic (National Register of Historic Places) site in the vicinity of the Station, the Illinois and Michigan Canal, located seven miles southwest of Joliet on U.S. 6, in Channahon (AEC 1973). At that time, it was determined that this site was not affected by construction of DNPS. (AEC 1973). Additionally, 13 archaeological sites were discovered within the "immediate environs" of the site and 432 sites were located within a 50-mile radius (AEC 1973). One site, designated GR-2, fell within the Station boundary and was examined in 1973 by a professional archaeologist, Dr. Robert Hall of the University of Illinois, who determined that any disturbance caused by construction was minimal (AEC 1973).

Current Status

As of 2001, 25 sites in Will County are listed on the National Register of Historical Places. Two of these fall within a six-mile radius of the Station (U.S. Department of the Interior 2001a). Five sites are located in Grundy County; two of these sites fall within a six- mile radius of the Station

(U.S. Department of the Interior 2001b). Table 2-10 lists these sites.

White and Company's Goose Lake Stoneware Manufactory and Tile Works

The Goose Lake Stoneware Manufactory and Tile Works was established in 1856 in the area now encompassed by Goose Lake State Natural Area. This establishment was one of the earliest attempts at industrialized pottery and tile production in Illinois, but ceased production in 1866 due to financial problems. The pottery works site is characterized by stoneware shards and discrete concentrations of domestic debris. Archaeologists have used these remnants to isolate the location of several houses and the pottery workshops. The Tile Works site also includes stoneware shards and structural debris, as well as the remains of three well-preserved kilns. This discovery has given archaeologists new insights to the size and shape of early kilns (IDNR 2000).

The Illinois and Michigan Canal

The Illinois and Michigan Canal was completed in 1848 and connected the Great Lakes to the Mississippi River watershed along a long-standing Indian portage route. The 97-mile Canal extended from the Chicago River (near Lake Michigan) to the Illinois River at Peru, Illinois. It transformed Chicago from a small settlement into a critical transportation hub between the East and the developing Midwest (U.S. Department of the Interior 2001c).

The Briscoe Mounds

The Briscoe Mounds archaeological site is located in the Village of Channahon, on Front Street along the Des Plaines River. They are the largest Native American burial mounds in northern Illinois (Village of Channahon undated). The mounds are rare, preserved earthworks constructed in approximately 1,000 to 1,200 A-D during the Mississippian period (Will County undated).

Other Historical Landmarks of Interest

Begun in 1926, Route 66 was one of the first roads to cross the continent. Originating in Chicago, Route 66 passed through Illinois, Missouri, Kansas, Oklahoma, Texas, New Mexico, Arizona, and California before terminating at the Pacific Ocean near Los Angeles. The route was over 2,400 miles in length. Nearly one-eighth of the highway fell within the bounds of Illinois. Two segments of Route 66 (one temporary and one permanent) pass within 6 miles of DNPS (State of Illinois 1996).

2.13 Other Projects and Activities

Dresden Nuclear Power Station, Unit 1

Dresden Nuclear Power Station Units 2 and 3 share the DNPS site with the retired Unit 1. Dresden Unit 1 was a 700-megawatts-thermal demonstration boiling water reactor that operated from November 1959 until October 1978. EGC completed Unit 1 decontamination in 1984, including removal of fuel from the reactor. Spent fuel remains stored in dry casks or in Unit 2/3 fuel pool. NRC has approved the Unit 1 decommissioning plan and EGC intends to decommission the three units simultaneously. Figure 3-1 shows Unit 1 and its former cooling water intake and discharge canals.

Des Plaines River Basin Generating Stations

As discussed previously, the region upstream from DNPS is heavily industrialized. Five electric generating stations are located in this region in the Des Plaines River watershed. These stations are identified in Table 2-11 and Figure 2-4 shows their locations.

EGC has studied temperature and dissolved oxygen patterns in this portion of the watershed to develop an understanding of the potential for ecological impacts. The study included reviewing data sources and conducting field investigations. Results indicate that none of the thermal discharges individually or cumulatively interact with or inhibit DNPS from complying with its discharge permit limits. There were some excursions from dissolved oxygen limits during the summer months, but these could not be attributed conclusively to upstream power plant discharges (ComEd 1995b).

Braidwood Nuclear Power Station

The Braidwood Nuclear Power Station (Figure 2-1) is a 2,376 MWe nuclear plant located approximately 14 miles south (upstream) of DNPS. Braidwood utilizes a closed-cycle (cooling pond) heat dissipation system that withdraws makeup water from and discharges blowdown to the Kankakee River. The operating permit for Braidwood stipulates that the Station can only withdraw a certain amount of water from the river in order to ensure that downstream users have sufficient supplies. EGC has noted trace quantities of tritium in DNPS intake water that are attributable to Braidwood, but has no indication that other discharge parameters reach DNPS.

LaSalle County Station

The LaSalle County Station is a 2,280 MWe nuclear plant located approximately 22 miles west (downstream) of DNPS (Figure 2-1). LaSalle utilizes a closed-cycle (cooling pond) heat dissipation system that withdraws makeup water from and discharges blowdown to the Illinois River.

General Electric (GE) Morris, Illinois Nuclear Facility

General Electric Company has a facility to store spent fuel away from reactors, using wet storage pool technology, across Collins Road from DNPS (Figure 2-2). General Electric received a license to receive and store nuclear material at this facility beginning in 1971. The facility is essentially full; the company has completed contracts with specific utilities (under which it had agreed to accept their used fuel) and has no plans to accept additional spent fuel. The facility currently operates under NRC license SNM-2500.

Dresden Lock and Dam

The U.S. Army Corps of Engineers operates the Dresden Lock and Dam on the Illinois River adjacent to DNPS (Figure 2-3). The structure is approximately 33 feet high and 1,750 feet long and stores 12,000 acre-feet of water. The single lock is 600 feet long, 110 feet wide, and provides 22 feet of lift. Annually, it passes approximately 7,000 vessels and 18,000 barges (COE 2001).

Collins Station

The Collins Station, a 2,698-megawatts-electrical gas-fired electrical generation station operated by Midwest Generation, is located about five miles southwest (downstream) of DNPS (Figure 2-2). This Station utilizes water from the Illinois River for cooling in a man-made reservoir, Heidecke Lake.

Table 2-1. Threatened or Endangered State and Federal Species that Occur in the Vicinity of DNPS or along DNPS Transmission Lines.

Species	Status: Federal	Status: State of Illinois	County
Decurrent false aster (*Boltonia decurrens*)	T[a]		Tazewell and Woodford[a]
Mead's milkweed (*Asciepias meadii*)	T[a]		Will[a]
Lakeside daisy (*Hymenopsis herbacea*)	T[a]		Tazewell and Will[a]
Leafy praine clover (*Dalea foliosa*)	E[a]		Will[a]
Prairie bush clover (*Lespedeza leptostachya*)	T[a]		DuPage[a]
Eastern prairie fringed orchid (*Platanthaera leucophaea*)	T[a]		Grundy and DuPage[a]
Hines emerald dragonfly (*Somatochlora hineana*)	E[a]		Will and DuPage[a]
Indiana bat (*Myotis sodalis*)	E[a]		DuPage, Grundy, LaSalle, Tazewell, Woodford, and Will[a]
Bald eagle (*Haliaeetus leucocephalus*)	T[a]	T[a]	Grundy, LaSalle, Tazewell, Woodford, and Will[a]
River Redhorse (*Moxostoma carinatum*)		T[b]	Grundy[c]
Greater Redhorse (*Moxostoma valenciennesi*)		E[b]	Grundy and Livingston[c]
Pallid Shiner (*Notropis amnis*[d])		E[b]	Grundy[c]
Pied-Billed Grebe (*Podilymbus podiceps*)	-	T[b]	DuPage[c]
Least Bittern (*Ixobrychus exilis*)	-	T[b]	DuPage[c]
Black-Crowned Night Heron (*Nycticorax nycticorax*)	-	E[b]	DuPage[c]
Common Moorhen (*Gallinula chloropus*)	-	T[b]	DuPage[c]
Yellow-Headed Blackbird (*Xanthocephalus xanthocephalus*)	-	E[b]	DuPage[c]

T = Threatened
E = Endangered
\- = Not listed
a. FWS 2002.
b. IDNR 2002b
c. IDNR 2002c.
d. Formerly known as *Hybopsis amnis* and identified as such on the Illinois web site referenced.

Table 2-2. Illinois-Listed Threatened or Endangered Fish Species Collected in the Vicinity of DNPS.[a]

Species	Year Collected	Location Collected	Number Collected	State Status
River Redhorse (*Moxostoma carinatum*)	1979	Upstream of Dresden Lock and Dam	1	Threatened
	1982	Upstream of Dresden Lock and Dam	1	Threatened
	1988	Illinois River, downstream of Dresden Lock and Dam	1	Threatened
	1989	Upstream of Dresden Lock and Dam	3	Threatened
	1990 and 1991	Lower Kankakee River above DNPS intake	24	Threatened
	1991	Lower Des Plaines River downstream of Brandon Road Lock and Dam	2	Threatened
	1993	Upstream of Dresden Lock and Dam	1	Threatened
	1994	Lower Des Plaines River area of Dresden Pool	2	Threatened
	1995	Lower Des Plaines River area of Dresden Pool	2	Threatened
	1995	Illinois River just downstream of Dresden Lock and Dam	1	Threatened
Greater Redhorse (*Moxostoma valencienneis*)	1989	Illinois River, downstream of Dresden Lock and Dam	1	Endangered
	1991	Illinois River about one mile below Dresden Lock and Dam	1	Endangered
	1992	Illinois River about one mile below Dresden Lock and Dam	1	Endangered
	1993	Upstream of Dresden Lock and Dam	1	Endangered
	2000	Illinois River, downstream of Dresden Lock and Dam	1	Endangered
Pallid Shiner (*Notropis amnis*)	1987	Illinois River about one-half mile below Dresden Lock and Dam	1	Endangered
	2000	Illinois River basin backwater area 3.7 miles upstream of Dresden Lock and Dam	2	Endangered

a ComEd 1993, 2000.

Table 2-3. Estimated Populations and Annual Growth Rates in Will and Grundy Counties from 1980 to 2030.

	Population and Average Annual Growth Rate in the Previous Decade			
	Will County		Grundy County	
Year	Number	Percent	Number	Percent
1980	324,460[a]	3.0	30,582[a]	1.5
1990	357,313[a]	1.0	32,337[a]	0.6
2000	502,266[b]	4.1	37,535[b]	1.6
2010	608,600[c]	2.1	39,546[c]	0.5
2020	738,185[c]	2.1	43,584[c]	1.0
2030	807,468[d]	0.9	46,753[d]	0.7

a. USCB 1995.
b. USCB 2000a.
c. Illinois Department of Commerce and Community Affairs 2001.
d. Tetra Tech NUS, Inc. 2001.

Table 2-4. Minority and Low-Income Populations.

County	State	2000 Block Groups	American Indian or Alaskan Native	Asian	Native Hawaiian or other Pacific Islander	Black Races	All Other Single Minorities	Multi-racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity	1990 Tracts	1990 Tracts Low-Income
Bureau	IL	12	0	0	0	0	0	0	0	0	5	0
Cook	IL	3713	1	67	0	1321	549	7	1797	819	1209	242
De Kalb	IL	64	0	0	0	0	0	0	1	1	20	2
Du Page	IL	541	0	16	0	0	3	0	11	28	116	0
Ford	IL	3	0	0	0	0	0	0	0	0	1	0
Grundy	IL	33	0	0	0	0	0	0	0	0	9	0
Iroquois	IL	23	0	0	0	0	1	0	0	1	12	0
Kane	IL	253	0	0	0	4	40	0	33	88	67	0
Kankakee	IL	81	0	0	0	16	0	0	16	0	26	3
Kendall	IL	33	0	0	0	0	0	0	0	1	8	0
La Salle	IL	106	0	0	0	0	0	0	0	0	27	0
Lee	IL	6	0	0	0	0	0	0	0	0	2	0
Livingston	IL	38	0	0	0	1	0	0	0	0	10	0
McLean	IL	5	0	0	0	0	0	0	0	0	1	0
Marshall	IL	3	0	0	0	0	0	0	0	0	2	0
Ogle	IL	1	0	0	0	0	0	0	0	0	1	0
Putnam	IL	4	0	0	0	0	0	0	0	0	2	0
Will	IL	265	0	0	0	27	8	0	37	15	79	1
Woodford	IL	1	0	0	0	0	0	0	0	0	1	0
Lake	IN	311	0	0	0	101	27	0	128	51	93	15
Newton	IN	7	0	0	0	0	0	0	0	0	2	0
TOTAL		5503	1	83	0	1470	628	7	2023	1004	1693	263

State Averages

States	American Indian or Alaskan Native	Asian	Native Hawaiian or other Pacific Islander	Black Races	All Other Single Minorities	Multi-racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity	Low-Income
Illinois	0.25%	3.41%	0.04%	15.11%	5.82%	0.19%	24.82%	12.32%	11.47%
Indiana	0.26%	0.97%	0.03%	8.39%	1.61%	1.24%	12.51%	3.53%	10.78%

Table 2-5. Tax Information for DNPS and Grundy County.

Year	Total Grundy County Levees Extended[a,b]	Property Tax Paid By DNPS	Percent of Collections Available for Distribution	Collections Available for Distribution to Districts[a,b]
1997	$58,357,982	$11,959,131	20.6	$58,174,086
1998	$60,179,988	$12,231,397	20.4	$59,907,894
1999	$65,732,995	$12,781,547	19.7	$64,618,506
2000	$71,374,702	$9,272,017	13.3	$69,576,291

a Miller 2001.
b Miller 2002.

Table 2-6. Tax Information for DNPS and Will County.

Year	Total Will County Levees Extended[a,b]	Property Tax Paid By DNPS	Percent of Collections Available for Distribution	Collections Available for Distribution to Districts[a,b]
1997	$506,762,529	$35,554	Less than 1%	$505,223,460
1998	$549,980,677	$35,831	Less than 1%	$548,930,903
1999	$607,896,708	$37,530	Less than 1%	$606,168,761
2000	$682,421,747	$38,975	Less than 1%	$679,812,340

a. Hart 2001.
b. Hart 2002.

Table 2-7. Will County Public Water Suppliers and Capacities.

Water Supplier	Average Daily Use (Gallons per day)	Maximum Daily Capacity (Gallons per day)
Beecher	265,000	2,160,000
Braidwood	475,000	1,002,000
Channahon	223,000	950,000
Crest Hill	1,150,000	1,937,000
Crete	640,000	2,780,000
Elwood	149,000	344,000
Frankfort	2,370,000	3,989,000
Joliet	11,850,000	21,470,000
Lockport	1,380,000	3,024,000
Manhattan	191,000	1,425,000
Mokena	1,285,000	3,168,000
Monee	124,000	1,382,000
New Lenox	1,000,000	3,534,000
Peotone	328,000	3,384,000
Plainfield	711,000	2,196,000
Rockdale	713,000	1,253,000
Romeoville	3,286,000	7,740,000
Wilmington	517,000	3,430,000
Bolingbrook	1,458,000	6,365,000
CTZNS West Suburban DVN	3,175,000	8,186,000
Bolingbrook System #2	921,000	1,836,000
Consumers IL Water University Park	1,096,000	3,960,000
CTZNS Arbury DVN	141,000	1,584,000
CTXNS Santa Fe DVN	245,000	1,534,000
Shorewood	436,000	2,124,000
Bonnie-Brae Forest MNR SNDST	222,000	1,512,000
CTZNS Chicksaw Hill DVN	1,170,000	3,636,000
CTZNS Derby Meadows DVN	1,112,000	4,092,000
Southeast Joliet SNDST	172,000	468,000
Ridgewood SBDV	103,000	115,000
Willowbrook UTL Co.	220,000	965,000
Stateville Correctional Center	585,000	3,024,000
Joliet Correctional Center	289,000	749,000

Source: IEPA 2001a and 2001b

Table 2-8. Grundy County Public Water Suppliers and Capacities.

Water Supplier	Average Daily Use (Gallons per day)	Maximum Daily Capacity (Gallons per day)
Coal City	450,000	2,080,000
Diamond	116,000	144,000
Gardner	169,000	864,000
Minooka	439,000	1,440,000
Morris	1,689,000	6,480,000

Source: IEPA 2001a and 2001b

Table 2-9. Traffic Count Data for Roads Near DNPS.

Route No./ Road Name	Route Location	Estimated AADT	AADT Year
Pine Bluff Road	State Route 47 to Old Pine Bluff Road	4500	2000
Pine Bluff Road	Old Pine Bluff Road to Goose Lake Road	4600	1996
Pine Bluff Road	Goose Lake Road to Dresden Road	5100	1996
Pine Bluff Road	Dresden Road to Grundy County Line	7100	1996
Dresden Road	DNPS Plant to Pine Bluff Road	4050	1996
Dresden Road	Pine Bluff Road to Coal City Limits	1550	1997

Source: Knutson 2001.
AADT = Annual Average Daily Traffic volumes

Table 2-10. Sites on the National Register of Historic Places Within a Six-Mile Radius of DNPS.

Site Name	City	Location
Grundy County		
White and Company's Goose Lake Stoneware Manufactory and Tile Works	Morris	5010 N. Jugtown Road
White and Company's Goose Lake Tile Works	Morris	5010 N. Jugtown Road
Will County		
Illinois and Michigan Canal	Joliet	7 miles SW of Joliet on U.S. 6, in Channahon State Park
Briscoe Mounds	Channahon	On Front St. along the Des Plaines River

Source: U S. Department of the Interior 2001a and 2001b

Table 2-11. Location, Size in MWe, and Cooling Water Source of Electric Generating Stations Near DNPS.

Station	River Mile[a]	Water Body	Size
Fisk	322.5	South Branch of Chicago River	324 MWe
Crawford	318.5	Chicago Sanitary and Shipping Canal	581 MWe
Will County	295.2	Chicago Sanitary and Shipping Canal	1,154 MWe
Joliet Nos. 7 and 8	284.2	Des Plaines River	1,025 MWe
Joliet No. 6	284.2	Des Plaines River	302 MWe

MWe = megawatts-electric

a Distance, as river miles, upstream from confluence of Illinois and Mississippi Rivers

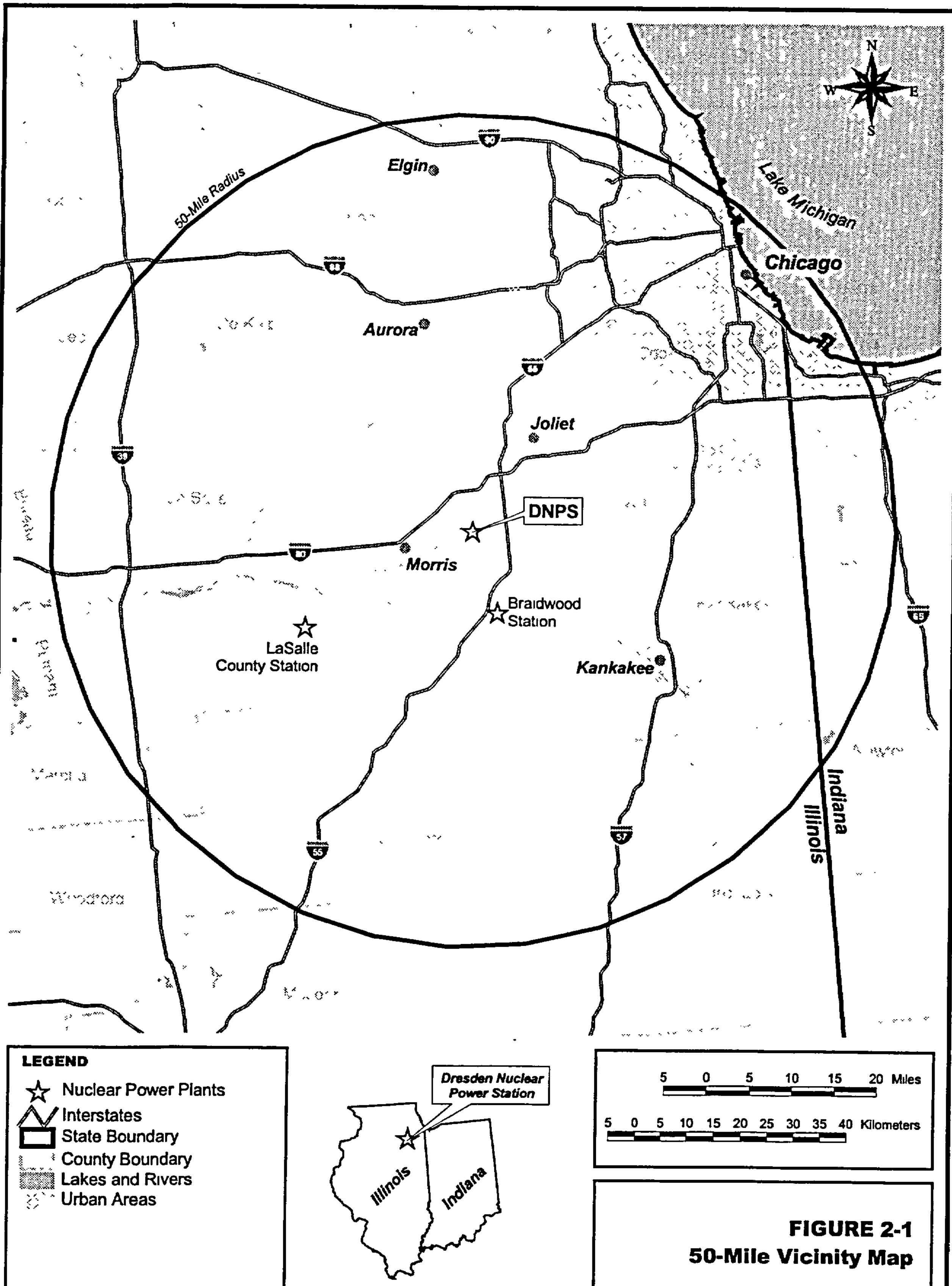

FIGURE 2-1
50-Mile Vicinity Map

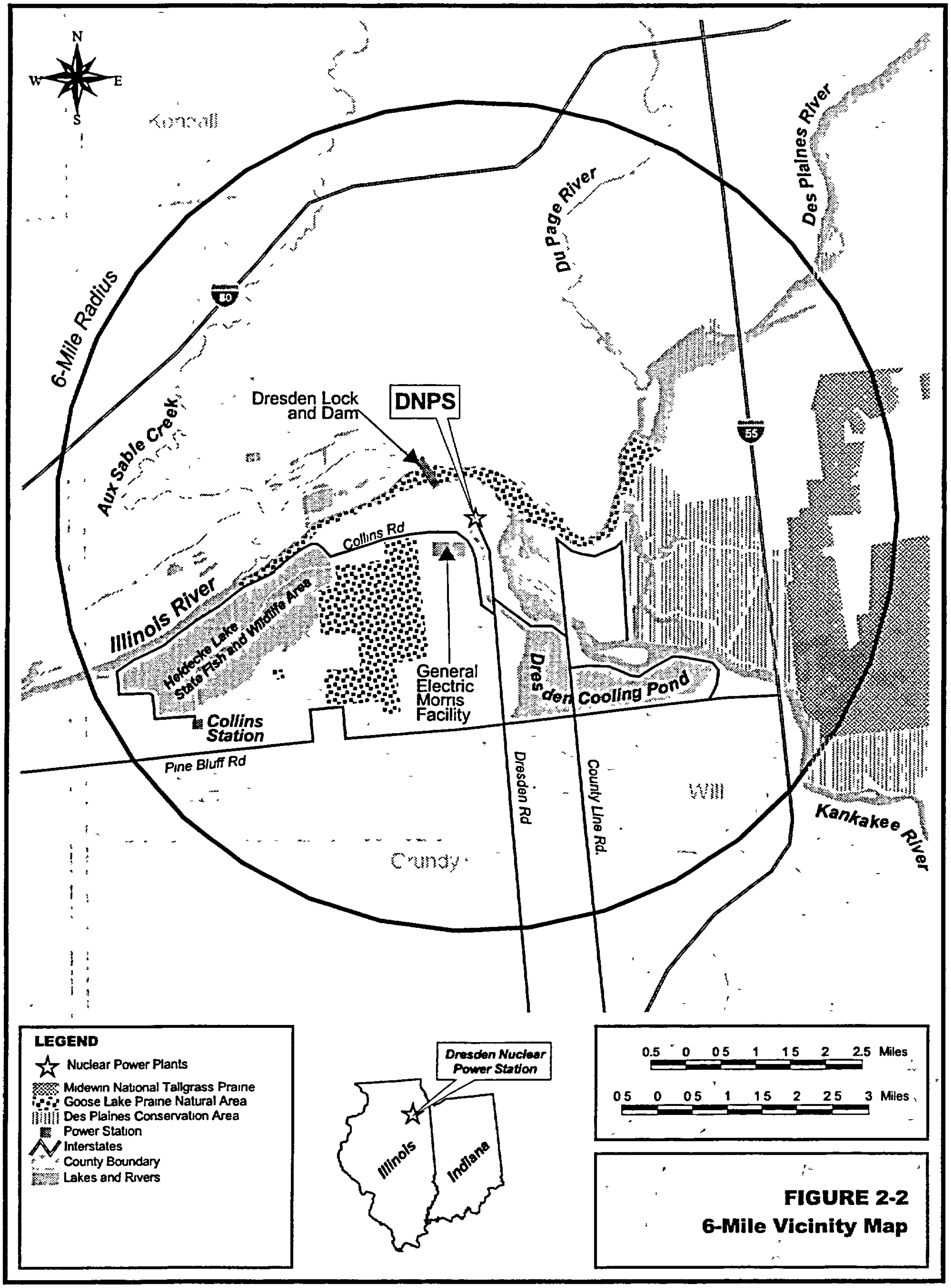

FIGURE 2-2
6-Mile Vicinity Map

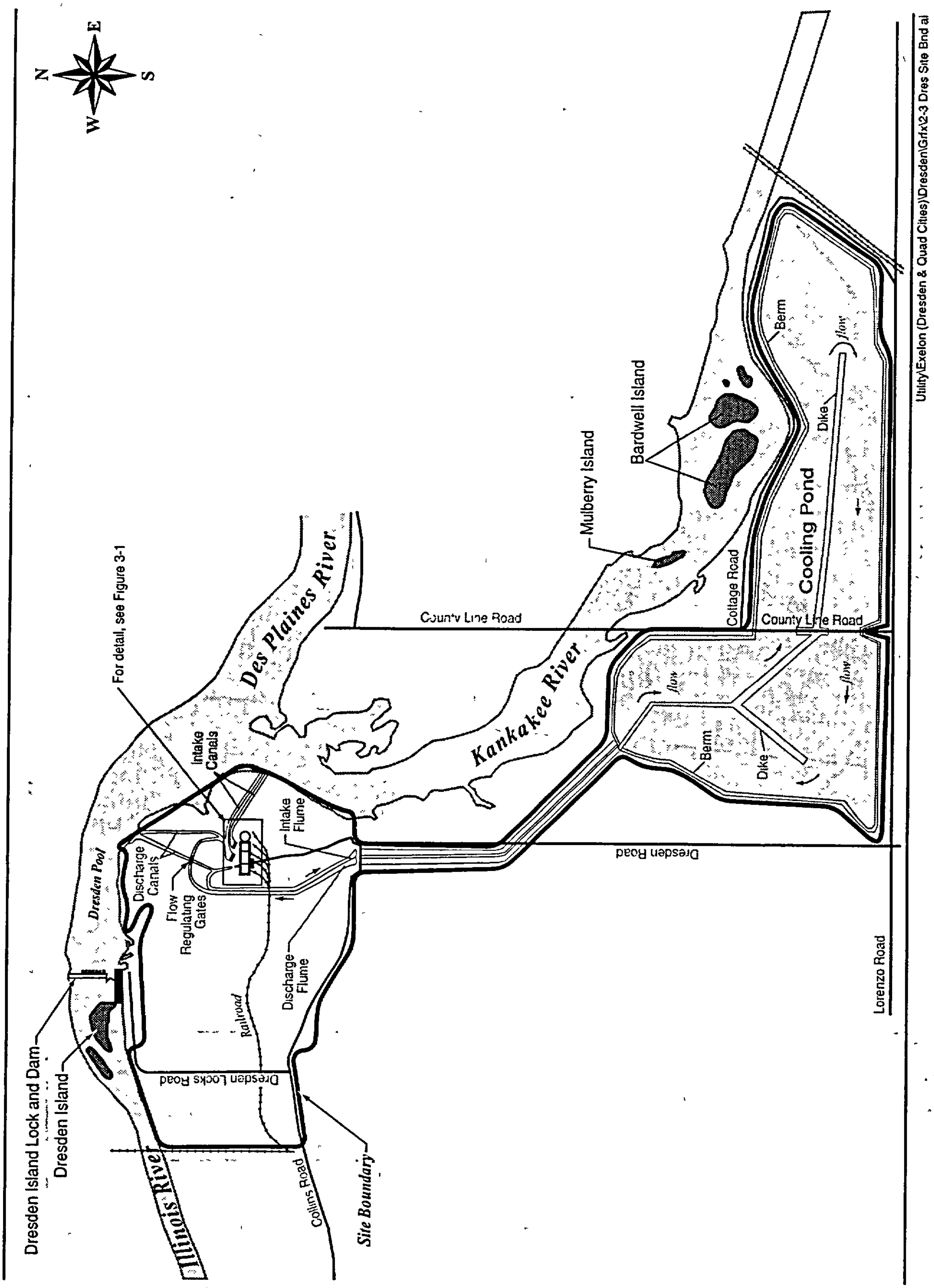

FIGURE 2-3. Site Boundary.

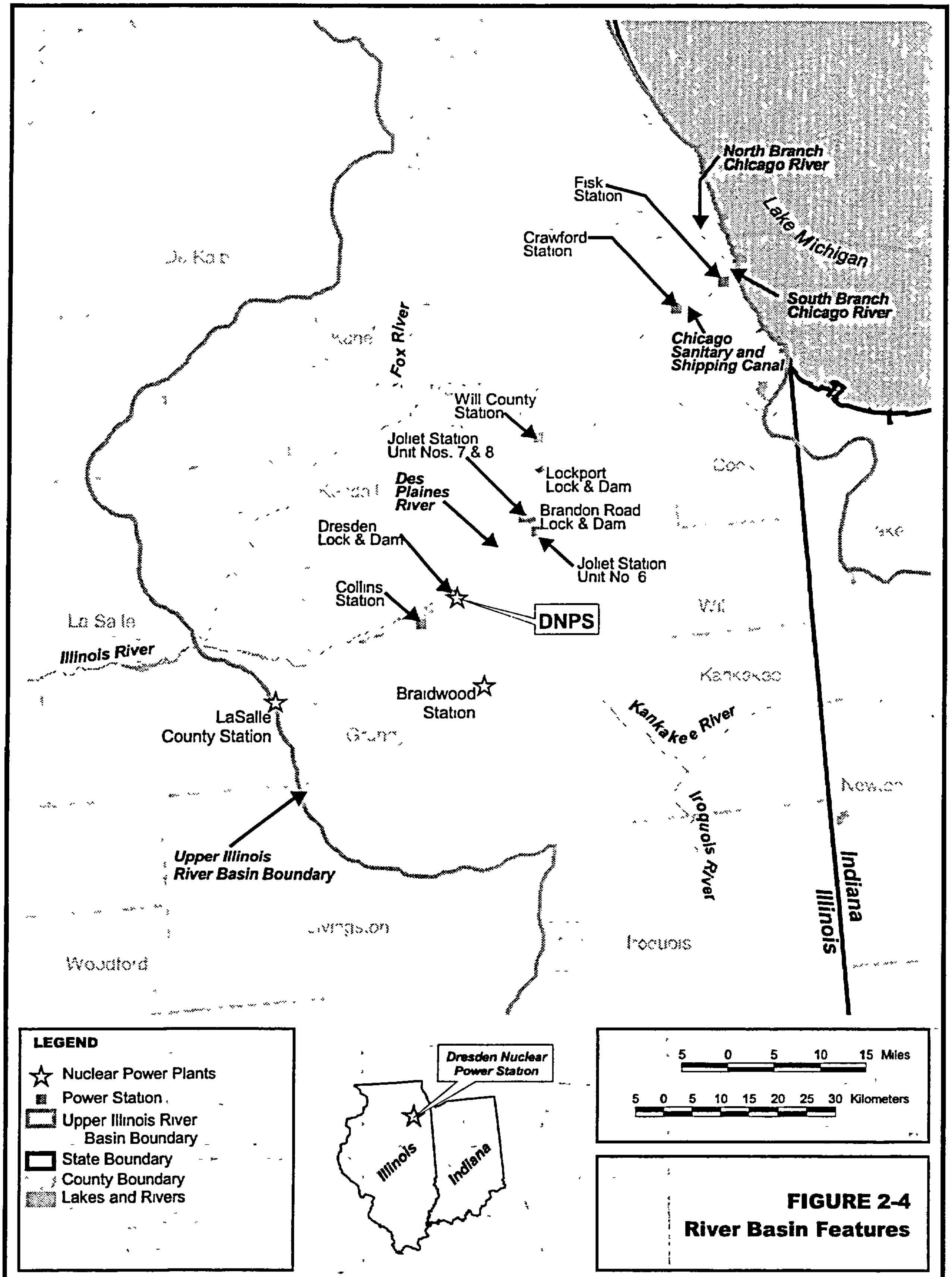

FIGURE 2-4
River Basin Features

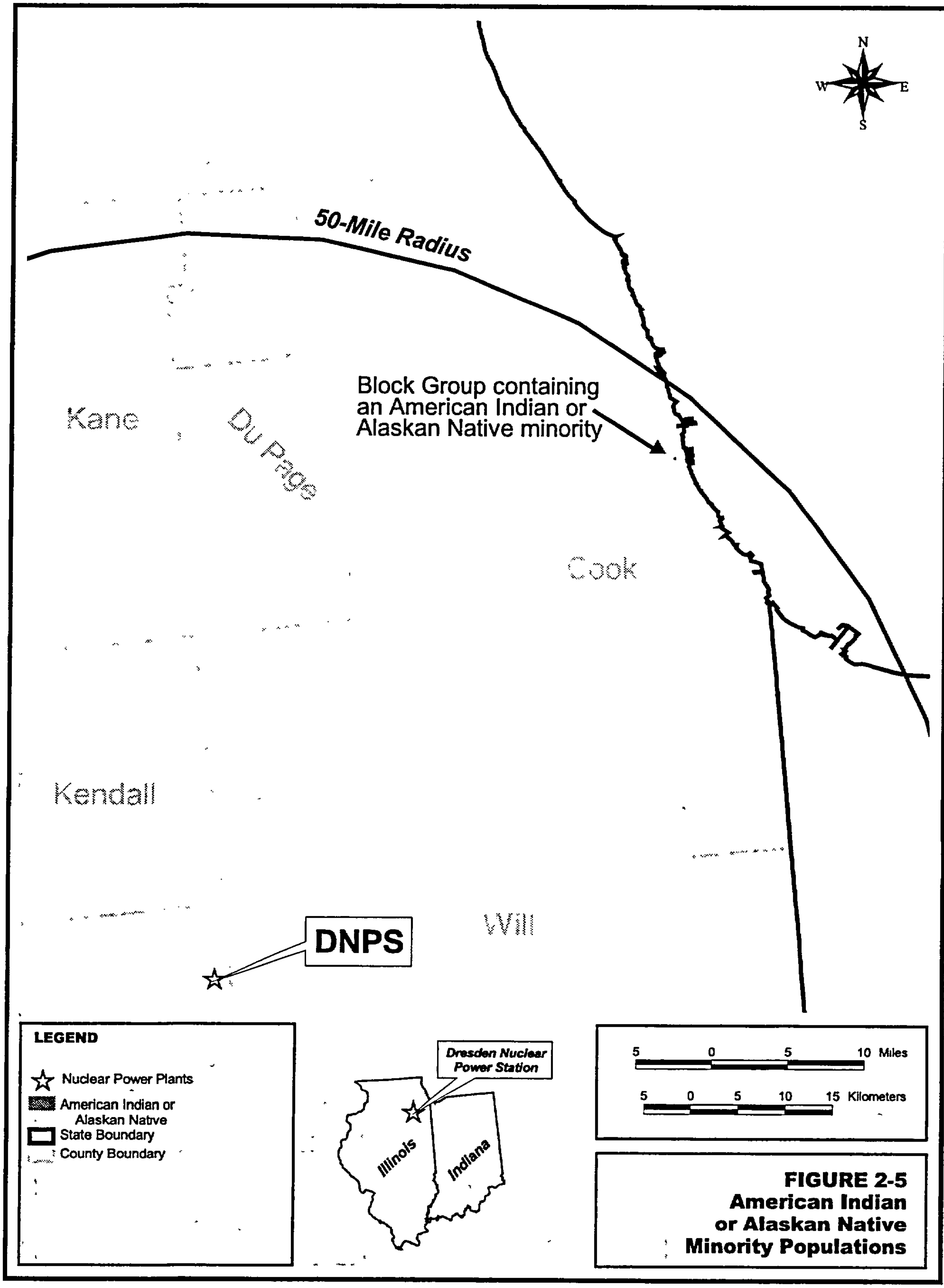

FIGURE 2-5
American Indian or Alaskan Native Minority Populations

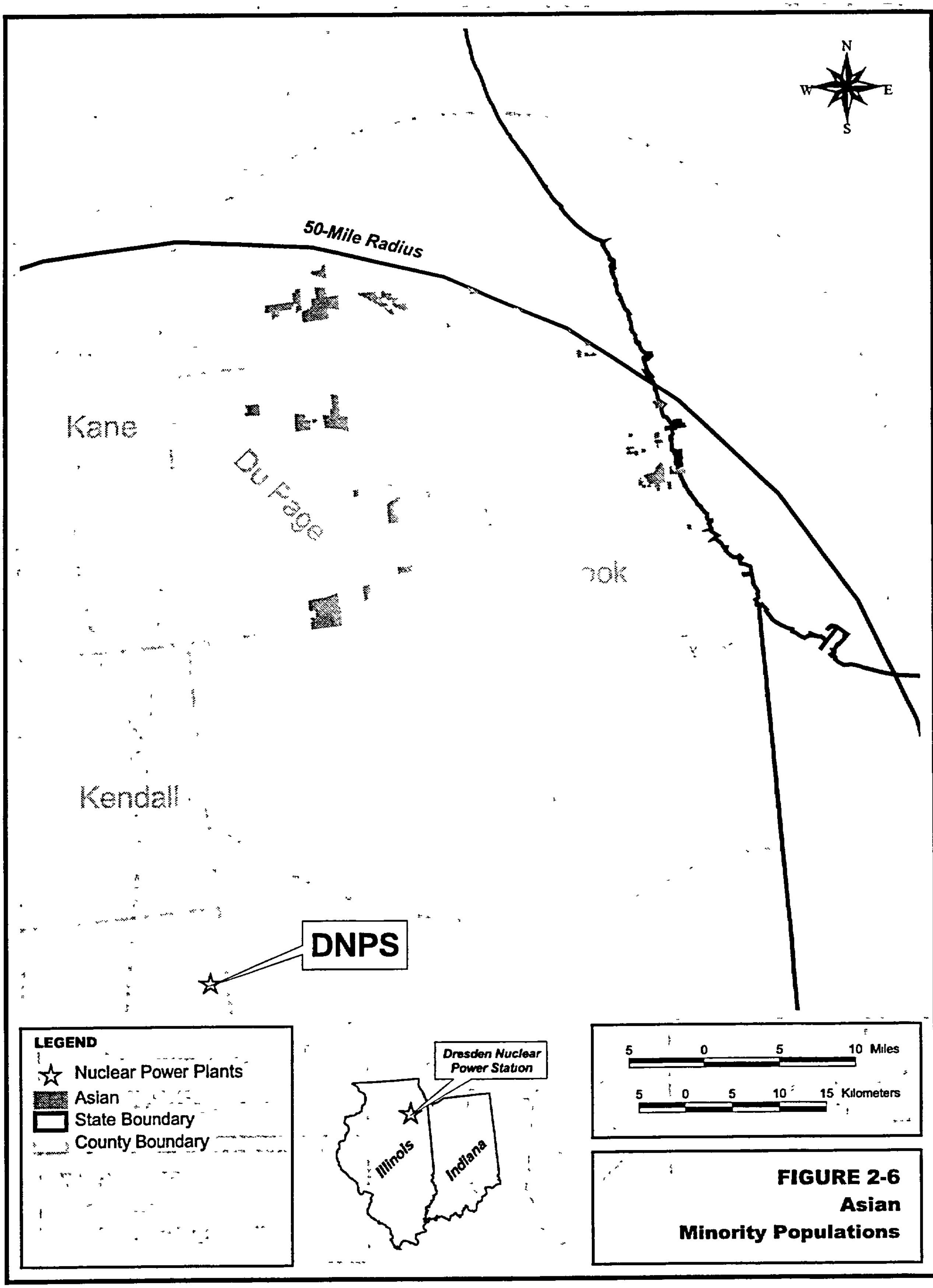

FIGURE 2-6
Asian
Minority Populations

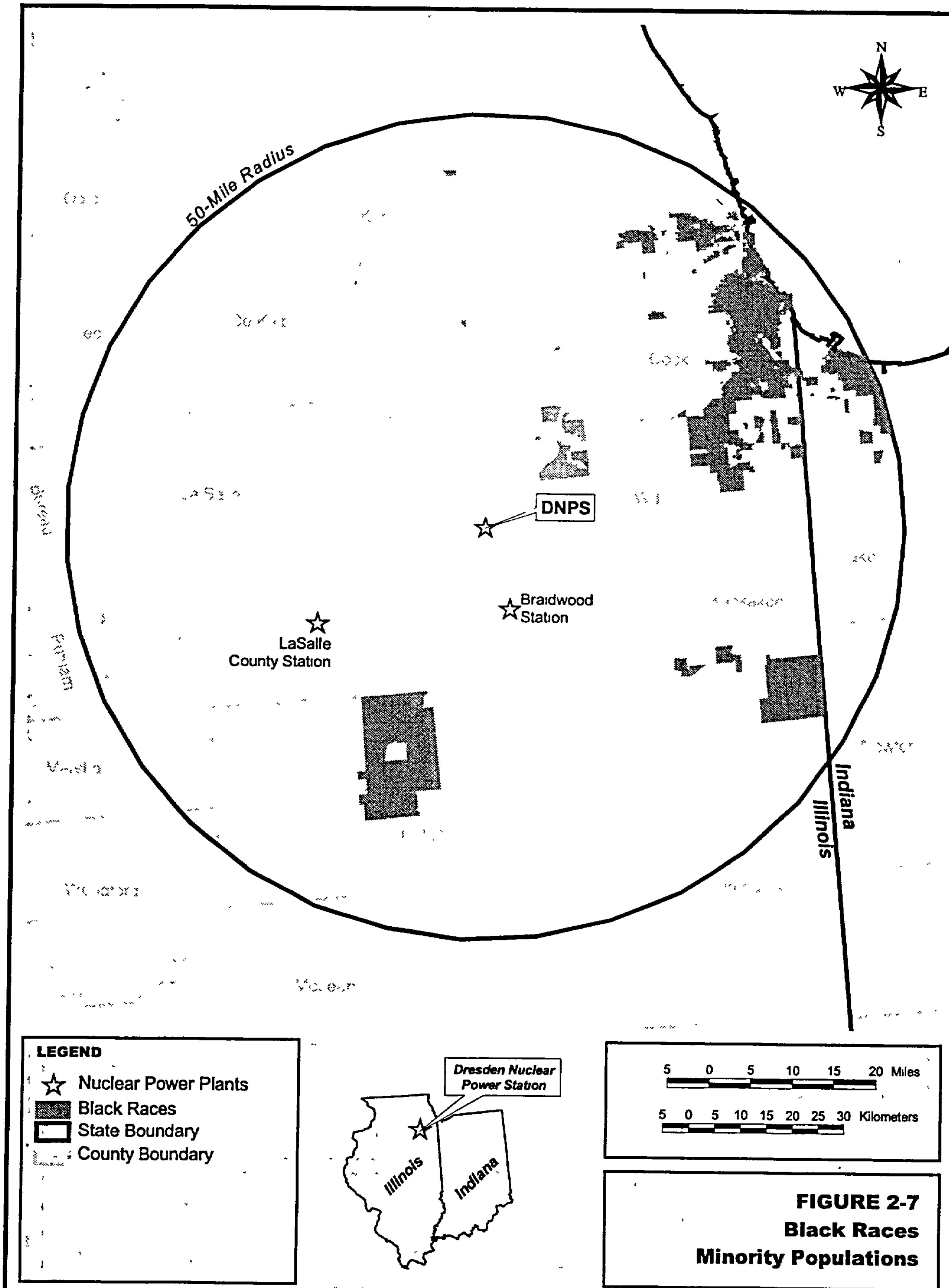

FIGURE 2-7
Black Races
Minority Populations

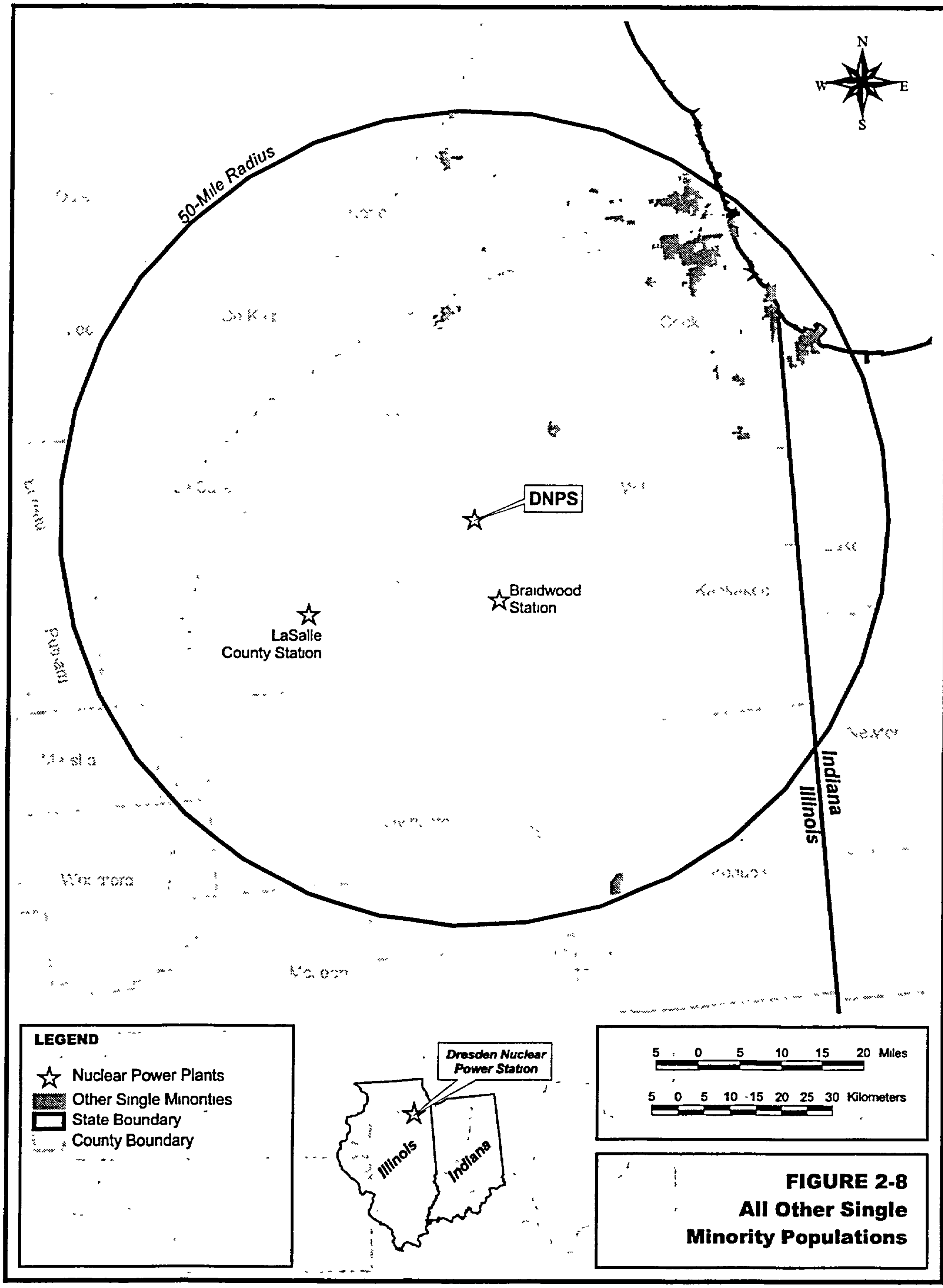

FIGURE 2-8
All Other Single Minority Populations

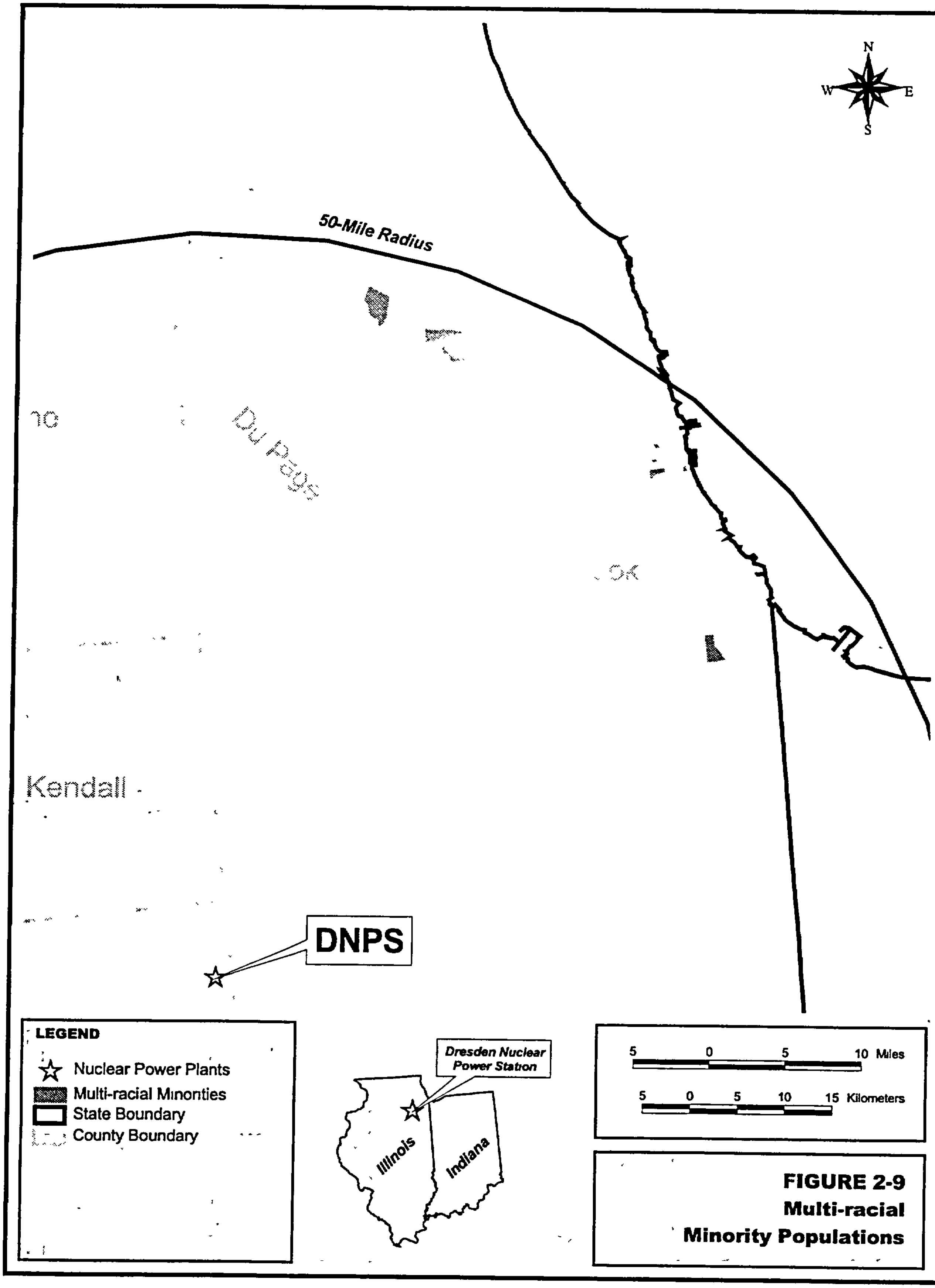

FIGURE 2-9
Multi-racial Minority Populations

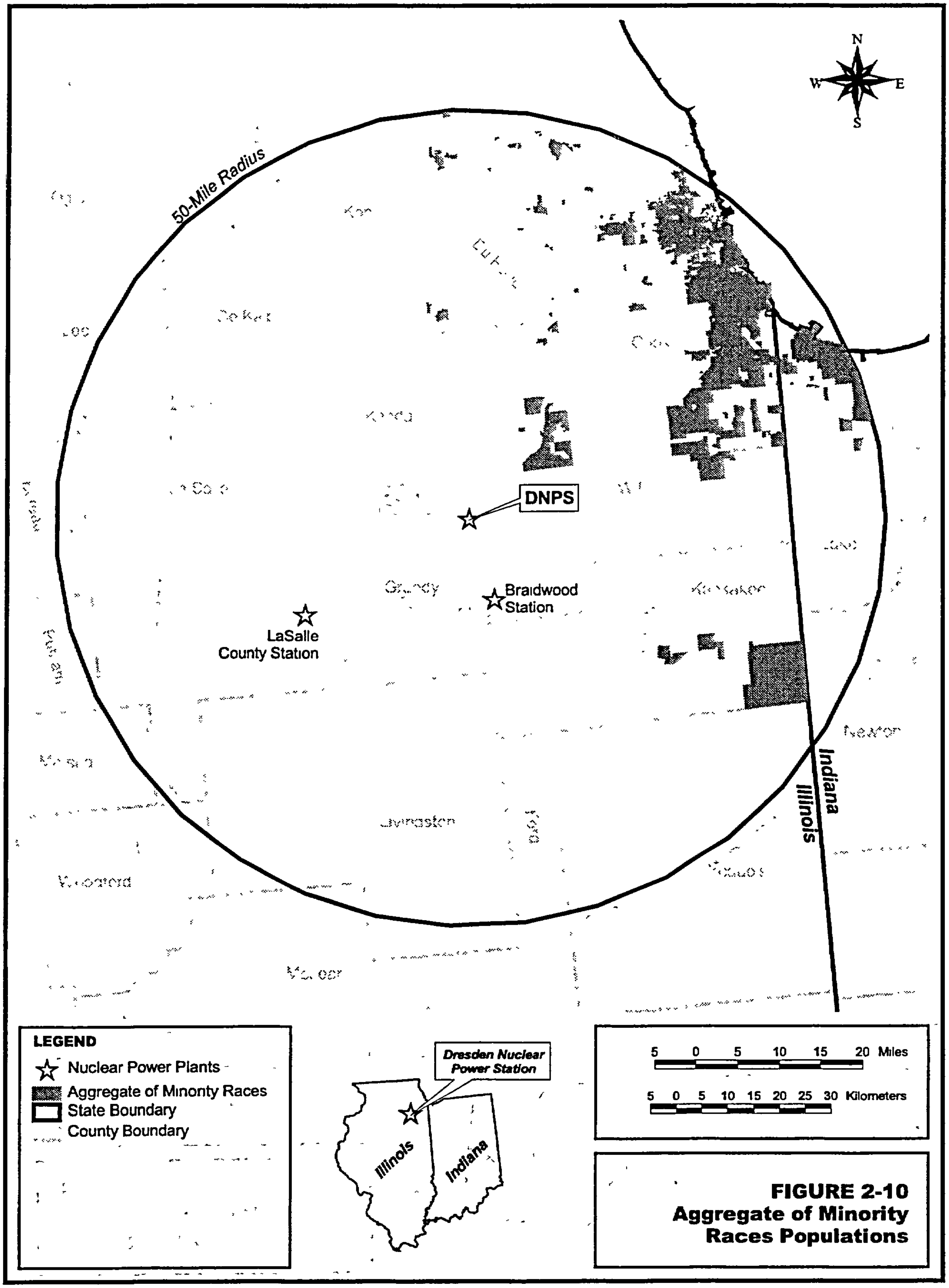

FIGURE 2-10
Aggregate of Minority Races Populations

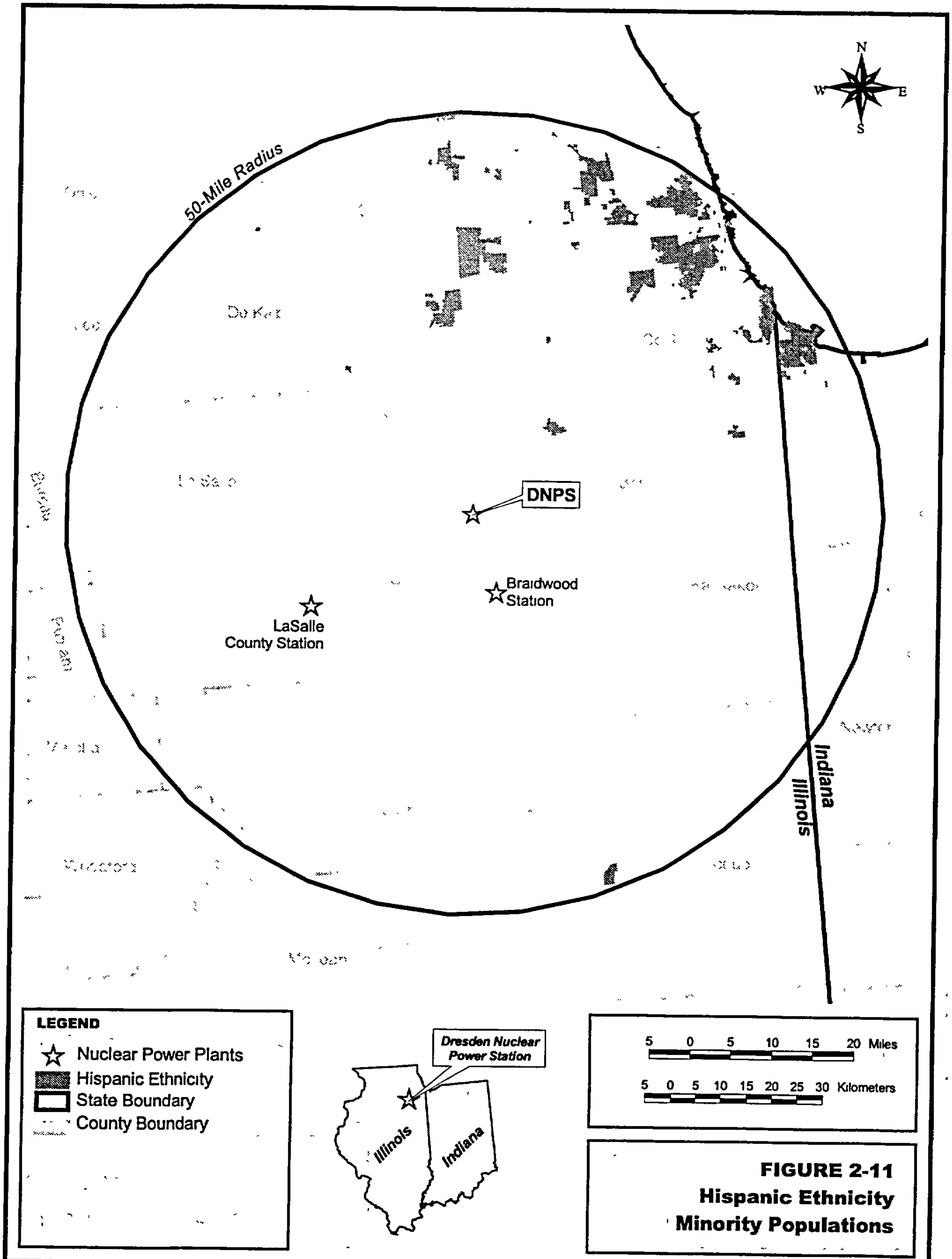

FIGURE 2-11
Hispanic Ethnicity
Minority Populations

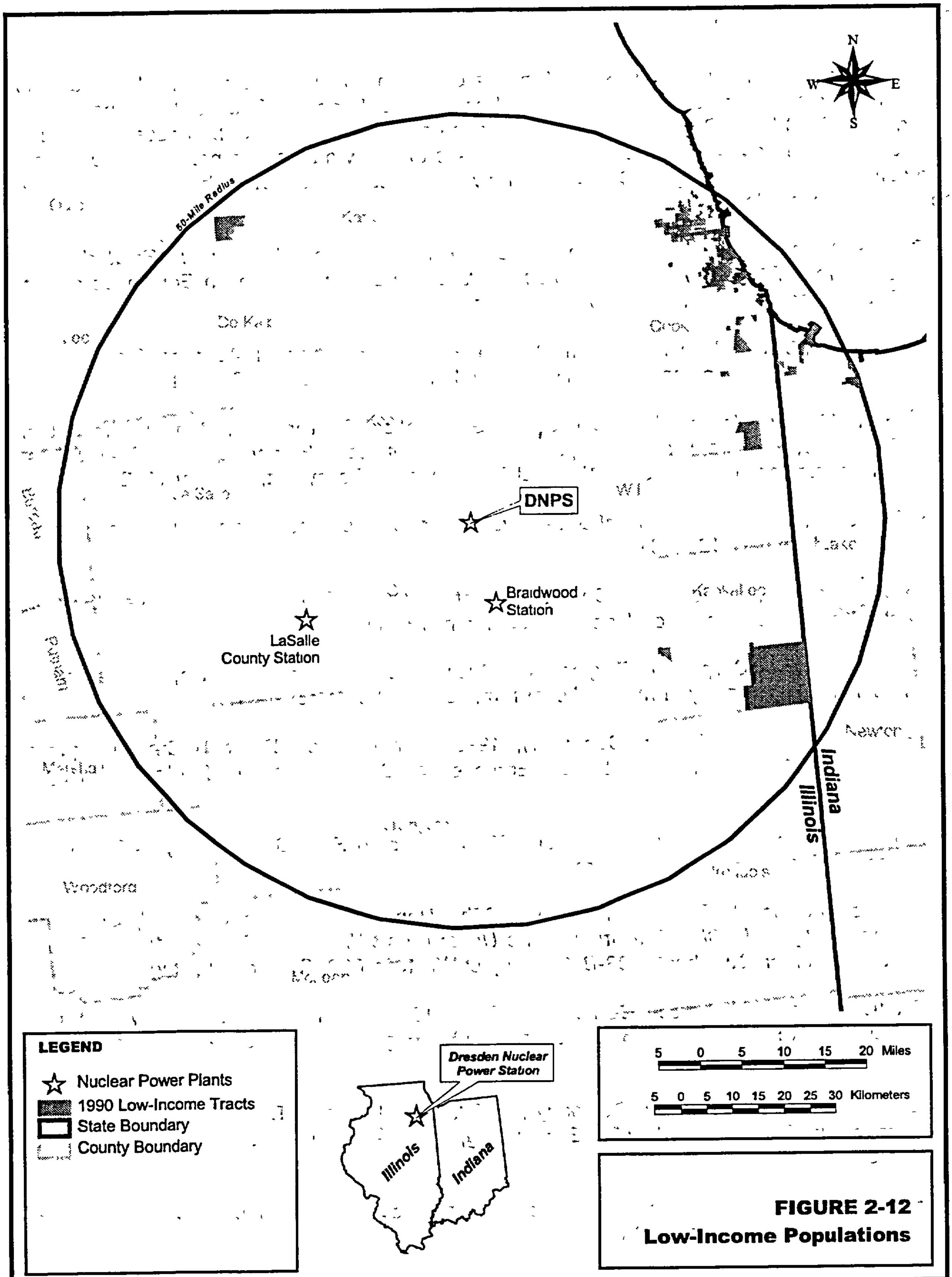

FIGURE 2-12
Low-Income Populations

2.14 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 all cited web pages are available in EGC files. Some sites, for example the census data, cannot be accessed through their URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by EGC have been given for these pages, even though they may not be directly accessible.

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Chapter 3

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)

EGC proposes that NRC renew the operating licenses for DNPS Units 2 and 3 for an additional 20 years beyond the current license expiration dates of December 22, 2009, and January 12, 2011, respectively. Renewal would give EGC and the State of Illinois the option of relying on DNPS to meet future electricity needs. Section 3.1 discusses the major features of the Station and the operation and maintenance practices directly related to the license renewal period. Sections 3.2 through 3.4 address potential changes that could occur as a result of license renewal.

3.1 General Plant Information

DNPS is a nuclear-powered steam electric generating facility that consists of three boiling water reactors (BWRs). Section 2.13 discusses Unit 1. Units 2 and 3 are the only generating units subject to the proposed license renewal. DNPS Unit 2 began commercial operation on June 9, 1970, and Unit 3 began on November 16, 1971. Units 2 and 3 are powered by General Electric Company BWRs that produce a combined 2,957 megawatts-thermal. The design net electrical capacity is 912 MWe per unit. Figure 3-1 depicts the Station layout.

3.1.1 REACTOR AND CONTAINMENT SYSTEMS

The nuclear steam supply system at DNPS is typical of General Electric BWRs. The reactor core produces heat that boils the reactor water into steam which, after drying, is routed to the turbines. The steam yields its energy to turn the turbines, which are connected to the electrical generator. DNPS uses a BWR 3 reactor and a Mark I primary containment. The nuclear fuel is low-enriched uranium dioxide with enrichments of 5 percent by weight uranium-235 and fuel burnup levels less than 60,000 megawatt-days per metric ton uranium. NRC prepared an Environmental Assessment and Finding of No Significant Impact which concluded that there were no measurable environmental impacts associated with fuel enrichment increasing from 4 to 5 weight percent and burnup increasing to 60,000 megawatt-days per metric ton uranium (NRC 2000).

The primary containment for each unit consists of a drywell, a steel structure that encloses the reactor vessel and related piping, a toroidal-shaped pressure suppression chamber containing a large volume of water, and a vent system that connects the drywell to the suppression chamber. The primary containment is designed to condense steam released during a postulated loss-of-coolant accident, to limit the release of fission products associated with such an accident, and to serve as a source of water for the emergency core cooling system. The containment is designed to withstand an internal pressure of 62 pounds per square inch above atmospheric pressure.

The concrete reactor building, which houses the primary containment for both units, serves as a radiation shield and fulfills a secondary containment function. Secondary containment is needed to provide a controlled, filtered, elevated release of the building atmosphere under accident conditions. The reactor building provides primary containment protection when the drywell is opened for maintenance during outages.

The reactor building is maintained under a slight negative pressure, with the building exhaust monitored prior to release to the atmosphere through the reactor building ventilation exhaust stack. Radiation monitors on the exhaust stream can isolate the ventilation system in the event of a process upset that could release excess radioactivity to the environment. A standby gas treatment system is provided to filter and hold up the exhaust before discharging it to the 310-foot main stack.

3.1.2 COOLING AND AUXILIARY WATER SYSTEMS

The water systems most pertinent to license renewal are those that draw from surface water bodies and groundwater. At DNPS, the circulating water system draws from the Kankakee River and discharges to the Illinois River. This system removes heat rejected from the main condensers. The service water system also draws from the Kankakee River and discharges to the Illinois River. Groundwater from two wells

(Wells 1 and 2; Figure 3-1) are used for domestic water consumption and for other industrial purposes that do not include condenser cooling. The following subsections describe these three systems

<u>Circulating Water System</u>

Overview

The DNPS circulating water system can operate in either of the following heat dissipation modes:

- <u>Indirect Open-Cycle</u> – In this mode, cooling water is withdrawn from the Kankakee River and pumped through the condensers. Heated effluent is circulated through a cooling pond before being discharged to the Illinois River.

- <u>Closed-Cycle</u> – In this mode, effluent is recirculated through the condensers Withdrawal from the Kankakee River is limited to makeup water needed to compensate for evaporative, seepage, and blowdown losses.

At a location near the discharge point, flow regulating gates (see Figures 3-1 and 3-2) are used to direct effluent to the river (indirect open-cycle mode) or to the intake structure (closed-cycle mode). In either mode, effluent can also be routed through helper cooling towers for supplemental cooling. The following paragraphs expand on this description and Figure 3-2 illustrates water flow through the system.

Background

The original design of the condenser cooling water system was a once-through, or open-cycle, system that discharged the heated water to the Illinois River downstream of the intake. However, a number of configuration changes have been made in the cooling system at DNPS since the operating licenses were approved in December 1969. In addition, a number of environmental regulations have been implemented that affect Station operations (e.g., the National Environmental Policy Act in 1970). These configuration changes included the construction of a cooling pond and associated cooling canals, the installation and eventual removal of spray modules in the cooling canals, the installation of temporary mechanical draft cooling towers, and finally the construction of permanent mechanical draft cooling towers. NRC categorized DNPS as a cooling-pond plant (NRC 1996). NRC performed this categorization, however, prior to installation of the cooling towers.

Intake

Condenser cooling water for Units 2 and 3 is withdrawn from the Kankakee River through a canal that is approximately 2,000 feet long and 50 feet wide. A log boom separates the Kankakee River and the intake canal. This log-boom prevents logs and other large debris from entering the intake canal. During Kankakee River low-flow periods, Des Plaines River water may also enter the canal. At the end of the canal, bar racks, consisting of one-half by two-inch bars spaced vertically on two-and-one-half-inch centers, prevent large objects from entering the cooling system. The circulating water pumps are further protected by sets of traveling screens that have a 3/8-inch mesh. Therefore, organisms larger than this mesh are prevented from entering the cooling system. The maximum design water intake velocity at the bar racks is 0.6 feet per second and the velocity at the travelling screens is 1.85 feet per second.

Dresden Cooling Pond Dike

EGC has a permit (No. DS2000233) from the Illinois Department of Natural Resources for operation and maintenance of the DNPS cooling pond dike and associated structures, in accordance with approved plans and specifications submitted on October 19, 2000 (IDNR 2000). The cooling pond dike is characterized as an intermediate-size Class 1 (high hazard) structure. Special conditions associated with the permit require that the dike and associated structures be inspected annually by a Certified Civil Engineer. An Annual Report is submitted to the Illinois Department of Natural Resources and signed by the Station Manager. In addition to this, EGC performs an independent inspection every two months. This inspection consists of visual inspections of the dike and of monitoring 18 piezometers installed around the cooling pond on the dikes.

Indirect Open-Cycle

DNPS operates in the indirect open-cycle mode from June 15 through September 30. In this mode of operation, a maximum of 940,000 gallons per minute (gpm) is withdrawn from the Kankakee River by 6 pumps (rated at 157,000 gpm/each) for condenser cooling water use. NPDES permit allows for a maximum of 1,075,000 gpm. After circulating through the condensers, water is discharged into a two-mile-long cooling canal (i.e., hot canal). As water travels through the hot canal, it may be withdrawn and circulated through a series of 36 mechanical draft cooling towers. These towers (Figure 3-2) that have a maximum water withdrawal capacity of 630,000 gpm and average evaporative losses of 14,300 gpm. The water passes through the towers and returns to the hot canal at a cooler temperature. During this indirect open-cycle mode, the cooling towers operate as necessary to maintain water temperatures within National Pollutant Discharge Elimination System (NPDES) permit limits. An earthen berm approximately 30 to 35 feet high has been constructed just south of the cooling towers (Figure 3-2) to attenuate noise from the towers and to ensure compliance with regulatory requirements for offsite noise levels.

From the hot canal, a lift station pumps cooling water into a 1,275-acre cooling pond. The cooling pond consists of five pools through which the cooling water is circulated for a mean retention time of approximately two and one-half days at full pumping capacity. After circulation through the cooling pond, the water is discharged via a spillway into another two-mile-long canal (i.e., cold canal) flanking the hot canal. Adjacent to the cold canal is a second bank of 12 mechanical draft cooling tower cells (Figure 3-2). Water may be pumped from the cold canal at a maximum rate of approximately 210,000 gpm. Average evaporative losses through these 12 towers are 4,800 gpm. The water is circulated through the cooling tower cells as needed to maintain water temperatures within NPDES permit limits, and is returned to the cold canal at a cooler temperature. The water is then discharged to the Illinois River.

Closed-Cycle

The other mode of plant operation is closed-cycle. The Station can operate in closed-cycle at any time, but normally operates in this mode from October 1 through June 14, when the mechanical draft cooling towers are typically not utilized. In this mode, water is circulated through the condensers for Units 2 and 3, passed through the hot canal, the cooling pond, and the cold canal, and then routed back to the intake structure via the flow regulating station gates (i.e., recirculated). In order to prevent an increase in the dissolved solids concentrations in the cooling pond (which would impact condenser efficiency), approximately 50,000 gpm of the cooling water is discharged (i.e., blown down) to the Illinois River. A small portion of condenser cooling water (70,000 gpm) is withdrawn from the Kankakee River to compensate for evaporative, seepage, and blowdown losses in the cooling pond.

De-Icing

DNPS has approval to allow the Grundy County Emergency Management Agency (transfer to Will County Emergency Management Agency will occur upon issuance of a separate NPDES permit for operation) to operate a de-icing project on the Kankakee River, using heated water from the DNPS cooling pond (IEPA 2000). The ice control project was initiated to help alleviate possible ice jams, boat dock damage, and flooding along the Kankakee River in Wilmington Township. Heated water from the cooling pond is transported through a permanent pipe (Figure 3-2) by siphon to the Kankakee River. The siphon consists of three pipes that go over the retention dike, under Cottage Road, between two private residences, and out to three points in the Kankakee River (ComEd 1999). Special Condition 10 of the permit allows the system to operate for only two runs during the winter, with each run to last no more than 14 days (never past March 15), with a maximum amount of heat limited to 0.5 BTUs per hour; a fish barrier net must be in place around the siphon inlet at all times of operation. A report is submitted to the Illinois Environmental Protection Agency each spring at the conclusion of siphon de-icing operations. During January 2001, EGC discharged just over 67,000 gpm during de-icing operations.

<u>Service Water System</u>

This system provides strained water from the Kankakee River for cooling several closed cooling water systems, the recirculation motor-generator set oil coolers, the generator stator coolers, the turbine oil coolers, the generator hydrogen coolers, and other systems. It also is used to wash the circulating water travelling screens and to pressurize the fire header.

The service water pumps draw from the same intake system as the circulating water system. The five pumps withdraw a maximum of 75,000 gpm. One additional pump is available as a backup. The pumps discharge through strainers with automatic self-cleaning capability. Biocide and silt dispersant can be injected into the pump discharge if needed. The system discharges to the Station discharge flume, which leads to the Illinois River.

<u>Groundwater Systems</u>

There are currently three operating wells (Figure 3-1) providing water to various systems on the DNPS property. During 2000, the two primary wells for Station operations, numbers 1 and 2, pumped at a combined average rate of 71.5 gpm. These wells are approximately 1,500 feet deep and provide processing, washing, cooling, condensing, boiler feed, and sanitary water for employees. Well 3 is 160 feet deep and pumps up to 30 gpm; however, it is typically used only 10 minutes per day, (averages a daily yield of 0.2 gpm). This well supplies water for the wastewater treatment plant operation. Therefore, the total groundwater production rate for DNPS is approximately 72 gpm.

3.1.3 TRANSMISSION FACILITIES

The Final Environmental Statement (AEC 1973) identifies five transmission lines that were built to connect DNPS to the electric grid. Two 1.1-mile lines, located on Station property, connect DNPS to an existing line between the Pontiac and Electric Junction (east of Aurora, Illinois) substations. The third line runs directly to the Electric Junction substation and was installed in a vacant position on existing towers. The two remaining lines run to the Goodings Grove substation, east of Lockport, Illinois. The first four miles of these lines were installed on a new right-of-way (ROW) and the remaining 25.8 miles were installed on new structures on an existing ROW.

In its current configuration, DNPS is connected to the power grid through seven 345-kilovolt (kV) lines. Two additional lines, one each to Powerton Substation and Collins Station, were constructed after the publication of the Final Environmental Statement. In addition, the two Goodings

Grove lines were terminated at the new Elwood Substation. Each line is identified by the substation it connects with and its line number. Figures 3-3 and 3-4 are maps of the transmission system of interest.

- Electric Junction (1221 and 1223) – The corridor for the Electric Junction lines runs east from DNPS and then turns north, crossing the Illinois River. The lines run 31.1 miles and have an ROW ranging from 130 to 380 feet in width.

- Goodings Grove (1220 and 1222) – These two lines cross the Kankakee River south of DNPS and then run northeast to the Elwood Substation. The corridor is 12.4 miles long with a 250-foot-wide ROW.

- Pontiac Mid-Point (8014) – This 43.3-mile-long line runs in a southwesterly direction, terminating to the south of Pontiac, Illinois. The Pontiac Mid-Point ROW is 145 feet wide.

- Powerton (0302) – The 104.5-mile-long Powerton line crosses the Kankakee River twice before heading southwest and terminating near the Illinois River. This is the longest corridor connecting DNPS to the power grid and has a ROW of 250 feet in most areas, with a few segments that are 210 and 240 feet wide.

- Collins Station (2311) – This line crosses the Illinois River along the Electric Junction corridor and then runs west for approximately four miles before crossing back over the Illinois River to the Collins Station. The total length is 11.8 miles with an ROW of 150 feet in width.

In total, for the specific purpose of connecting DNPS to the transmission system, ComEd has approximately 250 miles of transmission lines (200 miles of corridor) that occupy approximately 5,500 acres of land. The corridors pass through land that is primarily flat farmland with a minimal amount of forest. The areas are mostly remote, with low population densities. The longer lines cross numerous state and U.S. highways, including I-80 and I-55. Corridors that pass through farmlands generally continue to be used in this fashion. ComEd plans to maintain these transmission lines indefinitely, as they are integral to the larger transmission system. The transmission lines will remain a permanent part of the transmission system after DNPS is decommissioned.

ComEd designed and constructed all DNPS transmission lines in accordance with the Illinois Commerce Commission General Order 160, which is identical to the National Electrical Safety Code® (IEEE 1997), and industry guidance that was current when the lines were built. Ongoing ROW surveillance and maintenance of DNPS transmission facilities ensure continued conformance to design standards. These maintenance practices are described in Sections 2.4 and 4.13.

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.... 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, and (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, pg. 2-41. (SMITTR defined in NRC 1996, Section 2.4, pg. 2-30, as surveillance, monitoring, inspections, testing, trending, and recordkeeping.)**

EGC has addressed refurbishment activities in this environmental report in accordance with NRC regulations and complementary information in the NRC *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) for license renewal (NRC 1996). NRC requirements for the renewal of operating licenses for nuclear power plants include the preparation of an integrated plant assessment (IPA) (10 CFR 54.21). The IPA must identify and list systems, structures, and components subject to an aging management review. Items that are subject to aging and might require refurbishment include, for example, the reactor vessel, piping, supports, and pump casings (see 10 CFR 54.21 for details), as well as those that are not subject to periodic replacement.

In turn, NRC regulations for implementing the National Environmental Policy Act require environmental reports to describe in detail and assess the environmental impacts of refurbishment activities, such as planned modifications to systems, structures, and components or plant effluents [10 CFR 51.53(c)(2)]. Resource categories to be evaluated for impacts of refurbishment include terrestrial resources, threatened and endangered species, air quality, housing, public utilities and water supply, education, land use, transportation, and historic and archaeological resources.

The DNPS IPA conducted by Exelon under 10 CFR 54 has not identified the need to undertake any major refurbishment or replacement actions to maintain the functionality of important systems, structures, and components during the DNPS license renewal period. Exelon has included the IPA as part of its license renewal application.

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, and (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. (SMITTR is defined in NRC 1996, Section 2.4, as surveillance, monitoring, inspections, testing, trending, and recordkeeping.)**

The IPA required by 10 CFR 54.21 identifies the programs and inspections for managing aging effects at DNPS. These programs are described in the *Application for Renewed Operation Licenses, Dresden Nuclear Power Station, Units 2 and 3*, Appendix B.

3.4 Employment

Current Workforce

EGC employs a permanent workforce of approximately 870 workers and an additional 120 to 130 contract and matrixed employees at DNPS to operate two functioning reactors. This is less than the range of 600 to 800 personnel per reactor unit estimated in the GEIS (NRC 1996). Approximately 72 percent of the DNPS employees live in Will or Grundy Counties (see Section 2.6). Figure 2-1 shows the locations of these Counties.

DNPS is on a staggered 24-month refueling cycle for each unit. During refueling outages, site employment increases above the 870 permanent workforce by roughly 760 workers for temporary (20+ days) duty. This number is above the GEIS range of 200 to 900 additional workers per reactor outage.

License Renewal Increment

It is not anticipated that performing the license renewal activities described in Section 3.3 would necessitate increasing DNPS staff workload.

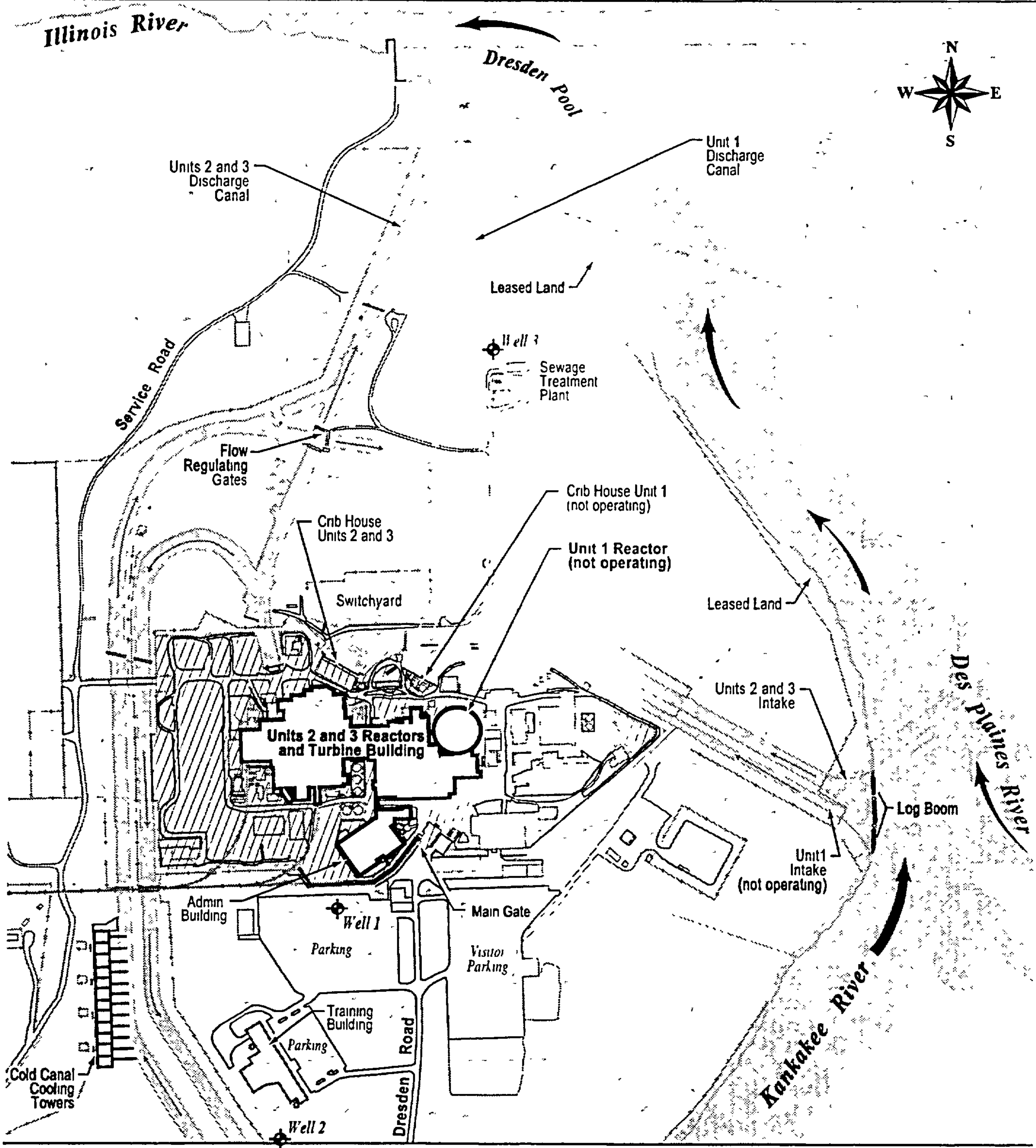
The GEIS (NRC 1996) assumes that NRC would renew a nuclear power plant license for a 20-year period, plus the duration remaining on the current license, and that NRC would issue the renewal approximately 10 years prior to license expiration. In other words, the renewed license would be in effect for approximately 30 years. The GEIS further assumes that the utility would initiate 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 refueling outages (NRC 1996).

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

The GEIS estimates that the maximum 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 refueling. Having established this upper limit for what would be a single event in 20 years, the GEIS uses this value 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...."

EGC expects that existing "surge" capabilities for routine activities, such as outages, will enable EGC to perform the increased SMITTR workload without adding DNPS staff. Therefore for analysis purposes, EGC is conservatively assuming that DNPS would require no more than a total of 60 additional permanent workers to perform all license renewal SMITTR activities.

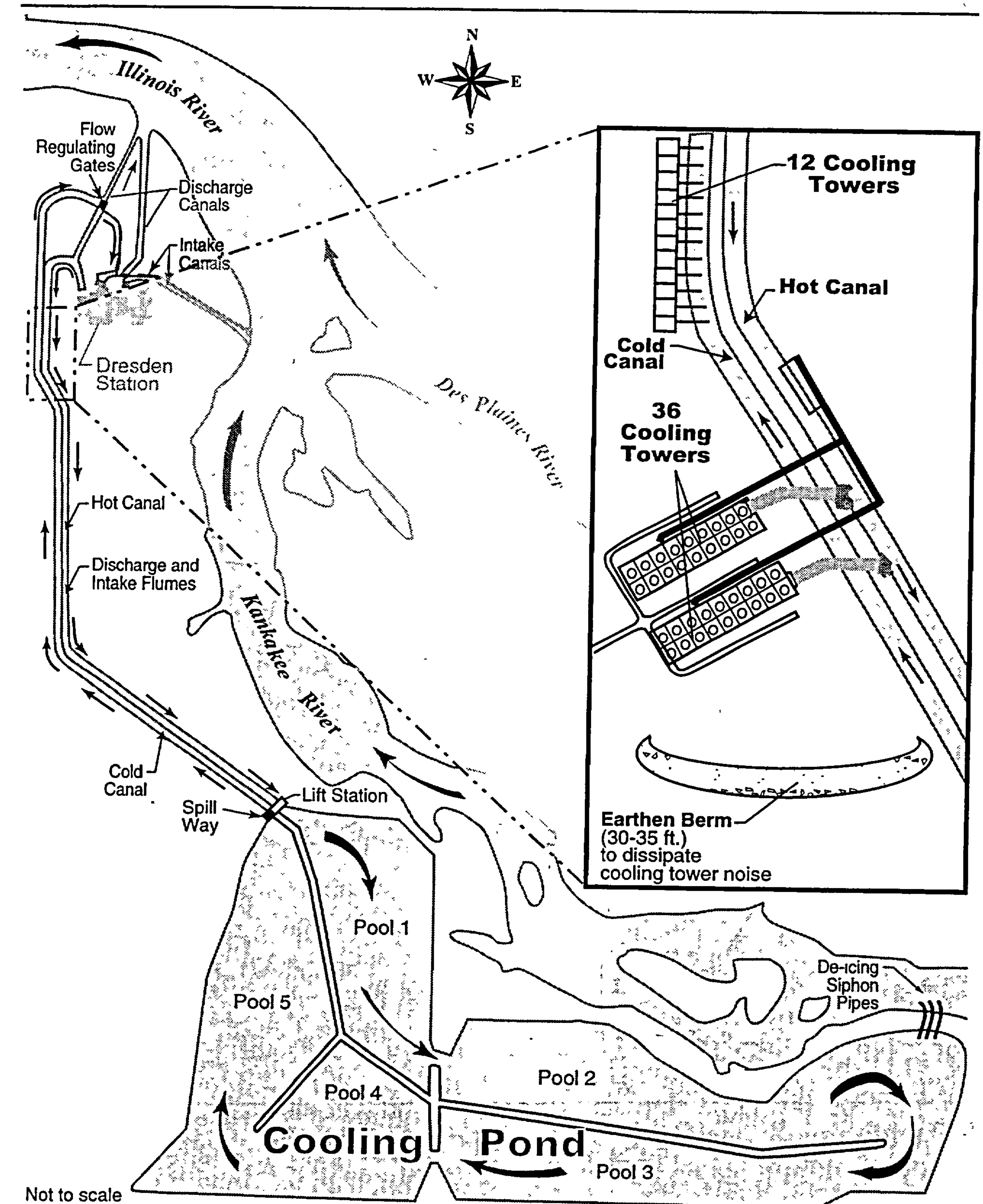
Adding permanent employees to the Station workforce for the license renewal operating term would have the indirect effect of creating additional jobs and spurring related population growth in the community. EGC has used an employment multiplier appropriate to the region (2.85) to calculate the total direct and indirect jobs in service industries that would be supported by the spending of the DNPS workforce (U.S. Department of Commerce 2001). The addition of 60 license renewal employees would generate approximately 111 indirect jobs. This number was calculated as follows: 60 (additional employees) × 2.85 (regional multiplier) = 171 (total employees). Of these, 60 would be direct employees and 111 would be indirect. Seventy-two percent of the direct and indirect workforce (approximately 123 employees) would be distributed across potentially impacted communities in Will and Grundy Counties.



LEGEND

Railroad
Fence
/////, Protected Area

FIGURE 3-1
Station Layout.



Utility\Exelon (Dresden & Quad Cities)\Dresden\Grfx\3-2 Dres cool syst.ai

FIGURE 3-2. Cooling Water System Schematic.

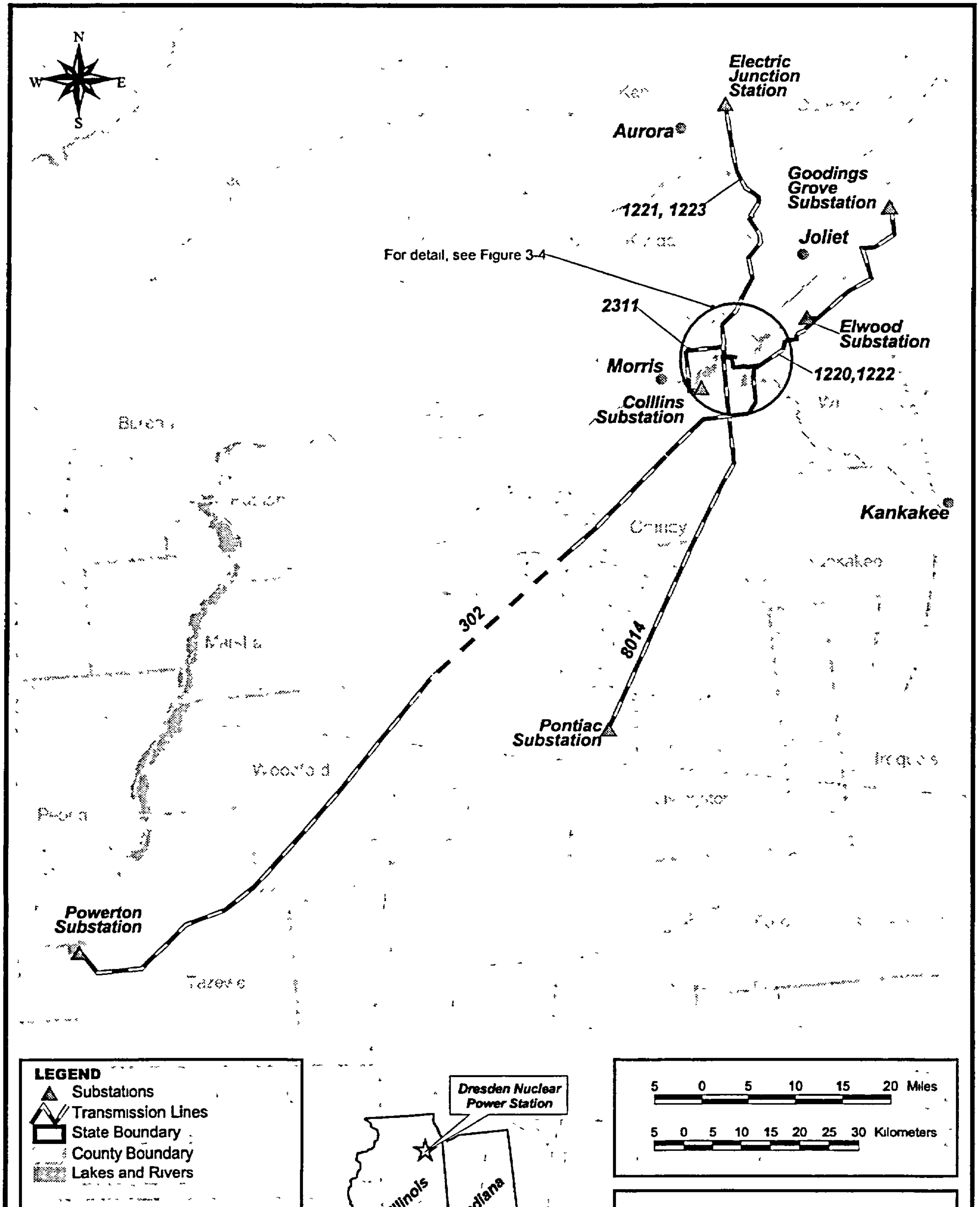


FIGURE 3-3
Transmission Line Map

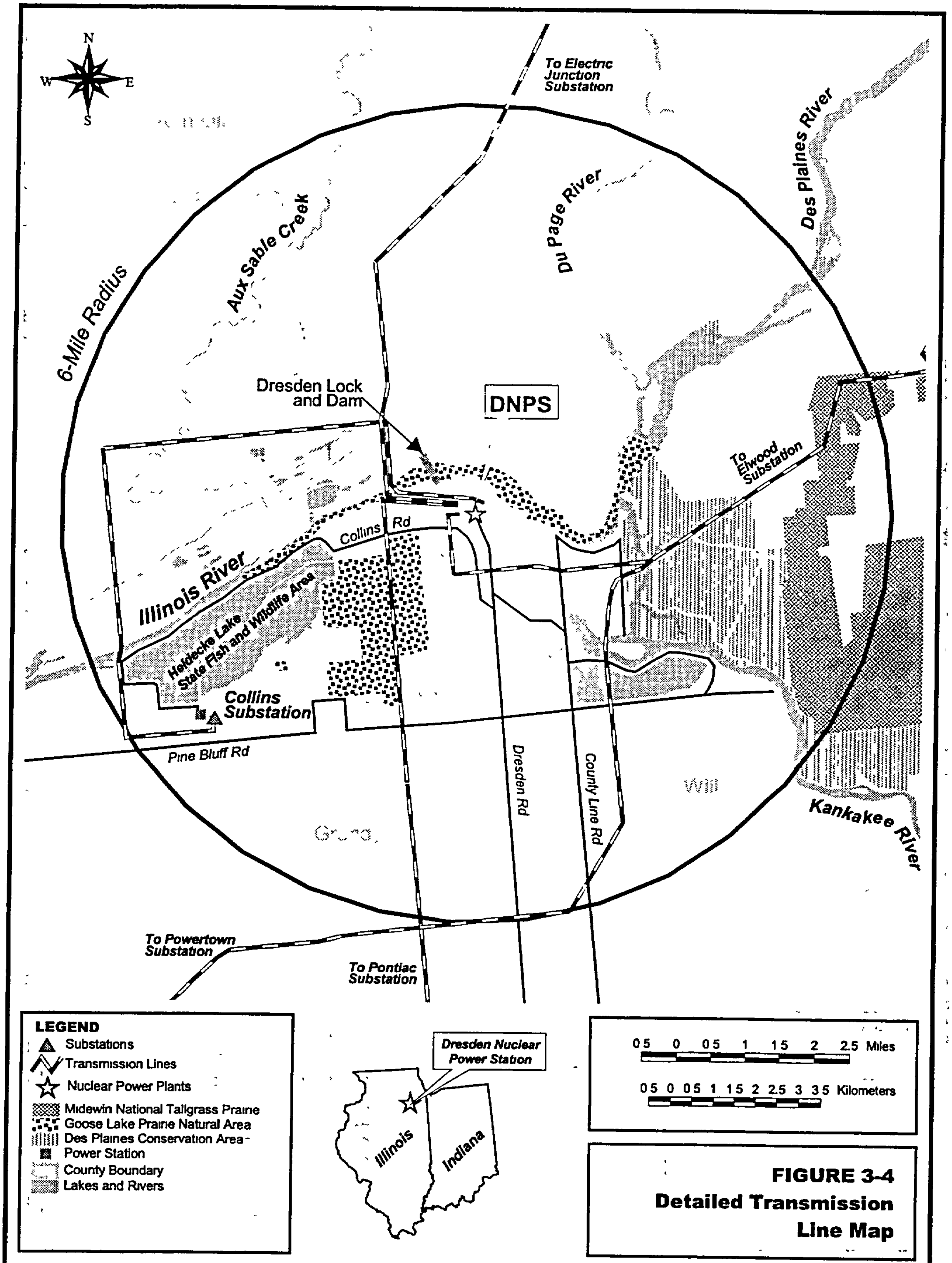


FIGURE 3-4
Detailed Transmission Line Map

3.5 References

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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 and potential mitigating actions associated with the renewal of DNPS operating licenses. The assessment tiers from NRC's *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996), which identified and analyzed 92 environmental issues that NRC considered to be associated with nuclear power plant license renewal. In its analysis, NRC designated each of the 92 issues as Category 1, Category 2, or NA (not applicable) and required plant-specific analysis of only the Category 2 issues.

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.

NRC rules do not require analyses of Category 1 issues because NRC resolved them and presented generic findings in 10 CFR 51, Appendix B, Table B-1. An applicant may reference the generic findings or GEIS analyses for Category 1 issues.

If the NRC analysis concluded that one or more of the Category 1 criteria could not be met, the issue was assigned as Category 2. NRC requires plant-specific analyses for Category 2 issues. NRC designated two issues as "NA" (Issues 60 and 92), signifying that the categorization and impact definitions do not apply to these issues. Appendix A of this report lists the 92 issues and identifies the environmental report section that addresses each issue.

Category 1 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)**
>
> **"...Absent new and significant information, the analysis for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant's environmental report for license renewal...." (NRC 1996, pg. 28473).**

As described in Section 3.1.2, DNPS operates a cooling pond and helper cooling towers. The Station cooling pond was created by excavating and berming former agricultural land and it does not impede the flow of a navigable system. For this reason, the NRC GEIS categorizes DNPS as a cooling pond site (NRC 1996). Ordinarily, issues associated with cooling tower environmental impacts would be inapplicable to a cooling pond site, and a license renewal environmental report would evaluate either cooling pond issues or cooling tower issues. However, EGC constructed the DNPS cooling towers after NRC prepared the GEIS, so today's Station cooling configuration was unavailable for NRC review in the GEIS. For this reason, EGC has chosen in the DNPS license renewal environmental report to assume that both cooling pond and cooling tower issues apply.

EGC has determined that, of the 69 Category 1 issues, six do not apply to DNPS because they apply to design or operational features that do not exist at the facility. In addition, because EGC does not plan to conduct any refurbishment activities, the NRC findings for the seven Category 1 issues that pertain only to refurbishment do not apply to this application. Table 4-1 lists these 13 issues and explains EGC's basis for determining that these issues are not applicable to DNPS.

Table 4-2 lists the 58 Category 1 issues that EGC has determined to be applicable to DNPS (including the 2 "NA" issues for which NRC came to no generic conclusion). The table includes the findings that NRC codified and references to the supporting GEIS analysis. EGC has reviewed the NRC findings and has identified no new and significant information that would make the NRC findings inapplicable to DNPS. Therefore, EGC adopts by reference the NRC findings for these Category 1 issues.

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 address each of these issues, beginning with a statement of the issue. As is the case with Category 1 issues, some Category 2 issues apply to operational features that DNPS does not have. In addition, some Category 2 issues apply only to refurbishment activities. If an issue does not apply to DNPS, the section explains the basis for inapplicability.

For the 15 Category 2 issues that EGC has determined to be applicable to DNPS, analyses are provided. These analyses include conclusions regarding the significance of the impacts relative to renewal of the operating licenses for DNPS and, when applicable, discuss potential mitigative alternatives to the extent required. EGC 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, EGC 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).

"NA" License Renewal Issues

NRC determined that its categorization and impact-finding definitions were not applicable (NA) to two issues (Issues 60 and 92); however, EGC included these issues in Table 4-2. Applicants currently do not need to submit information on chronic effects from electromagnetic fields (10 CFR 51, Appendix B, Table B-1, Footnote 5). For environmental justice, NRC does not require information from applicants, but noted that it will be addressed in individual license renewal reviews (10 CFR 51, Appendix B, Table B-1, Footnote 6). EGC has included minority and low-income demographic information in Section 2.6.2.

4.1 Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a Small River with Low Flow)

NRC

"...If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup 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." 10 CFR 51.53(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.

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 several closed-cycle plants (e.g., Limerick and Palo Verde) 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).

As discussed in Section 3.1.2, DNPS operates a closed- and indirect open-cycle cooling system that includes cooling towers, cooling water canals, and a cooling pond. Makeup water for the cooling system is withdrawn from the Kankakee River at its confluence with the Des Plaines River. The Kankakee and Des Plaines Rivers combine to form the Illinois River. The Dresden Island Lock and Dam forms a pool in the Illinois River at the confluence. During periods of average to high flow, water is predominantly removed from the Kankakee River. During periods of low flow, water flow from the Des Plaines River comprises a larger portion of the DNPS influent. Cooling water discharges to the Illinois River except during the winter months when approximately 70,000 gallons per minute (gpm) of water from the cooling pond may be siphoned to the Kankakee River as part of a de-icing program.

This issue is applicable to DNPS because the plant uses cooling canals, a cooling pond and cooling towers, and ultimately discharges to the Illinois River, which has a mean annual flow of 3.4×10^{11} cubic feet per year (USGS 2000a) at the confluence of the two rivers and is categorized as a small river (see Section 2.2.1). The annual mean flow of the Illinois River at the U.S. Geological Survey gaging station at Marseilles, Illinois, was used to represent flow at the Des Plaines River and Kankakee River confluence. This gaging station is the closest U.S. Geological Survey station to the Station on the Illinois River, approximately 26.5 river miles downstream of DNPS. The flow used extends over the period from water years (October through September) 1920 to 1999. The flow data also indicates a historical lowest recorded daily mean flow of 1,460 cubic feet per second (cfs) occurred on October 16, 1943 and November 10, 1999 (USGS 2000a).

As stated in Section 3.1.2, DNPS withdraws during indirect open-cycle operation up to 2,099 cfs (940,000 gpm) water from the Kankakee River side of the Dresden Pool for condenser cooling.

During closed-cycle operation, approximately 156 cfs (70,000 gpm) is withdrawn from the Kankakee River side of the Dresden Pool to compensate for evaporative, seepage, and blowdown losses in the cooling pond. Approximately 45 cfs (20,196 gpm) of the river water withdrawn is makeup water for that lost to evaporation and seepage from the cooling pond. Approximately 29 percent (20,196/70,000) of the water withdrawn is lost to evaporation and seepage during this cycle; this represents 3 percent (45/1,460) of the historical lowest recorded daily mean flow.

During the indirect open-cycle operation, approximately 87 cfs (39,240 gpm) of the water withdrawn is makeup water for that lost to evaporation and seepage from the cooling pond (50 cfs or 22,435 gpm) and cooling towers (37 cfs or 16,800 gpm). Therefore, approximately 4.2 percent (39,240/940,000) of the water withdrawn is lost to evaporation and seepage. Makeup water represents approximately 6 percent (87/1,460) of the historical lowest recorded daily mean flow for the Illinois River near Marseilles, Illinois.

Changes in the Dresden Pool level at the confluence of the Kankakee and Illinois Rivers caused by DNPS operations (i.e., evaporative losses and seepage) are small. Any impacts from DNPS on instream and riparian communities in the area of the DNPS intakes over the license renewal term would be small and would not warrant 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**

NRC made impacts on fish and shellfish resources resulting from entrainment a Category 2 issue, because it could not assign a single significance level (small, moderate, or large) to the issue. The impacts of entrainment are small at many plants, but they may be moderate or large at others. Also, ongoing restoration efforts may increase the number of fish susceptible to intake effects during the license renewal period (NRC 1996). Information needed to address this issue includes the type of cooling system employed (once-through or cooling pond) and the current Clean Water Act (CWA) Section 316(b) determination or equivalent state documentation.

As Section 3.1.2 describes, DNPS utilizes a cooling pond heat dissipation system, withdraws from the Kankakee River, discharges to the Illinois River, and can operate in either an indirect open-cycle or closed-cycle mode.

Section 316(b) of the CWA requires that any standard established pursuant to Sections 301 or 306 of the CWA shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts (33 USC 1326). Entrainment through the condenser cooling system of fish and shellfish in early life stages is a potential adverse environmental impact that can be minimized by the best available technology.

On February 28, 1977, ComEd submitted its original Section 316(b) Demonstration for DNPS to the U.S. Environmental Protection Agency (EPA). In October 1977, EPA Region V delegated authority to the State of Illinois to manage the State's National Pollutant Discharge Elimination System (NPDES) program.

The current NPDES permit for DNPS (NPDES Permit No. IL0002224) notes in Special Condition 8 that:

> "Pursuant to Section 316(b) of the Clean Water Act, a determination for the Dresden Nuclear Power Station

has not been made. Data submitted by Commonwealth Edison Company pursuant to Section 316 (b) of the CWA for the Dresden Nuclear Power Station has been reviewed by the Illinois Environmental Protection Agency and the review determination is: That whereas additional intake monitoring is not being required at this time, further monitoring is not precluded if determined necessary at the time of any modification or reissuance of NPDES Permit No. IL0002224."

Thus, the state determined that it could issue the DNPS permit without requiring additional monitoring, but reserved its right to require monitoring in the future. The DNPS NPDES permit, included as Appendix B of this environmental report, constitutes the Station's CWA Section 316(b) determination.

As noted in Section 2.2.2, EGC has monitored the fish community in the vicinity of DNPS since the late 1960s and has conducted a variety of studies designed to detect possible environmental impacts of DNPS operations on the fish community. There have been no measurable changes in the local fishery and no indications that entrainment has had a destabilizing impact on fish populations. Naturally occurring environmental perturbations (e.g., droughts, floods, and severe winters) and the influence of upstream discharges to the Upper Illinois River Basin from various industrial operations appear to influence fish populations more than Station operations. EGC concludes that impacts to fish and shellfish from entrainment are small, and no mitigation is required.

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

NRC made impacts on fish and shellfish resources resulting from impingement a Category 2 issue, because it could not assign a single significance level to the issue. Impingement impacts are small at many plants, but might be moderate or large at other plants (NRC 1996). Information needed to address this issue includes the type of cooling system employed (once-through or cooling pond) and the current CWA 316(b) determination or equivalent state documentation.

As discussed in Section 4.2, ComEd submitted to the EPA a CWA Section 316(b) Demonstration for DNPS on February 28, 1977. The demonstration also evaluated impingement at DNPS. The state no longer requires DNPS to perform impingement sampling (Illinois Department of Conservation 1987).

As noted in Section 4.2, the current NPDES permit for DNPS constitutes the Station's CWA Section 316(b) determination. It is provided as Appendix B of this report.

EGC's monitoring of the fish community in the vicinity of the Station since the late 1960s, which combined a variety of studies designed to detect possible environmental impacts of DNPS operations on the fish community, has revealed no measurable changes in the local fishery and no indications that impingement has had a destabilizing impact on fish populations. Naturally occurring environmental perturbations (e.g., droughts, floods, and severe winters) combined with the influence of upstream discharges to the Upper Illinois River Basin from various industrial operations appear to influence fish populations more than DNPS operations. EGC concludes that impacts to fish and shellfish from impingement are small, and no mitigation is warranted.

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 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**

NRC made impacts on fish and shellfish resources resulting from heat shock a Category 2 issue, because of continuing concerns about thermal discharge effects and the possible need to modify thermal discharges in the future in response to changing environmental conditions (NRC 1996). Information needed to address this issue includes the type of cooling system employed (once-through or cooling pond) and evidence of a CWA Section 316(a) variance or equivalent state documentation.

As Section 3.1.2 describes, DNPS utilizes a cooling pond, withdraws from the Kankakee River and discharges to the Illinois River, and can operate in either an indirect open-cycle or closed-cycle mode. As discussed below, EGC also has Section 316(a) alternative thermal effluent limits.

Section 316(a) of the CWA establishes a process whereby a thermal effluent discharger can demonstrate that thermal discharge limitations are more stringent than necessary to protect a balanced indigenous population of fish and wildlife, and can obtain alternative facility-specific thermal (i.e., a variance) discharge limits (33 USC 1326). ComEd complied with 35 Illinois Administrative Code 302.211(f) and Section 316(a) of the CWA in demonstrating that the thermal discharge from DNPS has not caused and cannot be reasonably expected to cause significant ecological damage to receiving waters as approved by the Illinois Pollution Control Board (PCB) in PCB Order 73-359 (January 17, 1974) and PCB Order 73-134 (July 9, 1981). ComEd submitted a Section 316(a) Demonstration on July 6, 1977, to EPA. Special Condition 7 of the current NPDES Permit (No. IL0002224; Appendix B) refers to this submittal and further states that, pursuant to 35 Illinois Administrative Code 302.211(g), no additional monitoring or modification is now being required for reissuance of this NPDES Permit. This variance approval has become part of each subsequent NPDES Permit as a Special Condition since the initial submittal.

Based on results of the CWA Section 316(a) Demonstration and approval from the Illinois Environmental Protection Agency (IEPA), issuance of an NPDES permit, and monitoring of the fish community since the 1960s, EGC concludes that this environmental impact is small and does not warrant further assessment or mitigation.

4.5 Groundwater Use Conflicts

> **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 gallons per minute (gpm), a cone of depression could extend offsite. This could deplete the groundwater supply available to offsite users, creating an impact that could warrant mitigation. Information needed to address this issue includes the DNPS groundwater withdrawal rate (whether greater than 100 gpm), offsite drawdown, and impact on neighboring wells

Based on information presented in Section 3.1.2, the DNPS sustained groundwater use is less than 100 gpm. Therefore, the issue of groundwater use conflicts does not apply.

4.6 Groundwater Use Conflicts (Plants Using Cooling Towers or Cooling Ponds that Withdraw Makeup Water from a Small River)

> **NRC**
>
> **"... If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river whose annual flow rate is less than $3.15 \times 10^{12} ft^3$ / year.... The applicant shall also provide an assessment of the impact 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 a Category 2 issue because the significance of the indirect groundwater use conflict resulting from surface water withdrawals could not be determined without site-specific information (NRC 1996). Information needed to address this issue includes river flow characteristics, surface water withdrawals, and impacts to alluvial aquifer recharge.

This issue is applicable to DNPS because the plant uses cooling towers and a cooling pond, and withdraws makeup water from the Des Plaines-Kankakee River confluence, which has a mean annual flow of 3.4×10^{11} cubic feet per year (10,781 cfs) and is categorized as a small river (see Section 2.2.1). The historical low mean daily flow is 1,460 cfs (USGS 2000a).

As discussed in Section 2.2.1, these flow values are for the gage at Marseilles, Illinois, approximately 26.5 miles downstream of the confluence of the Kankakee and Des Plaines Rivers. The Dresden Pool, formed as part of the lock and dam system installed along the river, encompasses the confluence of the Kankakee and Des Plaines Rivers.

As noted in Section 4.1, data for the site indicates that approximately 45 cfs of makeup water is used to replace that lost to evaporation and seepage during the closed-cycle is used operation and 87 cfs of makeup water is used during the indirect open-cycle operation. These losses represent approximately 29 percent and 4.2 percent, respectively, of the cooling water removed from the Kankakee River side of the Dresden Pool confluence. Maximum makeup water use (87 cfs during indirect open-cycle operation) represents approximately 6 percent of the historical lowest recorded daily mean flow (87/1,460) reported by the U.S. Geological Survey in its 1999 annual report (USGS 2000a).

The site is located within the glaciated section of the Central Lowlands physiographic province. Rivers in the area typically cut through the glacial drift and form meandering streams with well-developed alluvial floodplains. The Kankakee and Des Plaines Rivers are typical of the area. The surrounding area is characterized by a surficial water table aquifer in the glacial drift (AEC 1973). Water flow within a surficial aquifer in glacial drift typically ranges from very slow to fast, depending on the amount of sand in the soils encountered. Flow is generally toward rivers and streams, but may follow sand lenses within the glacial material parallel or away from surface water courses.

The DNPS cooling pond is expected to have no significant impact on the alluvial aquifer in the vicinity of the Station during periods of low natural stream flow. The DNPS withdrawal location is between the site on the Kankakee River side of the Pool and opposite the confluence of the two rivers, limiting any radius of influence that withdrawal would create. The controlled water elevation maintained by Dresden Lock and Dam provides a consistent level of surface water that interacts with the alluvial aquifer. Continued operation of DNPS will not affect the water transfer equilibrium between these surface and ground waters. Some of the cooling water pumped to the cooling canals and the cooling pond is returned directly to the surficial aquifer through infiltration (AEC 1973), thereby limiting the impact of any loss of water to the aquifer. Loss of water within the pool from pumping would be compensated by adjusting pool releases to maintain water level. Poor water quality in the rivers, especially the Des Plaines River, also limits use of the glacial alluvial aquifer in this area as a potable water source. Therefore, EGC concludes that impacts due to groundwater use conflicts would be small, if detectable, and mitigation 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 groundwater depression beyond the site boundary. Impacts of large groundwater 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**

The issue of groundwater use conflicts does not apply to DNPS, because the plant does not use Ranney wells. As Section 3.1.2 describes, DNPS uses a cooling pond heat dissipation system that withdraws from the Kankakee River side of the Dresden Pool and discharges to the Illinois River, just downstream of the Station.

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 water groundwater quality. For plants located inland, the quality of the groundwater 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 groundwater quality degradation a Category 2 issue because concentration(s) of contaminants in cooling ponds could adversely affect the quality of shallow groundwater resources. (NRC 1996). Information needed to address this issue includes the degree to which cooling pond water might recharge groundwater resources and, if likely, the extent of possible contamination, and mitigation measures that would be warranted.

The issue of groundwater degradation applies to DNPS because the Station uses a cooling pond. As Section 3.1.2 describes, DNPS employs a cooling pond that covers approximately 1,275 acres and has an average depth of 10 feet. The pond contains approximately four billion gallons of water with a circulation time of about 2.5 days. The chemical makeup of the cooling pond is essentially that of the Kankakee River. A five-year study (1969 - 1973) of water quality indicated very little difference between samples collected and analyzed from the water intake location and from the cooling pond discharge. The lack of any significant change between these sampling locations strongly suggests that there is no impact of DNPS on surface water quality past the confluence of the rivers (ComEd 1974).

In addition, a 1981 water quality study (Brinker 1981) performed by Commonwealth Edison compared cooling pond water quality to that at the intake (i.e., Kankakee River). The results of the study indicated that during low flow periods when parameter concentrations were high at the intake, significant improvements in water quality were noted at the discharge point for fecal coliform, iron, manganese, and total suspended solids. This would indicate that some of these constituents may be retained within the cooling pond system. Due to the presence of the cooling pond within the glacial drift aquifer, a concentration of constituents within the cooling pond could potentially migrate to the glacial aquifer and eventually return to the Kankakee River or to the Illinois River. Because there is only minor interaction between the cooling pond/glacial drift aquifer and the shallow dolomite aquifer and the shallow dolomite aquifer is isolated from the Cambrian-Orodovician aquifer (the source for municipal and industrial water) (AEC 1973), DNPS concludes that any impacts are small from continued operation and would not warrant mitigation.

4.9 Impacts of Refurbishment on Terrestrial Resources

NRC

The environmental report must contain an assessment of "...the impacts 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 resources 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 1996, Section 3.6, pg. 3-6)

The issue of impacts of refurbishment on terrestrial resources is not applicable to DNPS because, as discussed in Section 3.2, EGC has no plans for refurbishment or other license-renewal-related construction activities at DNPS.

4.10 Threatened or Endangered Species

> **NRC**
>
> **"... 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 1996).

Section 2.4 discusses ecological habitats at DNPS and along associated transmission lines. Section 2.5 discusses threatened or endangered terrestrial and aquatic species that may occur at DNPS or along associated transmission lines. As discussed in Section 3.2, EGC has no plans to conduct refurbishment or construction at DNPS during the license renewal period. Therefore, there would be no refurbishment-related impacts to threatened or endangered species, and no further analysis of refurbishment-related impacts is applicable.

EGC has corresponded with the state of Illinois and the U.S. Fish and Wildlife Service regarding the presence of threatened or endangered species in the project area and potential impacts to those species. Copies of this correspondence are provided in Appendix C.

EGC is not aware of any resident threatened or endangered terrestrial species being present at DNPS or along the associated transmission corridors. The presence of transient species is possible, but EGC is aware of no DNPS or transmission activities that would adversely impact species that might occur. EGC has no plans for the license renewal term that would alter the conclusion that DNPS has no adverse impacts on threatened and endangered species.

As stated in Section 2.5, EGC has not found any federally listed threatened or endangered aquatic species in the vicinity of DNPS. However, three species of fish on the Illinois state list have been reported and their distribution and abundance are discussed in Section 2.5. Therefore, because EGC has no plans to alter the current aquatic ecosystem in the vicinity of DNPS and resource agencies contacted by EGC provided no serious concerns about relicensing impacts to the aquatic ecosystem, EGC concludes that adverse impacts to threatened or endangered species from license renewal, if any, would be small and mitigation is not warranted.

4.11 Air Quality During Refurbishment (Non-Attainment and 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**

Air quality during refurbishment is not applicable to DNPS because, as discussed in Section 3.2, EGC has no plans for refurbishment at DNPS.

4.12 Impact on Public Health of Microbiological Organisms

> **NRC**
>
> **"If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river having an annual average flow of less than $3.15 \times 10^{12} ft^3$/year ($9 \times 10^{10} m^3$/year), an assessment 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 for facilities using cooling ponds, lakes, or canals that discharge to small rivers, NRC designated impacts on public health from thermophilic organisms a Category 2 issue. Information needed to address this issue includes the mean flow of the Illinois River, and favorability of the discharge (particularly temperature) to the survival of thermophilic organisms.

This issue is applicable to DNPS because the plant uses cooling canals, a cooling pond, and ultimately discharges to the Illinois River, which has an average annual flow of 3.4×10^{11} cubic feet per year at the gaging station at Marseilles, Illinois, about 26.5 miles downstream of DNPS and is categorized as a small river (USGS 2000b). Also, there is public access to the Illinois River, including recreational fishing, swimming, water skiing, and boating.

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.

Pathogenic bacteria have evolved to survive in the digestive tracts of mammals and, accordingly, have optimum temperatures of around 99 degrees Fahrenheit (°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. Thermo-philic bacteria generally occur at temperatures of 77°F to 176°F, with maximum growth at 122°F to 140°F (Joklik and Smith 1972).

From a public health standpoint, the assessment of thermophilic organisms is more relevant for the Illinois River in the vicinity of the discharge than for the DNPS cooling pond or discharge canals, because there is no public access to the pond or discharge canals.

The mean maximum monthly discharge temperature at DNPS from January 1998 through September 2001 was 80.3 °F with a range of monthly maximum temperatures from 55.1 °F in February 1999 to 100.5 °F in

July 1999. During the warmer months (May through October), the river temperatures could support survival of these organisms; however these temperatures are generally below the range most conducive to the growth of thermophilic microorganisms.

Another factor controlling the survival and growth of thermophilic organisms in the Illinois River in the vicinity of the discharge is the disinfection of DNPS sewage treatment plant effluent. This reduces the likelihood that a seed source or inoculant will be introduced into the cooling canals, pond, and ultimately into the Illinois River.

Fecal coliform bacteria are regarded as indicators of other pathogenic microorganisms, and are the organisms normally monitored by state health agencies. The NPDES permit for DNPS requires weekly monitoring of fecal coliforms in the sewage treatment plant effluent from May through October. The NPDES permit specifies a daily maximum of 400 organisms per 100-milliliter sample (400/100 ml) (IEPA 2000). The limit was exceeded once during the past three years. The exceedance observed in October 1999 of 3,400/100 ml resulted from a loss of power to the ultraviolet disinfection system. A repeat sample collected two days later indicated that no fecal colonies were present (ComEd 1999).

It should also be noted that waterborne-disease outbreaks are generally rare and depend upon specific exposure conditions. The Centers for Disease Control and Prevention reports on waterborne-disease outbreaks throughout the United States. From 1977 to 1998, a total of 18 states reported 32 outbreaks associated with recreational water, which includes both thermophilic and non-thermophilic microorganisms as confirmed etiological agents (CDC 2000). Most of the outbreaks associated with thermophilic micro-organisms involved swimming and wading pools, hot tubs, and springs. Fecal contamination was frequently a contributing factor. In 1998, only four cases of disease attributable to *Naegleria* were confirmed in the entire United States (CDC 2000), none associated with power plant effluents. *Naegleria* infection usually occurs only in warm weather environments, when water near the bottom of a lake is forced up the nasal passage of a swimmer, and where pollution appears to be a factor (EPA 1979). However, studies have shown the absence of *Naegleria* infection and related disease among swimmers in lakes with high numbers of the pathogenic organism present (EPA 1979). Statistical evidence reported by the Centers for Disease Control and Prevention provides evidence that thermophilic organisms present a low risk to the public.

Given the thermal characteristics of the Illinois River in the vicinity of the DNPS discharge and disinfection of the station's treated sewage effluent, DNPS plant operations will not stimulate growth or reproduction of thermophilic micro-organisms.

EGC has written the Illinois Department of Public Health and the Illinois Environmental Protection Agency requesting information on any studies either agency or their contractors might have conducted of thermophilic microorganisms in the Illinois River in the vicinity of DNPS, and any concerns they might have relative to these organisms. Based on agency responses and the discussion in this section, EGC concludes that the impact of microbiological organisms is small and does not warrant mitigation. Copies of the consultation letters and agency responses are included in Appendix D of this environmental report.

4.13 Electromagnetic Fields - Acute Effects

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, Appendix B, 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) (IEEE 1997) criteria, NRC could not determine the significance of the electric shock potential.

In the case of DNPS, there have been no previous NRC or National Environmental Policy Act analyses of transmission-line-induced current hazards. Therefore, this section provides an analysis of the Station transmission lines' conformance with the NESC standard. The analysis is based on computer modeling of induced current under the lines.

Objects 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 discharge of the capacitive charge through the person's body to the ground. After the initial discharge, a steady-state current can develop of which the magnitude 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 charged object on the ground
- the extent to which the object is grounded.

In 1977, the NESC adopted a provision that describes an additional criterion to establish minimum vertical clearances to the ground for electric lines having voltages exceeding 98-kilovolt (kV) alternating current to ground.[1] The clearance must limit the steady-state induced current[2] 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.

As described in Section 3.1.3, there are seven 345-kV lines that were specifically constructed to distribute power from DNPS to the electric grid. EGC's analysis of these transmission lines began by identifying the limiting case for each line. The limiting case is the configuration along each line where the potential for current-induced shock would be greatest. Once the limiting case was identified, EGC calculated the electric field strength for each transmission line, then calculated the induced current.

EGC calculated electric field strength and induced current using a computer code called AC/DCLINE, produced by the Electric Power Research Institute (EPRI 1991). The results of this computer program have been field-verified through actual electric field measurements by several utilities. The input parameters included the design features of the limiting-case scenario, the NESC® requirement that line sag be determined at 120 degrees Fahrenheit conductor temperature, and the maximum vehicle size under the lines as a tractor-trailer truck.

The largest modeled induced current under the DNPS transmission lines is 5.2 milliamperes. The NESC standard (5 milliamperes) for preventing electric shock from induced current contains a single significant digit. Therefore, EGC concludes that all seven DNPS transmission lines conform to the NESC provisions for preventing electric shock from induced current. The results for each transmission line are provided in Table 4-3. Details of the analysis, including the input parameters for each line's limiting case, can be found in (TtNUS 2001).

ComEd surveillance and maintenance procedures provide assurance that design ground clearances will not change. These procedures include inspection on a regular basis. Routine aerial patrols of all corridors include checks for encroachments, broken conductors, broken or leaning structures, and signs of trees burning, 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, which might fall on the transmission lines. Problems noted during any inspection are brought to the attention of the appropriate organizations for corrective action.

EGC's assessment under 10 CFR 51 concludes that electric shock is of small significance for the DNPS transmission lines and, therefore, mitigation measures, such as installing warning signs at road crossings or increasing clearances, are not warranted. This conclusion would remain valid into the future, provided there are no changes in line use, voltage, current, and maintenance practices and no changes in land use under the lines.

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1. Part 2, Rules 232C1c and 232D3c.
2. The NESC and the GEIS use the phrase "steady-state current," whereas 10 CFR 51.53(c)(3)(ii)(H) uses the phrase "induced current." The phrases mean the same here.

4.14 Housing Impacts

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, Appendix B, 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, Section 4.7.1).

NRC made housing impacts a Category 2 issue, because impact magnitude depends on local conditions that the NRC could not predict for all plants at the time of GEIS publication (NRC 1996). Information needed to address this issue includes the population categorization as small, medium, or high, and the applicability of growth control measures. As used in the GEIS, "growth control measures" constitute institutional controls that would limit the market's ability to meet a demand for additional housing.

Refurbishment activities and continued operations could result in housing impacts due to increased staffing. As described in Section 3.2, EGC does not plan to perform refurbishment. EGC concludes that there would be no refurbishment-related impacts to area housing and no analysis is therefore required. Accordingly, the following discussion focuses on impacts of continued operations on local housing availability.

As described in Section 2.6, DNPS is located in a high population area. Section 2.9 describes area zoning. The main purposes of zoning are to (1) separate conflicting land uses, (2) ensure that new development is located according to a plan, and 3) promote quality development that will not harm the health, safety, and welfare of the public (Daniels 1995). Thus, whereas zoning is an institutional tool that could be used to limit growth, it can be and most frequently is a growth guidance mechanism. EGC's analysis of the DNPS-area zoning indicates that it is used to guide, not limit, growth. Therefore, EGC concludes that growth control measures are not in effect in the DNPS area. 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. Therefore, EGC concludes housing impacts to be small.

This conclusion is supported by the following site-specific housing analysis. The maximum impact to area housing is calculated using the following assumptions: (1) all direct and indirect jobs would be filled by in-migrating residents; (2) the residential distribution of new residents would be similar to current worker distribution; and (3) each new job created (direct and indirect) represents one housing unit. As described in Section 3.4, approximately 72 percent of the DNPS employees reside in Will and Grundy Counties. Therefore, the focus of the housing impact analysis is on these areas. As also discussed in Section 3.4, EGC conservatively assumes 60 license renewal employees could generate the demand for 171 housing units (60 direct and 111 indirect jobs). If it is assumed that 72 percent of the 171 new workers would locate in Will and Grundy Counties, consistent with current employee trends, approximately 123 housing units would be required in these two counties. In an area that has a population of more than 500,000, this demand would not create a discernible change in housing availability, rental rates or housing values, or spur housing construction or conversion. EGC concludes that impacts to housing availability resulting from Station-related population growth would be small and would not warrant mitigation.

4.15 Public Utilities: Public Water Supply Availability

> **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)(I)**
>
> **"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, Section 3.7.4.5).**

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 to address this issue includes a description of water shortages experienced in the area and an assessment of the available capacity of the public water supply systems.

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. Section 3.4 describes potential population increases, and Section 2.6 describes the distribution of that population in the area associated with license renewal activities at DNPS. Section 2.10.1 describes the public water supply systems potentially affected by license renewal activities, their permitted capacities, and current demands. DNPS does not use water from a municipal system; therefore, EGS concludes DNPS will not have an effect on local water supplies. As discussed in Section 3.2, no refurbishment is planned for DNPS and no refurbishment impacts are therefore expected.

The impact to the local water supply systems resulting from Station-related population growth can be determined by calculating the amount of water that would be required by these individuals. The average American uses between 50 and 80 gallons per day for personal use (Fetter 1980). As described in Section 3.4, EGC's conservative assumption of 60 license renewal employees could generate a total of 171 new jobs, with 123 of the new employees residing in Will and Grundy Counties. This would result in a population increase of 326 in the area (123 jobs multiplied by 2.65, which is the average number of persons per household in Illinois) (USCB 1999). Using the average consumption rate, the plant-related population increase would require an additional 26,080 gallons per day (326 people multiplied by 80 gallons per day). If it is assumed that this increase is distributed across the two potentially affected counties, consistent with current employee trends, the increase in water demand would represent an insignificant percentage of capacity for the water supply systems in these counties (see Section 2.10.1 for a discussion of the current capacities of these systems). EGC concludes that impacts to public water supplies resulting from DNPS-related population growth would be small, requiring no additional capacity and not warranting mitigation.

4.16 Education Impacts from Refurbishment

NRC

> The environmental report must contain "...an 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)(I)
>
> "...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, Appendix B, 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 generally are 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 greater than 8 percent...." (NRC 1996, Section 3.7.4.1).

This issue is not applicable to DNPS because, as Section 3.2 discusses, EGC has no plans for refurbishment at DNPS.

4.17 Offsite Land Use

4.17.1 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)(I)**
>
> **"...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, Section 3.7.5).**

This issue is not applicable to DNPS because, as Section 3.2 discusses, EGC has no plans for refurbishment at DNPS.

4.17.2 LICENSE RENEWAL TERM

NRC

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

"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)

"If 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 pre-established 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 adverse by others. Therefore, NRC could not assess the potential significance of site-specific offsite land-use impacts (NRC 1996). Site-specific factors to consider in an assessment of new tax-driven land-use impacts include the size of plant-related population growth compared to the area's total population, the size of the plant's tax payments relative to the community's total revenue, the nature of the community's existing land-use pattern, and 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).

<u>Population-Driven-Related Impacts</u>

Based on the GEIS case-study analysis, NRC concludes 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 areas" total population than the percentage presented by operations-related growth (NRC 1996).

<u>Tax-Revenue-Related Impacts</u>

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 (NRC 1996).

NRC further determined that, if a plant's tax payments are projected to be a dominant source of a local government's total revenue (i.e., greater than 20 percent of revenue), new tax-driven land-use changes would be large.

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.

Tables 2-5 and 2-6 provide a comparison of total tax payments made by EGC to Grundy and Will Counties and their respective County levee extensions. For the 3-year period from 1997 through 1999, EGC's tax payments to Grundy County represented approximately 20 percent of the County's total levee extensions and 21 percent of Grundy County's total collections available for distribution. Using NRC's criteria, EGC's tax payments are of large significance to Grundy County. EGC's contribution is less than one percent of Will County's extensions and is therefore considered negligible. For the following three reasons, however, EGC does not anticipate large land-use changes as a result of company tax payments.

First, as described in Section 3.2, EGC does not anticipate refurbishment or construction during the license renewal period. Therefore, EGC does not anticipate any increase in the assessed value of DNPS due to refurbishment-related improvements nor any related tax-increase-driven changes to offsite land use and development patterns.

Next, there has been additional economic and population growth in the Will and Grundy County areas which may be attributable to the expansion of the Chicago metropolitan area economy (and its resultant suburbs). Areas sectioned along the major eastbound transportation corridors leading to Chicago have seen the largest commercial and residential development. Land-use changes that have occurred as a result of this expansion are not attributable to the DNPS-generated tax payments. The expansion has been largely fueled by market forces, which have had large impacts on the surrounding area. Though DNPS has been a dominant source of tax revenue for Grundy County, the County has not experienced large land-use changes that may be attributable to DNPS tax payments, alone. EGC believes the continued operation of DNPS to be an important contribution in the County's ability to provide basic development guidance and public services. EGC anticipates no plant-induced changes to local land use or development patterns as a result of license renewal.

Finally, EGC projects that DNPS' annual property taxes will not remain constant throughout the license renewal period. In 1997, the State of Illinois deregulated the utility industry which, in turn, changed the methods of plant value assessment. EGC has reassessed the utility's tax payments to the counties. Before deregulation, the utility's tax payments were derived using depreciated book value assessments. Since deregulation, payments are derived using fair market value assessments. Because economic conditions and market forces influence fair market values, current fair market values are significantly less than depreciated book values. Therefore, county property tax revenues will be somewhat lower than in the past. For this reason, EGC negotiated with the counties to develop a payment schedule so that its reduced contribution will not cause dislocation to these districts. The agreement will give the counties time to adapt to the anticipated reduction in revenue.

Conclusion

EGC views the continued operation of DNPS as a significant benefit to Grundy and Will Counties economies through its direct and indirect payroll expenditures and tax contributions. Because (1) population growth related to the license renewal of DNPS is expected to be relatively small, (2) land-use changes are projected to be largely influenced by the expansion of the Chicago metropolitan area, and (3) the license renewal-related tax impacts to Grundy County land use are large, EGC concludes that renewal of DNPS' licenses would have a continued beneficial impact on Grundy and Will Counties. However, deregulation-related corporate tax obligations could cause a measure of economic difficulty for the Counties and their districts. While tax base impacts are considered large now, the impacts may be smaller in the future as EGC's levee declines. Station-related tax revenues have a positive impact on surrounding communities and their reduction is likely to create a measurable level of hardship.

4.18 Transportation

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 renewal 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 the additional workers and 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 a free flowing traffic stream where users are unaffected by the presence of other users (level of service A) or stable flow in which the freedom to select speed is unaffected but the freedom to maneuver is slightly diminished (level of service B)." (NRC 1996, Section 3.7.4)

NRC made impacts to transportation a Category 2 issue, because impact significance is determined primarily by road conditions existing at the time of the project, which NRC could not forecast for all facilities (NRC 1996). Local road information needed to address this issue includes the level of service conditions and incremental increases in traffic associated with refurbishment activities and license renewal staff.

As described in Section 3.2, no major refurbishment is planned and no refurbishment impacts to local transportation are therefore anticipated.

As discussed in Section 2.10.2, traffic count information is available for DNPS area roads, but level-of-service information is not. EGC's DNPS workforce includes approximately 870 permanent and 120 to 130 contract and matrixed employees. Approximately once a year, roughly 760 additional workers join the permanent workforce for a refueling outage. Each unit will be refueled on a staggered 24-month cycle. EGC's conservative assumption of 60 additional employees associated with license renewal for DNPS represents a 5.7 percent increase in the current number of employees and an even smaller percentage of employees present onsite during refueling outages. Given these employment projections and the average number of vehicles per day currently using the surrounding roads to DNPS (Table 2-9), EGC concludes that impacts to transportation would be small and mitigative measures would be unwarranted.

4.19 Historic and Archaeological Resources

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, Section 3.7.7)

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).

EGC does not plan any refurbishment activities, therefore no refurbishment-related impacts to historic or archaeological resources are anticipated.

As described in Section 2.12, EGC did not perform an archaeological survey prior to DNPS construction. However, a number of historical and archaeological sites are located within the vicinity and during DNPS construction, one archaeological site was identified within the site boundary. The in-boundary site was surveyed by an archaeologist and determined to be "minimally disturbed" by construction activities. The Final Environmental Statement also determined that DNPS construction did not affect the archaeological or historical sites outside of the boundary (AEC 1973). Section 2.12 lists National Historic Register sites of significance located within a six-mile radius of the Station. EGC has consulted with the Illinois Historic Preservation Agency regarding whether any historic/archaeological properties would be impacted by the proposed action. The Deputy State Historic Preservation Officer replied that no historical properties would be affected. Copies of the consultation letter and agency response is included in Appendix E of this environmental report.

EGC is not aware of any historic or archaeological sites that are being or have been impacted by DNPS operations, facility, or ROW management. EGC does not expect current practices to change as a result of license renewal. Based on the information accumulated at this time, EGC concludes that the continued use of facilities, transmission lines, and ROWs is projected to cause little or no impact on historic sites over the license renewal term.

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**

The purpose of this subsection is to summarize the SAMA analysis process and results. Appendix F provides a detailed description of the material presented here.

4.20.1 METHODOLOGY

The methodology selected for this analysis involves identifying those SAMA candidates that have the highest potential for reducing core damage frequency and person-rem risk and determining whether or not the implementation of those candidates is beneficial on a cost-risk reduction basis. This process consists of the following steps:

- Dresden Probabilistic Safety Assessment (PSA) Model – Use the Dresden Nuclear Power Station (DNPS) PSA model as the basis for the analysis.
- Level 3 PSA Analysis – Use DNPS Level 1 and 2 PSA output and site-specific meteorology, demographic, land use, and emergency response data as input in performing a Level 3 probabilistic safety assessment (PSA) using the MELCOR Accident Consequences Code System Version 2 (MAACS2).
- Baseline Risk Monetization – Use NRC regulatory analysis techniques, calculate the monetary value of the unmitigated DNPS severe accident risk. This becomes the maximum averted cost-risk that is possible.
- Phase I SAMA Analysis – Identify potential SAMA candidates based on DNPS, NRC, and industry documents. Screen out Phase 1 SAMA candidates that are not applicable to the DNPS design or are of low benefit in boiling water reactors (BWRs) such as DNPS, candidates that have already been implemented at DNPS or whose benefits have been achieved at DNPS using other means, and candidates whose estimated cost exceeds the maximum possible averted cost-risk.
- Phase II SAMA Analysis – Calculate the risk reduction attributable to each remaining SAMA candidate and compare to a more detailed cost analysis to identify any net cost benefit. Probabilistic safety assessment (PSA) insights are also used to screen SAMA candidates in this phase.

- Uncertainty Analysis – Evaluate how a reduced discount value might affect the cost/benefit analyses.

- Conclusions – Summarize results and identify conclusions.

4.20.2 DRESDEN PSA MODEL

The 2002 update to the DNPS PRA is the most recent evaluation of the risk profile at the DNPS Unit 2 for internal event challenges. It is a periodic update in accordance with EGC internal guidance, ER-AA-600-1015, "Full Power Internal Events (FPIE) PRA Model Update." There have been a series of probabilistic evaluations beginning with the Individual Plant Examination (IPE) issued in 1993 as requested by the NRC in Generic Letter 88-20 (NRC 1989a).

The baseline CDF is 1.9E-6/year. The radionuclide release frequencies including LERF are provided in Section F.6.

The DNPS 2002 update includes the following changes since the 1999 update:

- Approximately 17% Extended Power Uprate (EPU) plant configuration and MAAP 4.0.4 analysis

- Revised human reliability analysis (HRA) based on the most recent operator interviews

- Revised electric power dependency logic

- Bayesian updated initiating event frequencies utilizing DNPS most recent operating experience

- Revised LOOP/DLOOP analysis for initiating event frequencies and non-recovery probabilities based upon a Midwest regional data filtering approach

- Revised mechanical and electrical ATWS probabilities, based on information in NUREG/CR-5500

- Response to DNPS BWROG Peer Review comments using the NEI PRA Peer Review Process (NEI 00-02)

- Incorporated internal flood sequences into model

- Updated selected equipment failure rates

- Added credit for feedwater in Medium LOCA event tree and added a higher HEP for operators to depressurize with a water break Medium LOCA

- Added a conditional probability of 0.1 that Recirculation Pump Seal failure results in a need for vessel makeup to the Isolation Condenser logic during Station Blackout event

- Increased the HEP for Operator Switching ECCS pump injection to the CST during decay heat removal scenarios

The DNPS PRA model update has been performed with as-built, as-operated information, current as of June 2001. This includes plant-specific initiating event data for the 4-1/2-yr period ending in June 2001.

The documentation to support the PRA Update has been compiled in a set of modularized notebooks to provide the specific information needed for the PRA Update.

The PRA computer model has been developed within the CAFTA environment. The model exists in two logic formats:

- A sequence model -- PRAQUANT

- A single top fault tree model -- ONE4ALL

Both quantification methodologies (PRAQuant and ONE4ALL) use the same PRA model logic and data input. The PRAQuant sequence quantification was retained because it provides sequence-level results and CDF contribution by accident class, which is not provided by ONE4ALL. The ONE4ALL methodology permits quantification at a lower truncation limit, consistent for every sequence, and the single top model is used for most sensitivity studies and for assessing the risk of on-line maintenance.

4.20.3 DRESDEN LEVEL 3 PSA ANALYSIS

4.20.3.1 Analysis

The MACCS2 code (Chanin and Young 1997) was used to perform the level 3 probabilistic risk assessment (PRA) for the Dresden Nuclear Power Station (DNPS). The input parameters given with the MACCS2 "Sample Problem A," which included the NUREG-1150 food model (NRC 1989b) formed the basis for the present analysis. These generic values were supplemented with parameters specific to DNPS and the surrounding area. Site-specific data included population distribution, economic parameters, and agricultural production. Plant-specific release data included the time-nuclide distribution of releases, release frequencies, and release locations. The behavior of the population during a release (evacuation parameters) was based on plant and site-specific set points (i.e., declaration of a General Emergency) and the emergency planning zone (EPZ) evacuation table (ComEd 1994). These data were used in combination with site-specific meteorology to simulate the probability distribution of impact risks (exposure and economic) to the surrounding (within 50 miles) population from the large early release accident sequences at DNPS.

4.20.3.2 Population

The population surrounding the DNPS site was estimated for the year 2031. Population projections within 50 miles of DNPS were determined using a geographic information system (GIS), U.S Census block-group level population data for 2000 allocated to each sector based on the area fraction of the census block-groups in each sector, and populations growth rates estimates for each county. The projected county growth rates were weighted by the fraction of each county in the 50-mile radius. The calculated growth rate of 1.408 from 2000 to 2031 was applied uniformly to all sectors. The distribution was given in terms of population at distances to 1, 2, 3, 4, 5, 10, 20, 30, 40 and 50 miles from the plant and in the direction of each of the 16 compass points (i.e., N, NNE, NE, NNW). The total year 2031 population for the 160 sectors (10 distances × 16 directions) in the region was estimated as 9,967,934.

4.20.3.3 Economy

MACCS2 requires the spatial distribution of certain economic data (fraction of land devoted to farming, annual farm sales, fraction of farm sales resulting from dairy production, and property value of farm and non-farm land) in the same manner as the population. This was done by updating the database in the SECPOP90 code (NRC 1997c) for each of the 21 counties surrounding the plant to a distance of 50 miles, using the methodology in NUREG/CR-6525 (NRC 1997c) and data from USBC 2001, USDC 2000, BEA 2000a, BEA 2000b, and USDA 1998. The values for up to 97 economic zones allocated to each of the 160 sectors were then calculated using SECPOP90 code with the updated economic and agricultural database.

In addition, generic economic data that are applied to the region as a whole were revised from the MACCS2 sample problem input when better information was available. These revised parameters include per diem living expenses (applied to owners of interdicted properties and relocated populations), relocation costs (for owners of interdicted properties), value of farm and non-farm wealth, and fraction of farm wealth from improvements (e.g., buildings, equipment).

4.20.3.4 Agriculture

Agricultural production information was taken from the 1997 Agricultural Census (USDA 1998). Production within 50 miles of the site was estimated based on those counties within this radius. Production in those counties, which lie partially outside of this area, was multiplied by the fraction of the county within the area of interest. Of the food crops, grain (56 percent of the total cropland, made up of corn and wheat), and legumes (46 percent of the total cropland, made up of soybeans) were harvested from the largest areas. Pasture (2.3 percent) and stored forage (1.6 percent of total cropland, consisting of hay) made up most of the remaining harvested cropland.

The lengths of the growing seasons for grains and legumes were obtained from Reference 10. The duration of the growing season for the remaining crop categories (pasture, stored forage, green leafy vegetables, roots/tubers and other food crops) was based on reasonable estimates. The uncertainty in these estimates does not have a significant impact due to the much smaller fraction of land dedicated to these crops.

4.20.3.5 Nuclide Release

The core inventory at the time of the accident was based on the input supplied in the MACCS User's Guide (Chanin and Young 1997). The core inventory corresponds to the end-of-cycle values for a 3578-MWth BWR plant. A scaling factor of 0.8264 was used to provide a representative core inventory of 2957-MWth at DNPS. Each DNPS category corresponded with a single release duration (either puff or continuous).

All releases were modeled as occurring at ground level. The thermal content of each of the releases was conservatively assumed to be the same as ambient; i.e., buoyant plume rise was not modeled.

4.20.3.6 Evacuation

Scram for each sequence was taken as time zero relative to the core containment response times. A General Emergency is declared when plant conditions degrade to the point where it is judged that there is a credible risk to the public.

The MACCS2 User's Guide input parameters of 95 percent of the population within 10 miles of the plant (Emergency Planning Zone) evacuating and 5 percent not evacuating were employed. These values have been used in similar studies (e.g., Hatch (SNC 2000), Calvert Cliffs (NRC 1999) and are conservative relative to the NUREG-1150 study, which assumed evacuation of 99.5 percent of the population within the emergency planning zone (NRC 1989a). The evacuees are assumed to begin evacuation 15 minutes (ComEd 1994) after a General Emergency has been declared and are evacuated at an average radial speed of 2.7 miles per hour (1.19 m/sec). This speed is calculated from the maximum evacuation time of 225 minutes from the full 0-10mi. EPZ under daytime adverse weather conditions, and includes the average times required for leaving work, travelling home, and preparing home for evacuation (120 minutes) after having received notice of evacuation (ComEd 1994).

4.20.3.7 Meteorology

Annual meteorology data sets from 1998 through 2001 were investigated for use in MACCS2. The 2000 data set was used, supplemented as follows to fill in the data gaps:

- Available tower data were used whenever possible. For example, if the lower wind direction was unavailable, mid and/or upper directions were used to estimate the lower wind direction (or speed). If only a brief period of missing data existed, interpolation was used between hours.
- Indirect measurements of other parameters were used to help fill data gaps (rapidly lowering temperatures may indicate a wind shift has occurred).
- Hourly observations from the Joliet municipal airport were utilized to fill in the larger data voids, and the Romeo airport was used when Joliet data were incomplete.
- Two meteorologists (one with over 20 years experience and the other with over 15 years experience) reviewed the data to interpret and suggest values to fill data gaps.

Wind speed and direction from the 10-meter sensor were combined with precipitation (hourly cumulative) and atmospheric stability (specified according to the vertical temperature gradient as measured between the 60-meter and 10-meter levels).

Atmospheric mixing heights were specified for AM and PM hours. These values were taken as 500 and 1200 meters, respectively (NRC 1983).

4.20.3.8 MACCS2 Results

Table 4-4 shows the mean off-site doses and economic impacts to the region within 50 miles of DNPS for each of eight release categories calculated using MACCS2. These impacts are multiplied by the annual frequency for each release category and then summed to obtain the risk-weighted mean doses and economic costs. Table 4-5 provides a summary of the DNPS Level 2 PRA results.

4.20.4 COST BENEFIT ANALYSIS

This sub-section explains how EGC calculated the monetary value of the status quo (i.e., accident consequences without SAMA implementation). EGC also used this analysis to establish the maximum benefit that a SAMA could achieve if it eliminated all risk due to at-power internal events.

4.20.4.1 Off-Site Exposure Cost

The baseline annual off-site exposure risk was converted to dollars using the NRC's conversion factor of $2,000 per person-rem (NRC 1997b), and discounting to present value using NRC standard formula (NRC 1997b):

$$W_{pha} = C \times Z_{pha}$$

Where:

W_{pha}	=	monetary value of public health risk after discounting
C	=	[1-exp(-rt_f)]/r
t_f	=	years remaining until end of facility life = 20 years
r	=	real discount rate (as fraction) = 0.07/year
Z_{pha}	=	monetary value of public health (accident) risk per year before discounting ($/year)

The Level 3 analysis showed an annual off-site population dose risk of 10.23 person-rem. The calculated value for C using 20 years and a 7 percent discount rate is approximately 10.76. Therefore, calculating the discounted monetary equivalent of accident risk involves multiplying the dose (person-rem per year) by $2,000 and by the C value (10.76). The calculated off-site exposure cost is $220,209.

4.20.4.2 Off-Site Economic Cost Risk (OECR)

The Level 3 analysis showed an annual off-site economic risk of $18,410. Calculated values for off-site economic costs caused by severe accidents must be discounted to present value as well. This is performed in the same manner as for public health risks and uses the same C value. The resulting value is $198,145.

4.20.4.3 On-Site Exposure Cost Risk

Occupational health was evaluated using the NRC methodology (NRC 1997b) which involves separately evaluating "immediate" and long-term doses.

Immediate Dose - For the case where the plant is in operation, the equation that NRC recommends using (NRC 1997b) is:

Equation 1:

$$W_{IO} = R\{(FD_{IO})_S - (FD_{IO})_A\}\{[1 - \exp(-rt_f)]/r\}$$

Where:

W_{IO} = monetary value of accident risk avoided due to immediate doses, after discounting
R = monetary equivalent of unit dose ($/person-rem)
F = accident frequency (events/yr)
D_{IO} = immediate occupational dose (person-rem/event)
$_S$ = subscript denoting status quo (current conditions)
$_A$ = subscript denoting after implementation of proposed action
r = real discount rate
t_f = years remaining until end of facility life.

The values used in the DNPS analysis are:

R = $2,000/person-rem
r = 0.07
D_{IO} = 3,300 person-rem/ accident (best estimate)
t_f = 20 years (license extension period)
F = 1.89E-6 (total core damage frequency)

For the basis discount rate, assuming F_A is zero, the best estimate of the immediate dose cost is:

$$W_{IO} = R\,(FD_{IO})_S\{[1 - \exp(-rt_f)]/r\}$$
$$= 2{,}000*1.89E\text{-}6\ *3{,}300*\{[1 - \exp(-0.07*20)]/0.07\}$$
$$= \$134$$

Long-Term Dose - For the case where the plant is in operation, the NRC equation (NRC 1997b) is:

Equation 2:

$$W_{LTO} = R\{(FD_{LTO})_S - (FD_{LTO})_A\}\{[1 - \exp(-rt_f)]/r\}\{[1-\exp(-rm)]/rm\}$$

Where:

W_{IO} = monetary value of accident risk avoided long-term doses, after discounting, $
m = years over which long-term doses accrue

The values used in the DNPS analysis are:

R = $2,000/person-rem
r = 0.07
D_{LTO} = 20,000 person-rem/ accident (best estimate)
m = "as long as 10 years"
t_f = 20 years (license extension period)

F = 1.89E-6 (total core damage frequency)

For the basis discount rate, assuming F_A is zero, the best estimate of the long-term dose is:

$$W_{LTO} = R\,(FD_{LTO})_S\,\{[1 - \exp(-rt_f)]/r\}\,\{[1 - \exp(-rm)]/rm\}$$
$$= 2{,}000 * 1.89E\text{-}6 * 20{,}000 * \{[1 - \exp(-0.07*20)]/0.07\}\,\{[1 - \exp(-0.07*10)]/0.07*10\}$$
$$= \$584$$

Total Occupational Exposure - Combining Equations 1 and 2 above and using the above numerical values, the total accident related on-site (occupational) exposure avoided (W_O) is:

$$W_O = W_{IO} + W_{LTO}$$
$$= (\$134 + \$584) = \$718$$

4.20.4.4 On-Site Cleanup and Decontamination Cost

The net present value that NRC provides for cleanup and decontamination for a single event is $1.1 billion discounted over a 10-year cleanup period (NRC 1997b). NRC uses the following equation to integrate the net present value over the average number of remaining service years:

$$U_{CD} = [PV_{CD}/r][1-\exp(-rt_f)]$$

Where:

PV_{CD} = net present value of a single event
r = real discount rate
t_f = years remaining until end of facility life.

The values used in the DNPS analysis are:

PV_{CD} = $1.1E+9
r = 0.07
t_f = 20

The resulting net present value of cleanup integrated over the license renewal term, $1.18E+10, must be multiplied by the total core damage frequency of 1.89E-6 to determine the expected value of cleanup and decontamination costs. The resulting monetary equivalent is $22,329.

4.20.4.5 Replacement Power Cost

Long-term replacement power costs were determined following the NRC methodology (NRC 1997b). The net present value of replacement power for a single event, PVRP, was determined using the following equation:

$$PV_{RP} = [\$1.2E+8/r] * [1-\exp(-rt_f)]^2$$

Where:

PV_{RP} = net present value of replacement power for a single event, ($)
r = 0.07
t_f = 20 years (license renewal period)

To attain a summation of the single-event costs over the entire license renewal period, the following equation is used:

$$U_{RP} = [PV_{RP}/r] * [1 - \exp(-rt_f)]^2$$

Where:

U_{RP} = net present value of replacement power over life of facility ($-year)

After applying a correction factor to account for DNPS's size relative to the "generic" reactor described in NUREG/BR-0184 (NRC 1997b) (i.e., 912 MWe/910 MWe), the replacement power costs are determined to be 7.9×10^9 ($-year). Multiplying this value by the CDF (1.89E-6) results in a replacement power cost of $14,914.

4.20.4.6 Total

The sum of the baseline costs is as follows:

Off-site exposure cost	=	$220,209
Off-site economic cost	=	$198,145
On-site exposure cost	=	$718
On-site cleanup cost	=	$22,329
Replacement power cost	=	$14,914
Total cost	=	$456,314

EGC rounded this value up to $457,000 to use in screening out SAMAs as economically infeasible. The averted cost-risk calculations account for this rounding such that it does not impact the result. This cost estimate was used in screening out SAMAs that are not economically feasible; if the estimated cost of implementing a SAMA exceeded $457,000 it was discarded from further analysis. Exceeding this threshold would mean that a SAMA would not have a positive net value even if it could eliminate all severe accident costs. On the other hand, if the cost of implementation is less than this value, then a more detailed examination of the potential fractional risk benefit that can be attributed to the SAMA is performed.

4.20.5 PHASE I SAMA ANALYSIS: SAMA CANDIDATES AND SCREENING PROCESS

The initial list of Severe Accident Mitigation Alternative candidates for DNPS was developed from lists of SAMAs at other nuclear power plants (SNC 2000, TVA 1994a, PECO 1989, TVA 1992, TVA 1994c, TVA 1994b), NRC documents (NRC 1989b, NRC 1997a, NRC 1996, NRC 1995, NRC 1989a, and NRC 1999), and documents related to advanced power reactor designs (GE 1994, WEC 1992, and NRC 1994). In addition, plant specific analyses (ComEd 1997, ComEd 1996) have been used to identify potential SAMAs which address DNPS vulnerabilities. This process is considered to adequately address the requirement of identifying significant safety improvements that could be performed at DNPS.

The DNPS IPEEE (ComEd 1997) also identified potential opportunities for plant improvements. As a result of the Seismic and Fire Analysis, potential plant changes were considered and dispositioned according to their importance.

Given the existing assessments of external events and internal fires at DNPS, the cost benefit analysis uses the internal events PSA as the basis for measuring the impact of SAMA implementation. No fire or external events models are used in this analysis as the fire and IPEEE programs are considered to have already addressed potential plant improvements related to those categories.

This initial list was then screened to remove those candidates that were not applicable to DNPS due to design differences or high implementation cost. In addition, SAMAs were eliminated if they were related to changes that would be made during the design phase of a plant rather than to an existing plant. These would typically screen on high cost, but they are categorized separately for reference purposes. The SAMA screening process is summarized in Figure 4-1.

A majority of the SAMAs were removed from further consideration as they did not apply to the GE BWR3/Mark I design used at DNPS. The SAMA candidates that were found to be implemented at DNPS were screened from further consideration.

The SAMAs related to design changes prior to construction (primarily consisting of those candidates taken from the ABWR SAMAs) were removed as they were not applicable to an existing site. Any candidate known to have an implementation cost that far exceeds any possible risk benefit is screened from further analysis. Any SAMA candidates that were sufficiently similar to other SAMA candidates were treated in the same manner to those that they were related to either combined or screened from further consideration.

A preliminary cost estimate was prepared for each of the remaining candidates to focus on those that had the possibility of having a positive benefit and to eliminate those whose costs were beyond the possibility of any corresponding benefit (as determined by the DNPS baseline screening cost). When the screening cutoff of $457,000 was applied, a majority of the remaining SAMA candidates were eliminated, as their implementation costs were more expensive than the maximum postulated benefit associated with the elimination of all risk associated with full power internal events. This left 10 candidates for further analysis. Those SAMAs that required a more detailed cost benefit analysis are evaluated in Section 4.20.6.

4.20.6 PHASE II SAMA ANALYSIS

For each of the remaining SAMA candidates that could not be eliminated based on screening cost or PSA/application insights, a more detailed conceptual design was prepared. This information was then used to evaluate the effect of the candidates' changes upon the plant safety model.

The final cost-risk based screening method used to determine the desirability of implementing the SAMA is defined by the following equation:

Net Value = (baseline cost-risk of plant operation – cost-risk of plant operation with SAMA implemented) – cost of implementation

If the net value of the SAMA is negative, the cost of implementation is larger than the benefit associated with the SAMA and the SAMA is not considered beneficial. The baseline cost-risk of plant operation was derived using the methodology presented in Section 4.20.4. The cost-risk of plant operation with the SAMA implemented is determined in the same manner with the exception that the PSA results reflect the application of the SAMA to the plant (the baseline input is replaced by the results of a PSA sensitivity with the SAMA change in effect).

Subsections 4.20.6.1 – 4.20.6.10 describe the detailed cost benefit analysis that was used to determine how the remaining candidates were ultimately treated.

4.20.6.1 <u>Phase II SAMA Number 1</u>

<u>Description</u>: Enhance RCS Seal Cooling.

The DNPS plant has new improved recirculation pump seals that prevent or minimize any leakage. This SAMA is a procedure change to the EOPs that would direct RPV depressurization given the loss of recirculation pump seal cooling or damage to the seals.

The approach to assessing this SAMA is to assume complete reliability of the recirculation pump seals. This would be the maximum benefit associated with a procedure change that is intended to minimize the leakage.

The results from this case indicate a decrease from the base CDF of 1.89E-6/yr to 1.83E-6/yr (SAMA number 1). The decrease in CDF applies primarily to late station blackout scenarios (Class IBL). The results of the cost benefit analysis are shown below:

Phase II SAMA Number 1 Net Value

Base Case: Cost-Risk for DNPS	SAMA 1 Cost-Risk for DNPS	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$448,682	$8,318	Not Required	Not Cost Beneficial

Implementation of this SAMA would include potential procedural modifications to the plant. In addition, engineering analysis would be required to assess the benefit of this proposed action. It is estimated that the total cost to implement such changes would be substantially higher than the averted cost-risk. This SAMA would not be cost beneficial for DNPS.

4.20.6.2 Phase II SAMA Number 2

Description: Provide alternate means to LPCI heat exchanger cooling.

This is a hardware change to provide an alternate means of cooling the LPCI heat exchangers. This could take the form of a separate diesel driven pump that provides secondary cooling to the LPCI heat exchangers.

The approach to assessing this SAMA is to assume complete reliability of the CCSW cooling function for the LPCI heat exchangers. This would be the maximum benefit associated with a change that provides alternate cooling to the LPCI torus cooling heat exchangers.

The results from this case indicate a decrease from the base CDF of 1.89E-6/yr to 1.85E-6/yr (SAMA number 2). The decrease in CDF applies primarily to loss of DHR scenarios (Class II). The results of the cost benefit analysis are shown below:

Phase II SAMA Number 2 Net Value

Base Case: Cost-Risk for DNPS	SAMA 2 Cost-Risk for DNPS	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$449,287	$7,713	Not Required	Not Cost Beneficial

Implementation of this SAMA would include extensive hardware modifications to the plant. It is estimated that the cost of such changes would be substantially higher than the averted cost-risk. This SAMA would not be cost beneficial for DNPS.

4.20.6.3 Phase II SAMA Number 3

Description: Develop an enhanced drywell spray system.

The Fire Protection system cannot currently provide adequate water to the LPCI system at DNPS; in addition, no procedures have been developed to use it as a containment spray source. This containment spray function could be further enhanced at DNPS.

The modeling approach for this SAMA is to assign complete success to the drywell spray effectiveness in Level 2 for all sequences except Class II, IV, and V.

This will require both hardware and procedure changes in addition to engineering analysis to support the use of fire water in this manner.

Note, no reduction in CDF is expected from this SAMA, however, there is a reduction in the Level 2 consequences.

The results from this case indicate no reduction in CDF (base CDF = 1.89E-6/yr). The results of the cost benefit analysis are shown below:

Phase II SAMA Number 3 Net Value

Base Case: Cost-Risk for DNPS	SAMA 3 Cost-Risk for DNPS	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$388,050	$68,950	~$265,000	-196,050

Implementation of this SAMA would involve procedural and hardware changes to the plant. In addition, engineering analysis would be required to justify the use of firewater in this capacity. The cost for implementing such a modification has been estimated to be at least $265,000, approximately $15,000 for the procedure change and $250,000 for the hardware and engineering analysis. The total cost would, therefore, be significantly more than the averted cost-risk. This SAMA would not be cost beneficial for DNPS.

4.20.6.4 Phase II SAMA Number 4

Description: Provide procedural enhancement to re-open MSIVs.

This SAMA provides an enhanced procedure that allows the MSIVs to be reopened to re-establish the main condenser as the heat sink. This provides a containment heat removal path.

The modeling approach for this SAMA is to modify the condenser availability gate "COND-FAILS" to allow restoration of the condenser for MSIV closure initiators. The failure of the restoration is changed from the current 0.5 (unlikely) to the assessed HEP for cases with a procedure and training as assessed for Quad Cities of 3.7E-3.

The results from this case indicate no decrease from the base CDF of 1.89E-6/yr (SAMA number 4). The zero decrease in CDF occurs because of the low frequency of loss of DHR accident sequences. The results of the cost benefit analysis are shown below:

Phase II SAMA Number 4 Net Value

Base Case: Cost-Risk for DNPS	SAMA 4 Cost-Risk for DNPS	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$457,000	$0 00	Not Required	Not Cost Beneficial

This SAMA has essentially no impact on the calculated CDF and would cost substantially more than the averted cost-risk value. Implementation of this SAMA, therefore, would not be cost beneficial for DNPS.

4.20.6.5 Phase II SAMA Number 5

Description: Enhance seismic ruggedness of plant components

This SAMA remains under investigation for resolution as part of the DNPS close out of the IPEEE commitments (GL 88-20).

No further quantification is performed.

4.20.6.6 Phase II SAMA Number 6

Description: Include passive containment vent system.

This SAMA is to provide a containment vent system for containment heat removal that does not require operator intervention for initiation.

The modeling of this SAMA creates a containment vent success path for non-ATWS sequences with no operator intervention or active components required. A rupture disk is used to provide the containment boundary.

This SAMA is modeled by providing an automatic relief for all non-ATWS sequences.

The results from this case indicate a decrease from the base CDF of 1.89E-6/yr to 1.85E-6/yr (SAMA number 6). The decrease in CDF applies to loss of DHR scenarios (Class II). The results of the cost benefit analysis are shown below:

Phase II SAMA Number 6 Net Value

Base Case: Cost-Risk for DNPS	SAMA 6 Cost-Risk for DNPS	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$450,631	$6,369	Not Required	Not Cost Beneficial

This SAMA would involve extensive hardware changes to the plant in addition to engineering analysis to support the modification. The total implementation cost would be substantially more than the averted cost-risk. Implementation of this SAMA, therefore, would not be cost beneficial for DNPS.

4.20.6.7 Phase II SAMA Number 7

Description: Diversify the explosive valve operation.

An alternate means of opening a pathway to the RPV for SBLC injection would improve the success probability for reactor shutdown.

This SAMA is modeled by assuming that the random and common cause failure of the SLC explosive valves goes to zero by providing a perfectly redundant flow path.

The results from this case indicate a decrease from the base CDF of 1.89E-6/yr to 1.85E-6/yr (SAMA number 7). The decrease in CDF applies to ATWS scenarios (Class IV). The results of the cost benefit analysis are shown below:

Phase II SAMA Number 7 Net Value

Base Case: Cost-Risk for DNPS	SAMA 7 Cost-Risk for DNPS	Averted Cost-Risk	Cost of Implementation	Net Value
457,000	$432,485	$24,515	Not Required	Not Cost Beneficial

This SAMA would involve hardware changes to the plant and would cost substantially more than the averted cost-risk value. Implementation of this SAMA, therefore, would not be cost beneficial for DNPS.

4.20.6.8 Phase II SAMA Number 8

Description: Enrich Boron.

The increased boron concentration will reduce the time required to achieve the shutdown concentration. This will provide increased margin in the accident timeline for successful operator activation of SBLC.

The modeling approach used in this evaluation is to reduce the HEPs for boron initiation and RPV water level control by 50% to reflect the approximate improvement in operator success when the allowed time for action is increased due to the enriched boron.

The results from this case indicate a slight decrease from the base CDF of 1.89E-6/yr (SAMA number 8). The results of the cost benefit analysis are shown below:

Phase II SAMA Number 8 Net Value

Base Case: Cost-Risk for DNPS	SAMA 8 Cost-Risk for DNPS	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$455,561	$1,439	Not Required	Not Cost-Beneficial

This SAMA has essentially no impact on the calculated CDF and would cost substantially more than the averted cost-risk value. Implementation of this SAMA, therefore, would not be cost beneficial for DNPS.

4.20.6.9 Phase II SAMA Number 9

Description: Bypass the low RPV pressure permissive on ECCS injection valves.

This SAMA is to allow operator intervention to bypass the low RPV pressure permissive signal that inhibit the opening of the ECCS injection valves when RPV pressure is too high. This operator intervention could be performed by a bypass switch and associated circuitry. It would be implemented when the crew recognizes by confirmed signals that: (1) RPV pressure is low; (2) RPV injection is needed; but, (3) the ECCS injection valves have been inhibited from opening due to sensor or logic failures in the low pressure permissive logic.

This SAMA is conservatively modeled by setting the logic, sensor, and miscalibration failure modes to zero in the sensitivity model. This maximizes the potential benefit of the SAMA.

The results from this case indicate a decrease from the base CDF of 1.89E-6/yr to 1.86E-6/yr (SAMA number 9). The decrease in CDF applies to loss of injection for Class IIIC and Class ID. The results of the cost benefit analysis are shown below.

Phase II SAMA Number 9 Net Value

Base Case: Cost-Risk for DNPS	SAMA 9 Cost-Risk for DNPS	Averted Cost-Risk	Cost of Implementation	Net Value
$457,000	$432,391	$24,609	Not Required	Not Cost Beneficial

This SAMA would involve both procedure and hardware changes to the plant that would substantially exceed the averted cost-risk value. Implementation of this SAMA, therefore, would not be cost beneficial for DNPS.

4.20.6.10 <u>Phase II SAMA Number 10</u>

<u>Description</u>: Provide supplemental air supply to the containment hard pipe vent path AOVs.

The containment hard pipe vent paths have valves that require air to operate the valves. Instrument air is a non-safety system. The availability of supplemental air supplies to open these valves under scenarios where instrument air may be unavailable.

This SAMA is conservatively modeled by setting the instrument air recovery basic event 2CVOP-REC-IA-H-- to 0.0. This modeling maximizes the potential risk reduction for the proposed SAMA.

The results from this case indicate a decrease from the base CDF of 1.89E-6/yr to 1.85E-5/yr (SAMA number 10). The decrease in CDF applies to ATWS scenarios (Class II). The results of the cost benefit analysis are shown below:

Phase II SAMA Number 10 Net Value

Base Case: Cost-Risk for DNPS	SAMA 10 Cost-Risk for DNPS	Averted Cost-Risk	Cost of Implementation	Net Value
$457 000	$450,974	$6,026	Not Required	Not Cost Beneficial

This SAMA would involve a hardware change to the plant and would cost substantially more than the averted cost-risk value. Implementation of this SAMA, therefore, would not be cost beneficial for DNPS.

4.20.7 PHASE II SAMA ANALYSIS SUMMARY

The SAMA candidates which could not be eliminated from consideration by the baseline screening process or other PSA insights required the performance of a detailed analysis of the averted cost-risk and SAMA implementation costs. SAMA candidates are potentially justified only if the averted cost-risk resulting from the modification is greater than the cost of implementing the SAMA. None of the SAMAs analyzed were found to be cost-beneficial as defined by the methodology used in this study. However, this evaluation should not necessarily be considered a definitive guide in determining the disposition of a plant modification that has been analyzed using other engineering methods. These results are intended to provide information about the relative estimated risk benefit associated with a plant change or modification compared with its cost of implementation and should be used as an aid in the decision making process. The results of the detailed analysis are shown in Table 4-6.

4.20.8 CONCLUSIONS

The benefits of revising the operational strategies in place at DNPS and/or implementing hardware modifications can be evaluated without the insight from a risk-based analysis. Use of the PSA in conjunction with cost benefit analysis methodologies has, however, provided an enhanced understanding of the effects of the proposed changes relative to the cost of implementation and projected impact on a much larger future population. The results of this study indicate that none of the identified potential improvements were cost beneficial based on the methodology applied in this analysis.

Table 4-1. Category 1 Issues that are Not Applicable to Dresden Nuclear Power Station (DNPS).[a]

Issues	Basis for Inapplicability to DNPS
Surface Water Quality, Hydrology, and Use (for all plants)	
1 Impacts of refurbishment on surface water quality	Issue applies to refurbishment, which DNPS will not undertake
2. Impacts of refurbishment on surface water use	Issue applies to refurbishment, which DNPS will not undertake
4. Altered salinity gradients	Issue applies to discharge to a natural water body that has a salinity gradient to alter, not inland freshwaters
12. Water use conflicts (plants with once-through cooling systems)	Issue applies to plants using a once-through heat dissipation system DNPS uses a cooling pond and towers.
Aquatic Ecology (for all plants)	
14. Refurbishment	Issue applies to refurbishment, which DNPS will not undertake
Groundwater Use and Quality	
31. Impacts of refurbishment on groundwater use and quality	Issue applies to refurbishment, which DNPS will not undertake
36. Groundwater quality degradation (Ranney wells)	Issue applies to a plant feature, Ranney wells, that DNPS does not have
37. Groundwater quality degradation (saltwater intrusion)	Issue applies to plants in coastal areas, not inland sites such as DNPS
38. Groundwater quality degradation (cooling ponds in salt marshes)	Issue applies to cooling ponds[b] in salt marshes, not inland sites such as DNPS
Terrestrial Resources	
43. Bird collisions with cooling towers	Issue applies to plants with natural-draft cooling towers DNPS uses mechanical-draft towers.
Human Health	
54. Radiation exposures to the public during refurbishment	Issue applies to refurbishment, which DNPS will not undertake.
55. Occupational radiation exposures during refurbishment	Issue applies to refurbishment, which DNPS will not undertake.
Socioeconomics	
72. Aesthetic impacts (refurbishment)	Issue applies to refurbishment, which DNPS will not undertake.

NRC = U S. Nuclear Regulatory Commission

a. NRC listed the issues in Table B-1 of 10 CFR 51 Appendix B. EGC added issue numbers for expediency.

b. NRC has defined "cooling pond" as "a manmade impoundment that does not impede the flow of a navigable system and that is used primarily to remove waste heat from condenser water prior to recirculating the water back to the main condenser...." (NRC 1996)

Table 4-2. Category 1 and "NA" Issues that are Applicable to Dresden Nuclear Power Station (DNPS).[a]

Issue	NRC Findings[b]	GEIS (Section/Page)
Surface Water Quality, Hydrology, and Use (for all plants)		
3 Altered current patterns at intake and discharge structures	SMALL. Altered current patterns have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.	4 2.1.2.1/4-4 4.3 2 2/4-31 4 4 2/4-52
5. Altered thermal stratification of lakes	SMALL. Generally, lake stratification has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.	4.2.1.2.3/4-6 4.4.2.2/4-53
6. Temperature effects on sediment transport capacity	SMALL These effects have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.	4 2.1.2.3/4-6 4.4.2.2/4-53
7. Scouring caused by discharged cooling water	SMALL. Scouring has not been found to be a problem at most operating nuclear power plants and has caused only localized effects at a few plants. It is not expected to be a problem during the license renewal term.	4.2 1.2 3/4-6 4 4 2 2/4-53
8. Eutrophication	SMALL. Eutrophication has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.	4.2.1 2.3/4-6 4.4.2 2/4-53
9 Discharge of chlorine or other biocides	SMALL. Effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term.	4 2.1 2 4/4-10 4 4.2 2/4-53
10. Discharge of sanitary wastes and minor chemical spills	SMALL Effects are readily controlled through NPDES permit and periodic modifications, if needed, and are not expected to be a problem during the license renewal term	4.2.1 2 4/4-10 4 4 2 2/4-53
11. Discharge of other metals in waste water	SMALL. These discharges have not been found to be a problem at operating nuclear power plants with cooling-tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. They are not expected to be a problem during the license renewal term.	4 2 1 2.4/4-10 4 3.2 2/4-31 4.4 2.2/4-53
Aquatic Ecology (for all plants)		
15. Accumulation of contaminants in sediments or biota	SMALL. Accumulation of contaminants has been a concern at a few nuclear power plants, but has been satisfactorily mitigated by replacing copper alloy condenser tubes with those of another metal. It is not expected to be a problem during the license renewal term.	4 2 1 2.4/4-10 4 3 3/4-33 4.4 2 2/4-53 4 4 3/4-56
16. Entrainment of phytoplankton and zooplankton	SMALL. Entrainment of phytoplankton and zooplankton has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.	4 2 2.1.1/4-15 4.3 3/4-33 4 4 3/4-56

Table 4-2. Category 1 and "NA" Issues that are Applicable to Dresden Nuclear Power Station (DNPS)[a] (Continued).

Issue	NRC Findings[b]	GEIS (Section/Page)
17. Cold shock	SMALL. Cold shock has been satisfactorily mitigated at operating nuclear plants with once-through cooling systems, has not endangered fish populations or been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds, and is not expected to be a problem during the license renewal term.	4 2 2.1.5/4-18 4.3.3/4-33 4.4.3/4-56
18. Thermal plume barrier to migrating fish	SMALL Thermal plumes have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.	4 2 2.1 6/4-19 4 4.3/4-56
19 Distribution of aquatic organisms	SMALL. Thermal discharge may have localized effects, but is not expected to affect the larger geographical distribution of aquatic organisms	4 2 2 1 6/4-19 4 4 3/4-56
20. Premature emergence of aquatic insects	SMALL. Premature emergence has been found to be a localized effect at some operating nuclear power plants, but has not been a problem and is not expected to be a problem during the license renewal term	4.2.2.1.7/4-20 4.4.3/4-56
21. Gas supersaturation (gas bubble disease)	SMALL. Gas supersaturation was a concern at a small number of operating nuclear power plants with once-through cooling systems, but has been satisfactorily mitigated It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term	4 2 2 1.8/4-21 4.4.3/4-56
22 Low dissolved oxygen in the discharge	SMALL. Low dissolved oxygen has been a concern at one nuclear power plant with a once-through cooling system, but has been effectively mitigated It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.	4 2 2.1 9/4-23 4.3.3/4-33 4.4 3/4-56
23. Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	SMALL. These types of losses have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.	4.2.2.1.10/4-24 4.4.3/4-56
24. Stimulation of nuisance organisms (e.g., shipworms)	SMALL. Stimulation of nuisance organisms has been satisfactorily mitigated at the single nuclear power plant with a once-through cooling system where previously it was a problem It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.	4 2 2.1.11/4-25 4 4.3/4-56
Aquatic Ecology (for plants with cooling-tower–based heat dissipation systems)		
28. Entrainment of fish and shellfish in early life stages	SMALL. Entrainment of fish has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.	4.3 3/4-33

Table 4-2. Category 1 and "NA" Issues that are Applicable to Dresden Nuclear Power Station (DNPS)[a] (Continued).

Issue	NRC Findings[b]	GEIS (Section/Page)
29. Impingement of fish and shellfish	SMALL. The impingement has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.	4 3 3/4-33
30. Heat shock	SMALL. Heat shock has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.	4.3 3/4-33
Groundwater Use and Quality		
32. Groundwater use conflicts (potable and service water; plants that use < 100 gpm)	SMALL. Plants using less than 100 gpm are not expected to cause any groundwater use conflicts.	4 8.1.1/4-116
Terrestrial Resources		
41. Cooling tower impacts on crops and ornamental vegetation	SMALL Impacts from salt drift, icing, fogging, or increased humidity associated with cooling tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.	4.3 4/4-34
42. Cooling tower impacts on native plants	SMALL. Impacts from salt drift, icing, fogging, or increased humidity associated with cooling tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.	4.3 5 1/4-42
44. Cooling pond impacts on terrestrial resources	SMALL. Impacts of cooling ponds on terrestrial ecological resources are considered to be of small significance at all sites.	4.4 4/4-58
45 Power line right-of-way management (cutting and herbicide application)	SMALL. The impacts of right-of-way maintenance on wildlife are expected to be of small significance at all sites.	4.5 6.1/4-71
46. Bird collision with power lines	SMALL. Impacts are expected to be of small significance at all sites.	4.5 6.2/4-74
47. Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	SMALL. No significant impacts of electromagnetic fields on terrestrial flora and fauna have been identified. Such effects are not expected to be a problem during the license renewal term.	4.5 6.3/4-77
48. Floodplains and wetlands on power line right of way	SMALL. Periodic vegetation control is necessary in forested wetlands underneath power lines and can be achieved with minimal damage to the wetland. No significant impact is expected at any nuclear power plant during the license renewal term.	4.5 7/4-81
Air Quality		
51. Air quality effects of transmission lines	SMALL. Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases	4.5 2/4-62

Table 4-2. Category 1 and "NA" Issues that are Applicable to Dresden Nuclear Power Station (DNPS)[a] (Continued).

Issue	NRC Findings[b]	GEIS (Section/Page)
Land Use		
52. Onsite land use	SMALL. Projected onsite land use changes required during refurbishment and the renewal period would be a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant.	3 2/3-1 4 5 3/4-62
53 Power line right of way	SMALL. Ongoing use of power line right of ways would continue with no change in restrictions The effects of these restrictions are of small significance.	4.5.3/4-62
Human Health		
56 Microbiological organisms (occupational health)	SMALL. Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures	4 3 6/4-48
58 Noise	SMALL. Noise has not been found to be a problem at operating plants and is not expected to be a problem at any plant during the license renewal term.	4 3 7/4-49
60 Electromagnetic fields, chronic effects	Not Applicable. Biological and physical studies of 60-Hz electromagnetic fields have not found consistent evidence linking harmful effects with field exposures However, research is continuing in this area and a consensus scientific view has not been reached	4 5 4.2/4-67
61. Radiation exposures to public (license renewal term)	SMALL. Radiation doses to the public will continue at current levels associated with normal operations	4 6 2/4-87
62. Occupational radiation exposures (license renewal term)	SMALL Projected maximum occupational doses during the license renewal term are within the range of doses experienced during normal operations and normal maintenance outages, and would be well below regulatory limits.	4 6 3/4-95
Socioeconomics		
64. Public services: public safety, social services, and tourism and recreation	SMALL. Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites.	4.7.3/4-104 (public services) 4.7.3.3/4-106 (safety) 4.7.3 4/4-107 (social) 4.7.3 6/4-107 (tourism, recreation)
67. Public services, education (license renewal term)	SMALL. Only impacts of small significance are expected.	4.7.3 1/4-106
73. Aesthetic impacts (license renewal term)	SMALL No significant impacts are expected during the license renewal term.	4.7 6/4-111
74. Aesthetic impacts of transmission lines (license renewal term)	SMALL. No significant impacts are expected during the license renewal term.	4.5.8/4-83

Table 4-2. Category 1 and "NA" Issues that are Applicable to Dresden Nuclear Power Station (DNPS)[a] (Continued).

Issue	NRC Findings[b]	GEIS (Section/Page)
Postulated Accidents		
75. Design basis accidents	SMALL. The NRC staff has concluded that the environmental impacts of design basis accidents are of small significance for all plants	5.3 2/5-11 5.5 1/5-114 (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)	SMALL. Offsite impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 of this part. Based on information in the GEIS, impacts on individuals from radioactive gaseous and liquid releases including radon-222 and technetium-99 are small.	6 2.4/6-27 6.6/6-87
78. Offsite radiological impacts (collective effects)	The 100-year environmental dose commitment to the U.S. population from the fuel cycle, high-level waste and spent fuel disposal is calculated to be about 14,800 person rem, or 12 cancer fatalities, for each additional 20-year power reactor operating term Much of this, especially the contribution of radon releases from mines and tailing piles, consists of tiny doses summed over large populations. This same dose calculation can theoretically be extended to include many tiny doses over additional thousands of years as well as doses outside the U.S The result of such a calculation would be thousands of cancer fatalities from the fuel cycle, but this result assumes that even tiny doses have some statistical adverse health effect, which will not ever be mitigated (for example, no cancer cure in the next thousand years), and that these dose projections over thousands of years are meaningful. However, these assumptions are questionable. In particular, science cannot rule out the possibility that there will be no cancer fatalities from these tiny doses. For perspective, the doses are very small fractions of regulatory limits, and even smaller fractions of natural background exposure to the same populations Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective effects of the fuel cycle, this issue is considered Category 1.	Not in GEIS.
79. Offsite radiological impacts (spent fuel and high level waste disposal)	For the high-level waste and spent fuel disposal component of the fuel cycle, there are no current regulatory limits for offsite releases of radionuclides for the current candidate repository site. However, if we assume that limits are developed along the lines of the 1995 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain	Not in GEIS.

Table 4-2. Category 1 and "NA" Issues that are Applicable to Dresden Nuclear Power Station (DNPS)[a] (Continued).

Issue	NRC Findings[b]	GEIS (Section/Page)
	Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site which will comply with such limits, peak doses to virtually all individuals will be 100 millirem per year or less. However, while the Commission has reasonable confidence that these assumptions will prove correct, there is considerable uncertainty since the limits are yet to be developed, no repository application has been completed or reviewed, and uncertainty is inherent in the models used to evaluate possible pathways to the human environment. The NAS report indicated that 100 millirem per year should be considered as a starting point for limits for individual doses, but notes that some measure of consensus exists among national and international bodies that the limits should be a fraction of the 100 millirem per year. The lifetime individual risk from 100 millirem annual dose limit is about 310^{-3} Estimating cumulative doses to populations over thousands of years is more problematic. The likelihood and consequences of events that could seriously compromise the integrity of a deep geologic repository were evaluated by the U S Department of Energy in the "Final Environmental Impact Statement Management of Commercially Generated Radioactive Waste," October 1980 The evaluation estimated the 70-year whole-body dose commitment to the maximum individual and to the regional population resulting from several modes of breaching a reference repository in the year of closure, after 1,000 years, after 100,000 years, and after 100,000,000 years. Subsequently, the NRC and other federal agencies have expended considerable effort to develop models for the design and for the licensing of a high-level waste repository, especially for the candidate repository at Yucca Mountain. More meaningful estimates of doses to population may be possible in the future as more is understood about the performance of the proposed Yucca Mountain repository. Such estimates would involve very great uncertainty, especially with respect to cumulative population doses over thousands of years. The standard proposed by the NAS is a limit on maximum individual dose. The relationship of potential new regulatory requirements, based on the NAS report, and cumulative population impacts has not been determined, although the report articulates the view that protection of individuals will adequately protect the population for a repository at Yucca Mountain. However, (EPA's) generic repository standards in 40 CFR part 191 generally provide an indication of the order of magnitude of cumulative risk to population that could result from the licensing of a Yucca Mountain repository, assuming the ultimate standards will be within the range of standards now under consideration. The	

Table 4-2. Category 1 and "NA" Issues that are Applicable to Dresden Nuclear Power Station (DNPS)[a] (Continued).

Issue	NRC Findings[b]	GEIS (Section/Page)
	standards in 40 CFR part 191 protect the population by imposing "containment requirements" that limit the cumulative amount of radioactive material released over 10,000 years. The cumulative release limits are based on EPA's population impact goal of 1,000 premature cancer deaths worldwide for a 100,000 metric ton (MTHM) repository. Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent fuel and high-level waste disposal, this issue is considered Category 1.	
80 Nonradiological impacts of the uranium fuel cycle	SMALL. The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant are found to be small.	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) 6 6/6-90 (conclusion)
81. Low-level waste storage and disposal	SMALL. The comprehensive regulatory controls that are in place, and the low public doses being achieved at reactors, ensure that the radiological impacts to the environment will remain small during the term of a renewed license. The maximum additional onsite land that may be required for low-level waste storage during the term of a renewed license and associated impacts will be small. Nonradiological impacts on air and water will be negligible. The radiological and nonradiological environmental impacts of long-term disposal of low-level waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient low-level waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.	6 4 2/6-36 ("low-level" definition) 6 4 3/6-37 (low-level volume) 6.4.4/6-48 (renewal effects) 6 6/6-90 (conclusion)
82 Mixed waste storage and disposal	SMALL. The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal will not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable	6 4 5/6-63 6 6/6-91 (conclusion)

Table 4-2. Category 1 and "NA" Issues that are Applicable to Dresden Nuclear Power Station (DNPS)[a] (Continued).

Issue	NRC Findings[b]	GEIS (Section/Page)
	assurance that sufficient mixed waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.	
83. On-site spent fuel	SMALL. The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available.	6 4 6/6-70 6.6/6-91 (conclusion)
84. Nonradiological waste	SMALL. No changes to generating systems are anticipated for license renewal Facilities and procedures are in place to ensure continued proper handling and disposal at all plants.	6.5/6-86 6 6/6-92 (conclusion)
85. Transportation[c]	SMALL. The impacts of transporting spent fuel enriched up to 5 percent uranium-235 with average burnup for the peak rod to current levels approved by NRC up to 62,000 MWd/MTU and the cumulative impacts of transporting high-level waste to a single repository, such as Yucca Mountain, Nevada are found to be consistent with the impact values contained in 10 CFR 51 52(c), Summary Table S-4-Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor. If fuel enrichment or burnup conditions are not met, the applicant must submit an assessment of the implications for the environmental impact values reported in §51 52	Addendum 1
Decommissioning		
86. Radiation doses	SMALL. Doses to the public will be well below applicable regulatory standards regardless of which decommissioning method is used Occupational doses would increase no more than 1 man-rem caused by buildup of long-lived radionuclides during the license renewal term	7.3.1/7-15 7 4/7-25 (conclusion)
87. Waste management	SMALL. Decommissioning at the end of a 20-year license renewal period would generate no more solid wastes than at the end of the current license term. No increase in the quantities of Class C or greater than Class C wastes would be expected.	7.3.2/7-19 7.4/7-25 (conclusion)
88. Air quality	SMALL. Air quality impacts of decommissioning are expected to be negligible either at the end of the current operating term or at the end of the license renewal term.	7 3 3/7-21 7 4/7-25 (conclusion)
89. Water quality	SMALL. The potential for significant water quality impacts from erosion or spills is no greater whether decommissioning occurs after a 20-year license renewal period or after the original 40-year operation period, and measures are readily available to avoid such impacts.	7.3.4/7-21 7.4/7-25 (conclusion)
90. Ecological resources	SMALL. Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts.	7.3.5/7-21 7.4/7-25 (conclusion)

Table 4-2. Category 1 and "NA" Issues that are Applicable to Dresden Nuclear Power Station (DNPS)[a] (Continued).

Issue	NRC Findings[b]	GEIS (Section/Page)
91. Socioeconomic impacts	SMALL. Decommissioning would have some short-term socioeconomic impacts. The impacts would not be increased by delaying decommissioning until the end of a 20-year relicense period, but they might be decreased by population and economic growth.	7.3.7/7-24 7.4/7-25 (conclusion)
Environmental Justice		
92. Environmental Justice	Not Applicable. The need for and the content of an analysis of environmental justice will be addressed in plant-specific reviews.	Not in GEIS

CFR = Code of Federal Regulations
EPA = U S. Environmental Protection Agency
GEIS = Generic Environmental Impact Statement (NRC 1996)
Hz = Hertz
NA = Not applicable
NEPA = National Environmental Policy Act
NPDES = National Pollutant Discharge Elimination System
NRC = U.S. Nuclear Regulatory Commission

a. NRC listed the issues in Table B-1 of 10 CFR 51 Appendix B EGC added issue numbers for expediency

b. NRC has defined SMALL to mean that, for the issue, environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, NRC has concluded that those impacts that do not exceed permissible levels in the NRC's regulations are considered small (10 CFR 51 Appendix B, Table B-1, Footnote 3)

c NRC published, on September 3, 1999, a GEIS addendum in support of its rulemaking that re-categorized Issue 85 from 2 to 1

Table 4-3. Results of Induced Current Analysis.

Transmission Line	Voltage (kV)	Limiting Case Peak Electric Field Strength (kV/meter)	Limiting Case Induced Current (milliampers)
Pontiac Mid-Point (8014)	345	5.6	5.2
Electric Junction (1221)	345	2.4	2.7
Electric Junction (1223)	345	2.4	2.7
Goodings Grove (1220) (Elwood)	345	2.1	2.7
Goodings Grove (1222) (Elwood)	345	2.1	2.7
Collins (2311)	345	1.4	0.8
Powerton (0302)	345	5.1	4.9

Table 4-4. MACCS Results Frequency-Weighted Off-Site Population Dose and Economic Costs.

MAAP Run	Release Category	Dose (Sv)	Costs ($)	Frequency	Weighted Dose (person-rem)	Weighted Cost ($)
DR0024	L2-1	2.22E+05	4.68E+10	3.01E-07	6.682E+00	1.41E+04
DR0040	L2-2	1.86E+05	4.42E+10	1.48E-08	2.753E-01	6.54E +02
DR0034	L2-4	1.21E+05	2.08E+10	1.09E-07	1.319E+00	2.27E+03
DR0031	L2-5	5.44E+04	3.44E+09	2.79E-07	1.518E+00	9.60E+02
DR0028	L2-7	1.17E+05	1.89E+10	3.29E-09	3.849E-02	6.22E+01
DR0042	L2-8	6.07E+04	4.67E+09	5.78E-08	3.508E-01	2.70E+02
DR0039	L2-9	2.79E+05	6.19E+10	1.74E-09	4.855E-02	1.08E+02
DR0043	L2-10	2.08E+01	8.25E+04	1.12E-06	2.330E-03	9.24E-02
Frequency Weighted Totals (p-rem and $)				1.89E-06	10.23	18408

Table 4-5. Accident Sequence Timings as a Function of Consequence Category.

Consequence Category	Dominant Release Category	MAAP Case	Time to TAF	Time to Core Damage	Time of Initial Release	Time of Gen. Emg. Declaration	Time of End of Release	EAL Basis
L2-1	H/E(LERF) (23%)[(2)]	DR 0024 IA-L2-1A-NSPR	26 min	54 min	4.1 hr	60 min	36 hr	FG1
L2-2	H/I (35%)	DR 0040 IIA-L2-9C[(1)]	46.0 hr[(1)]	47.5 hr	47.5 hr	15 hr	72 hr	HG2
L2-3	H/L	None	--	--	--	--	--	--
L2-4	M/E (1.7%)	DR 0034 IVA-L2-14A-ED-DW	8.6 min	1.4 hr	1.1 hr	1.1 hr	36 hr	FG1
L2-5	M/I (1.8%)	DR 0031 IIA-l2-9a	34.9 hr	37.8 hr	37.8 hr	15 hr	72 hr	HG2
L2-6	M/L	None	--	--	--	--	--	--
L2-7	L or LL/E (0.35%)	DR 0028 ID-L2-7B NSPR	26 min	40 min	5.7 hr	45 min	36 hr	FG1
L2-8	L or LL/I or L or LL/L (0.22%)	DR 0042 ID-L2-7BA-SPRY	26 min	40 min	5.7 hr	45 min	36 hr	HG2
L2-9	Class V (96%)	DR 0039 V-L2-17	1.5 min	17 min	17 min	20 min	36 hr	FG1
L2-10	Intact	DR 0043 IB-L2-22	26 min	49 min	48 min	60 min	36 hr	FG1

(1) Containment fails at 45.9 hr.

(2) % of CsI released at end of release.

Table 4-6. Accident Summary of the Detailed SAMA Analyses.

Phase II SAMA ID	Averted Cost- Risk	Cost of Implementation	Net Value	Cost Beneficial?
1	$8,318	Not Required	N/A	No
2	$7,713	Not Required	N/A	No
3	$68,950	Est. ~ $265,000	-$196,050	No
4	$0.00	Not Required	N/A	No
5	Not quantified			
6	$6,369	Not Required	N/A	No
7	$24,515	Not Required	N/A	No
8	$1,439	Not Required	N/A	No
9	$24,609	Not Required	N/A	No
10	$6.026	Not Required	N/A	No

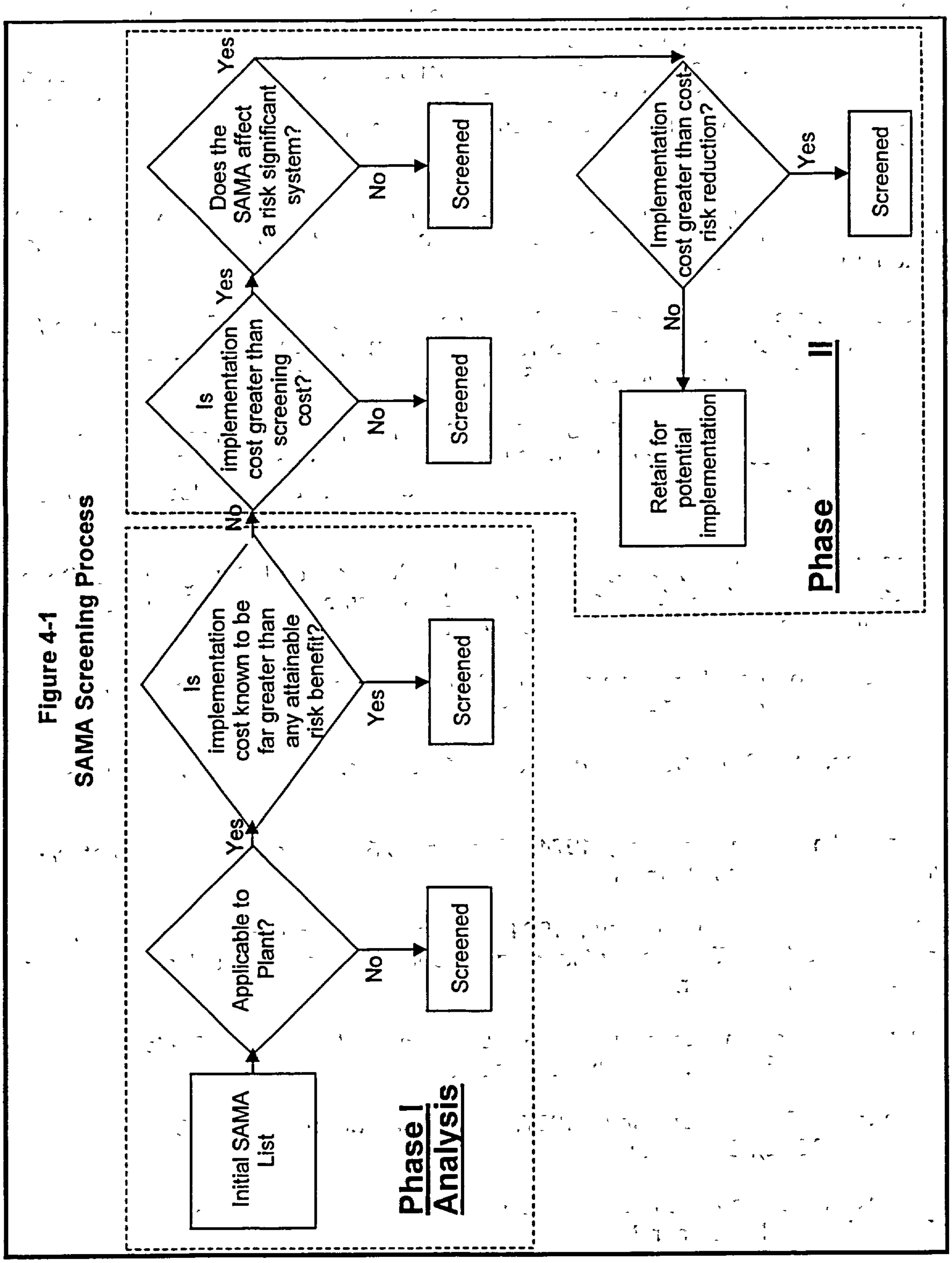

Figure 4-1
SAMA Screening Process

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 all cited web pages are available in EGC files. Some sites, for example the census data, cannot be accessed through their URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by EGC have been given for these pages, even though they may not be directly accessible.

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