Appendix E

Applicant's Environmental Report
Operating License Renewal Stage

Donald C. Cook Nuclear Plant

October 2003

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Acronyms and Abbreviations

AADT	Annual Average Daily Traffic
AEP	American Electric Power
AQCR	Air Quality Control Region
Btu	British thermal unit
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CNP	Donald C. Cook Nuclear Plant
CWA	Clean Water Act
DSM	demand-side management
EPA	U.S. Environmental Protection Agency
°F	degrees Fahrenheit
FES	Final Environmental Statement
FWS	U.S. Fish and Wildlife Service
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants
gpm	gallons per minute
IDNR	Indiana Department of Natural Resources
I&M	Indiana Michigan Power Company
IMECo	Indiana & Michigan Electric Company
IMPCo	Indiana & Michigan Power Company
IPA	integrated plant assessment
kW-h	kilowatt-hour
LOS	level of service
MDNR	Michigan Department of Natural Resources
MSA	Metropolitan Statistical Area
MW	megawatt
MWe	megawatts-electrical
NESC	National Electrical Safety Code
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission

Acronyms and Abbreviations (Continued)

PWR	pressurized water reactor
SAMA	Severe Accident Mitigation Alternatives
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping

Chapter 1

Introduction

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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. Indiana Michigan Power Company operates the Donald C. Cook Nuclear Plant (CNP) Units 1 and 2 pursuant to NRC Operating Licenses DPR-58 (Docket No. 50-315) and DPR-74 (Docket No. 50-316), respectively. The Unit 1 license expires October 25, 2014; and the Unit 2 license expires December 23, 2017.

Indiana Michigan Power Company has prepared this environmental report in conjunction with its application to NRC to renew the CNP Units 1 and 2 operating licenses, in compliance with 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).

- 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 CNP, 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 plant operation beyond the current CNP 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. 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 CNP Environmental Report, Indiana Michigan Power Company has relied on NRC regulations and the following supporting documents:

- NRC supplemental information in the *Federal Register* (NRC 1996b; NRC 1996c; NRC 1996d; and NRC 1999a)
- *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996a 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)

Indiana Michigan Power Company 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 bold, italicized quote of the regulatory language and applicable supporting document language.

1.3 Cook Nuclear Plant Licensee and Ownership

CNP is currently owned and operated by Indiana Michigan Power Company (I&M), a wholly-owned subsidiary of American Electric Power (AEP). At the time the CNP Final Environmental Statement (FES; AEC 1973) was published, the CNP license application was in the names of Indiana & Michigan Electric Company (IMECo) and Indiana & Michigan Power Company (IMPCo). IMPCo was a wholly-owned subsidiary of IMECo, which was a wholly-owned subsidiary of AEP. The operating licenses were subsequently granted to IMECo and IMPCo in 1974 for Unit 1 and 1977 for Unit 2. The plant was operated by IMPCo.

In 1979, IMECo and IMPCo merged, with the resulting company known as IMECo. In 1988, IMECo changed its name to Indiana Michigan Power Company; and the licenses were amended to reflect this name change. I&M still holds the NRC licenses to operate CNP. I&M also owns the transmission lines connected to CNP.

In 2000, AEP merged with Central and Southwest Electric Company, and the resulting corporation operates under the name AEP. As a result, AEP now has a 25 percent ownership of South Texas Project, a nuclear plant near Bay City, Texas. CNP is the only operating nuclear plant owned by I&M. CNP and South Texas Project are the only nuclear plants owned by AEP.

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 Water Towers or Cooling Ponds and Withdrawing 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)
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 and Endangered Species

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)(F)	4.11	Air Quality During Refurbishment (Nonattainment and Maintenance Areas)
10 CFR 51.53(c)(3)(ii)(G)	4.12	Microbiological Organisms
10 CFR 51.53(c)(3)(ii)(H)	4.13	Electric Shock from Transmission Line-Induced Currents
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

AEC (U.S. Atomic Energy Commission). 1973. *Final Environmental Statement Related to Operation of Donald C. Cook Nuclear Plant, Units 1 & 2*, Docket Nos. 50-315 and 50-316, Directorate of Licensing, Washington, DC, August.

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

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

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 9-1, "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

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2.1 Location and Features

CNP is in Lake Charter Township, Berrien County, Michigan, on the southeastern shoreline of Lake Michigan. This location is approximately 55 miles east of downtown Chicago, Illinois; 50 miles southwest of Kalamazoo, Michigan; and 11 miles south-southwest of the twin cities of St. Joseph and Benton Harbor, Michigan (Figure 2-1). The nearest town is Bridgman, which is approximately two miles south of CNP (Figure 2-2).

The CNP property is approximately 650 acres owned by I&M (Figure 2-3) and includes 4,350 feet of lake frontage. The property extends approximately one and one quarter miles eastward from Lake Michigan. The local terrain consists of a gentle upward sloping beach that rises sharply into sand dunes after about 200 feet. The area surrounding CNP property is largely rural, characterized by agriculture and heavily-wooded, rugged sand dunes along the lakeshore. Buildings on the property include the following:

- Two reactor containment buildings
- A turbine building
- An auxiliary building
- Service buildings
- A fuel handling facility
- Two switchyards
- A radioactive waste building
- A training center
- A visitor's center
- An indoor firing range
- Other supporting buildings

The Grand Mere State Park is approximately one mile north-northeast of CNP. This park includes approximately one mile of Lake Michigan shoreline and is characterized by sand dunes and deep blowouts, as well as three inland lakes that lie in an undeveloped natural area behind the dunes (MDNR 2003a). Warren Dunes State Park is about 3.5 miles south-southwest of the plant. This park has more than two miles of shoreline with sand dunes rising 240 feet above Lake Michigan, as well as a variety of natural settings (MDNR 2003a). Figure 2-2 shows the location of these natural areas.

2.2 Aquatic Ecological Communities

Overview of Lake Michigan Ecosystem

CNP lies on the southeastern shore of Lake Michigan, the only Great Lake that lies entirely within the boundaries of the U.S. Lake Michigan is the second largest of the Great Lakes by volume (1,180 cubic miles) and third largest by area (22,300 square miles). It drains an area of 45,600 square miles (EPA 1995). Major tributaries of Lake Michigan include the Fox-Wolf, Grand, St. Joseph, Menominee, and Kalamazoo Rivers. Lake Michigan is joined to Lake Huron at the Straits of Mackinac; thus, the two basins are hydrologically connected.

The northern part of the Lake Michigan watershed is forested and sparsely populated, except for the Fox River Valley, which drains into Green Bay. The southern part of Lake Michigan is among the most urbanized areas in the Great Lakes region, containing both the Milwaukee and Chicago metropolitan areas.

The water quality of Lake Michigan has been degraded by industrial, municipal, agricultural, navigational, and recreational water users for more than 150 years. Green Bay receives waste from the world's largest concentration of pulp and paper mills. The U.S. and Canada, in consultation with state and provincial governments, are working to "…restore and maintain the chemical, physical, and biological integrity of the water of the Great Lakes Basin Ecosystem" under the provisions of the Great Lakes Water Quality Agreement, signed in 1972 and amended in 1987 (EPA 2000).

As part of this effort, the Lake Michigan Technical Committee developed a Lake Michigan Lakewide Management Plan (EPA 2000) that describes the current state of lake habitats (open waters, wetlands, tributary streams), identifies areas of concern, and recommends future steps that should be taken to protect and restore Lake Michigan ecosystems. These recommendations range from controls on ballast water to remediation of contaminated (sediment) sites to the implementation of Total Maximum Daily Load strategies for tributary streams. The Lake Michigan Lakewide Management Plan lists a number of areas in which improvements have already been made (e.g., reduction of point-source pollutants entering the basin, and protection and restoration of wetlands) but notes other areas still needing improvement (e.g., deposition of toxic air pollutants in the watershed and nonpoint-source pollutants). The Lake Michigan Lakewide Management Plan is one of the most comprehensive sources of information available on the current state of "health" of the Lake Michigan ecosystem.

Aquatic Communities of Lake Michigan

Nearshore benthic communities in Lake Michigan have undergone dramatic changes since the 1960s as a result of reductions in nutrient loads (phosphorus in particular) and the establishment of the nonnative zebra mussel (*Dreissena polymorpha*). Higher nutrient loads in the 1950s and 1960s were associated with higher productivity and higher densities of amphipods, oligochaetes, and sphaeriids (Nalepa et al. 1998).

Lower nutrient loads, the result of Clean Water Act-mandated changes and NPDES programs that reduced point-source and nonpoint-source pollutants in the 1970s and 1980s, produced declines in oligochaetes and sphaeriids throughout southern Lake Michigan. Densities of the amphipod *Diporeia*, an important food for lake whitefish (*Coregonus clupeaformis*) and a number of forage (prey) species, declined as zebra mussel densities increased in the 1990s (Nalepa et al. 1998). Large populations of zebra mussels filter feeding in nearshore waters appear to reduce the amount of food available to *Diporeia*, a surface-feeding detritivore, and limit its numbers.

Phytoplankton, which are consumed by zooplankton, benthic macroinvertebrates, and planktivorous fish (e.g., alewife), are the most basic component of Great Lakes food webs. Makarewicz et al. (1994) examined trends in phytoplankton abundance in Lake Michigan from 1983 to 1992 (and to a limited extent, historical trends) and related them to "top-down mediated changes" observed in the fish and zooplankton communities. Diatoms dominated spring samples in all years but one (1989), making up 69 percent (1983) to 95 percent (1986) of total algal biomass. Depending on zooplankton community composition, summer samples were dominated by diatoms, green algae, chrysophytes (golden-brown algae), and pyrrophytes (dinoflagellates; unicellular flagellated algae). As a general rule, the presence of the large-bodied zooplankton *Daphnia* was correlated with an increasing abundance of colonial algae and filamentous algae, while low numbers of *Daphnia* were associated with small, unicellular algae.

Makarewicz et al. (1994) also noted that large zooplankton (large cladocerans, calanoid copepods, and cyclopoid copepods) became more abundant from 1983 to 1985 after a "sharp decline" in the abundance of the planktivorous alewife (*Alosa pseudoharengus*) in 1982 and 1983. The reduction in alewife predation pressure may have also played a role in the establishment of *Bythotrephes cederstroemi*, a large cladoceran that preys on other zooplankton. Native to northern Europe, this species first appeared in the Great Lakes in 1984. It was first identified in Lake Michigan samples in 1986 and was consistently present in summer samples from 1987 to 1992 (Makarewicz et al. 1994). Aside from possible impacts on zooplankton populations (with which it competes and on which it preys), *Bythotrephes cederstroemi* (now commonly known as the spiny water flea) also competes with larval fish for food, with unknown consequences.

Fish populations in Lake Michigan have been shaped by the introduction of a number of aquatic species, some accidentally introduced and others planted by state and federal fish and game agencies. Several Atlantic Coast species, the sea lamprey (*Petromyzon marinus*) and the alewife being the most important, entered Lake Michigan via the Erie Barge Canal (which connects the Hudson River and Lake Erie) and the Welland Canal (which connects Lake Ontario and Lake Erie). Both species have had a devastating effect on native fish populations, including lake herring, whitefish, and lake trout, all of which were commercially and/or recreationally important prior to the arrival of these exotics.

The sea lamprey, an anadromous species within its native range, first appeared in the Great Lakes in the 1930s. In 1936, sea lampreys were discovered in Lake Michigan. The sea lamprey, a primitive predaceous species, attaches to large pelagic fishes by rasping holes in the sides of fish and digesting blood and tissues of the prey. The aftermath of the attack is usually death for the prey, either directly from the loss of fluids or indirectly from secondary infection of the wound. Lampreys remain attached until they are satiated or the host dies. Fish that survive are usually in poor condition and may take years to recover. Lake trout, burbot, and lake whitefish populations were devastated by lamprey predation in the 1940s and 1950s. Sea lamprey predation, in combination with other factors (overfishing, in particular), led to the extinction of three native coregonids: the longjaw cisco (*Coregonus alpenae*), the deepwater cisco (*Coregonus johannae*), and the blackfin cisco (*Coregonus nigripinnis*) (Fuller and Nico 2000).

The alewife, which first appeared in Lake Michigan in 1949, increased in abundance as its main predators (lake trout and burbot) were weakened or eliminated by sea lampreys. Alewife populations grew rapidly in the 1950s, and by 1967, made up an estimated 85 percent of fish biomass in Lake Michigan (Peeters 1998). The expansion of alewife populations in Lake Michigan and other Great Lakes almost certainly contributed to the decline of native planktivorous fishes, including the emerald shiner, the whitefish, the lake herring, and a number of chubs (Peeters 1998; Fuller and Nico 2000).

In the mid-1960s, massive die-offs of alewives created eyesores and potential health risks as they washed onto Lake Michigan's shores. The exact cause of these die-offs is unknown, but they may have been related to sudden temperature changes associated with weather changes or upwellings (Moy undated).

In an effort to control alewife and rainbow smelt numbers and improve the sport fishery, American and Canadian fish and game agencies in the mid-1960s began stocking several Pacific trout and salmon species (steelhead, coho and chinook salmon) and brown trout in Lake Michigan (Crawford 2001). These trout and salmon flourished, and by the 1970s, Lake Michigan fishermen were landing large numbers of healthy trout and salmon. Catch rates peaked in the mid- to late-1980s, and then leveled off, as alewife numbers declined.

Because of concern that alewife and smelt populations in Lake Michigan were not adequate to support the booming populations of trout and salmon, fisheries managers reduced stocking of nonnative salmonids in the 1990s. This appears to have allowed alewife and smelt populations to stabilize while at the same time improving the growth and overall health of trout and salmon. The massive plantings of nonnative salmonids (745 million fish were stocked between 1966 and 1998), originally viewed as an unqualified success, are now being reconsidered in view of disease outbreaks and possible impacts to native species (brook trout and lake trout) (Crawford 2001).

Abundance of adult alewives was generally high over the 1973 to 1981 period; markedly lowered over the 1982 to 1986 period; spiked in 1987 (reaching levels seen in the 1970s); and fluctuated from 1988 to 1999 (Fleischer et al. 2000). Since 1988, alewife abundance and biomass have fluctuated with no consistent trend, as strong year classes (1998 in particular) produced short-term increases in number; and poor year classes produced decreases in number. Although generally less abundant than in the 1950s and 1960s, the alewife remains the most important forage species for salmonids in Lake Michigan and continues to be the focus of fisheries managers (Fleischer et al. 2000).

Three other forage species – bloater (*Coregonus hoyi*), rainbow smelt (*Osmerus mordax*), and deepwater sculpin (*Myoxocephalus thompsoni*) – are also important components of the Lake Michigan fish community. Bloaters, which are eaten by lake trout and salmon, exhibit density-dependent growth and recruitment. Bloaters were abundant in Lake Michigan in the late 1980s, but the bloater population declined steadily thereafter, as high population densities apparently inhibited reproduction and recruitment (Fleischer et al. 2000). Rainbow smelt abundance was low throughout the 1990s, with biomass measures approximately one-fourth of those observed in the 1980s. Deepwater sculpin population numbers were relatively constant throughout the 1980s and 1990s, and there was some indication of increasing biomass in the late 1990s. The deepwater sculpin and closely-related slimy sculpin (*Cottus cognatus*) are eaten by juvenile lake trout and burbot.

Taken as a group, biomass of Lake Michigan forage fishes increased from the 1970s to the late 1980s, peaked in 1989, and appear to have declined steadily since 1989. The overall decline in forage fish biomass over the 1990s is due primarily to the decline in abundance of a single species: the bloater (Fleischer et al. 2000).

Although the top of the Lake Michigan food chain is now dominated by introduced species of trout and salmon, two native predators that had been largely eliminated by the 1960s appear to be recovering. The burbot (*Lota lota*), scarce in the 1960s, increased in abundance in the 1970s as a result of sea lamprey controls. Burbot abundance increased throughout the 1980s and 1990s, peaking in 1997; but in recent years, numbers have declined (Fleischer et al. 2000). Lake trout, almost eliminated by the sea lamprey in the 1950s, have also increased in abundance; but numbers are maintained by stocking programs rather than natural reproduction. Current efforts to restore the lake trout to Lake Michigan focus on stocking a variety of lake trout strains in offshore refuges that offer protection from commercial and recreational fishermen. Two to four million yearling lake trout are stocked annually in Lake Michigan (McKee and Jonas 2000).

As noted previously, non-native fish species have exerted a profound “top-down” effect on Lake Michigan’s aquatic communities in recent years. Large predatory fishes control abundance and distribution of forage species, such as alewife and rainbow smelt, which in turn selectively crop zooplankton. The composition of the zooplankton community determines the composition of the phytoplankton community, which directly affects primary productivity and water clarity.

The zebra mussel, another exotic, has had an equally important effect on Lake Michigan's aquatic communities by consuming zooplankton and phytoplankton, fundamentally altering food webs and displacing native mussels. The first zebra mussel was discovered in Lake Michigan in May 1988 in Indiana Harbor at Gary, Indiana. By 1990, adult zebra mussels had been found at multiple sites in the Chicago area; and by 1992, ranged along the eastern and western shoreline in the southern two-thirds of the lake, as well as Green Bay and Grand Traverse Bay (Fleischer et al. 2000).

Because they are capable of filtering large volumes of water (up to one liter a day per adult), zebra mussels remove large numbers of phytoplankton and zooplankton from the water column. As a consequence, plankton populations tend to decline precipitously and water clarity increases. Secondary impacts can be positive (increased water clarity and increased light transmissivity allow submerged aquatic vegetation to become established in deeper waters) or negative (zebra mussels bioconcentrate contaminants are eaten by fish and waterfowl).

Zebra mussels displace native clams and unionid mussels by interfering with their feeding, growth, reproduction, and respiration; often directly by attaching to the clam or mussel. They typically attach to live unionids rather than dead unionids or rocks, a behavior that tends to focus and magnify the impact of a zebra mussel invasion. Hundreds or thousands of zebra mussels may attach to a single large unionid. Because zebra mussels also have a high reproductive potential, they can eliminate native unionid mussels from an area in two to three years (Schloesser et al. 1996).

The latest exotic species to invade Lake Michigan, the round goby, appeared in southern Lake Michigan in 1994 (Fuller and Benson 2001). This small (generally less than 7 inches long) fish, native to the Black and Caspian Seas, was introduced into the Great Lakes via the ballast water of ocean-going ships. Round gobies are voracious feeders (preying on eggs and young of other bottom-dwelling species) that spawn several times over a long (April through September) spawning season, and aggressively defend spawning sites (Great Lakes Science Center 2002). They apparently occupy prime spawning areas and prevent native species from spawning. Biologists fear that the round goby will displace native sculpins and darters and feed on eggs of recreationally-important centrarchids (INHS 1998). In addition, there is a concern that the round goby will feed on lake trout eggs, which could hinder the recovery of this native salmonid in Lake Michigan (INHS 1995).

In summary, the aquatic communities of Lake Michigan are surprisingly dynamic and can change quickly in response to water quality changes and introductions of exotic species. Abundance and distribution of particular species (and species associations) in Lake Michigan can vary locally and regionally from year to year with weather and weather-related changes in currents and thermal regimes. The impact of exotic species such as the zebra mussel, sea lamprey, and alewife on aquatic communities is profound and far-reaching; and will challenge the best efforts of lake managers to restore the biological integrity of the Lake Michigan ecosystem.

Studies conducted by I&M and its contractors suggest that aquatic communities in southeastern Lake Michigan in the vicinity of CNP are shaped by the same complex array of interrelated factors that shape aquatic communities lake-wide. These include:

- Water quality trends in the basin (whether improving or deteriorating);
- Weather (locally, regionally, and globally);
- Interspecific interactions (predator-prey relationships; predator-prey boom and bust cycles; interspecific competition for space, food, and spawning areas); and
- Human impacts (manipulation of fish populations by fisheries managers, fishing mortality, and introduction of exotic species).

Studies of Aquatic Communities near Cook Nuclear Plant

Information on the aquatic communities of southeastern Lake Michigan in the vicinity of CNP may be found in the following:

- Final Environmental Statement (AEC 1973),
- *Southeastern Nearshore Lake Michigan: Impact of the Donald C. Cook Nuclear Plant* (University of Michigan 1986), and
- A 1995 evaluation of the impact of a proposed power uprate at the plant on fish and other aquatic organisms (Jude 1995).

The Final Environmental Statement summarizes early (1969 to 1972) studies of phytoplankton, periphyton, zooplankton, benthos, and fish in the area of CNP; and presents historical information on the abundance and distribution of commercially- and recreationally-important fish populations.

The second reference, a compilation of studies conducted by the University of Michigan's Great Lakes Research Division in the area of CNP, is a valuable source of information on the biotic communities of southeastern Lake Michigan circa 1970 to 1982. It also contains detailed descriptions of the abiotic components and processes that shape the aquatic communities, including:

- Winds, waves, and currents in the region;
- Physical and chemical characteristics of water in the region;
- Sediment composition; and
- The near-shore ice complex.

Thermal bars and upwellings, both of which influence the composition of near-shore plankton and fish communities are discussed in considerable detail.

(Jude 1995) described changes in the aquatic communities of southeastern Lake Michigan (in the general area of CNP) over the 1970 to 1993 period, changes that mirrored those observed in Lake Michigan as a whole. Aquatic populations in the vicinity of CNP were shaped by the same basic factors that operated on aquatic communities lake-wide: a reduction in nutrient loading, heavy stocking of nonnative salmonids, and the introduction of a number of exotic species, with the following results in the 1980s:

- Changes in benthic community structure,
- Reductions in zooplankton production,
- Declines in alewife populations (the result of cold winters and increased stocking of salmonids), and
- Increases in abundance of bloaters, yellow perch, and deepwater sculpins.

The recruitment of bloater and yellow perch slowed in the early 1990s, an indication that "population maxima" had been reached and density-dependent factors were controlling population growth. These changes were observed throughout Lake Michigan and were not unique to eastern Lake Michigan or the area of CNP. Jude's monograph, although focused on potential impacts of a power uprate (increased heat loading), is a valuable source of information on the aquatic communities of southeastern Lake Michigan in the 1970s, 1980s, and early 1990s.

Migratory Waterfowl

Although not aquatic organisms in the strictest sense, waterfowl are often found in the vicinity of CNP during their seasonal migrations. Diving ducks (including lesser scaup, greater scaup, buffleheads, common goldeneyes, redheads, and canvasbacks) migrate along the eastern shore of Lake Michigan. Several hundred scaups now winter in southwestern Michigan and are found at times feeding near the CNP intake structures during calm weather. They have also been spotted near the Grand Mere State Park north-northeast of the plant. Waterfowl in the CNP area appear to be attracted to zebra mussels that colonize the intake cribs and surrounding rip-rap; and to the protected warm water surrounding the center intake, which is used for deicing in winter.

2.3 Groundwater Resources

CNP is located within a local physiographic area known as the Grand Marais Embayment. This area extends 16 miles parallel to the lake and has an average width of one mile. On the Lake Michigan side, it is characterized by high sand dunes and shoreline features of several glacial lake stages. The area is bounded on the east by a glacial moraine known as Covert Ridge, which serves as a drainage divide and groundwater barrier (AEP 2002).

The subsurface geology consists of a surface Pleistocene deposit of dune sand that overlies older beach sand, which in turn is underlain by glacial lake clays, glacial till, and shale bedrock. In the eastern half of the CNP property, the beach sands are absent and the dunes rest directly on glacial lake deposits. The dune sand is generally loose at and near the surface, and grades to moderately compact with depth. The underlying beach sands are generally compact and commonly range from about 25 to 35 feet in thickness in the west-central portion of the property. The deeper bedrock formations consist predominantly of interbedded dolomites, limestones and shales, with important sandstone members (AEC 1973).

Groundwater supplies in the region are obtained primarily from unconsolidated Pleistocene drift deposits, termed water sands, which lie at 19- to 54-foot depths (AEC 1973). This unconfined aquifer is comprised of fine dune and lake sands that are underlain by thick impermeable clays with occasional sand or gravel lenses, which do not support heavy groundwater pumpage. The shale bedrock has no aquifer properties and the deeper sediments produce brines that are unsuitable for drinking water (AEC 1973). Recharge of ground water by infiltration of precipitation through the permeable sandy surficial soils is rapid.

As of 1999, the major parks, public facilities, and communities within 10 miles of CNP obtained their drinking water from Lake Michigan. However, there are a number of private domestic wells within the 10-mile radius. The nearest well is approximately 2,100 feet to the north. This well is not used for drinking water and may not be in use at all; however, there is no record of abandonment. The two nearest drinking water wells are approximately one mile each to the southeast and to the northeast from plant center. According to the Water Supervisor of Lake Charter Township, with the exception of these two wells, all residences surrounding CNP are supplied with water by the Township, which uses Lake Michigan water. CNP does not have any operable production wells (see Section 3.1.2).

Covert Ridge is a groundwater barrier as well as a watershed boundary between the glacial plain to the east and the Grand Marais Embayment to the west. Static groundwater levels east of the ridge are generally at elevation 650 feet above sea level. In contrast, static water levels west of the ridge occur generally at elevations of 580 to 610 feet above sea level. The chemical characteristics of the groundwater on each side of the ridge are also different. No wells are located between the CNP site and Covert Ridge to the east.

The overall gradient of the water table, except in the easternmost part of the site, is westward toward Lake Michigan. The groundwater divide between Thornton Valley and the dunes area is close to the topographic divide, some 3,500 feet east of the lake. Consequently, only minor groundwater seepage escapes into Thornton Valley, and this seepage originates from the extreme eastern part of the site. The water table gradient is very flat, with typical values of 0.5 to 0.7 percent in the dune area and one to four percent close to the lakefront. Consequently, the rate of groundwater flow under these conditions is extremely slow. In-place field permeability tests indicate an average permeability of the upper sands on the order of one to two feet per day with a maximum measured value of three feet per day.

As described more fully in Section 3.1.4, CNP discharges process wastewater and treated sewage effluent to ponds and lagoons southeast of the plant (Figure 2-3). These permitted discharges have created a groundwater mound that has superimposed a radial flow pattern on the regional flow towards Lake Michigan. The Groundwater Monitoring Program shows that the plant effluents are in compliance with National Drinking Water Standards, although there is an increase above background for total dissolved solids and sulfate. The groundwater plume from the absorption ponds has migrated to the southern plant boundary, but has not exceeded primary drinking water standards (AEPSC 1991). I&M has recorded a restrictive covenant in Berrien County to assure that water impacted by the containment plume would not be withdrawn for any purpose (McDonough 2000).

2.4 Critical and Important Terrestrial Habitats

The CNP property includes generation and maintenance facilities, laydown areas, parking lots, roads, and mowed grass. The local terrain consists of a gentle upward sloping beach that rises sharply into dunes. These dunes, some of which are over 290 feet high, are part of the highest series of forested dunes along eastern Lake Michigan.

Much of the CNP property includes stable dunes, covered by hardwood forest, which is the most prevalent habitat at CNP. The hardwood forests at CNP are complex and diverse, depending on different slope aspects and moisture regimes. In dry areas just behind the foredunes, black ash (*Fraxinus nigra*) and black oak (*Quercus velutina*) are dominant, but white pine (*Pinus strobus*) and jack pine (*Pinus Banksiana*) are also common. Where humus has accumulated on the ground surface, red oak (*Quercus rubra*), shag-bark hickory (*Carya ovata*), pignut hickory (*Carya glabra*), and white ash (*Fraxinus americana*) have become common canopy species. Beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*) dominate the forest further inland from Lake Michigan.

There are several wetlands in low-lying areas at CNP. Some of these wetlands contain standing water throughout the year while others have no visible surface water but have a water table near the surface. The marsh wetlands contain sedges (*Carex* spp.), rushes (*Juncus* spp.), umbrella-sedges (*Cyperus* spp.), and cattail (*Typha latifolia*). The swampy wetlands along streams and surrounding ponds contain several species of woody plants, such as white willow (*Salix alba*), black willow (*Salix nigra*), sandbar willow (*Salix exigua*), and buttonbush (*Cephalanthus occidentalis*).

A variety of small mammals occur in the natural habitats at CNP. Migrating birds occasionally are found in large numbers in the dunes and along the shoreline, since CNP lies in the Mississippi flyway. CNP includes the Cook Energy Center, a visitor's center and a natural area operated by I&M. The Nipissing Dune Trails, a series of interpretive nature trails, wind through several habitats at the Cook Energy Center, which is open to educational groups by appointment.

Physical features (e.g., length, width, route) of each of the transmission lines associated with CNP are described in Section 3.1.3. The transmission lines that originate at CNP traverse land-use categories typical of southern Michigan and northern Indiana, such as row crops, pasture, and abandoned (old) fields. In addition, the transmission corridors pass through more natural habitat types, such as hardwood forests.

No areas designated by the U.S. Fish and Wildlife Service as "critical habitat" for endangered species occur at CNP or adjacent to associated transmission lines. In addition, the transmission corridors do not cross any state or federal parks, wildlife refuges, or wildlife management areas. Grand Mere State Park is located approximately one mile north-northeast of CNP.

The transmission corridors associated with CNP are maintained by trimming and removal of undesirable vegetation from the floor and sides of the corridors, and by use of approved herbicides. Vegetation that is cut down is often left for habitat and erosion control. Transmission lines are patrolled annually by helicopter in spring and late summer. Unless otherwise needed, the maintenance schedule follows a four-year cycle. Herbicide application includes broadcast foliar applications and stump treatments, and is accomplished by certified applicators according to label specifications (Maskal undated).

2.5 Threatened and Endangered Species

Table 2-1 lists animal and plant species that are state- or federally-listed as endangered, threatened, or extirpated; and that have been recorded or observed in counties within which CNP and associated transmission lines are located. The transmission lines traverse Berrien (the location of CNP), Cass, and Van Buren Counties in Michigan; and Allen, DeKalb, Elkhart, Lagrange, Laporte, Noble, and St. Joseph Counties in Indiana (Figure 3-2). The scope of the transmission line corridors included in this survey is described in Section 3.1.3 of this report.

Species included in Table 2-1 are those that are either state- or federally-listed and meet at least one of the following conditions:

- Records maintained by the Michigan Department of Natural Resources (MDNR) indicate that the species is known to occur in Berrien, Cass, or Van Buren County (MDNR 2003b)

- Records maintained by the Indiana Department of Natural Resources (IDNR) indicate that the species is known to occur in Allen, DeKalb, Elkhart, Lagrange, Laporte, Noble, or St. Joseph County (IDNR 2002)

- The species was observed during field surveys commissioned by I&M and conducted in 2002 (see below)

- The species has been observed in the vicinity of CNP by I&M personnel

A field survey of the CNP site conducted in 1998 found one of two plant species known to occur and listed by MDNR as threatened - rose pink (*Sabatia angularis*). Broad-leaved sedge (*Carex platyphylla*), the other species previously known to occur, was not located during the 1998 survey. (RMG 1998).

In order to update information on endangered and threatened species, I&M commissioned field surveys of state- or federally-listed plant and animal species on the CNP site and its transmission line corridors. The field surveys were conducted in the spring, summer, and autumn of 2002; and are described in a report entitled “Threatened and Endangered Species Survey Final Field Report” (TRC 2002). The surveys were intended to: (1) identify listed species on the CNP site and associated transmission corridors; and (2) provide a sound basis for the assessment of potential impacts to these species over the license renewal term.

No federally-listed plants or animals were found during the 2002 surveys of the CNP site and associated transmission line corridors.

One animal and seven plant species listed by MDNR (i.e., state-listed) as endangered, threatened, or extirpated were observed during the 2002 field surveys on the CNP property:

- Numerous Caspian terns (*Sterna caspia*) (state-listed as threatened) and one Caspian tern egg, were observed along the beach at CNP during the spring survey (Whitten 2002).

- Approximately 90 to 100 straw sedge (*Carex straminea*) plants (state-listed as endangered) were found in a wetland in the northeastern portion of the CNP property. .

- Approximately 75 scirpus-like rush (*Juncus scirpoides*) plants (state-listed as threatened) were found in a wetland in the northeastern corner of the CNP site.

- One specimen of red mulberry (*Morus rubra*) (state-listed as threatened) was discovered on a wooded dune near the absorption ponds.

- Water-meal (*Wolffia papulifera*), a minute floating aquatic plant (state-listed as threatened), was abundant on a small intermittent stream in the southern portion of CNP.

- Carey's smartweed (*Polygonum careyi*) (state-listed as threatened) was found at two locations at the CNP property. About 20 plants were found in a swale near the Nipissing Dune NatureTrails; 10 to 15 plants were located in a swale near Thornton Road.

- One specimen of purple coneflower (*Echinacea purpurea*) (state-listed as extirpated) was found on a sand dune north of the Visitor's Center near the end of the Nipissing Dune Nature Trail at CNP. Botanical references discussed by Third Rock Consultants (TRC 2002) indicate that some occurrences of the purple coneflower in Michigan are escapes from cultivation. Since only a single specimen of purple coneflower was observed, and since its location was near a butterfly garden just north of the Visitor's Center (where this species has been cultivated), it is unclear whether this occurrence represents a native specimen or is the result of an escape from cultivation.

- Three populations of rose-pink (*Sabatia anagularis*) (state-listed as threatened) were observed at CNP. One group of approximately 25 plants was beneath the transmission lines immediately east of the switchyard; one population of approximately 30 plants was found in a mowed area near Interstate 94; and one population of 30 to 40 plants was found just east of Red Arrow Highway within a transmission corridor.

The bald eagle (Haliaeetus leucocephalus) is federally-listed and state-listed in Michigan as threatened, and is state-listed in Indiana as endangered. The osprey (Pandion haliaetus) and common tern (Sterna hirundo) are state-listed in Michigan as threatened. Bald eagles and ospreys are occasionally observed flying along the shoreline at CNP or perched in trees overlooking the shoreline, and common terns are occasionally seen along the shoreline; however, no bald eagle, osprey, or common tern nests are known to occur at CNP.

The spotted turtle (Clemmys guttata) was previously known to occur in a wetland east of the CNP absorption pond. However, I&M personnel have not observed any spotted turtles in this wetland or at any other location at CNP in the past 10 years.

Field surveys of transmission lines associated with CNP identified two state-listed animal species and six state-listed plant species on the transmission line corridors. Both of the following animal species (listed by IDNR as endangered) were observed on the Twin Branch No. 2 transmission corridor in Indiana:

- A single loggerhead shrike (*Lanius ludovicianus*), and
- Two golden-winged warblers (*Vermivora chrysoptera*).

The following three plant species (listed as endangered by IDNR) were discovered along transmission corridors in Indiana:

- Two populations of southern dewberry (*Rubus enslenii*). Approximately 30 to 50 plants were found on the Collingwood transmission corridor, and about 20 to 25 plants were found on the Twin Branch No. 2 corridor.
- One population of approximately 75 individuals of Drummond's rockcress (*Arabis drummondii*), on the Twin Branch No. 1 transmission corridor, just north of the Twin Branch Substation.
- One population of approximately 25 to 30 swamp smartweed (*Polygonum hydropiperoides setaceum*) plants, on the Twin Branch No. 2 corridor.

The following three plant species (listed as threatened by MDNR) were discovered along transmission corridors in Michigan:

- Four populations of prairie trillium (*Trillium recurvatum*) were discovered. Populations of 25 plants, 20 plants, and 5 plants were found on the Olive corridor in Berrien County. One population of 10 plants was found on the Twin Branch No. 1 corridor in Cass County.
- One population of water-meal (*Wolffia papulifera*) was observed on the Palisades No. 1 and No. 2 transmission corridor.
- One population of 65 to 75 scirpus-like rush plants (*Juncus scirpoides*) was also discovered on the Palisades No. 1 and No. 2 corridor.

With the exception of occasional sightings of transient bald eagles, I&M is not aware of the occurrence of any federally-listed terrestrial species along the transmission lines corridors. As shown in Table 2-1, very few federally-listed species are known to occur in the counties in which the transmission corridors are located. However, several species (particularly plants) listed by Indiana or Michigan have been recorded in these counties (Table 2-1).

A previous study (Sackschewsky 1997) suggested that two federally-listed plant species, Pitcher's thistle (*Cirsium pitcheri*) and the small whorled pogonia (*Isotria medeoloides*), might occur along the CNP transmission corridors. Neither of these species was discovered during the 2002 field surveys of the transmission corridors.

It should be noted that the transmission corridors are managed to prevent woody growth from reaching the transmission lines. The removal of woody species can provide outstanding grassland and wetland habitats for many rare plant species that are dependent on open conditions.

No federally-listed aquatic species are believed to occur in Lake Michigan in the vicinity of CNP. Three federally-listed mollusks are found in Indiana counties crossed by CNP-associated transmission lines (Table 2-1) and could occur in streams that cross the transmission corridors. Sackschewsky (1997) suggested that the clubshell mussel (*Pleurobema clava*) and the tubercle-blossom pearly mussel (*Epioblasma torulosa torulosa*) might occur in streams crossed by the transmission lines, primarily in Indiana. However, neither IDNR nor MDNR has records of the tubercle-blossom pearly mussel (federally-listed and state-listed in Indiana as endangered) in the counties crossed by the transmission lines (IDNR 2002; MDNR 2003b). The field surveys discussed above included a survey (conducted in August 2002) for threatened and endangered mussels. No state- or federally-listed mussels were observed during the survey (TRC 2002).

2.6 Regional Demography

The 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.

"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.

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

GEIS Sparseness and Proximity Matrix

Sparseness \ Proximity	1	2	3	4
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.

2.6.1 General Population

I&M used 2000 census data from the U.S. Census Bureau website (USCB 2000a) and geographic information system software (ArcView®) to determine most demographic characteristics in the CNP vicinity. As derived from 2000 Census Bureau information, 156,663 people live within 20 miles of CNP (USCB 2000a). Applying the GEIS sparseness measures, CNP has a population density of 238 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 2000 Census Bureau information, 1,447,303 people live within 50 miles of CNP (USCB 2000a). This equates to a population density of 283 persons per square mile. Applying the GEIS proximity measures, CNP is classified as Category 4 (greater than or equal to 190 persons per square mile within 50 miles). According to the GEIS sparseness and proximity matrix, the CNP ranks as a Category 4 for both factors, resulting in the conclusion that CNP is located in a high population area. There are no growth control measures currently in effect that would limit housing development in this area.

The following are located within 50 miles of CNP (Figure 2-1):

- Sixteen whole or partial counties,
- The Benton Harbor Metropolitan Statistical Area,
- Portions of the Chicago Metropolitan Statistical Area, and
- The city of South Bend, Indiana.

The Benton Harbor Metropolitan Statistical Area (Benton Harbor MSA), which contains Berrien County, is a varied mixture of rural and smaller metropolitan areas, with a current total population of 162,453 (USCB 2001). From 1990 to 2000, the population of the Benton Harbor MSA grew from 161,378 to 162,453, an average annual increase of 0.007 percent (USCB 2001). Of the 280 MSAs in the United States, the Benton Harbor MSA is the 192nd largest. The largest cities in the Benton Harbor MSA include Benton Harbor and St. Joseph. Their 2000 populations are 11,182 and 8,789, respectively (USCB 2000b and USCB 2000c).

The Chicago Metropolitan Statistical Area (Chicago MSA) is a densely populated region consisting of Chicago, Illinois; Gary, Indiana; and Kenosha, Wisconsin (USCB 2001). The City of Chicago lies across Lake Michigan, approximately 55 miles southeast of CNP. From 1990 to 2000, the population of the Chicago MSA increased from 8,239,820 to 9,157,540, an average annual increase of 1.1 percent (USCB 2001). Of the 280 MSAs in the United States, the Chicago MSA ranks third in population size (USCB 2001).

The City of South Bend, located in St Joseph County, Indiana, reported a 2000 population of 107,789 (USCB 2000d).

Due to the current distributions of employees at CNP, Berrien County, Michigan, and St. Joseph County, Indiana, are the counties with the greatest potential to be socioeconomically affected by license renewal activities at CNP (see Section 3.4). These two counties are growing at slower rates than the States of Michigan and Indiana, respectively. From 1970 to 2000, Michigan's average annual population growth rate was 0.4 percent (USCB 1995a and 2000e), while Berrien County's population *decreased* by 0.03 percent (USCB 1995a and 2000f). From 1970 to 2000, Indiana's average annual population growth rate was 0.6 percent (USCB 1995b and 2000g), while St. Joseph County grew by only 0.3 percent (USCB 1995b and 2000h).

Table 2-2 shows estimated populations and annual growth rates for Berrien County, Michigan, and St. Joseph County, Indiana. Between the years 2000 and 2040, the population of Berrien County is projected to *decrease* at an average annual rate of 0.1 percent (TtNUS 2002). For the same period, St. Joseph County is projected to grow at the average annual rate of 0.3 percent (TtNUS 2002). The populations of Michigan and Indiana are projected to grow at the average annual rates of 0.3 and 0.4 percent, respectively (TtNUS 2002).

Because of its location on Lake Michigan between Chicago and Detroit, Berrien County has a summer influx of tourists. St. Joseph City, the County Seat, lies just north-northeast of the Bridgman area where CNP is located. The City and surrounding areas receive tens of thousands of tourists who enjoy the beaches, Lake Michigan, the St. Joseph River, and a number of annual festivals (City of St. Joseph undated). Silver Beach County Park, located in downtown St. Joseph, attracts over 150,000 annually (City of St. Joseph undated).

Table F.2-7 of Appendix F presents population data by sector and radius.

2.6.2 Minority and Low-Income Populations

Background

When the NRC performed environmental justice analyses for previous license renewal applications, it 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. I&M has adopted this approach for identifying the CNP minority and low-income populations that could be affected by CNP operations.

I&M used ArcView® geographic information system software to combine Census Bureau TIGER line data with Census Bureau 2000 census data to determine the minority characteristics on a block group level. Low-income demographic data is not available on a block group level. Therefore, the TIGER line data was combined with census tract level demographic data to determine the low-income characteristics. I&M included all block groups if any of their area lay within 50 miles of CNP. The 50-mile radius includes 1,244 block groups and 382 census tracts. I&M defines the geographic area for CNP as the entire state of Michigan, Illinois, or Indiana, separately for block groups or tracts that are contained in each state. The largest portion of minority block groups is located in Indiana.

Minority Populations

The NRC's "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues" defines a minority population as any of the following:

- American Indian or Alaskan Native;
- Asian;
- Native Hawaiian or other Pacific Islander;
- Black races;
- Other single minorities;
- Multiracial;
- 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.

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

The NRC guidance calls for use of the most recent Census Bureau decennial census data. I&M used 2000 census data from the Census Bureau website (USCB 2000i; USCB 2000j; USCB 2000k) in determining the percentage of the total population within Michigan, Illinois, and Indiana for each minority category; and in identifying minority populations within 50 miles of CNP.

I&M 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 1,244 block groups within 50 miles of CNP, I&M 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. I&M defines the geographic area for CNP as the entire State of Michigan when the block group is contained within Michigan, the State of Illinois when the block group is contained within Illinois, and all of Indiana when the block group is contained within Indiana.

Census Bureau data (USCB 2000i) for Michigan characterizes Michigan's minority populations as follows:

- 0.6 percent as American Indian or Alaskan Native;
- 1.8 percent Asian;
- 0.03 percent Native Hawaiian or other Pacific Islander;
- 14.2 percent Black races;
- 1.3 percent all other single minorities;
- 1.9 percent multiracial;
- 19.8 percent aggregate of minority races; and
- 3.3 percent Hispanic ethnicity.

Census Bureau data (USCB 2000j) for Illinois characterizes Illinois' minority populations as follows:

- 0.2 percent as American Indian or Alaskan Native;
- 3.4 percent Asian;
- 0.04 percent Native Hawaiian or other Pacific Islander;
- 15.1 percent Black races;
- 5.8 percent all other single minorities;
- 1.9 percent multiracial;
- 26.5 percent aggregate of minority races; and
- 12.3 percent Hispanic ethnicity.

Indiana contains the largest portion of the geographic area at approximately 66 percent of the block groups. Census Bureau data (USCB 2000k) for Indiana characterizes Indiana's minority populations as follows:

- 0.3 percent as American Indian or Alaskan Native;
- 1.0 percent Asian;
- 0.03 percent Native Hawaiian or other Pacific Islander;
- 8.4 percent Black races;
- 1.6 percent all other single minorities;
- 1.2 percent multiracial;
- 12.5 percent aggregate of minority races; and
- 3.5 percent Hispanic ethnicity.

Table 2-3 presents the numbers of block groups within each county that exceed the threshold for determining the presence of minority populations. Figures 2-4 through 2-8 display the minority block group distributions among the counties in the geographic area.

Based on the "more than 20 percent" or the "exceeds 50 percent" criteria, none of the following minority populations exist in the geographic area:

- American Indian or Alaskan Native;
- Native Hawaiian or other Pacific Islander; or
- Multiracial.

Based on the "more than 20 percent" criterion:

- The Asian minority population exists in one block group (Table 2-3). Figure 2-4 displays the location of this minority block group: Kalamazoo County, Michigan.

- The Black Races minority populations exist in 212 block groups (Table 2-3). Figure 2-5 displays the locations of these minority block groups.

- The All Other Single Minorities minority populations exist in 43 block groups (Table 2-3). Figure 2-6 displays the minority block group distributions among the counties in the geographic area.

- The Aggregate of Minority Races populations exist in 267 block groups (Table 2-3). Figure 2-7 displays the locations of these block groups.

- The Hispanic Ethnicity minority populations exist in 85 block groups (Table 2-3). Figure 2-8 displays the locations of these block groups.

Low-Income Populations

NRC guidance defines "low-income" using Census Bureau statistical poverty thresholds (NRC 2001). I&M divided "low-income" household numbers for each block group by the total households for that block group to obtain the percentage of "low-income" households per census tract. Census Bureau data (USCB 2000l) characterize 10 percent of Michigan households as low-income, 10 percent of Illinois households as low-income, and 10 percent of Indiana households as low-income.

A "low-income population" is considered to be present if:

1. The low-income population of the census block or environmental impact site exceeds 50 percent.

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 "exceeds 50 percent" criteria, no low-income populations were present in any of the tracts analyzed. Based on the "more than 20 percent" criterion, 29 block groups contain a low-income population (USCB 2002). Seventeen tracts are in Indiana, eight tracts are in Michigan, and four tracts are in Illinois. Table 2-3 displays the low-income household block group distributions among the counties in the geographic area. Figure 2-9 locates low-income household tracts.

2.7 Taxes

CNP pays annual property taxes to Lake Charter Township, located in Berrien County. Lake Charter Township retains the majority of CNP-generated revenues to meet township budgets, while forwarding the balance of the revenues to Berrien County and the State. Property tax revenues provide funds for township, county, and state programs such as emergency management services, school systems, county operations, road maintenance, and libraries (Korcek 2002).

For the years 1996 to 2000, CNP's property taxes provided 50 to 52 percent of Lake Charter Township's total property tax revenues. For the years 1996 to 2000, CNP's property taxes provided 2 to 3 percent of Berrien County's total property tax revenues. Table 2-4 compares CNP's tax payments to Lake Charter Township and Berrien County tax revenues.

I&M projects that CNP's annual property taxes will remain relatively constant throughout the license renewal period. In June 2000, Michigan restructuring legislation was signed into law. The Michigan Public Service Commission is currently in the process of implementing electric power industry restructuring and the effects are not yet fully known. The changes could affect CNP's tax payments to the Township and County. However, any changes to CNP tax rates due to restructuring would be independent of license renewal.

2.8 Land Use Planning

The majority of the permanent CNP workforce lives in Berrien County, Michigan, and St. Joseph County, Indiana (Section 3.4). Therefore, this section focuses on Berrien and St. Joseph Counties. Berrien County's population changes have fluctuated between positive and negative growth rates over the last 30 years. Overall, the County has exhibited slightly negative growth. In contrast, St. Joseph County has experienced steadily increasing growth over the last several decades. In both counties, land use planning tools, such as zoning, have guided growth and development. Regional and local planning officials share the goals of encouraging growth and development in areas where public facilities, such as water and sewer systems, are planned, and discouraging incompatible land use mixes in contiguous areas and strip development.

Berrien County, Michigan

Current Land Use (Berrien County 2003)

Berrien County occupies roughly 583 square miles of land area. Major county-wide land use categories are classified as follows: residential (9.4 percent), commercial (1.3 percent), industrial (1.5 percent), public and semipublic (3.5 percent), and agricultural or vacant (84.2 percent).

Approximately 20 years ago, the County consisted of residential and commercial uses coexisting in the urban centers. Industrial uses were developed in urban centers or just beyond urban boundaries. Parks and recreation areas were scattered throughout the County (as it is presently), with the natural beauty of Lake Michigan enhancing the quality of life. Farming dominated the rural landscape; however, the trend of development encroaching on prime farmland was beginning.

Today, the majority of the land in the County is rural in character, either vacant, forested, or in agricultural production. The land is well suited for the production of a variety of row crops, specialty crops, and livestock. According to the Farm Bureau, the acreage of farms has increased, but number of farms has decreased. An estimated 315,000 acres comprise the agricultural/vacant land use in the County.

Residential land use constitutes the next largest form of land use. The Twin City Area (St. Joseph, Benton Harbor) and Niles are the major urban centers. With the exception of Niles and the Twin City Area, most developed land is classified as low density residential. Residential development appears to be moving away from the core urban centers and creating "sprawl." It is evident that population growth is relatively "stagnant"; however, the trends of smaller household sizes, increased new development, and the boom in subdivisions and condominium construction are on the rise.

The Lake Michigan lakefront is continually confronting growth pressures for new residential development. An estimated 35,000 acres make up the residential land use in Berrien County.

Commercial land uses are centered around core urban areas and along major traffic corridors. The Fairplain area (Benton Township) has experienced substantial commercial development in the last 5 years and has built new roads to accommodate the increased traffic volumes associated with the new commercial activity. There is an estimated 4,900 acres of commercial land in the County. Since the previous Development Plan of 1975, commercial land uses have doubled in size.

Industrial land uses throughout the County are typically located near urban areas. Industrial land uses comprise 5,600 acres of the total land area. Since the Development Plan of 1975, industrial acreage has more than doubled. Industrial parks have become the predominant development tools to foster industrial growth. Tax incentives have also contributed to the attraction of new industry to the County.

Future Land Use (Berrien County 2003)

Preservation is a primary focus of the communities and their planning entities for future land use decision-making. Farmland, open space, and historic preservation legislation provide tools to assist in managing growth. Due to the autonomy of the local municipalities, each municipality must create its own development tools.

The Berrien County Planning Commission has developed an overall strategy that provides consistent guidance to all municipalities. The strategy consists of a series of goals that are categorized into four primary issues: land use, environment, economy, and transportation. With respect to these goals, the County encourages the employment of a “smart growth” methodology, which includes the following:

1. Promoting mixed land uses
2. Utilizing compact building designs
3. Creating a range of housing opportunities and choices
4. Creating pedestrian-friendly neighborhoods
5. Fostering distinctive, attractive communities with a strong sense of place
6. Preserving open space, farmland, natural beauty, and critical environmental areas
7. Directing development towards and strengthening existing communities
8. Providing a variety of transportation choices
9. Making development decisions predictable, fair, and cost-effective
10. Encouraging communities and interested parties to cooperate in determining development designs

St. Joseph County, Indiana

Current Land Use (St. Joseph County/City of South Bend 2002)

St. Joseph County occupies approximately 462 square miles.

Current county-wide land use categories are classified as follows:

- Agriculture (69.1 percent),
- Industrial/office/retail (1.8 percent),
- Residential (10.7 percent),
- Institutional (3.0 percent), and
- Natural/vacant (15.4 percent).

The most densely urbanized area of the County is the northeast portion, which contains:

- The Cities of South Bend and Mishawaka;
- The Towns of Osceola, Indian Village, and Roseland; and
- The unincorporated area of Granger.

When comparing historical and existing data regarding land use development within the County, it is apparent that much of the growth of the urbanized area has been in areas adjacent to urban centers. Prior to 1960, the urbanized areas of the County were more consolidated. However, over the next several decades, the urbanized areas expanded to the east and northeast. Minimal expansion occurred to the northwest and southwest.

Overall growth patterns in the County have been attributed to several factors:

(1) An effective agricultural preservation zoning policy has provided a growth boundary on the southern and western edges of the urbanized area. The policy requires a minimum of 20 acres per residential unit in agriculturally-zoned areas.

(2) Topographic and drainage features have constrained some types of urban extension.

(3) Because of the large expense involved, many areas throughout the County contain residential communities that have been built without public water or wastewater services. Therefore, the County is heavily dependent on private well use and groundwater sources.

Agricultural preservation has been somewhat successful in St. Joseph County. The amount of land in farms has remained relatively constant, despite a drop in the number of farms. Agricultural conversion has primarily occurred in preselected areas and within acceptable limits as established by the County's previous (1973) Comprehensive Plan.

Future Land Use (St. Joseph County/City of South Bend 2002)

The County's Comprehensive Plan proposes that future land use expansion occur in the following categories and increments: commercial (12 percent), industrial (31 percent), and residential (57 percent). Planned residential growth has three facets:

1. New growth will be focused on the northwestern and southern parts of the City of South Bend.

2. Infill growth will be encouraged in the northeastern part of the County.

3. Rural growth will be encouraged in some of the smaller towns and communities throughout the County.

The Plan recommends that new commercial growth areas should be located in currently urbanized areas such as South Bend and Mishawaka. Industrial growth will be encouraged in the northern part of the County and in one location on the southwest side of Walkerton.

The County is pursuing a policy of growth based on "smart growth" standards, a set of standards designed to balance the needs of the County with the desire to protect natural resources. "Smart growth" standards employ a number of key techniques, including the following:

- Urban growth boundaries – As a result of the current agricultural zoning ordinance, areas that have been protected form a continuous boundary around existing urban areas. The boundary largely restricts growth to areas that are already classified as urban or are planned for growth. The goals are to maximize population densities and help minimize the costs of public services.

- Phased growth – By phasing growth, the development of public facilities and services can be timed in such a manner so as to provide greater efficiency and minimize disruption.

- Integrated land uses – The goals are to minimize the impacts of differing land use types on one another and to provide easy access to commercial and industrial developments without intruding on natural or residential areas.

2.9 Social Services and Public Facilities

2.9.1 Public Water Supply

Because CNP is located in Lake Charter Township (in Berrien County) and most of the CNP employees reside in Berrien or St. Joseph Counties, the discussion of public water supply systems will focus on these two counties. CNP acquires potable and fire protection system water from Lake Charter Township. The average daily usage by CNP in 2001 was roughly 470,000 gallons. This usage represents approximately 9.4 percent of Lake Charter Township's 2001 daily maximum capacity (see Table 2-5) and 27 percent of the Township's 2001 average daily use.

Berrien County

Water supplies include both surface and groundwater sources. However, surface water is the primary source of potable water for the communities in Berrien County. Lake Michigan is the major surface water source for the western communities in the County.

Overall, Lake Michigan meets the Water Quality Standards set by the State (Berrien County 2003). However, this resource is threatened by nonpoint-source pollution from runoff near urban areas, construction sites, and agricultural lands and by point discharges from municipal and industrial processes. This pollution can result in increased nutrient enrichment, sedimentation, and toxins in the water. Lake Michigan is classified as having a moderate nutrient level and its water quality has improved with decreased discharges of phosphorus from point sources (Berrien County 2003). However, the water quality is threatened by the introduction of exotic aquatic species and the presence of persistent toxic pollutants. Due to bioaccumulation of toxins in fish tissues, public health fish consumption advisories are in effect for the Great Lakes (Berrien County 2003).

Fortunately, because Lake Michigan is so large and severe contamination appears to be localized, contamination has not been a major issue for the residents of Berrien County. Therefore, excess water capacity is high (Alimenti 2003). When presented with new residential, commercial, or industrial development-related water demands, required infrastructure supports are readily provided (Alimenti 2003). Table 2-5 provides the details of Berrien County's respective water suppliers and capacities. The data reflect that Berrien County's water suppliers have excess capacity in every major system.

St. Joseph County

There are 230 potable water suppliers in St. Joseph County that are monitored by the State of Indiana (IDEM 2002). Water supplies include both surface and groundwater sources. Because the County is relatively landlocked and does not have access to large quantities of surface water sources, the County is heavily dependent on groundwater. The largest groundwater supply source in the area is the St. Joseph aquifer, followed by the Nappanee and the Hilltop acquifers. In recently published studies about the groundwater quality of the St. Joseph aquifer, several sample sites have tested positive for contamination. Among the contaminants that have exceeded Environmental Protection Agency guidelines are nitrates, antimony, and chloride (St. Joseph County/City of South Bend 2002).

The large expense involved in providing public infrastructure (such as public water or wastewater services) has prevented many newly constructed residential communities throughout the County from gaining access to these services (St. Joseph County/City of South Bend 2002). The County is, therefore, heavily dependent on private well use (St. Joseph County/City of South Bend 2002). Most private wells are not monitored by the State of Indiana, and details regarding their number or nature are unknown.

Because the number of water suppliers, public and private, are numerous and only 8.9 percent of the current CNP workforce resides in St. Joseph County, the suppliers will not be listed in this document. However, the two largest municipal water suppliers in St. Joseph County, South Bend Water Works and Mishawaka Utilities (EPA 2002), both report ample water supplies to meet customer demand (South Bend Water Works 2002; Mishawaka Utilities 2002). Together, they serve a population of approximately 161,000 (EPA 2002) by tapping into the St. Joseph Aquifer, which has been reported to support withdrawal rates of up to 1,500 gallons per minute (St. Joseph County/City of South Bend 2002).

2.9.2 Transportation

Road access to CNP is via Cook Place, a one-mile two-lane paved road with an east-west orientation. Cook Place intersects with Red Arrow Highway, a 4-lane highway, which has a northeast-southwest orientation (Figure 2-2). Running parallel to Red Arrow Highway is Interstate 94, a 6-lane highway. Employees traveling from the communities of St. Joseph and Bridgman, and other communities to the north or south of CNP use either Interstate 94 or Red Arrow Highway. Employees traveling from South Bend, Indiana, and other communities to the east have no direct routes to CNP. They use numerous trunk and ancillary roads in order to reach the plant; because optional routes are plentiful, it is not possible to analyze them all. Additionally, the percentage of employees traveling from the east is small and, when spread throughout the numerous routes from the east, their presence is highly diluted. However, when nearing CNP, all employees must use Red Arrow Highway.

Many of the principal and minor arterials in southwest Michigan have experienced moderate increases in traffic volumes over the last several decades. A number of roads have been reclassified and maintained in order to accommodate the increasing loads (Southwestern Michigan Commission 2000). Interstate 94, in particular, has been impacted by a large increase in commercial traffic volumes. The Annual Average Daily Traffic (AADT) volumes on Interstate 94 in the region surrounding CNP range from 38,000 to 63,000 vehicles (MDOT 2000). In response to the increased burden on Interstate 94 and other arterials in the area, the State of Michigan is reprioritizing funding for maintenance and improvement projects to accommodate the ongoing development, population redistribution, and growth (Southwestern Michigan Commission 2000).

In 1999 and 2000, I&M hired a traffic engineering firm to develop a solution for congestion at the intersection of Cook Place and Red Arrow Highway (Traffic Engineering Consultants 1999). The addition of a fourth approach to the intersection, the addition of a remote parking lot, and an increase in the number of personnel at the plant contributed to the need for a significantly higher capacity at that location. I&M decided against increasing capacity through physical/geographic modifications (i.e., lane addition), so the traffic signal control system was optimized to address the problem (Traffic Engineering Consultants 1999).

In determining the significance levels of transportation impacts for license renewal, the NRC employs the use of the Transportation Research Board's level of service (LOS) definitions (NRC 1996). LOS is a quantitative measure describing operational conditions within a traffic stream and their perception by motorists. LOS definitions are as follows:

A - Free flow of the traffic stream; users are unaffected by the presence of others.

B - Stable flow in which the freedom to select speed is unaffected, but the freedom to maneuver is slightly diminished.

C - Stable flow that marks the beginning of the range of flow in which the operation of individual users is significantly affected by interactions with the traffic stream.

D - High-density, stable flow in which speed and freedom to maneuver are severely restricted; small increases in traffic will generally cause operational problems.

E - Operating conditions at or near capacity level causing low but uniform speeds and extremely difficult maneuvering that is accomplished by forcing another vehicle to give way; small increases in flow or minor perturbations will cause breakdowns.

F - Defines forced or breakdown flow that occurs wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. This situation causes the formation of queues characterized by stop-and-go waves and extreme instability.

The Michigan Department of Transportation maintains LOS designations for state trunk roads only. In the event that LOS data is unavailable, annual average daily traffic volumes are substituted. Counts determining the average number of vehicles per day are available for selected state-maintained routes. Table 2-6 lists roadways in the vicinity of CNP and the LOS determinations or annual average number of vehicles per day, as determined by the Michigan Department of Transportation and the Southwestern Michigan Commission.

2.10 Meteorology and Air Quality

CNP is located in Berrien County, Michigan, which is part of the South Bend-Elkhart (Indiana)–Benton Harbor (Michigan) Interstate Air Quality Control Region (AQCR) (40 CFR 81.73). All counties in the AQCR are designated as unclassifiable or in attainment for all criteria pollutants, as are all counties in Michigan (40 CFR 81.323).

The nearest nonattainment area is the Metropolitan Chicago Interstate AQCR, which includes Lake and Porter Counties in Indiana (40 CFR 81.14). As shown in Figure 2-1, Porter County is approximately 30 miles southwest of CNP; Lake County is approximately 45 miles southwest of CNP. Both Lake and Porter counties are designated severe-17 nonattainment with respect to one-hour ozone standards. Parts of Lake County are also designated as nonattainment for particulate matter (PM-10) and sulfur dioxide (40 CFR 81.315).

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 Michigan and Indiana. There have been legal challenges to this revised standard. If these challenges are overcome by the EPA, portions of the South Bend (Indiana)–Benton Harbor (Michigan) AQCR, which includes the CNP site, are expected to become an eight-hour ozone nonattainment area.

Appendix F, Severe Accident Mitigation Alternative Analysis, contains additional site meteorological information.

2.11 Historic and Archaeological Resources

Area History in Brief

Since the end of the final Ice Age, Berrien County's rivers, prairies, and lakeshores have drawn settlers who have produced a varied array of archeological remains. The first inhabitants were the Paleo-Indians who settled along the high ridges that were once the shores of the lakes and streams created by the melting glacier. As the glacier receded and the deer and elk replaced the mastodon and caribou, the inhabitants evolved in their ways of life. The changing nature of arrowheads reflected the evolution of hunting techniques. Burial of the dead became increasingly elaborate (Mead 1980).

From 100 to 300 AD, the inhabitants of Berrien County lived in small, temporary villages, constructed mounds of earth over the graves of the dead, and participated in a trade network that linked most of eastern and central North America from the Great Lakes to the Gulf of Mexico. These people, called the Hopewellians, were the ancestors of present day Native Americans. It is postulated that agriculture was introduced from Ohio and Illinois at about this time (Mead 1980).

By roughly 1000 AD, the cultivation of corn, beans, and squash had become an important part of the Berrien County inhabitants' diet and economy. The people in the southwestern portion of the state were more closely related to the northern Illinois Native Americans than to those elsewhere in Michigan. Circular stockades reinforced by earthen embankments enclosed some of their villages. Most hunting was done with bow and arrow, and well-constructed pottery was produced. These inhabitants were related to the Miami and Potawatomi, and were the first Native Americans to encounter the earliest European settlers in present-day southwest Michigan (Mead 1980).

The French were the first Europeans to enter the area. Arriving in the late 1600s, they built Fort Miami at the mouth of the St. Joseph River (in what is present-day St. Joseph). Near the end of the seventeenth century, French explorers built Fort St. Joseph further up the river, at the present site of Niles. It was the site of the area's first Jesuit mission. Though Fort Miami fell into disuse, Fort St. Joseph was occupied until the French left the area in 1763. The British held the fort until captured by the Spanish in 1781. Though the Spanish stayed only a few days, their presence provided Niles with the unique distinction of being the "town of four flags," the only Michigan community able to make such a claim (Rosentreter 1980).

With the exception of transient traders, Berrien County remained unsettled until Squire Isaac Thompson, the County's first "settler," arrived at Niles in 1823. Berrien County was organized in 1831 and named after U.S. Attorney General John M. Berrien. The County was continually populated by settlers, and by the start of the Civil War, the County's population was well over 20,000. Following the Civil War, Berrien experienced "impressive" growth as a result of its major industries, which included agriculture (fruit production), tourism, and manufacturing (Rosentreter 1980).

Initial CNP Evaluation

The Final Environmental Statement (FES) for operation of CNP lists seven important historic landmarks in Berrien County (AEC 1973). Two of the landmarks were National Historic Register sites: the Old Berrien Courthouse and the Ring Lardner House.

In the FES, I&M reported that "None of the facilities listed…will be affected by the presence or operation of the Station" (AEC 1973). This statement was supported by a letter from Mr. Samuel A. Milstein, State of Michigan Liaison Officer for Historic Preservation, dated March 30, 1973 (AEC 1973). The letter stated that "As far as is presently known, this construction will not result in an adverse impact on these resources, other than what may have occurred during the already completed construction work" (AEC 1973). Mr. Milstein noted that no archeological survey of the area had been completed prior to plant construction. He requested that I&M notify the State Liaison Office for Historic Preservation (for salvage purposes) should they uncover any evidence of archeological sites during the remainder of construction (AEC 1973).

Current Status

As of 2002, the National Register of Historic Places lists 20 locations in Berrien County, Michigan (U.S. Department of the Interior 2002). Of these locations, three fall within a 6-mile radius of CNP (Figure 2-2). These three sites, two additional National Register sites nearby, and other sites of historical significance, are described below. Table 2-7 lists the three National Register of Historic Places sites within the 6-mile radius of CNP.

National Register of Historic Places Sites of Interest

Avery Road – Galien River Bridge

Erected in 1922 and spanning 60 feet, it is an example of a "curved-chord, through girder" bridge (Berrien County 2003).

Sandburg House

Pulitzer Prize winning author Carl Sandburg built this Georgian Revival house in 1928. In this home, he penned several of his most famous works including *The People*, *Yes*, and *Abraham Lincoln: The War Years* (Berrien County 2003).

Snow Flake Motel

In 1960, William Wesley Peters, Frank Lloyd Wright's apprentice and son-in-law, designed this hotel. The 57-room complex is unique due to its structural shape of a 6-point star or snowflake (Berrien County 2003).

Old Berrien Courthouse

Built in 1839, the Greek Revival temple was designed by Gilbert Avery, a local master builder. For 56 years, the courthouse was the center of Berrien County activity. In 1894, the county moved its governmental seat to St. Joseph and the courthouse passed into private hands. In 1967, Berrien County repurchased the courthouse and restored it to its original design (Rosentreter 1980).

Ring Lardner House

Born in Niles in 1885, Ring Lardner was one of the most famous American authors of the 1920s. His achievements included a series of Saturday Evening Post articles that were known to be the first literary uses of American common speech. His achievements were favorably compared to those of Mark Twain. Lardner died in 1933 (Rosentreter 1980).

Other Historic Sites of Interest

Bethany Beach

In 1905, this area was established as a Christian resort by three Chicago Swedish Baptist churches (Berrien County 2003).

Mielke House

Billy Mielke, a local fruit farmer, built this towered Italianate house in the 1860s (Berrien County 2003).

Tyron School

Built in 1864, Tyron School is the "County's oldest, publicly-owned, one-room school." (Berrien County 2003).

2.12 Other Projects and Activities

As indicated on Figure 2-2, there are few urban areas and little industrial development within the 6-mile radius of CNP. However, the small town of Bridgman, approximately 2.5 miles south of CNP, is the site of a proposed new gas-fired, combined-cycle power plant that would use 20 acres of the abandoned 50-acre Hoover-Ugine manufacturing site. If constructed, the Sempra Energy project would produce approximately 500 megawatts of electricity. Sempra is evaluating market demands to determine when to begin construction. Sempra plans to purchase water for the plant from Lake Charter Township, which obtains the water from Lake Michigan. Waste water would be discharged to Lake Michigan through a mile-long pipe that will substantially cool the water before reentering the Lake.

Approximately 28 miles north-northeast of CNP, on the shore of Lake Michigan, is the Palisades Nuclear Plant, a single-unit pressurized water reactor. Palisades is owned by Consumers Energy Company and operated by Nuclear Management Company. The Palisades plant uses mechanical draft cooling towers to cool the circulating water. Two 345-kilovolt transmission lines run between the Palisades Substation and CNP.

Table 2-1. Special-Status Species Recorded or Observed in Counties within which CNP and Associated Transmission Lines are Located.

Scientific Name	Common Name	Federal Status	State Status	
			Michigan	Indiana
Birds				
Ammodramus henslowii	Henslow's sparrow	-	T	E
Asio flammeus	Short-eared owl	-	E	E
Bartramia longicauda	Upland sandpiper	-	-	E
Botaurus lentiginosus	American bittern	-	-	E
Buteo lineatus	Red-shouldered hawk	-	T	-
Circus cyaneus	Northern harrier	-	-	E
Charadrius melodus	Piping plover	E	E	E
Childonias niger	Black tern	-	-	E
Cistothorus palustris	Marsh wren	-	-	E
Cistothorus platensis	Sedge wren	-	-	E
Dendroica discolor	Prairie warbler	-	E	-
Dendroica dominica	Yellow-throated warbler	-	T	-
Falco peregrinus	Peregrine falcon	-	E	E
Grus canadensis	Sandhill crane	-	-	E
Haliaeetus leucocephalus	Bald eagle	T	T	E
Ixobrychus exilis	Least bittern	-	T	E
Lanius ludovicianus	Loggerhead shrike	-	E	E
Nyctanassa violacaea	Yellow-crowned night-heron	-	-	E
Nycticorax nycticorax	Black-crowned night-heron	-	-	E
Pandion haliaetus	Osprey	-	T	E
Phalacrocorax auritus	Double-crested cormorant	-	-	X
Rallus elegans	King rail	-	E	E
Sterna caspia	Caspian tern	-	T	-
Sterna hirundo	Common tern	-	T	-
Tyto alba	Barn owl	-	E	E
Vermivora chrysoptera	Golden-winged warbler	-	-	E
Xanthocephalus xanthocephalus	Yellow-headed blackbird	-	-	E
Fish				
Acipenser fulvescens	Lake sturgeon	-	T	E
Erimyzon oblongus	Creek chubsucker	-	E	-
Moxostoma carinatum	River redhorse	-	T	-
Moxostoma valenciennesi	Greater redhorse	-	-	E
Notropis chalybaeus	Ironcolor shiner	-	X	-
Percina evides	Gilt darter	-	-	E

Table 2-1. Special-Status Species Recorded or Observed in Counties within which CNP and Associated Transmission Lines are Located. (Continued)

Scientific Name	Common Name	Federal Status	State Status	
			Michigan	Indiana
Mammals				
Lutra canadensis	Northern river otter	-	-	E
Lynx rufus	Bobcat	-	-	E
Microtus ochrogaster	Prairie vole	-	E	-
Myotis sodalis	Indiana bat	E	-	E
Spermophilus franklinii	Franklin's ground squirrel	-	-	E
Taxidea taxus	American badger	-	-	E
Amphibians				
Ambystoma opacum	Marbled salamander	-	T	-
Hemidactylium scutatum	Four-toed salmander	-	-	E
Reptiles				
Clemmys guttata	Spotted turtle	-	T	E
Clonophis kirtlandii	Kirtland's snake	-	E	E
Emydoidea blandingii	Blanding's turtle	-	-	E
Liochlorophis vernalis	Smooth green snake	-	-	E
Macroclemys temminckii	Alligator snapping turtle	-	-	E
Nerodia erythrogaster neglecta	Copperbelly water snake	T	-	E
Sistrurus catenatus catenatus	Eastern Massasauga	C	-	E
Terrapene ornata	Ornate box turtle	-	-	E
Thamnophis butleri	Butler's garter snake	-	-	E
Molluscs				
Epioblasma obliquata perobliqua	White cat's paw pearlymussel	E	-	E
Epioblasma torulosa rangiana	Northern riffleshell	E	-	E
Epioblasma triquetra	Snuffbox	-	E	E
Pleurobema clava	Clubshell	E	-	E
Quadrula cylindrica cylindrica	Rabbitsfoot	-	-	E
Insects				
Exyra rolandiana	-	-	-	E
Glaucopsyche lygdamus couperi	Silvery blue	-	-	E
Lepyronia gibbosa	Great plains spittlebug	-	T	-
Lycaeides melissa samuelis	Karner blue butterfly	E	-	E
Melanchra assimilis	Similar black noctuid	-	-	E
Neonympha mitchellii mitchellii	Mitchell's satyr	E	E	E
Nicrophorus americanus	American burying beetle	E	E	X
Oligia bridghami	A noctuid moth	-	-	T
Papaipema silphii	Silphium borer moth	-	T	-
Pieris oleracea	Veined white	-	-	E
Prairiana kansana	A leaf hopper	-	-	T

Table 2-1. Special-Status Species Recorded or Observed in Counties within which CNP and Associated Transmission Lines are Located. (Continued)

Scientific Name	Common Name	Federal Status	State Status	
			Michigan	Indiana
Insects				
Spartiniphaga includens	A noctuid moth	-	-	T
Speyeria idalia	Regal fritillary	-	E	E
Setodes oligius	A caddisfly	-	-	E
Plants				
Amelanchier humilis	Running serviceberry	-	-	E
Androsace occidentalis	Rock-jasmine	-	E	T
Arabis drummondii	Drummond's rockcress	-	-	E
Arabis glabra	Tower-mustard	-	-	T
Aralia hispida	Bristly sarsaparilla	-	-	E
Arabis missouriensis var *deamii*	Missouri rockcress	-	-	E
Aristida tuberculosa	Beach three-awned grass	-	T	-
Aristolochia serpentaria	Virginia snakeroot	-	T	-
Armoracia aquatica	Lake cress	-	T	E
Astragalus canadensis	Canadian milk-vetch	-	T	-
Baptista leucophaea	Cream wild indigo	-	E	-
Bartonia paniculata	Panicled screw-stem	-	T	-
Betula populifolia	Gray birch	-	-	X
Botrychium matricariifolium	Chamomile grape-fern	-	-	T
Botrychium simplex	Least grape-fern	-	-	E
Berula erecta	Cut-leaved water-parsnip	-	T	-
Besseya bullii	Kitten-tails	-	T	E
Bidens beckii	Beck water-marigold	-	-	E
Calamgrostis stricta	Narrow-leaved reedgrass	-	T	-
Calla palustris	Wild calla	-	-	E
Camassia scilloides	Wild-hyacinth	-	T	-
Carex albolutescens	Greenish-white sedge	-	T	-
Carex alopecoidea	Foxtail sedge	-	-	E
Carex arctata	Black sedge	-	-	E
Carex atherodes	Awned sedge	-	-	E
Carex atlantica ssp *atlantica*	Atlantic sedge	-	-	T
Carex atlantica ssp *capillacea*	Howe sedge	-	-	E
Carex bebbii	Bebb's sedge	-	-	T
Carex chordorrhiza	Creeping sedge	-	-	E
Carex crawei	Crawe sedge	-	-	T
Carex crus-corvi	Raven's-foot sedge	-	T	-
Carex debilis var *rudgei*	White-edge sedge	-	-	T
Carex echinata	Little prickly sedge	-	-	E
Carex flava	Yellow sedge	-	-	T
Carex folliculata	Long sedge	-	-	T

Table 2-1. Special-Status Species Recorded or Observed in Counties within which CNP and Associated Transmission Lines are Located. (Continued)

Scientific Name	Common Name	Federal Status	State Status	
			Michigan	Indiana
Plants				
Carex gravida	Sedge	-	X	E
Carex leptonervia	Finely-nerved sedge	-	-	E
Carex limosa	Mud sedge	-	-	E
Carex lupuliformis	False hop sedge	-	T	-
Carex oligocarpa	Eastern few-fruited sedge	-	T	-
Carex platyphylla	Broad-leafed sedge	-	T	-
Carex retrorsa	Retrose sedge	-	-	E
Carex scabrata	Rough sedge	-	-	E
Carex seorsa	Sedge	-	T	-
Carex sparganioides var *cephaloidea*	Thinleaf sedge	-	-	T
Carex straminea	Straw sedge	-	E	T
Castanea dentata	American chestnut	-	E	-
Chasmanthium latifolium	Wild-oats	-	T	-
Chimaphila umbellata ssp *cisatlantica*	Pipsissewa	-	-	T
Chrysosplenium americanum	American golden-saxifrage	-	-	T
Circaea alpina	Small enchanter's nightshade	-	-	X
Cirsium hillii	Hill's thistle	-	-	E
Cirsium pitcheri	Pitcher's thistle	T	T	T
Coeloglossum viride var *virescens*	Long-bract green orchis	-	-	T
Commelina erecta	Slender day-flower	-	X	-
Conioselinum chinense	Hemlock parley	-	-	E
Coreopsis palmata	Prairie coreopsis	-	T	-
Corydalis flavula	Yellow fumewort	-	T	-
Corydalis sempervirens	Pale corydalis	-	-	E
Crataegus prona	Illinois hawthorn	-	-	E
Cyperus dentatus	Toothed sedge	-	-	E
Cypripedium candidum	White lady-slipper	-	T	-
Dalea purpurea	Purple prairie-clover	-	X	-
Dasystoma macrophylla	Mullein foxglove	-	T	-
Diarrhena americana	Beak grass	-	T	-
Digtaria filiformis	Slender finger-grass	-	X	-
Dodecatheon meadia	Shooting-star	-	E	-
Draba reptans	Creeping whitlow-grass	-	T	-
Dryopteris celsa	Log fern	-	T	X
Dryopteris clintoniana	Clinton woodfern	-	-	X

Table 2-1. Special-Status Species Recorded or Observed in Counties within which CNP and Associated Transmission Lines are Located. (Continued)

Scientific Name	Common Name	Federal Status	State Status	
			Michigan	Indiana
Plants				
Echinacea purpurea	Purple coneflower	-	X	-
Eleocharis equisetoides	Horse-tail spikerush	-	-	E
Eleocharis melanocarpa	Black-fruited spike-rush	-	-	T
Equisetum variegatum	Variegated horsetail	-	-	E
Eriocaulon aquaticum	Pipewort	-	-	E
Eriophorum gracile	Slender cotton-grass	-	-	T
Eriophorum spissum	Dense cotton-grass	-	-	X
Eryngium yuccifolium	Rattlesnake-master	-	T	-
Eupatorium sessilifolium	Upland boneset	-	T	-
Euphorbia commutata	Tinted spurge	-	T	-
Euphorbia obtusata	Bluntleaf spurge	-	-	X
Filipendula rubra	Queen-of-the-prairie	-	T	-
Fimbristylis puberula	Chestnut sedge	-	X	E
Fragaria vesca var *americana*	Woodland strawberry	-	-	X
Fuirena pumila	Dwarf umbrella-sedge	-	-	T
Fuirena squarrosa	Umbrella-grass	-	T	-
Galearis spectabilis	Showy orchis	-	T	-
Gentiana flavida	White gentian	-	E	-
Gentiana puberulenta	Downy gentian	-	E	T
Gentiana saponaria	Soapwort gentian	-	X	-
Gentianella quinquefolia	Stiff gentian	-	T	-
Geranium bicknellii	Bicknell northern crane's-bill	-	-	E
Geranium robertianum	Herb-Robert	-	-	T
Geum rivale	Purple avens	-	-	E
Gnaphalium macounii	Winged cudweed	-	-	X
Glyceria grandis	American manna-grass	-	-	X
Helianthus microcephalus	Small wood sunflower	-	X	-
Helianthus mollis	Downy sunflower	-	T	-
Hydrocotyle americana	American water-pennywort	-	-	E
Hydrastis canadensis	Goldenseal	-	T	-
Hypericum pyramidatum	Great St. John's-wort	-	-	E
Iliamna remota	Kankakee globe-mallow	-	-	E
Isotria medeoloides	Small whorled pogonia	T	E	-
Isotria verticillata	Whorled pogonia	-	T	-
Juncus brachycarpus	Short-fruited rush	-	T	-
Juncus militaris	Bayonet rush	-	T	X
Juncus pelocarpus	Brown-fruited rush	-	-	T
Juncus scirpoides	Scirpus-like rush	-	T	T

Table 2-1. Special-Status Species Recorded or Observed in Counties within which CNP and Associated Transmission Lines are Located. (Continued)

Scientific Name	Common Name	Federal Status	State Status	
			Michigan	Indiana
Plants				
Lathyrus maritimus var *glaber*	Beach peavine	-	-	E
Lathyrus ochroleucus	Pale vetchling peavine	-	-	E
Lathyrus venosus	Smooth veiny pea	-	-	T
Lechea pulchella	Leggett's pinweed	-	T	-
Lemna perpusilla	Minute duckweed	-	-	X
Lespedeza procumbens	Trailing bush-clover	-	X	-
Linnaea borealis	Twinflower	-	-	X
Linum virginianum	Virginia flax	-	T	-
Lonicera canadensis	American fly-honeysuckle	-	-	X
Ludwigia sphaerocarpa	Globe-fruited seedbox (false—loosestrife)	-	T	E
Luzula acuminata	Hairy woodrush	-	-	E
Lycopodiella inundata	Northern bog clubmoss	-	-	E
Lycopodium tristachyum	Deep-root clubmoss	-	-	T
Malaxis unifolia	Green adder's-mouth	-	-	E
Morus rubra	Red mulberry	-	T	-
Myriophyllum pinnatum	Cutleaf water-milfoil	-	-	E
Myriophyllum verticllatum	Whorled water-milfoil	-	-	T
Nelumbo lutea	American lotus	-	T	-
Oenothera perennis	Small sundrops	-	-	T
Oryzopsis asperofolia	White-grained mountain—ricegrass	-	-	E
Oryzopsis pungens	Slender mountain-ricegrass	-	-	X
Oryzopsis racemosa	Black-fruited mountain—ricegrass	-	-	T
Oxalis violacea	Violet wood-sorrel	-	T	-
Panax quinquefolius	Ginseng	-	T	-
Panicum leibergii	Leiberg's panic-grass (witch grass)	-	T	T
Panicum subvillosum	A panic-grass	-	-	X
Panicum verrucosum	Warty panic-grass	-	T	T
Phlox maculata	Wild sweet william or spotted phlox	-	T	-
Phlox ovata	Mountain phlox	-	-	E
Platanthera ciliaris	Orange or yellow fringed orchid	-	T	E
Platanthera dilatata	Leafy white orchis	-	-	E
Platanthera hyperborrea	Leafy northern green orchis	-	-	T

Table 2-1. Special-Status Species Recorded or Observed in Counties within which CNP and Associated Transmission Lines are Located. (Continued)

Scientific Name	Common Name	Federal Status	State Status	
			Michigan	Indiana
Plants				
Platanthera leucophaea	Prairie (white) fringed orchid	T	E	X
Platanther orabiculata	Large roundleaf orchid	-	-	X
Poa paludigena	Bog bluegrass	-	T	-
Polemonium reptans	Jacob's ladder; Greek—valerian	-	T	-
Polygonum careyi	Carey's smartweed	-	T	T
Polygonum cilinode	Fringed black bindweed	-	-	E
Polygonum hydropiperoides var *opelousanum*	Northeastern smartweed	-	-	T
Polygonum hydropiperoides var *setaceum*	Swamp smartweed	-	-	E
Polymnia uvedalia	Large-flowered leafcup	-	T	-
Polytaenia nuttalli	Prairie parsley	-	-	E
Populus balsamifera	Balsam poplar	-	-	X
Populus heterophylla	Swamp or black cottonwood	-	E	-
Potamogeton bicupulatus	Waterthread pondweed	-	T	X
Potamogeton epihydrus	Nuttall pondweed	-	-	E
Potamogeton friesii	Fries' pondweed	-	-	E
Potamogeton praelongus	White-stem pondweed	-	-	E
Potamogeton pulcher	Spotted pondweed	-	T	E
Potamogeton richardsonii	Redheadgrass	-	-	T
Potamogeton robbinsii	Flatleaf pondwed	-	-	T
Potentilla anserina	Silverweed	-	-	T
Psilocarya scirpoides	Bald-rush	-	T	T
Pycnanthemum pilosum	Hairy mountain-mint	-	T	-
Pyrola secunda	One-sided wintergreen	-	-	X
Pyrola virens	Greenish-flowered wintergreen	-	-	X
Quercus prinoides	Dwarf chinquapin oak	-	-	E
Rhynchospora globularis var *recognita*	Globe beaked-rush	-	E	E
Rubus alumnus	A bramble	-	-	X
Rubus enslenii	Southern dewberry	-	-	E
Rubus setosus	Small bristleberry	-	-	E
Ruellia humils	Hairy ruellia	-	T	-
Sabatia anagularis	Rose-pink	-	T	-
Salix serissima	Autumn willow	-	-	T

Table 2-1. Special-Status Species Recorded or Observed in Counties within which CNP and Associated Transmission Lines are Located. (Continued)

Scientific Name	Common Name	Federal Status	State Status	
			Michigan	Indiana
Plants				
Satureja glabella var *angustifolia*	Calamint	-	-	E
Scheuchzeria palustris ssp *americana*	American scheuchzeria	-	-	E
Schizachne purpurascens	Purple oat	-	-	E
Scirpus purshianus	Weakstalk bulrush	-	-	E
Scirpus smithii	Smith's bulrush	-	-	E
Scleria pauciflora	Few-flowered nut-rush	-	E	-
Scleria reticularis	Netted nut-rush	-	T	T
Scutellaria parvula var *parvula*	Small skullcap	-	-	X
Selaginella apoda	Meadow spike-moss	-	-	E
Selaginella rupestris	Ledge spike-moss	-	-	T
Sida hermaphrodita	Virginia mallow	-	-	E
Silene regia	Royal catchfly	-	-	T
Silene stellata	Starry campion	-	T	-
Silphium integrifolium	Rosinweed	-	T	-
Silphium laciniatum	Compass-plant	-	T	-
Silphium perfoliatum	Cup-plant	-	T	-
Sisyrinchium montanum	Strict blue-eyed-grass	-	-	E
Solidago simplex var *gillmanii*	Sticky goldenrod	-	-	T
Sorbus decora	Northern mountain-ash	-	-	X
Stellaria crassifolia	Fleshy stitchwort	-	T	-
Sparganium androcladum	Branching bur-reed	-	-	T
Spiranthes magnicamporum	Great plains ladies' tresses	-	-	E
Spiranthes romanzoffiana	Hooded ladies'-tresses	-	-	E
Stipa avenacea	Blackseed needlegrass	-	-	T
Stipa comata	Sewing needlegrass	-	-	X
Stophostyles leiosperma	Slick-seed wild-bean	-	-	T
Tipularia discolor	Cranefly orchid	-	T	-
Trichostema dichotomum	Bastard pennroyal	-	T	-
Triglochin palustre	Marsh arrow-grass	-	-	T
Trillium recurvatum	Prairie trillium	-	T	-
Trillium sessile	Toadshade	-	T	-
Trillium undulatum	Painted trillium	-	E	-
Triphora trianthophora	Three-birds orchid	-	T	-
Utricularia cornuta	Horned bladderwort	-	-	T
Utricularia geminiscapa	Hidden-fruited bladderwort	-	-	E
Utricularia inflata	Floating bladderwort	-	E	-

Table 2-1. Special-Status Species Recorded or Observed in Counties within which CNP and Associated Transmission Lines are Located. (Continued)

Scientific Name	Common Name	Federal Status	State Status	
			Michigan	Indiana
Plants				
Utricularia minor	Lesser bladderwort	-	-	E
Utricularia resupinata	Northeastern bladderwort	-	-	X
Utricularia subulata	Zigzag bladderwort	-	T	T
Vaccinium oxycoccos	Small cranberry	-	-	T
Valeriana edulis	Hairy valerian	-	-	E
Valeriana uliginosa	Marsh valerian	-	-	E
Valerianella chenopodiifolia	Goosefoot corn-salad	-	T	E
Viburnum cassinoides	Northern wild-raisin	-	-	E
Viburnum opulus var *americanum*	Highbush-cranberry	-	-	E
Viola pedatifida	Prairie birdfoot violet	-	T	T
Vitis vulpina	Frost grape	-	T	-
Wisteria frutescens	Wisteria	-	T	-
Woodwardia areolata	Netted chain-fern	-	X	-
Wolffia papulifera	Water-meal	-	T	-
Xyris difformis	Carolina yellow-eyed grass	-	-	T
Zizania aquatica var *aquatica*	Wild-rice	-	T	-

LEGEND

T = Threatened; E = Endangered; C = Candidate for federal listing; X = Extirpated;

- (dash) = Not federally-listed as endangered, threatened, extirpated, or as a candidate for federal-listing; or not state-listed as endangered, threatened, or extirpated

Table 2-2. Estimated Populations and Annual Growth Rates in Berrien County, Michigan, and St. Joseph County, Indiana, from 1970 to 2040.

	Berrien County			St. Joseph County	
Year	**Number**	**Percent**	**Year**	**Number**	**Percent**
1970[a]	163,875	--	1970[b]	245,045	--
1980[a]	171,276	0.5	1980[b]	241,617	-0.1
1990[a]	161,378	-0.6	1990[b]	247,052	0.2
2000[c]	162,453	0.06	2000[d]	265,559	0.7
2010[e]	160,800	-0.1	2010[f]	272,800	0.3
2020[e]	158,900	-0.1	2020[f]	278,093	0.2
2030[g]	157,591	-0.08	2030[g]	286,091	0.3
2040[g]	156,013	-0.1	2040[g]	294,013	0.3

a. USCB 1995a.
b. USCB 1995b.
c. USCB 2000f.
d. USCB 2000h.
e. MDMB 1996.
f. Indiana University 1998.
g. TtNUS 2002.

Table 2-3. Minority and Low-Income Population.

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	Low-Income
Allegan	MI	32	0	0	0	0	0	0	0	3	0
Berrien	MI	145	0	0	0	21	0	0	24	0	5
Cass	MI	47	0	0	0	2	0	0	3	0	0
Kalamazoo	MI	81	0	1	0	0	0	0	1	0	2
St. Joseph	MI	27	0	0	0	0	0	0	0	0	0
Van Buren	MI	68	0	0	0	1	0	0	3	2	1
Elkhart	IN	125	0	0	0	5	5	0	19	17	0
Kosciusko	IN	5	0	0	0	0	0	0	0	0	0
Lagrange	IN	8	0	0	0	0	0	0	0	0	0
Lake	IN	233	0	0	0	119	18	0	132	34	15
La Porte	IN	83	0	0	0	11	0	0	11	0	0
Marshall	IN	43	0	0	0	0	0	0	0	1	0
Porter	IN	68	0	0	0	0	0	0	0	0	0
St. Joseph	IN	226	0	0	0	40	6	0	52	8	2
Starke	IN	26	0	0	0	0	0	0	0	0	0
Cook	IL	27	0	0	0	13	14	0	22	20	4
TOTAL		1244	0	1	0	212	43	0	267	85	29

	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%	10.3%
Indiana	0.26%	0.97%	0.03%	8.39%	1.61%	1.24%	12.51%	3.53%	9.6%
Michigan	0.60%	1.80%	0.00%	14.20%	1.30%	1.90%	19.80%	3.30%	10.2%

Table 2-4. D.C. Cook Nuclear Plant Property Tax Payments.

Lake Charter Township Property Tax Revenues from 1996 to 2000			
Year	**Lake Charter Township Property Tax Revenues[a]**	**Property Tax Paid by D.C. Cook Nuclear Plant**	**Percent of Lake Charter Township Revenues**
1996	$17,810,161	$9,259,971	52.0
1997	$17,760,226	$9,143,319	51.5
1998	$18,225,318	$9,315,919	51.1
1999	$18,482,145	$9,394,738	50.8
2000	$16,637,827	$8,234,879	49.5
Berrien County Property Tax Revenues from 1996 to 2000			
Year	**Berrien County Property Tax Revenues[b]**	**Property Tax Paid by D.C. Cook Nuclear Plant**	**Percent of Berrien County Revenues**
1996	$116,074,176	$3,047,804	2.6
1997	$120,231,768	$3,088,449	2.6
1998	$126,952,937	$3,165,459	2.5
1999	$131,543,607	$3,193,557	2.4
2000	$135,041,796	$2,790,277	2.1

a. Korcek 2002. Note: Revenues do not include additional revenues from sources such as cable fees, tower fees, and cemetery sales, as they are minimal.
b. Wolf 2002.

Table 2-5. Berrien County's Major Public Water Suppliers and Capacities.

Water Supplier	Water Source	Average Daily Use (MGD)	Maximum Capacity (MGD)
St. Joseph	SW	5.752	16.00
Benton Harbor	SW	4.864	12.00
Niles	GW	1.853	9.54
Lake Charter Twp	SW	1.76	5.00
Berrien Springs	GW	0.419	3.36
Buchanan	GW	0.503	2.16
New Buffalo	SW	0.505	2.00
Coloma	GW	0.26	1.728
Watervliet	GW	0.247	1.728
Bridgman	SW	0.326	1.44
Three Oaks	GW	0.204	1.44
Eau Claire	GW	0.145	1.08
Andrews University	GW	0.26	1.04
Chikaming Twp	GW & SW	0.56	0.936 (GW only)

GW = Groundwater
SW = Surface water
MGD = million gallons per day
Customer supplies not included. All surface water supplies are Lake Michigan source.
Mobile home parks and elderly care facilities not included.
Average Day Use for apartments and condos that do not meter, not included.
Average and Maximum Capacity based on 2001 information except Watervliet which is based on 1995 information.
Source: Wozniak 2002.

Table 2-6. LOS Determinations and Traffic Counts for Roads in the Vicinity of CNP.

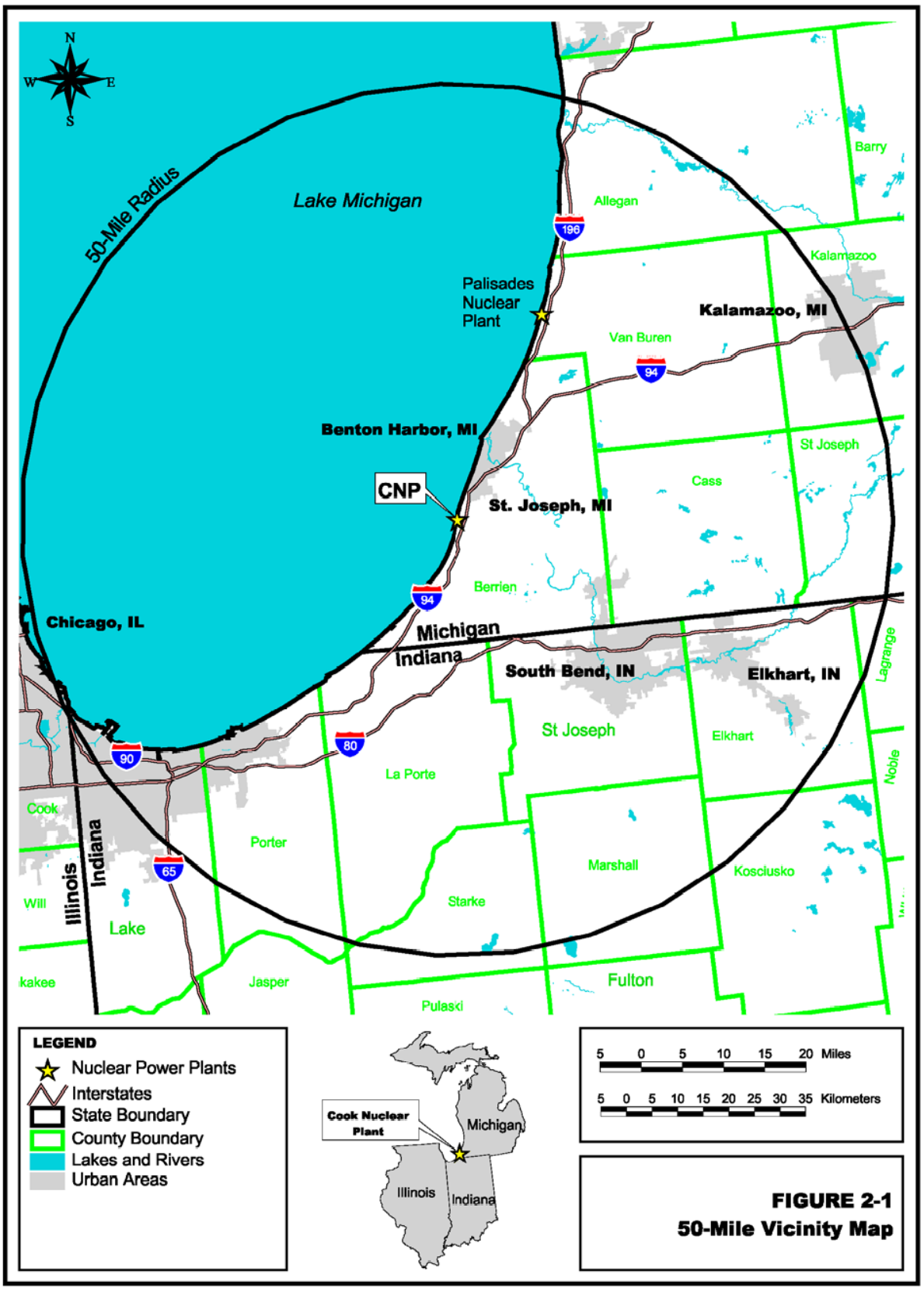
Roadway and Location	Annual Average Daily Traffic or LOS Determination
Red Arrow Highway (between Linco Rd. and the Stevensville city limit)	12,451[a]
Interstate 94 (intersection of Interstate 196 south to John Beers Rd)	Alternating LOS C[b] and D[b]
Interstate 94 (John Beers Rd. to junction of Red Arrow Highway at Bridgman Exit 16)	LOS D[b]
Interstate 94 (junction of Red Arrow Highway at Bridgman to Sawyer Rd.)	LOS E[b]
Interstate 94 (Sawyer Rd. to intersection of U.S. 12)	LOS D[b]

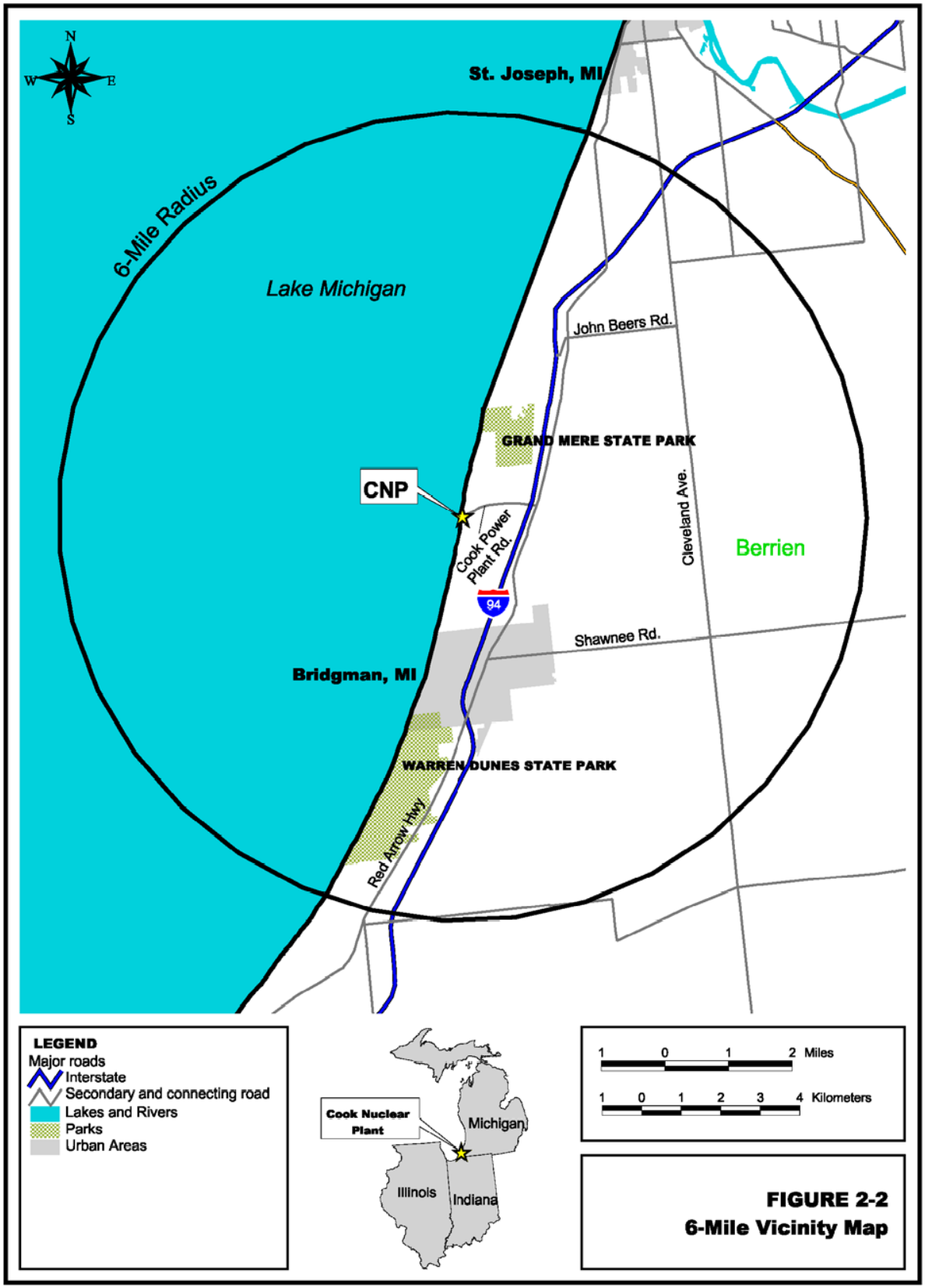
a. Southwestern Michigan Commission 2000.
b. Michigan Department of Transportation 2000.
LOS = Level of Service.

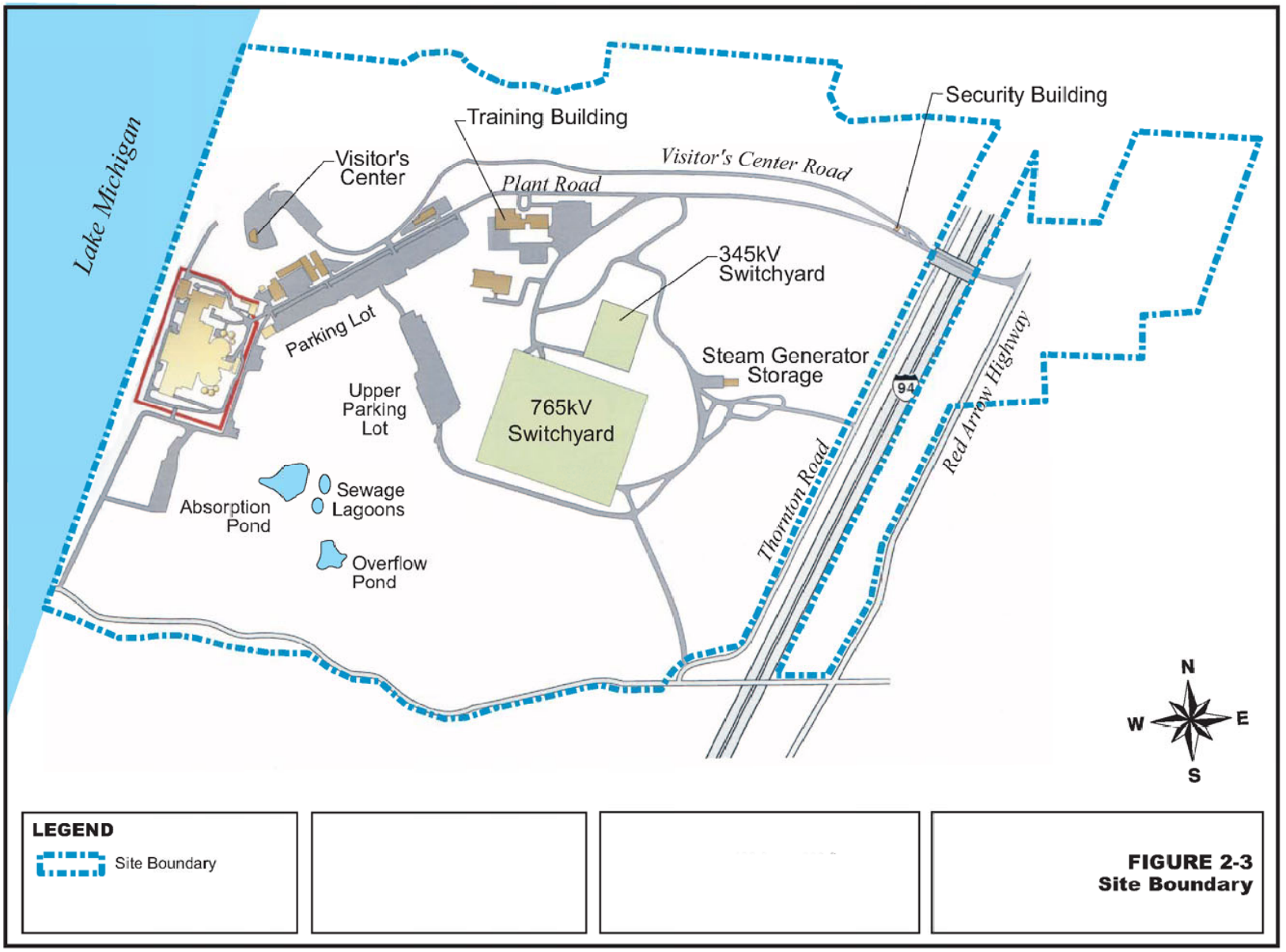
Table 2-7. Sites Listed in the National Register of Historic Places that Fall within a 6-mile Radius of CNP.

Site Name	Location
Avery Road – Galien River Bridge	Avery Road over Galien River, New Troy
Sandburg House	Address Restricted
Snow Flake Motel	3822 Red Arrow Highway, Lincoln Township

Source: U.S. Department of the Interior 2002.


N
W
E
S
50-Mile Radius
Lake Michigan
Palisades Nuclear Plant
Benton Harbor, MI
CNP
St. Joseph, MI
Chicago, IL
Michigan
Indiana
Kalamazoo, MI
South Bend, IN
Elkhart, IN
Barry
Allegan
Kalamazoo
Van Buren
St Joseph
Cass
Berrien
Lagrange
Noble
St Joseph
Elkhart
La Porte
Porter
Marshall
Kosciusko
Starke
Cook
Will
Lake
Jasper
Pulaski
Fulton
Illinois
Indiana
196
94
90
80
65
LEGEND
Nuclear Power Plants
Interstates
State Boundary
County Boundary
Lakes and Rivers
Urban Areas
Cook Nuclear Plant
Michigan
Illinois
Indiana
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 Kilometers
FIGURE 2-1
50-Mile Vicinity Map


N
W
E
S
St. Joseph, MI
6-Mile Radius
Lake Michigan
John Beers Rd.
GRAND MERE STATE PARK
CNP
Cook Power Plant Rd.
Cleveland Ave.
Berrien
94
Shawnee Rd.
Bridgman, MI
WARREN DUNES STATE PARK
Red Arrow Hwy
LEGEND
Major roads
Interstate
Secondary and connecting road
Lakes and Rivers
Parks
Urban Areas
Cook Nuclear Plant
Michigan
Illinois
Indiana
1 0 1 2 Miles
1 0 1 2 3 4 Kilometers
FIGURE 2-2
6-Mile Vicinity Map


Lake Michigan
Training Building
Security Building
Visitor's Center
Visitor's Center Road
Plant Road
345kV Switchyard
Parking Lot
Steam Generator Storage
Upper Parking Lot
765kV Switchyard
94
Red Arrow Highway
Thornton Road
Absorption Pond
Sewage Lagoons
Overflow Pond
N
W
E
S
LEGEND
Site Boundary
FIGURE 2-3
Site Boundary

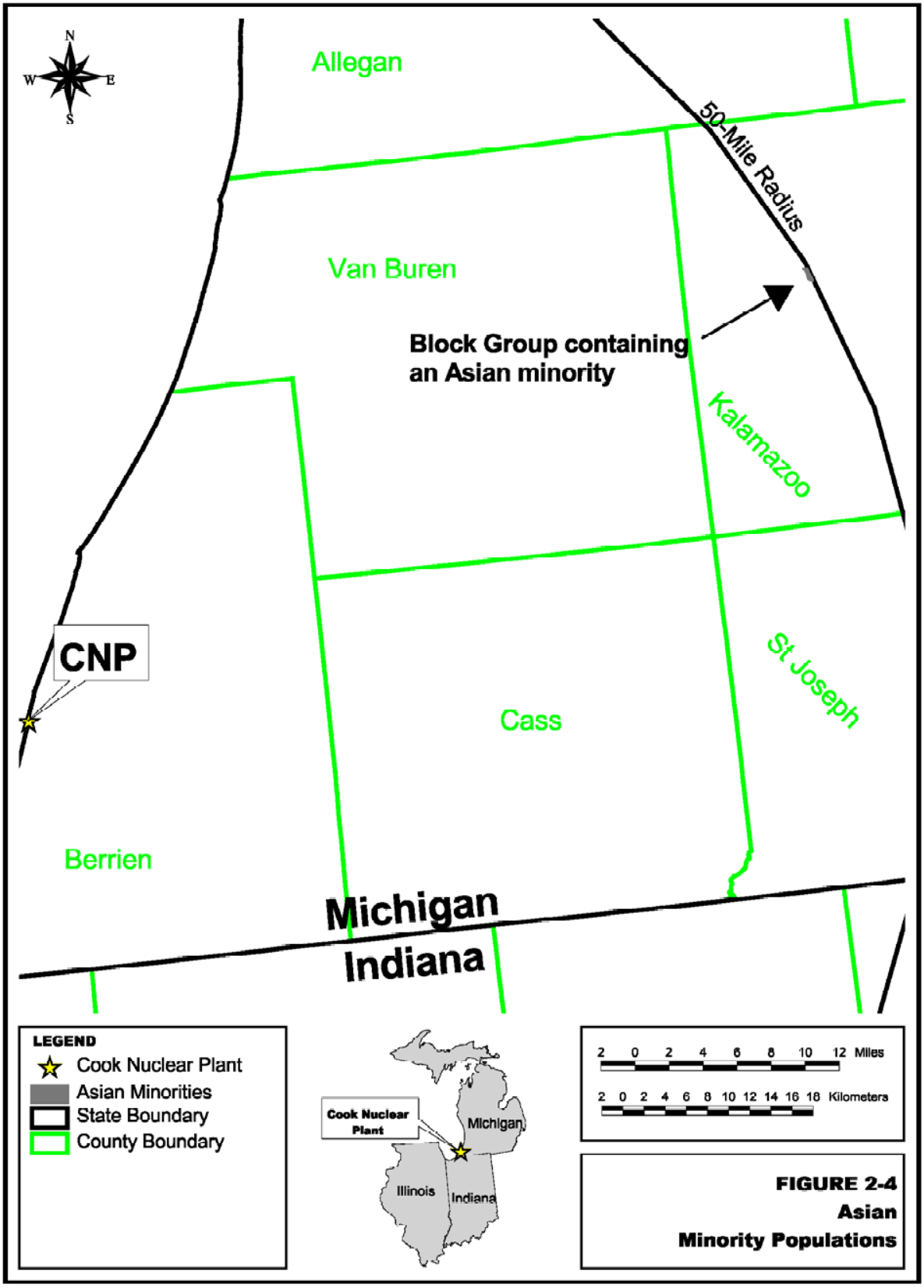
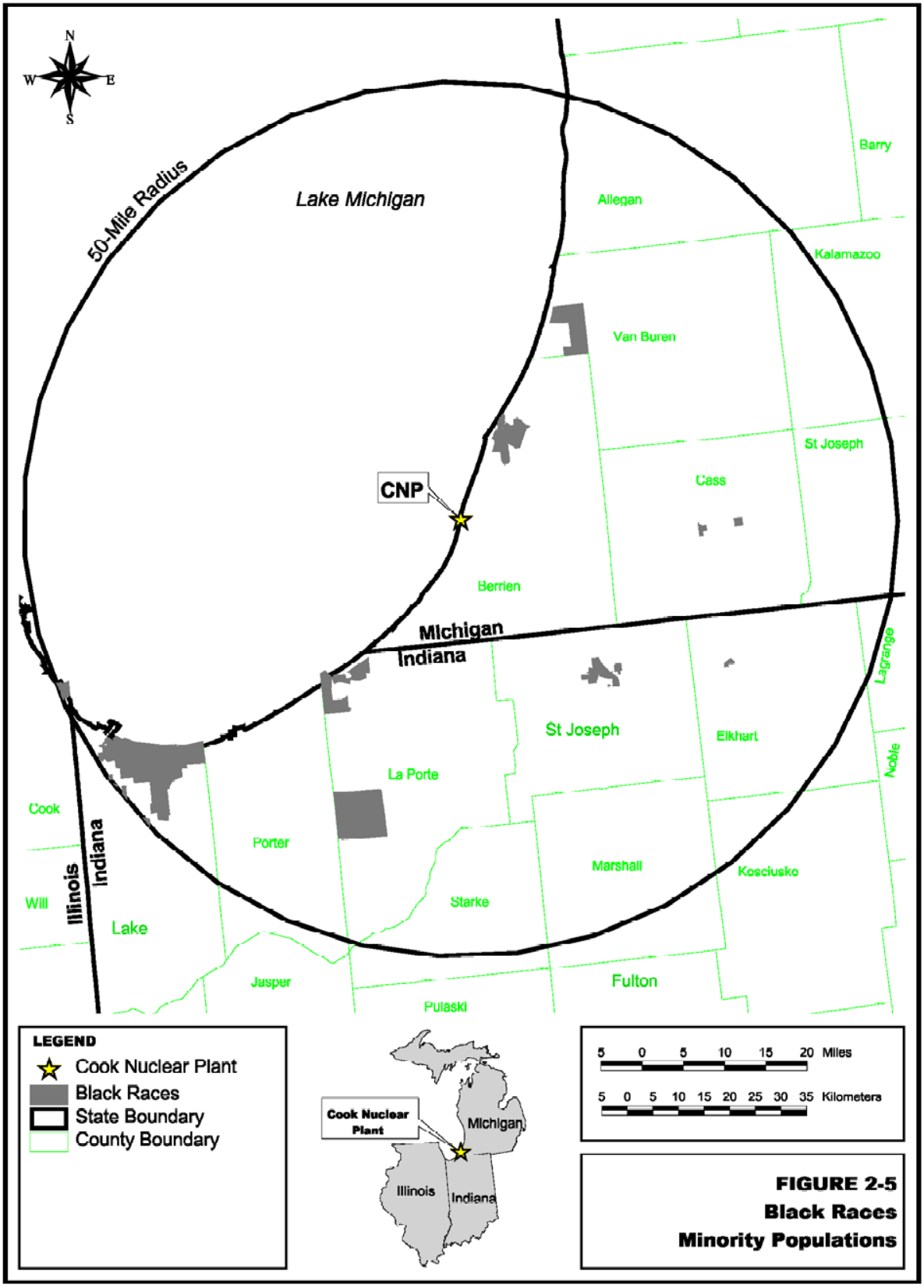
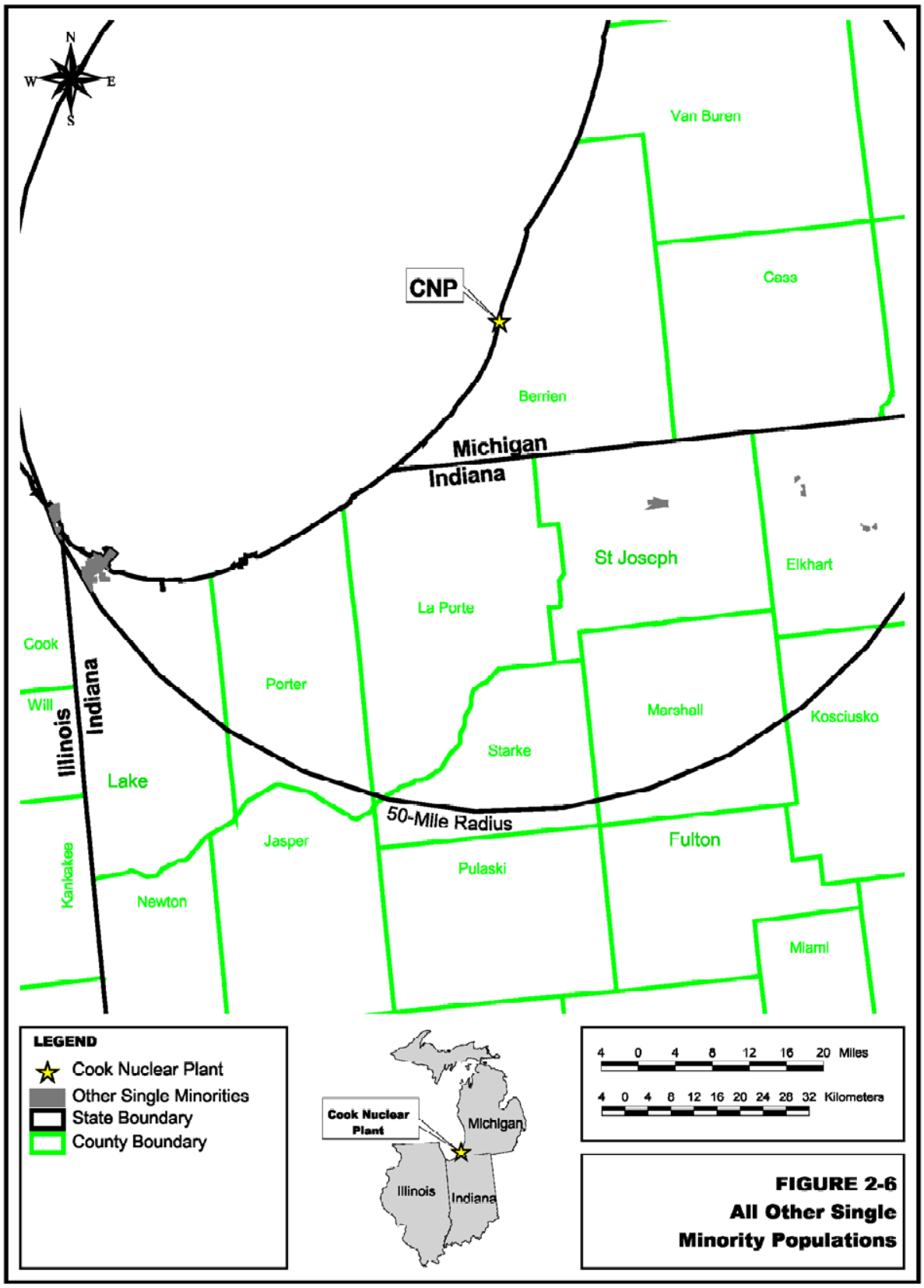
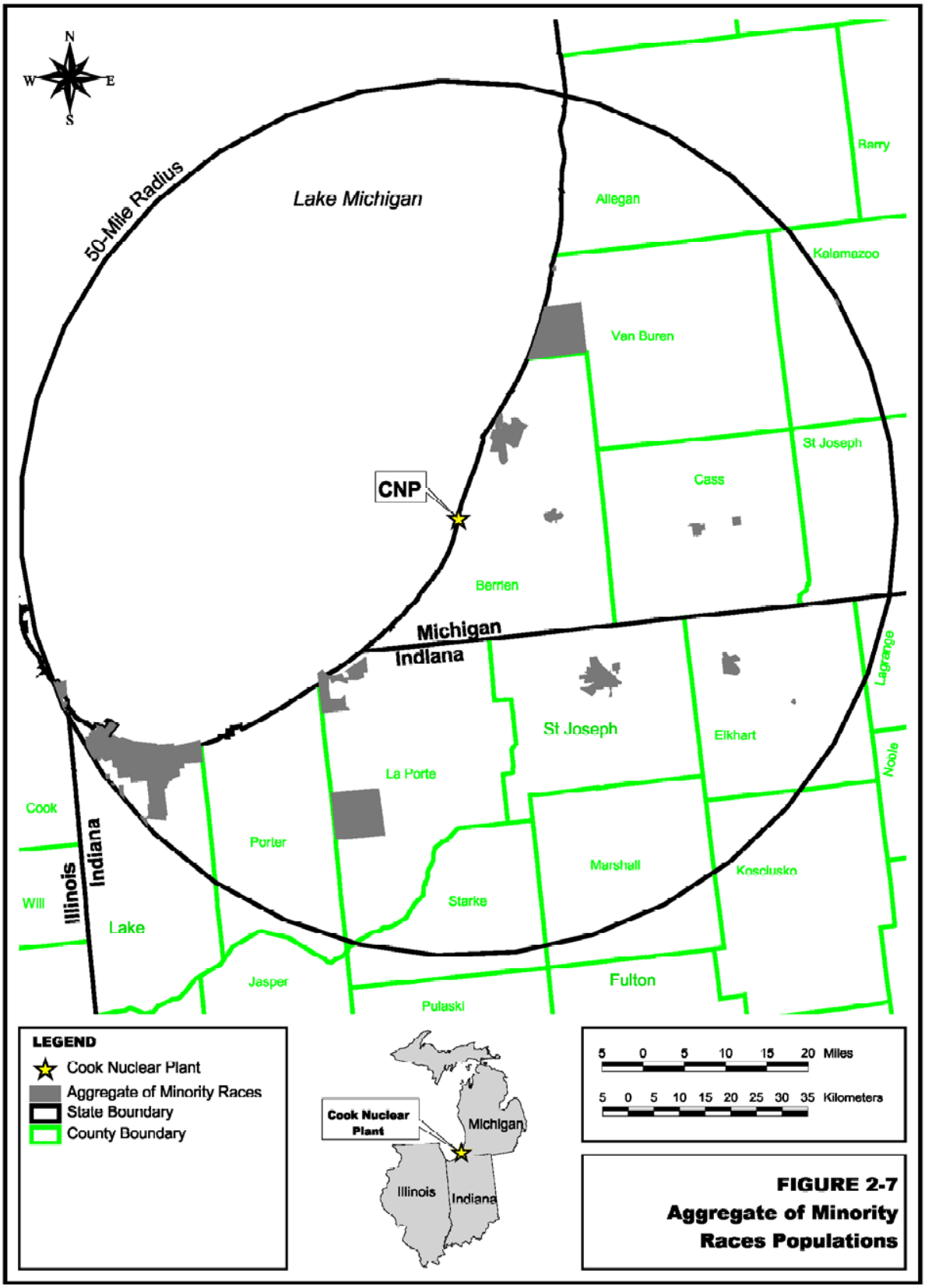
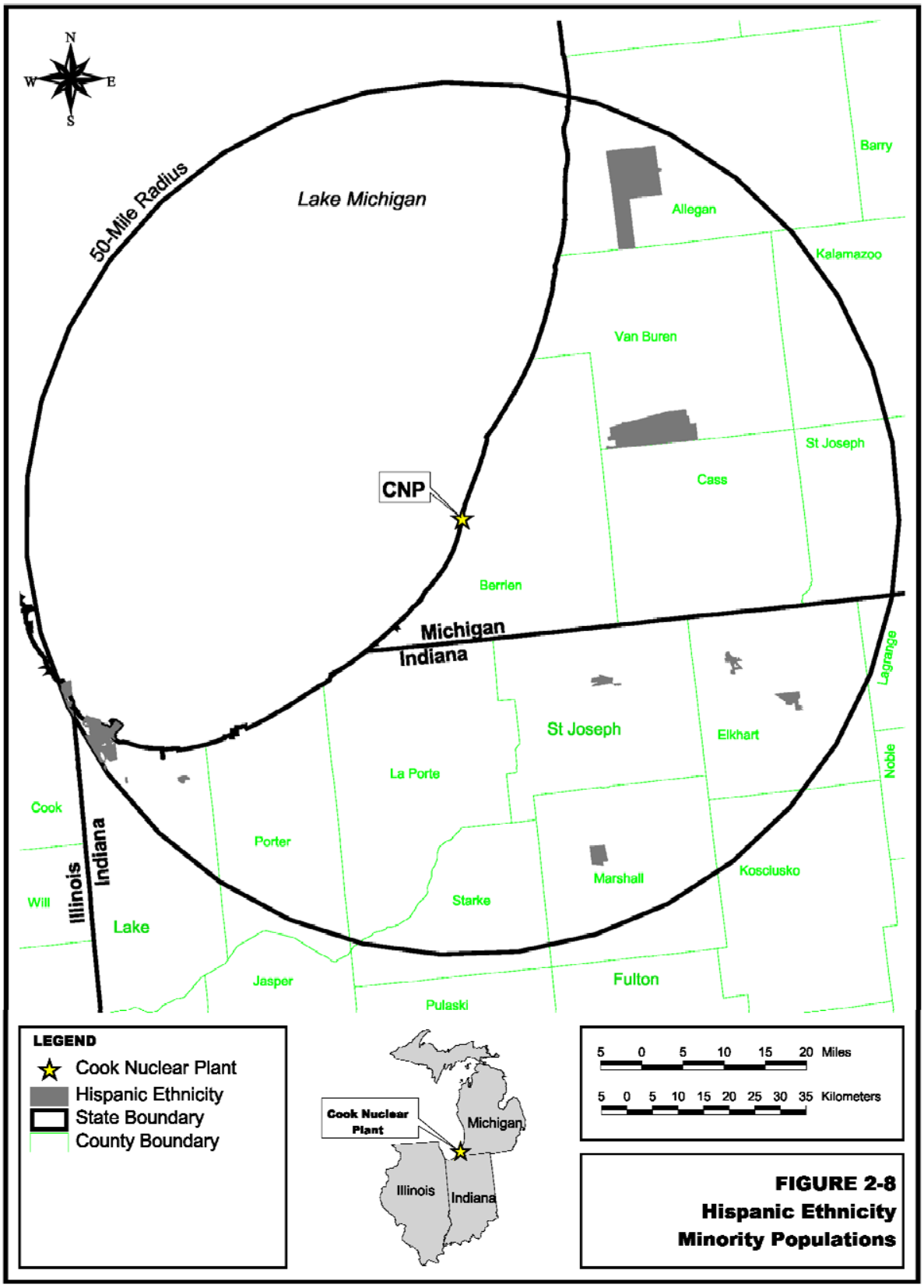


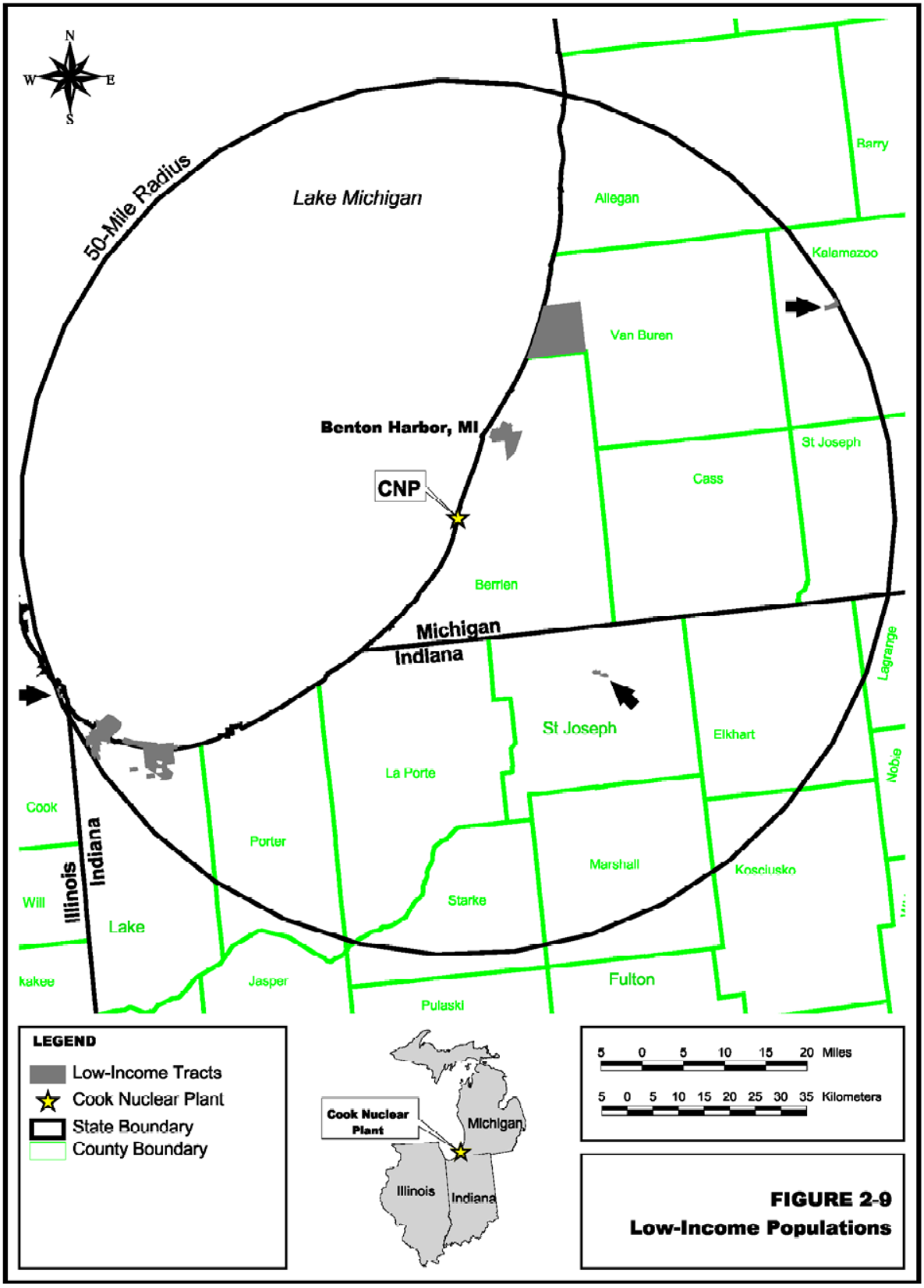
FIGURE 2-4
Asian
Minority Populations


N
W
E
S
50-Mile Radius
Lake Michigan
Barry
Allegan
Kalamazoo
Van Buren
St Joseph
Cass
CNP
Berrien
Michigan
Indiana
Lagrange
St Joseph
Elkhart
Noble
La Porte
Cook
Porter
Marshall
Kosciusko
Illinois
Indiana
Will
Lake
Starke
Jasper
Fulton
Pulaski
LEGEND
Cook Nuclear Plant
Black Races
State Boundary
County Boundary
Cook Nuclear Plant
Michigan
Illinois
Indiana
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 Kilometers
FIGURE 2-5
Black Races
Minority Populations


N
W
E
S
CNP
Van Buren
Cass
Berrien
Michigan
Indiana
St Joseph
Elkhart
La Porte
Cook
Porter
Will
Illinois
Indiana
Marshall
Kosciusko
Starke
Lake
50-Mile Radius
Jasper
Fulton
Pulaski
Kankakee
Newton
Miami
LEGEND
Cook Nuclear Plant
Other Single Minorities
State Boundary
County Boundary
Cook Nuclear Plant
Michigan
Illinois
Indiana
4 0 4 8 12 16 20 Miles
4 0 4 8 12 16 20 24 28 32 Kilometers
FIGURE 2-6
All Other Single
Minority Populations


N
W
E
S
50-Mile Radius
Lake Michigan
Barry
Allegan
Kalamazoo
Van Buren
St Joseph
Cass
CNP
Berrien
Michigan
Indiana
Lagrange
St Joseph
Elkhart
Noble
La Porte
Cook
Porter
Marshall
Kosciusko
Illinois
Indiana
Will
Lake
Starke
Jasper
Fulton
Pulaski
LEGEND
Cook Nuclear Plant
Aggregate of Minority Races
State Boundary
County Boundary
Cook Nuclear Plant
Michigan
Illinois
Indiana
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 Kilometers
FIGURE 2-7
Aggregate of Minority Races Populations


N
W
E
S
50-Mile Radius
Lake Michigan
Barry
Allegan
Kalamazoo
Van Buren
St Joseph
Cass
CNP
Berrien
Michigan
Indiana
Lagrange
St Joseph
Elkhart
Noble
La Porte
Cook
Porter
Marshall
Kosciusko
Illinois
Indiana
Will
Lake
Starke
Jasper
Fulton
Pulaski
LEGEND
Cook Nuclear Plant
Hispanic Ethnicity
State Boundary
County Boundary
Cook Nuclear Plant
Michigan
Illinois
Indiana
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 Kilometers
FIGURE 2-8
Hispanic Ethnicity
Minority Populations


N
W
E
S
50-Mile Radius
Lake Michigan
Barry
Allegan
Kalamazoo
Van Buren
Benton Harbor, MI
CNP
St Joseph
Cass
Berrien
Michigan
Indiana
Lagrange
St Joseph
Elkhart
Noble
La Porte
Cook
Porter
Marshall
Kosciusko
Illinois
Indiana
Will
Lake
Starke
Jasper
Fulton
Pulaski
LEGEND
Low-Income Tracts
Cook Nuclear Plant
State Boundary
County Boundary
Cook Nuclear Plant
Michigan
Illinois
Indiana
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 35 Kilometers
FIGURE 2-9
Low-Income Populations

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Chapter 3

Proposed Action

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NRC

"The report must contain a description of the proposed action..." 10 CFR 51.53(c)(2)

I&M proposes that NRC renew the operating licenses for CNP for an additional 20 years beyond the current license expiration date of October 25, 2014 for Unit 1 and December 23, 2017 for Unit 2. Renewal of the operating licenses would give I&M and the States of Michigan and Indiana the option of relying on CNP to meet future electricity needs. Section 3.1 discusses the major features of the plant 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

CNP is a nuclear-powered steam electric generating facility that began commercial operation on August 23, 1975 for Unit 1 and July 1, 1978 for Unit 2. Each unit is powered by a Westinghouse pressurized water reactor (PWR). Unit 1 produces a reactor core power of 3,304 megawatts-thermal; Unit 2 produces 3,468 megawatts-thermal. The design net electrical capacities are 1,044 and 1,117 megawatts-electric for Units 1 and 2, respectively. Figure 3-1 depicts the site layout.

The following subsections provide information on the reactor and containment systems, the cooling and auxiliary water systems, and the electrical transmission system. Additional information about CNP is available in the following documents:

- Final Environmental Statement (FES) for operation of the plant (AEC 1973),
- *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (NRC 1996), and
- CNP's Updated Final Safety Analysis Report (AEP 2002).

3.1.1 Reactor and Containment Systems

The nuclear steam supply system at CNP is a four-loop Westinghouse PWR. The reactor core heats water to approximately 600 degrees Fahrenheit. Because the pressure exceeds 2,000 pounds per square inch, the water does not boil. The heated water is pumped to four U-tube heat exchangers, known as steam generators, where the heat boils the water on the shell-side into steam. After drying, the steam is routed to the turbines. The steam yields its energy to turn the turbines, which are connected to the electrical generator. In 1988, the Unit 2 steam generators were replaced by new Westinghouse steam generators. In 2000, the Unit 1 steam generators were replaced with Babcock & Wilcox steam generators. The nuclear fuel is low-enriched uranium dioxide with enrichments below 5 percent by weight Uranium-235 and fuel burnup levels of a batch average of approximately 48,000 megawatt-days per metric ton uranium.

The reactor, steam generators, and related systems are enclosed in a containment building that is designed to prevent leakage of radioactivity to the environment in the improbable event of a rupture of the reactor coolant piping. The containment building is a reinforced concrete cylinder with a slab base and a hemispherical dome. A welded steel liner is attached to the inside face of the concrete shell to ensure a high degree of leaktightness. In addition, the 3.5-foot thick concrete walls serve as a radiation shield for both normal and accident conditions.

CNP uses an ice condenser system to condense steam following an improbable loss of coolant accident. This containment design allows a smaller containment building that blends into the surrounding dune landscape and helps preserve the natural beauty of the eastern Lake Michigan shore. The ice condenser is a completely enclosed annular compartment located around approximately 300 degrees of the perimeter of the containment. The ice is held in baskets to promote heat transfer to the ice, and a refrigeration system maintains the ice between 10 and 20 degrees Fahrenheit.

The containment building is ventilated to maintain pressure and temperatures within acceptable limits. The containment ventilation system also can purge the containment prior to entry. Exhaust from the ventilation system is monitored for radioactivity before being released to the plant vent. High efficiency particulate air filters can be used when needed to filter the air before releasing it. The containment can be isolated if needed.

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 CNP, the once-through Circulating Water System draws from and discharges to Lake Michigan. This system removes heat rejected from the main condenser. The Essential Service Water System and Nonessential Service Water System also draw from the lake. More than 98 percent of the water withdrawn from Lake Michigan is returned. Fire Protection System water and drinking water are supplied by Lake Charter Township at a rate of between 10 to 22 million gallons per month. The source of water for Lake Charter Township is Lake Michigan.

The plant does not use cooling towers or cooling ponds, or withdraw water from a river, either of which would bring CNP within the scope of NRC requirements in 10 CFR 51.53 (c)(3)(ii)(A). Nor does CNP use Ranney wells, which would bring it within the scope of 10 CFR 51.53(c)(3)(ii)(C).

Circulating Water System

Condenser cooling water is withdrawn from Lake Michigan through three intake cribs approximately 2,250 feet from the shoreline in approximately 20 feet of water. Each intake crib consists of a smoothly-rounded intake elbow set in the lake bottom, surrounded by sacked concrete and rip-rap to prevent erosion. The intake elbow is capped by an octagonal-shaped heavy steel frame to protect it from ice damage. Bar racks and guides on all sides of the steel frame prevent entry of large debris, and a steel plate roof prevents creation of a vortex and entry of debris from above.

Three 16-foot diameter buried steel pipes connect the intake cribs to the screen house just above the beach. The screen house is common to both units and contains the circulating water pumps, traveling screens, essential service water pumps, and associated equipment. There are seven circulating water pumps, three for Unit 1 and four for Unit 2. These pumps move the water to the condensers, from which the circulating water is returned to Lake Michigan through two unit-specific discharge tunnels (16 feet in diameter for Unit 1 and 18 feet in diameter for Unit 2). Each discharge tunnel ends with a discharge elbow.

The discharge elbows, located approximately 1,150 feet from shore, terminate in a high-velocity discharge. The high-velocity discharges are used to direct flow away from the intake pipes and to distribute the water so as to minimize the environmental effects of the warm water. Each discharge is accompanied by a scour bed to protect the lake bottom. Total plant circulating water flow is approximately 1,600,000 gallons per minute at full power. The Michigan Department of Environmental Quality has authorized CNP to discharge up to 17.3×10^9 British thermal units per hour for the total plant discharge (Appendix B of this report). This limit is a variance from the State Water Quality Standards, which specify a 3-degree Fahrenheit limit above seasonally-dependent maxima.

During the winter, operators may realign the circulating water system such that the center intake is used as a discharge. The warm water exiting the center intake elbow flows back to the other two intake elbows, raising the intake water temperature. This prevents icing on the traveling screens.

I&M injects sodium hypochlorite and various biocides to control aquatic nuisances and slime growth.

Service Water Systems

There are two independent service water systems: the Essential Service Water System and the Nonessential Service Water System. Both systems provide strained water from Lake Michigan for cooling several closed cooling water systems. The flow rate is variable, but design flow rates are approximately 9,000 gallons per minute for Essential Service Water and 10,000 gallons per minute for Nonessential Service Water. Nonessential Service Water is the source of water for the makeup demineralizer and thus represents some of the plant's water consumption.

The two service water systems are shared between the two units. They normally take suction from either unit's circulating water intake tunnels and discharge to the discharge tunnels. The systems can be aligned to take suction from the discharge tunnel. On a seasonal basis, when zebra mussels are particularly susceptible, I&M continuously injects sodium hypochlorite into the service water systems to control zebra mussels and other biofouling organisms.

Groundwater Systems

Although there are approximately 50 wells on the CNP property, most are monitoring wells, many of which have been abandoned. There are currently no operable production wells.

3.1.3 Transmission Facilities

The Final Environmental Statement (AEC 1973) identifies six 345-kilovolt and one 765-kilovolt transmission lines that were built to connect CNP to the electric grid. Two double-circuit lines (four transmission lines) were connected to an existing Olive-Palisades line 5 corridor miles from CNP. One double-circuit line was connected to the Robison Park Substation at Ft. Wayne, Indiana, 114 corridor miles from CNP. The 765-kilovolt line was connected to the Dumont Substation, 35 corridor miles from the plant.

Subsequent to the publication of the FES, several changes were made to the transmission system; namely:

- The double-circuit line that once terminated at Robison Park Substation now terminates with one circuit at the Collingwood Substation and the other circuit at the Twin Branch Substation (Twin Branch No. 1).

- The Olive-Palisades lines were cut, with the two Palisades Substation ends of the cut remaining connected to CNP. One circuit on the Olive side continues to connect to CNP. The other circuit of the Olive side was rerouted to connect CNP with the Twin Branch Substation (Twin Branch No. 2).

- Several taps were added:

  - The Benton Harbor Substation taps from the Palisades No. 1 line.

  - The Kenzie Creek Substation northwest of Niles, Michigan, taps from the Twin Branch No. 1 line.

  - The Jackson Road Substation in South Bend taps from the Twin Branch No. 2 line.

  - The East Elkhart Substation taps from the Collingwood line.

  These substation taps provide connections to the 138-kilovolt transmission system and thus do not constitute interconnections to the 345-kilovolt grid.

As a result of these system changes, the transmission lines of interest for this report are somewhat different than those described in the FES, as indicated below. Figure 3-2 is a map of the transmission system of interest. The six 345-kilovolt lines connect from the CNP Unit 1 switchyard; the single 765-kilovolt line connects from the Unit 2 switchyard.

- Palisades No. 1 and No. 2 – These two 345-kilovolt lines extend eastward on double-circuit towers for approximately five miles in a 600-foot wide corridor shared with the Olive and Twin Branch No. 2 lines. The lines then turn north to complete the total 31.4-mile run to the Palisades Substation. The right-of-way width on the northward leg is 150 feet. Ownership of the lines changes to CMS Energy after 22.2 miles, 9.2 miles south of the Palisades Substation. The scope of the right-of-way for these lines is essentially unchanged from that described in the FES.

- Olive – This single 345-kilovolt line extends eastward from CNP for approximately five miles on double-circuit towers shared with the Twin Branch No. 2 line. This initial five-mile right-of-way is the 600-foot wide corridor shared with the Palisades lines. The Olive line then continues southward for approximately 19 miles to the Olive Substation along a 150-foot wide corridor. The Olive Substation is west of South Bend, Indiana. The scope of the right-of-way for this circuit is essentially unchanged from that described in the FES.

- Twin Branch No. 1 – This 345-kilovolt line initially shares double-circuit towers with the Collingwood line. The 21.9-mile long, 150-foot wide shared right-of-way runs southeast from the plant, and includes a tap to the Kenzie Creek Substation, prior to turning southward in a separate right-of-way. The Twin Branch No. 1 line then runs 15.6 more miles in a 150-foot right-of-way to terminate at Twin Branch Substation, near South Bend. When the FES was written, this line was one of the two circuits that terminated in the Robison Park Substation north of Fort Wayne, Indiana. The transmission system changes associated with the Twin Branch No. 1 line include the additions of the Kenzie Creek Substation tap and the 15.6-mile right-of-way to the Twin Branch Substation and the deletion of the right-of-way between the Collingwood and Robison Park Substations.

- Twin Branch No. 2 – Initially sharing towers with the Olive line for 24.2 miles, this total 62.6-mile line ultimately connects to the Twin Branch Substation, following a number of preexisting corridors. The right-of-way for this 345-kilovolt line is 150 feet wide. The 38.4-mile right-of-way between the Olive and Twin Branch Substations, including the tap to the Jackson Road Substation, is an addition to the transmission lines described in the FES.

- Collingwood – This 345-kilovolt line initially shares double-circuit towers with the Twin Branch No. 1 line. South of the Kenzie Creek Substation, this circuit turns eastward, and includes a tap at the East Elkhart Substation before completing the 98.5-mile run at the Collingwood Substation near Fort Wayne, Indiana. This circuit runs in a 150-foot wide corridor. The East Elkhart and Collingwood Substations tap are additions to the transmission circuits described in the FES, and the 15.5-mile long, 150-foot wide right-of-way between Collingwood and Robison Park Substations are deleted from the scope of transmission lines described in the FES.

- Dumont – As described in the FES, this 765-kilovolt line runs south from the plant to the Dumont Substation southwest of South Bend, a distance of 35 miles. The right-of-way width is 200 feet. The scope of the right-of-way for this circuit is essentially unchanged from that described in the FES.

In total, for the specific purpose of connecting CNP to the transmission system, AEP has approximately 230 miles of corridor that occupy approximately 4,600 acres. The corridors pass through land that is primarily agricultural and forest land. The areas are mostly remote, with low population densities. The longer lines cross numerous state and U.S. highways; all lines cross I-94 immediately after leaving the switchyard. Impact of these corridors on land usage is minimal; e.g., farmlands that have corridors passing through them generally continue to be used as farmland.

AEP designed and constructed all CNP transmission lines in accordance with the National Electrical Safety Code (for example, IEEE 1997) and industry guidance that were current when the lines were built. Ongoing surveillance and maintenance of CNP transmission facilities ensure continued conformance to design standards. These maintenance practices are described in Sections 2.4 and 4.13.

AEP plans to maintain these transmission lines, which are integral to the larger transmission system, indefinitely. These transmission lines will remain a permanent part of the transmission system even after CNP is decommissioned.

3.1.4 Absorption Ponds and Sewage Lagoons

CNP uses the natural soil column as a means to provide uniform treatment to selected wastewater discharges. These discharges flow downward through the soil to the groundwater, which ultimately vents into Lake Michigan. Two separate waste streams are discharged in this manner: the turbine room sump and the sewage treatment plant effluent.

The turbine room sump accumulates various aqueous wastes from the secondary side. These wastes are then neutralized, if necessary, and discharged to absorption ponds. Approximately 825 feet southeast of the plant (Figure 3-1), the ponds consist of a 1.4-acre pond and a 0.69-acre overflow pond, connected by a small stream. Flow into the ponds is sufficient to keep the first pond full and overflowing to the overflow pond. Approximate capacity of the two ponds is 6 million gallons.

The sewage treatment plant discharges treated effluent to two sewage lagoons that are used alternately. The sewage lagoons are much smaller than the absorption ponds and are located above and immediately east of the absorption ponds (Figure 3-1).

Turbine room sump discharges to the absorption ponds and sewage treatment plant discharges to the sewage lagoons are permitted by the Michigan Department of Environmental Quality. The groundwater permit (excerpts of which are included in Appendix B of this report) limits the turbine room sump effluent to 2,400,000 gallons per day and sewage effluent to 60,000 gallons per day. The permit limits concentration of

various contaminants and requires groundwater monitoring. Section 2.3 describes the groundwater impact of both these soil discharges.

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…(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)

I&M has addressed potential 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 other items that are not subject to periodic replacement.

In turn, NRC regulations for implementing the National Environmental Policy Act require license renewal-phase environmental reports to describe in detail and assess the environmental impacts of any refurbishment activities, such as planned major 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 CNP IPA conducted by I&M under 10 CFR 54 (included as part of the license renewal application) 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 CNP license renewal period. Accordingly, I&M has determined that license renewal regulations in 10 CFR 51.53(c)(3)(ii) do not require I&M to assess the impact of refurbishment on any of the following:

- Plant and animal habitats [10 CFR 51.53(c)(3)(ii)(E)],
- Estimated vehicle exhaust emissions [10 CFR 51.53(c)(3)(ii)(F)],
- Housing availability, Land use, or Public schools [10 CFR 51.53(c)(3)(ii)(I)], or
- Highway traffic on local highways [10 CFR 51.53(c)(3)(ii)(J)].

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, pg. 2-41. ("SMITTR" is defined in NRC 1996 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 CNP. These programs are described in the Donald C. Cook License Renewal Application, to which this Environmental Report is appended.

3.4 Employment

Current Workforce

CNP employs a permanent workforce of approximately 1,200 employees and up to an additional 700 contract and matrixed employees at CNP. These values include the employees on the CNP site as well as those working at the Nuclear Generation Group offices in Buchanan, Michigan. I&M included the Nuclear Generation Group headquarters staff in its analyses because: (1) I&M owns only one nuclear plant, thus the Buchanan staff is dedicated to CNP; and (2) the Buchanan office is in the same county as CNP.

Upon the initiation of the renewed operating licenses, CNP estimates that the permanent workforce will decrease to approximately 1,000 and the contract workforce will decrease to approximately 250. These decreases are due to the eventual cessation of additional activities resulting from an extended shutdown that concluded in 2000. These values are within the range of 600 to 800 personnel per reactor unit estimated in the GEIS (NRC 1996). Approximately 88 percent of CNP's employees live in Berrien County, Michigan, and St. Joseph County, Indiana. About 9 percent are distributed across 20 counties in Michigan and Indiana with numbers ranging from 1 to 26 employees per county. A very small percentage (4 percent) of the workforce lives outside of Michigan and Indiana.

The CNP reactors operate on an 18-month refueling cycle. During refueling outages, site employment increases above the 1,200 permanent workforce by as many as 700 workers for temporary duty (28 to 30 days). This increase is within the GEIS range of 200 to 900 additional workers per reactor outage.

License Renewal Increment

Performing license renewal activities could necessitate increasing CNP staff workload by some increment. The size of this increment would be a function of the schedule within which I&M must accomplish the work and the amount of work involved. Having determined that it would not require refurbishment (Section 3.2), I&M focused its analysis of license renewal employment increment on programs and activities for managing the effects of aging (Section 3.3).

The GEIS 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 the 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, but mostly during normal refueling and the 5- and 10-year inservice refueling outages (NRC 1996).

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

The GEIS estimates that the most additional personnel needed to perform license renewal SMITTR activities would typically be 60 persons during the 3-month duration of a 10-year in-service refueling. Having established this upper value for what would be a single event in 20 years, the GEIS uses this number as the expected number of additional permanent workers needed per unit attributable to license renewal. GEIS Section 4.7 uses this approach in order to "...provide a realistic upper bound to potential population-driven impacts…."

I&M has not identified a need for significant new aging management programs or significant modifications to existing programs. I&M expects that existing "surge" capabilities for routine activities will enable I&M to perform the majority of the increased SMITTR workload with existing staff. It is estimated that, at most, one or two additional employees may be needed. Therefore, I&M has no plans to add more than one or two non-outage employees to support CNP operations during the license renewal term. Refueling and maintenance outages are expected to have durations of approximately 30 days, and as described above, these outages result in a large, temporary increase in employment at CNP. I&M believes that the majority of increased SMITTR tasks can be performed within this schedule and employment level. Therefore, I&M has no plans to add additional outage employees to perform SMITTR tasks for license renewal-term outages.

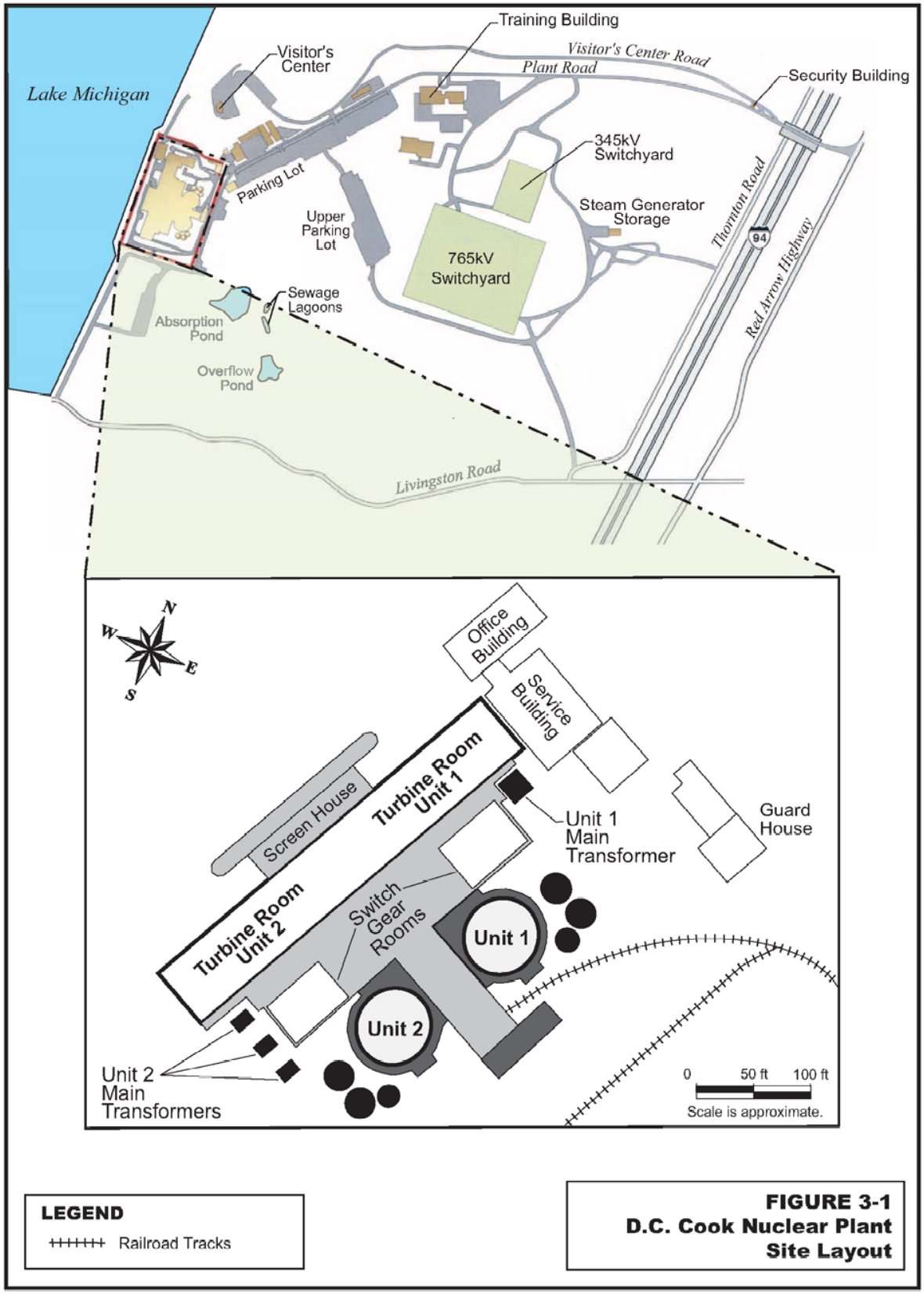
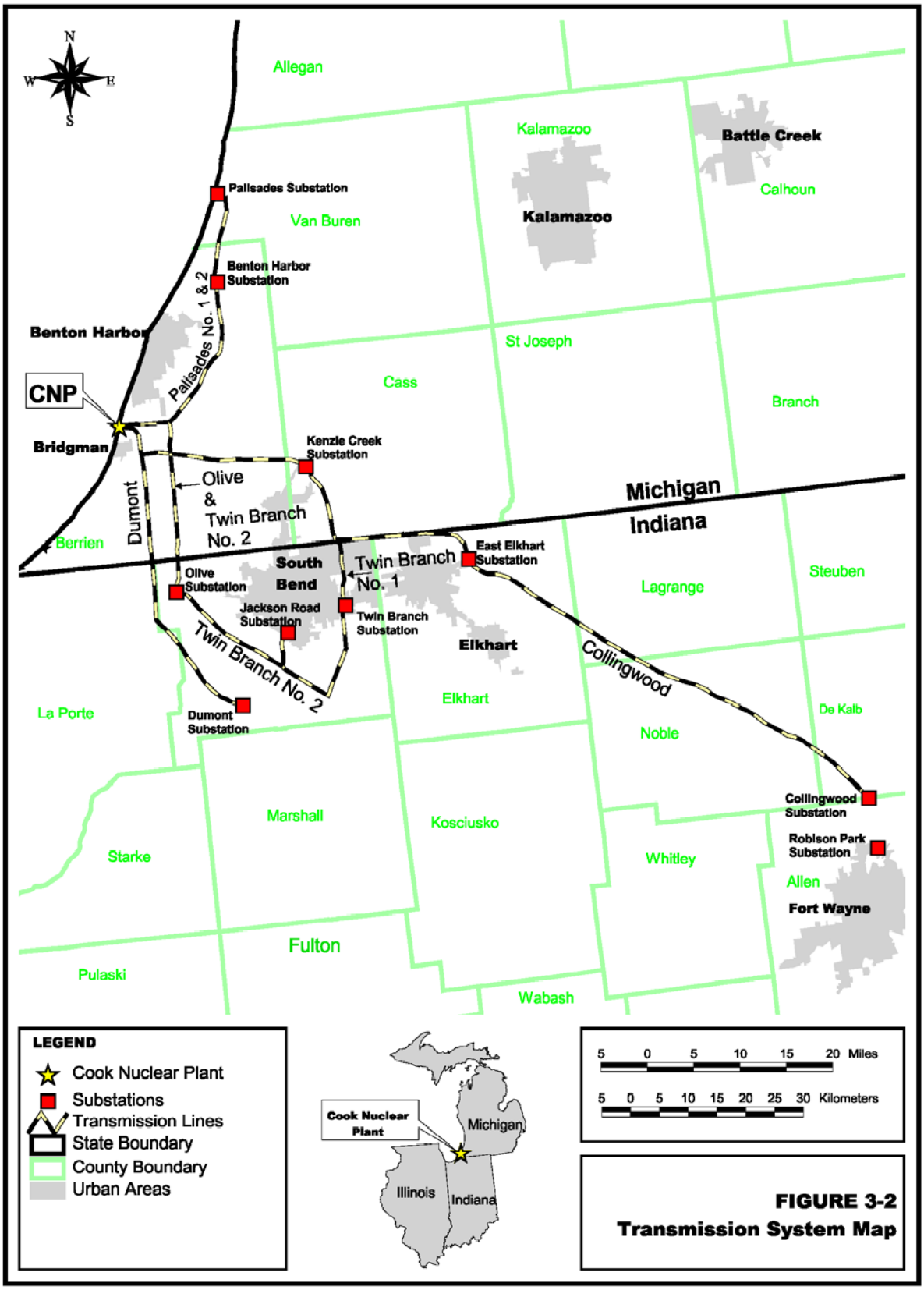


FIGURE 3-1
D.C. Cook Nuclear Plant
Site Layout


N
W
E
S
Allegan
Kalamazoo
Battle Creek
Calhoun
Palisades Substation
Van Buren
Kalamazoo
Benton Harbor Substation
Palisades No. 1 & 2
Benton Harbor
St Joseph
CNP
Cass
Branch
Bridgman
Kenzie Creek Substation
Olive & Twin Branch No. 2
Dumont
Michigan
Indiana
Berrien
East Elkhart Substation
Olive Substation
South Bend
Twin Branch No. 1
Steuben
Lagrange
Jackson Road Substation
Twin Branch Substation
Elkhart
Twin Branch No. 2
Collingwood
La Porte
Dumont Substation
Elkhart
De Kalb
Noble
Collingwood Substation
Marshall
Kosciusko
Robison Park Substation
Starke
Whitley
Allen
Fort Wayne
Fulton
Pulaski
Wabash
LEGEND
Cook Nuclear Plant
Substations
Transmission Lines
State Boundary
County Boundary
Urban Areas
Cook Nuclear Plant
Michigan
Illinois
Indiana
5 0 5 10 15 20 Miles
5 0 5 10 15 20 25 30 Kilometers
FIGURE 3-2
Transmission System Map

3.5 References

AEC (U.S. Atomic Energy Commission). 1973. *Final Environmental Statement Related to Operation of Donald C. Cook Nuclear Plant, Units 1 & 2*, Docket Nos. 50-315 and 50-316, Directorate of Licensing, Washington, DC, August.

AEP (American Electric Power). 2002. Donald C. Cook Nuclear Plant Updated Safety Analysis Report, Revision 18, Cook Nuclear Plant, Bridgman, Michigan, December 7.

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

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Chapter 4

Environmental Consequences of the Proposed Action and Mitigating Actions

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NRC

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

"…The environmental report shall include an analysis that considers…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) and 10 CFR 51.53(c)(3)(iii)

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 the CNP operating licenses. The assessment tiers from NRC's *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996a), which identified and analyzed 92 environmental issues that the NRC considered to be associated with nuclear power plant license renewal. In its analysis, the 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.

The NRC designated an issue as Category 1 if, based on the result of its analysis, all of 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.

Absent new and significant information (Chapter 5), NRC rules do not require analyses of Category 1 issues because the NRC resolved them using generic findings presented

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. The NRC requires plant-specific analyses for Category 2 issues. The 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)***
>
> ***"…[A]bsent 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 1996b)***

I&M has determined that of the 69 Category 1 issues, 12 do not apply to CNP because they apply to design or operational features that do not exist at the facility. In addition, because I&M 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 19 issues and explains I&M's basis for determining that these issues are not applicable to CNP.

Table 4-2 lists the 50 Category 1 issues that I&M has determined to be applicable to CNP (plus the two "NA" issues for which the NRC came to no generic conclusion). The table includes the findings that the NRC codified and references to the supporting GEIS analysis. I&M has reviewed the NRC findings and has identified no new and significant information that would make the NRC findings inapplicable to CNP. Therefore, I&M 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)

The NRC designated 21 issues as Category 2. Sections 4.1 through 4.20 address each of these issues (Section 4.17 addresses two 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 CNP does not have. In addition, some Category 2 issues apply only to refurbishment activities or to scenarios involving additional employment for managing plant aging. I&M does not plan any refurbishment or additional employment. If an issue does not apply to CNP, the section explains the basis for inapplicability.

For the 11 Category 2 issues that I&M has determined to be applicable to CNP, analyses are provided. These analyses include conclusions regarding the significance of the impacts relative to the renewal of the operating licenses for CNP and, when applicable, discuss potential mitigative alternatives. I&M has identified the significance of the impacts associated with each issue as either Small, Moderate, or Large, consistent with the criteria that the 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 any important attributes of the resource.

In accordance with National Environmental Policy Act practice, I&M 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

The NRC determined that its categorization and impact-finding definitions did not apply to two issues (Issues 60 and 92); however, I&M 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, the 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). I&M 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 make-up water from a river whose annual flow rate is less than 3.15×10^{12} ft^3 / year (9×10^{10} m^3 / year), an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided. The applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow." 10 CFR 51.53(c)(3)(ii)(A)

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

The NRC made surface water use conflicts a Category 2 issue because consultations with regulatory agencies indicate that water use conflicts are already a concern at two closed-cycle plants (Limerick and Palo Verde) and may be a problem in the future at other plants. In the GEIS, the 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).

This issue does not apply to CNP because, as indicated in Section 3.1.2, CNP does not use cooling ponds or cooling towers, or withdraw water from a small river.

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 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, Table B-1, Issue 25

The NRC made impacts on fish and shellfish 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 efforts to restore fish populations may increase the number of fish susceptible to intake effects during the license renewal period (NRC 1996). Information to be ascertained includes:

(1) Type of cooling system (whether once-through or cooling pond), and

(2) Current Clean Water Act (CWA) Section 316(b) determination or equivalent State documentation.

As Section 3.1.2 describes, CNP has a once-through heat dissipation system that withdraws from and discharges to Lake Michigan. As discussed later in this section, CNP has a CWA Section 316(b) determination.

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.

The original NPDES permit for CNP (issued in December 1974 and modified in April 1978) was issued with the provision that cooling water intake studies be conducted and submitted by January 1, 1977; and that these studies "…be adequate to show that the existing cooling water intake design, location, construction, and capacity reflect the best technology available for minimizing adverse environmental impact in accordance with Section 316(b)" of the CWA.

In January 1977, I&M submitted a "joint" report on 316(a) and 316(b) studies at CNP to the Michigan Water Resources Commission. This report, entitled "Report on the Impact of Cooling Water Use at the Donald C. Cook Nuclear Plant," along with study plans and other supporting documentation, "…constitute(d) the Company's demonstrations pursuant to Section 316 of the Federal Water Pollution Control Act" (I&M 1977). The report concluded that:

> …continued operation of this facility as planned will not cause significant harm to the aquatic environment, and will assure the protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife in and on the receiving water. In addition, the Report and the underlying studies show that the location, design, construction and capacity of the Plant's cooling water intake structures reflect the best technology available for minimizing adverse environmental impact (I&M 1977).

In September 1979, I&M submitted a report entitled, "Supplemental Report Demonstrating Compliance with Section 316(b) of the Clean Water Act," to the Michigan Water Resources Commission. It addressed concerns regarding the best available technology. The Supplemental Report also described alternative intake designs and possible modifications to the existing intake structures, including an evaluation of the advantages and disadvantages of each. It concluded that the existing CNP cooling water intakes did in fact reflect the best technology available because (1) entrainment losses at CNP appeared to have little or no impact on Lake Michigan fish populations and (2) at the time CNP was built, no technology existed that would further reduce larval entrainment. Moreover, an analysis of alternative intake structures showed that no design was clearly superior to that already installed at CNP (I&M 1979).

The NPDES permit issued September 19, 1985, by the Michigan Department of Natural Resources, indicated that the cooling water intake studies had been satisfactorily completed and made no mention of any additional intake studies or monitoring requirements. This approval was reiterated implicitly in NPDES permits issued by Michigan Department of Natural Resources in 1990, 1995, and 2000. Thus, Cook Nuclear Plant's current NPDES Permit No. MI0005827 (which was issued September 21, 2000, and expires October 1, 2003) constitutes the plant's current CWA Section 316(b) determination. Excerpts from this permit are included in Appendix B.

Therefore, I&M concludes that any environmental impact from entrainment of fish and shellfish in early life stages is SMALL and does not require further mitigation.

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, Table B-1, Issue 26

The NRC made impacts of impingement on fish and shellfish resources 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 to be ascertained includes:

(1) Type of cooling system (whether once-through or cooling pond), and

(2) Current CWA 316(b) determination or equivalent state documentation.

As discussed in Section 4.2, I&M submitted a combined CWA Sections 316(a) and 316 (b) report in 1977 that evaluated impingement at CNP and concluded that the intake structure represented the best technology available to minimize impacts (I&M 1977).

As discussed in Section 2.2, hundreds of scaup winter in southwestern Michigan and are sometimes found feeding in the area of the CNP intake. In early December 1991, approximately 400 lesser and greater scaup were entrained in the cooling water flow and drowned. An I&M investigation determined that scaup and other diving ducks had been gorging on the heavy growth of zebra mussels that had become established on the intake cribs and surrounding rip-rap. The waterfowl appeared to be attracted to the new food source and protected warm waters surrounding the center intake, which is used for deicing in the winter.

In consultation with Michigan Department of Natural Resources, CNP environmental personnel took a number of actions over the winter of 1991-1992 to prevent ducks from feeding in the area of the intake structures. These included harassing ducks by boat, firing blanks to frighten the ducks away, "herding" ducks away with a helicopter, and suspending "predator eye" balloons from buoys. These measures proved to be only temporarily effective.

During the 1992 refueling outage, the intake structures were hydrolazed (water-blasted) to remove zebra mussel encrustations. Since 1992, the intake racks and velocity caps have been cleaned to remove the food source (zebra mussels) and make the intake structures less attractive to foraging diving ducks. As a result, relatively few ducks have been entrained in the cooling water system. On the rare occasions that waterfowl are entrained, appropriate regulatory notifications are made.

As noted in Section 4.2, Cook Nuclear Plant's current NPDES Permit No. MI0005827 (which was issued September 21, 2000, and expires October 1, 2003) constitutes the plant's current Clean Water Act Section 316(b) determination. Excerpts from this permit are included in Appendix B.

Therefore, I&M concludes that any environmental impact from impingement of fish and shellfish is SMALL and does not warrant mitigation.

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, Table B-1, Issue 27

The 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 to be ascertained includes:

(1) Type of cooling system (whether once-through or cooling pond), and

(2) Evidence of a CWA Section 316(a) variance or equivalent State documentation.

As Section 3.1.2 describes, CNP has a once-through heat dissipation system that withdraws from and discharges to Lake Michigan. As discussed below, I&M has a Section 316(a) variance for CNP discharges.

In late 2002 (Unit 1) and early 2003 (Unit 2), the NRC granted CNP thermal power uprates of 1.66 percent for each unit. Prior to applying to the NRC for the uprate, I&M submitted a thermal plume study (Limno-Tech 2000) to the Michigan Department of Environmental Quality that demonstrated there would be no significant differences between the plumes at the existing (pre-uprate) and the uprated power levels.

As a consequence, the NPDES permit for CNP issued in September 2000 by Michigan Department of Environmental Quality contains a 17,300 million British thermal units per hour limit on heat loading to Lake Michigan. This permit level provides for more heat discharge than would occur from the two uprated units as currently uprated, leaving thermal capacity for future uprates. Thus, the current NPDES permit (No. MI0005827) (which was issued on September 21, 2000, and expires October 1, 2003) constitutes a CWA Section 316(a) variance in accordance with applicable state and federal regulations. Excerpts from this permit are included in Appendix B.

Therefore, I&M concludes that impacts to fish and shellfish from heat shock are SMALL and do not warrant further mitigation.

4.5 Groundwater Use Conflicts (Plants Using > 100 gpm of Groundwater)

NRC

"If the applicant's plant…pumps more than 100 gallons (total onsite) of ground water 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 ground-water use conflicts with nearby ground-water users…." 10 CFR 51, Subpart A, Table B-1, Issue 33

The NRC made this groundwater use conflict 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 cone could deplete the groundwater supply available to offsite users, creating an impact that could warrant mitigation. Information needed to address this issue includes the CNP groundwater withdrawal rate (whether greater than 100 gpm), offsite drawdown, and impact on neighboring wells.

This issue does not apply to CNP because, as indicated in Section 3.1.2, CNP groundwater use is substantially less than 100 gpm.

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

NRC

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

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

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

This issue does not apply to CNP because, as indicated in Section 3.1.2, CNP does not use cooling towers or cooling ponds, and does not withdraw water from a small river.

4.7 Groundwater Use Conflicts (Plants Using Ranney Wells)

NRC

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

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

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

This issue does not apply to CNP because, as indicated in Section 3.1.2, CNP does not use Ranney wells.

4.8 Degradation of Groundwater Quality

NRC

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

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

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

CNP discharges process and sanitary wastewater to the absorption ponds described in Section 3.1.4. These discharges are permitted by the Michigan Department of Environmental Quality. Excerpts from groundwater discharge permit M00988 are included in Appendix B. A restrictive covenant prevents withdrawal of the affected groundwater for any use. Section 2.3 describes the current status of water quality from these discharges.

This issue does not apply to CNP because, as indicated in Section 3.1.2, CNP does not use cooling water ponds.

4.9 Impacts of Refurbishment on Terrestrial Resources

NRC

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

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

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

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

This issue is not applicable to CNP because, as discussed in Section 3.2, I&M has no plans for refurbishment or other license-renewal-related construction activities at CNP.

4.10 Threatened and Endangered Species

NRC

"…Additionally, the applicant shall assess the impact of the proposed action on threatened and 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, Table B-1, Issue 49

The 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 throughout the renewal period. In addition, compliance with the Endangered Species Act requires consultation with the appropriate federal agency (NRC 1996).

Section 2.5 discusses threatened and endangered species that may occur at CNP or along associated transmission line corridors. As discussed in Section 3.2, I&M has no plans to conduct license renewal-related refurbishment or construction at CNP during the license renewal period. Therefore, there would be no refurbishment-related impacts to threatened and endangered species, and further analysis of refurbishment-related impacts is not applicable.

As discussed in Section 2.5, one animal species (Caspian tern) and seven plant species (straw sedge, scirpus-like rush, red mulberry, water-meal, Carey's smartweed, purple coneflower, and rose-pink) listed by Michigan Department of Natural Resources as endangered, threatened, or extirpated were observed on the CNP site during surveys conducted in 2002. No federally-listed species were found during the surveys of the CNP site, but the federally-listed bald eagle is known to occasionally forage along the CNP shoreline. Similarly, the state-listed osprey and common tern are known to occasionally forage along the CNP shoreline.

The 2002 surveys of transmission lines associated with CNP resulted in the discovery of two state-listed animal species (loggerhead shrike and golden-winged warbler) and six state-listed plant species (southern dewberry, Drummond's rockcress, swamp smartweed, prairie trillium, water meal, and scirpus-like rush) on the transmission line corridors. There are no other known occurrences of endangered or threatened species at CNP or along associated transmission corridors.

Based on the CNP location and habitat types, several other threatened or endangered species identified in Section 2.5 could be located on the CNP site or along associated transmission line corridors. However, I&M is not aware of any such occurrences.

I&M's plans for license renewal will not result in operational changes that would alter current natural resource management practices. I&M is not aware of any adverse impacts to threatened and endangered species from current operational practices. The station and its transmission lines have been in existence for more than 25 years, long enough for any operational impacts to have stabilized. As discussed in Section 2.5, current vegetation management practices in transmission corridors could actually be working to benefit species that depend on open, prairie-like conditions.

I&M submitted correspondence to the Michigan Department of Natural Resources, Indiana Department of Natural Resources, and the U.S. Fish and Wildlife Service requesting information on any listed species or critical habitats that might occur on the CNP site or along associated transmission line corridors, with particular emphasis on species that might be adversely affected by continued operations over the license renewal term. Responses from Michigan Department of Natural Resources and Indiana Department of Natural Resources indicate that the project is not expected to impact threatened and endangered species if the project proceeds according to the plans provided. The U.S. Fish and Wildlife Service suggested that a field survey be conducted to determine the presence of the federally-listed Pitcher's thistle (*Cirsium pitcheri*) in the project area. As discussed in Section 2.5, field surveys have been conducted for this and other federal and state listed species. Pitcher's thistle was not discovered during these surveys. Appendix C includes copies of I&M correspondence with the U.S. Fish and Wildlife Service, the Michigan Department of Natural Resources, and the Indiana Department of Natural Resources.

Due to the facts that I&M has no plans to alter current operations over the license renewal period, and that resource agencies contacted by I&M evidenced no concerns about relicensing, I&M concludes that any adverse impacts of operation on threatened or endangered species over the license renewal period would be SMALL and do not warrant mitigation.

4.11 Air Quality During Refurbishment (Nonattainment 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, Table B-1, Issue 50

The NRC made impacts to air quality during refurbishment a Category 2 issue because vehicle exhaust emissions could be cause for some concern, and a general conclusion about the significance of the potential impact could not be drawn without considering the compliance status of each site and the number of workers expected to be employed during an outage (NRC 1996). Information needed would include: (1) the attainment status of the plant-site area, and (2) the number of additional vehicles as a result of refurbishment activities.

The issue of air quality during refurbishment is not applicable to CNP because, as discussed in Section 3.2, I&M has no plans for refurbishment or other license renewal-related construction activities at CNP.

4.12 Microbiological Organisms

NRC

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

"…These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically…." 10 CFR 51, Subpart A, 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, the NRC designated impacts on public health from thermophilic organisms a Category 2 issue. Information to be ascertained is whether: (1) the plant uses a cooling pond, lake, or canal or discharges to a small river, and (2) discharge characteristics (particularly temperature) are favorable to the survival of thermophilic organisms.

This issue does not apply to CNP because, as indicated in Section 3.1.2, CNP does not use cooling ponds, lakes, or canals; and does not discharge to a small river.

4.13 Electric Shock from Transmission-Line-Induced Currents

NRC

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

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

The 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, the NRC could not determine the significance of the electrical shock potential.

There have been no previous NRC or National Environmental Policy Act analyses of transmission-line-induced current hazards at CNP. Therefore, this section provides an analysis of conformance of CNP's transmission lines with the NESC standard. The analysis is based on computer modeling, benchmarked with on-site measurements, of induced current under the lines.

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

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

In 1977, the NESC adopted a provision that describes how to establish minimum vertical clearances to the ground for electric lines having voltages exceeding 98-kilovolt alternating current to ground.[1] The clearance must limit the induced current[2] due to electrostatic effects to 5 milliamperes if the largest anticipated truck, vehicle, or equipment were short-circuited to ground. By way of comparison, the setting of ground fault circuit interrupters used in residential wiring (special breakers for outside circuits or those with outlets in the vicinity of water pipes) is 4 to 6 milliamperes.

As described in Section 3.1.3, six 345-kilovolt lines (three double-circuit tower lines) and one 765-kilovolt line were specifically constructed to distribute power from CNP to the electric grid. I&M'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, I&M calculated the electric field strength for each transmission line, then calculated the induced current. If the limiting case exceeded the NESC limit, additional analyses were performed to identify all locations with potential to exceed the limit.

I&M calculated electric field strength and induced current using a computer code called ENVIRO® (Version 2.51), produced by the Electric Power Research Institute. The results of this computer program have been field-verified through actual electric field measurements by several utilities, including I&M. The input parameters included:

- design features of the limiting-case scenario,
- the NESC requirement that line sag be determined at 120 degrees Fahrenheit conductor temperature,
- maximum operating voltage expected during normal load conditions, and
- the maximum vehicle size under the lines as a tractor-trailer.

The analysis determined that one of the seven transmission lines has the capacity to induce up to, but not exceed, 5 milliamperes in a vehicle parked beneath the lines. The analysis identified one location along the 765-kilovolt Dumont transmission line that yielded a 5.0 milliampere result. The results for each transmission line are provided in Table 4-3.

AEP conducts surveillance and maintenance to assure that design ground clearances will not change. These procedures include routine inspection by aircraft on a regular basis. Aerial patrols of all corridors include checks for the following, any of which would be evidence of clearance problems:

- Encroachments
- Broken conductors

[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.

- Broken or leaning structures
- Signs of burnt trees

Ground inspections include examination for clearance at questionable locations, examination of the integrity of structures, and surveillance for dead or diseased trees that might fall on the transmission lines.

Problems noted during any inspection are brought to the attention of the appropriate organizations for corrective action.

I&M's assessment under 10 CFR 51 concludes that electric shock is of SMALL significance for the CNP transmission lines. This conclusion is based on the determination that the transmission lines that distribute power from CNP to the electric grid continue to meet the NESC criterion for preventing electric shock from induced currents. Due to the small significance of this issue, mitigation measures are not warranted.

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)(l)

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

"...[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)

The 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). Local conditions that need to be ascertained are: (1) population categorization as small, medium, or high, and (2) applicability of growth control measures.

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

Sections 2.6 and 2.8 indicate that CNP is located in a high population area that is not subject to growth control measures that limit housing development. Using the NRC regulatory criteria, CNP license renewal housing impacts would be expected to be small. Continued operations could result in housing impacts due to increased staffing. However, I&M estimates that it would need to add, at most, one or two non-outage workers and no outage workers to support CNP operations during the license renewal term (Section 3.4).

I&M concludes that increased staffing, if any, would create indiscernible housing impacts; therefore, the appropriate characterization of CNP license renewal housing impact is SMALL.

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)(l)

"…An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability…." 10 CFR 51, Subpart A, 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)

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

The NRC's analysis of impacts to the public water supply system considered both plant demand and plant-related population growth demands on local water resources. As Section 3.4 indicates, I&M anticipates no more than a minimal increase (one or two additional employees) in CNP employment attributable to license renewal. Section 2.6 describes the CNP regional demography. Section 2.9.1 describes the public water supply systems in the area, their permitted capacities, and current demands. As discussed in Section 3.2, no refurbishment is planned for CNP and no refurbishment impacts are therefore expected.

CNP uses water from Lake Charter Township, a municipal system. As reported in Section 2.9, CNP's average daily usage in 2001 was approximately 470,000 gallons. This represents approximately 9.4 percent of Lake Charter Township's 2001 maximum daily capacity (see Table 2-5) and 27 percent of the Township's 2001 average daily use. I&M does not expect CNP operations to have any change in impact on local water supplies.

Because I&M has plans to increase plant employment by no more than one or two additional employees and there is existing excess capacity in the municipal water supply system, I&M concludes that impacts on the public water supply would be SMALL and would not require mitigation.

4.16 Education Impacts from Refurbishment

NRC

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

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

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

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

This issue is not applicable to CNP because, as discussed in Section 3.2, I&M has no plans for refurbishment or other license-renewal-related construction activities at CNP.

4.17 Offsite Land Use

4.17.1 Offsite Land Use - Refurbishment

NRC

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

"…Impacts may be of moderate significance at plants in low population areas…." 10 CFR 51, Subpart A, 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 (2.6 km^2), and at least one urban area with a population of 100,000 or more within 80 km (50 miles)…." (NRC 1996)

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

This issue is not applicable to CNP because, as discussed in Section 3.2, I&M has no plans for refurbishment or other license-renewal-related construction activities at CNP.

4.17.2 Offsite Land Use - License Renewal Term

NRC

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

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

"…[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…." (NRC 1996)

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

The 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, the NRC could not assess the potential significance of site-specific offsite land-use impacts (NRC 1996). Site-specific factors to be considered in an assessment of new tax-driven land-use impacts include:

(1) the size of plant-related population growth compared to the area's total population,

(2) the size of the plant's tax payments relative to the community's total revenue,

(3) the nature of the community's existing land-use pattern, and

(4) the extent to which the community already has public services in place to support and guide development.

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

Population-Related Impacts

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

Tax-Revenue-Related Impacts

The NRC has determined that the significance of tax payments as a source of local government revenue would be (NRC 1996) categorized as follows:

- SMALL - the payments are less than 10 percent of revenue,
- MODERATE - the payments are between 10 and 20 percent of revenue, or
- LARGE - the payments are greater than 20 percent of revenue.

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

The NRC further determined that if a plant's tax payments are projected to be moderate to large relative to the community's total revenue, new tax-driven land-use changes would be moderate.

Table 2-4 provides a comparison of total tax payments made by CNP to Lake Charter Township and Berrien County's annual property tax revenues. For the five-year period from 1996 through 2000, CNP's tax payments to Lake Charter Township represented 50 to 52 percent of the Township's total annual property tax revenues. Using the NRC's criteria, CNP's tax payments are of LARGE significance to Lake Charter Township. For the same period, CNP's tax payments to Berrien County represent only 2 to 3 percent of the County's total annual property tax revenues. Using the NRC's criteria, CNP's tax payments are of SMALL significance to Berrien County.

As depicted in Section 2.8, the County's developmental past consisted of residential and commercial uses coexisting in the urban centers. Industrial uses were developed in urban centers or just beyond urban boundaries. Parks and recreation areas were scattered throughout the County and farming dominated the rural landscape.

Over the last few decades, residential development has begun to move away from the core urban centers, creating a sprawling effect. Commercial and industrial growth has been experienced in the more centralized urban areas. However, although the County is experiencing an increase in development, population growth has remained minimal. This is supported by the fact that residential development patterns have reflected an increase in the numbers of smaller household sizes and single-family dwellings. When presented with new residential, commercial, or industrial development-related water demands, required infrastructure supports are readily provided. In effect, infrastructure development has not been deterred by its cost to the local government.

As described in Section 3.2, I&M does not anticipate refurbishment or license renewal-related construction during the license renewal period. Therefore, I&M does not anticipate any increase in the assessed value of CNP due to refurbishment-related improvements, or any related tax-increase-driven changes to offsite land-use and development patterns.

CNP was one of the case studies examined in the GEIS (NRC 1996). Section C.4.2.5.2 of the GEIS concludes that the indirect land-use impacts associated with the license renewal term are expected to be moderate. However, the GEIS case study assumed a certain level of refurbishment activity. As stated above, I&M will not conduct any refurbishment activities for CNP. Therefore, there are no land use changes expected during the license renewal period.

I&M concludes that the land-use impact will be SMALL. Additional mitigation for land-use impacts during the license renewal term is not warranted.

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 renewed license." 10 CFR 51.53(c)(3)(ii)(J)

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

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

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

As described in Section 3.2, no refurbishment is planned and no refurbishment impacts to local transportation are anticipated. Further evaluation for this impact is not applicable.

As described in Section 3.4, I&M anticipates no more than one or two additional license renewal term employees above the projected plant workforce of 1,200 and outage workforce of as many as 700 workers. Level-of-service determinations and daily traffic counts are provided in Table 2-6. Based on information in Table 2-6, Interstate 94 appears to have nearly reached maximum vehicle capacity. Red Arrow Highway, the principal highway used by most plant employees, is also reflecting large volumes of traffic. In 1999 and 2000, I&M hired a traffic engineering firm to develop a solution for congestion at the intersection of Cook Place and Red Arrow Highway (Traffic Engineering Consultants 1999). In order to reduce this congestion, I&M optimized the traffic signal control system.

However, the addition of one or two employees represents less than one percent of the existing plant workforce and an even smaller percentage of the existing workforce combined with the outage workforce. The additional personnel would not have a discernible effect on the current state of transportation in the area. Therefore, I&M concludes that increasing the current workforce by less than one percent would have a SMALL incremental impact on local traffic and that no mitigation is warranted.

4.19 Historic and Archaeological Resources

NRC

The environmental report must "…assess whether any historic or archeological 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 archeological 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, Table B-1, Issue 71

"…Sites are considered to have small impacts to historic and archeological 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)

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

In CNP's Final Environmental Statement for operation of CNP, it was reported that "None of the facilities listed…will be affected by the presence or operation of the Station" (AEC 1973). This statement was supported by a letter from Mr. Samuel A. Milstein, State of Michigan Liaison Officer for Historic Preservation (AEC 1973).

As discussed in Section 3.2, I&M has no refurbishment plans and no refurbishment-related impacts are anticipated. I&M is not aware of any historic or archaeological resources that have been affected to date by CNP operations, including operation and maintenance of transmission lines. I&M has no plans to change transmission line inspection and maintenance practices or right-of-way vegetation management practices over the license renewal term. Current practices are not expected to change significantly (there may well be minor changes in inspection and surveillance procedures, vegetation management procedures, etc.). Therefore, I&M concludes that operation of these same generation and transmission facilities over the license renewal term would not impact cultural resources; hence, no mitigation would be warranted.

4.20 Severe Accident Mitigation Alternatives

NRC

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

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

Section 4.20 summarizes the I&M analysis of alternative approaches to mitigating the impacts of severe accidents. Appendix F provides a detailed description of the severe accident mitigation alternatives (SAMA) analysis.

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

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

I&M maintains a probabilistic risk assessment (PRA) model for evaluating the most significant risks of radiological release from CNP fuel into the reactor and then into the containment structure (the Level 1 CNP PRA model), and from the containment structure into the environment (the Level 2 CNP PRA model). In 1992, a detailed Level 1 CNP PRA was developed using small event trees (primarily systemic) and large fault trees, representing accident and transient initiating events starting from power operation and continuing for a 24-hour mission time. The original Level 1 CNP PRA included both the Individual Plant Examination (IPE) for Severe Accident Vulnerabilities and Individual Plant Examination for External Events (IPEEE) in response to NRC Generic Letter 88-20. During development of the original Level 1 CNP PRA model,

CNP created a Level 2 CNP PRA model. Containment response and radioactive source terms for the plant damage states for this model were determined with Modular Accident Analysis Program (MAAP) Version 3.0B (PWR Version 19) for a 48-hour mission time.

Since development of the original Level 1 and Level 2 CNP PRA models, I&M has continued to improve and update these analyses to reflect latest PRA modeling insights, comments from peer reviewers and internal reviewers, and to reflect modifications to the facility. Each of these updates is described in Section F.2.1 of Appendix F. The most recent CNP PRA model updates include a revised Level 2 CNP PRA model, with containment response and radioactive source terms for the plant damage states for this model determined using MAAP Version 4.0.5.

For the SAMA analysis, I&M used the most recent CNP PRA model output as input to an NRC-approved PRA model as described in NUREG/BR-0184, "Regulatory Analysis Technical Evaluation Handbook." This Level 3 CNP PRA model calculates the monetary value of dose to the public and worker, offsite and onsite economic costs, and replacement power costs from hypothesized severe accidents and subsequent radiological releases from the containment structure into the environment. Then, using NRC regulatory analysis techniques from NUREG/BR-0184, I&M calculated the monetary value of the maximum theoretical benefit based upon the elimination of all plant risk from severe accidents. This value is then used for evaluating the cost benefit of potential SAMA candidates. A SAMA candidate whose cost of implementation exceeds the maximum theoretical benefit could be rejected as not being cost-beneficial.

I&M used CNP-specific information, including insights from the original IPE and IPEEE CNP PRA model and later updates, and industry and NRC information, to create a list of 194 SAMA candidates for consideration. I&M analyzed this list and initially screened out 122 SAMA candidates based on three criteria (See Section F.4 of Appendix F). These criteria included SAMA candidates: (1) that would not apply to the CNP design; (2) that I&M had already implemented at CNP; or (3) that would require extremely large implementation costs (i.e., greater than the maximum theoretical benefit). Following initial screening, 72 SAMA candidates remained for further consideration.

I&M calculated the risk reduction that would be attributable to each SAMA candidate (assuming SAMA implementation) and re-quantified the risk value. The difference between the base risk value and the SAMA-reduced risk value became the averted risk, or the value of implementing the SAMA candidate. I&M prepared cost estimates of varying degrees for implementing each SAMA and repeated the cost-benefit comparison. From this analysis, five categories of improvements were determined to be potentially cost-beneficial including:

- Improvements that would prevent or reduce the probability of a reactor coolant pump seal loss-of-coolant accident as a result of preventing or minimizing the probability of loss of cooling or seal injection to the reactor coolant pump;

- Improvements that would provide alternate ventilation to various risk-significant equipment, including electrical switchgear and the emergency diesel generators;

- Improvements that would minimize the potential for hydrogen generated by accident conditions to threaten containment structural integrity;

- Improvements that would provide the capability to cross-tie alternating current emergency power buses between the units; and

- Improvements that would revise the procedures used to respond to intersystem loss-of-coolant accidents to specifically address the accident sequence with the frequency that was dominant in the CNP PRA model.

These SAMA candidates were determined to be potentially cost-beneficial for mitigating the consequences of a severe accident. However, based on review of the details of these SAMA candidates, it is concluded that none relate to adequately managing the effects of aging. Therefore, implementation of these SAMA candidates would not be required pursuant to 10 CFR 54. Candidates from some of these categories of improvements could enhance operational flexibility or increase reliability of existing station equipment. As a result, I&M is further evaluating these items outside the context of the license renewal process.

Table 4-1. Category 1 Issues that are Not Applicable to CNP.[a]

Issues		Basis for Inapplicability to CNP
Surface Water Quality, Hydrology, and Use (for all plants)		
1.	Impacts of refurbishment on surface water quality	CNP will not undertake refurbishment.
2.	Impacts of refurbishment on surface water use	CNP will not undertake refurbishment.
4.	Altered salinity gradients	Issue applies to discharge to a natural water body that has a salinity gradient to alter, not inland freshwaters.
Aquatic Ecology (for all plants)		
14.	Refurbishment	CNP will not undertake refurbishment.
Aquatic Ecology (for plants with cooling-tower-based heat dissipation systems)		
28.	Entrainment of fish and shellfish in early life stages	CNP has a once-through cooling system; no cooling towers.
29.	Impingement of fish and shellfish	CNP has a once-through cooling system; no cooling towers.
30.	Heat shock	CNP has a once-through cooling system; no cooling towers.
Groundwater Use and Quality		
31.	Impacts of refurbishment on groundwater use and quality	CNP will not undertake refurbishment.
36.	Groundwater quality degradation (Ranney wells)	CNP does not have Ranney wells.
37.	Groundwater quality degradation (saltwater intrusion)	Issue applies to plants in coastal areas, not inland sites such as CNP.
38.	Groundwater quality degradation (cooling ponds in salt marshes)	Issue applies to cooling ponds in salt marshes, not inland sites such as CNP.
Terrestrial Resources		
41.	Cooling tower impacts on crops and ornamental vegetation	CNP has a once-through cooling system; no cooling towers.
42.	Cooling tower impacts on native plants	CNP has a once-through cooling system; no cooling towers.
43.	Bird collisions with cooling towers	CNP has a once-through cooling system; no cooling towers.
44.	Cooling pond impacts on terrestrial resources	CNP has a once-through cooling system; no cooling towers.

Table 4-1. Category 1 Issues that are Not Applicable to CNP.[a] (Continued)

Issues		Basis for Inapplicability to CNP
Human Health		
54.	Radiation exposures to the public during refurbishment	CNP will not undertake refurbishment.
55.	Occupational radiation exposures during refurbishment	CNP will not undertake refurbishment.
56.	Microbiological organisms (occupational health)	CNP has a once-through cooling system; no cooling towers.
Socioeconomics		
72.	Aesthetic impacts (refurbishment)	CNP will not undertake refurbishment.

< = less than

gpm = gallons per minute

NRC = U.S. Nuclear Regulatory Commission

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

Table 4-2. Category 1 and "NA" Issues that are Applicable to CNP.[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. 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.	4.2.1.2.3/4-6 4.4.2.2/5-53
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 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
12.	Water use conflicts (plants with once-through cooling systems)	SMALL. These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems.	4.2.1.3/4-13
Aquatic Ecology (for all plants)			
15.	Accumulation of contaminants in sediments or biota	SMALL. Accumulation of metals 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 CNP.[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
Groundwater Use and Quality			
32.	Groundwater use conflicts (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 (potable and service water) 4.8.1.2/4-117 (dewatering)
Terrestrial Resources			
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

Table 4-2. Category 1 and "NA" Issues that are Applicable to CNP.[a] (Continued)

Issue		NRC Findings[b]	GEIS Section/Page
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
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
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			
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.	4.7.3.3/4-106 (safety) 4.7.3/4-104 (public services) 4.7.3.4/4-107 (social) 4.7.3.6/4-107 (tourism, recreation)

Table 4-2. Category 1 and "NA" Issues that are Applicable to CNP.[a] (Continued)

Issue		NRC Findings[b]	GEIS Section/Page
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
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. Off-site 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 NRC designated this issue as Category 1, and stated the following in 10 CFR 51, Appendix B, Table B-1: "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."	6.2.4/6-27

Table 4-2. Category 1 and "NA" Issues that are Applicable to CNP.[a] (Continued)

Issue		NRC Findings[b]	GEIS Section/Page
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 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 3×10^{-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 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	6.2/6-27

Table 4-2. Category 1 and "NA" Issues that are Applicable to CNP.[a] (Continued)

Issue	NRC Findings[b]	GEIS Section/Page
79. Offsite radiological impacts (spent fuel and high-level waste disposal) (Continued)	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 and 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 assurance that sufficient mixed waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioned consistent with NRC decommissioning requirements.	6.4.5/6-63 6.6/6-91 (conclusion)

Table 4-2. Category 1 and "NA" Issues that are Applicable to CNP.[a] (Continued)

Issue		NRC Findings[b]	GEIS Section/Page
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)
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)

Table 4-2. Category 1 and "NA" Issues that are Applicable to CNP.[a] (Continued)

Issue	NRC Findings[b]	GEIS Section/Page
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.	9/9-1 Table 9.1 and footnote d/9-11

CFR = Code of Federal Regulations

EPA = U.S. Environmental Protection Agency

GEIS = Generic Environmental Impact Statement (NRC 1996a)

Hz = Hertz

NA = Not applicable

NAS = National Academy of Sciences

NEPA = National Environmental Policy Act

NPDES = National Pollutant Discharge Elimination System

NRC = U.S. Nuclear Regulatory Commission

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

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

Table 4-3. Results of Induced Current Analysis.

Transmission Line	Voltage (kV)	Limiting Case Induced Current (milliamperes)
Palisades No. 1	345	2.6
Palisades No. 2	345	2.4
Olive	345	2.4
Twin Branch No. 1	345	2.0
Twin Branch No. 2	345	2.4
Collingwood	345	3.3
Dumont	765	5.0[a]

a. One road crossing yielded a maximum induced current of 5.0 milliamperes.

4.21 References

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

NRC (U.S. Nuclear Regulatory Commission). 1996b. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." *Federal Register*. Volume 61, Number 109, page 28483. June 5.

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I&M (Indiana & Michigan Power Company). 1977. Report on the Impact of Cooling Water Use at the Donald C. Cook Nuclear Plant. Submitted to the Michigan Water Resources Commission and its Chief Engineer on January 1.

I&M (Indiana & Michigan Power Company). 1979. Supplemental Report Demonstrating Compliance with Section 316(b) of the Clean Water Act. Submitted to the Michigan Water Resources Commission on September 15.

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

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I&M (Indiana & Michigan Power Company). 1977. Report on the Impact of Cooling Water Use at the Donald C. Cook Nuclear Plant. Submitted to the Michigan Water Resources Commission and its Chief Engineer on January 1.

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

Section 4.4

Limno-Tech. 2000. Cook Plant Thermal Plume Study. Prepared for Indiana Michigan Power Company by Limno-Tech, Inc. Ann Arbor, Michigan. May 16.

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

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

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

TRC (Third Rock Consultants). 2002. Threatened and Endangered Species Survey Final Field Report. Prepared under contract to Tetra Tech NUS, Inc., for American Electric Power, Buchanan, Michigan. December.

Section 4.11

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

Section 4.13

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

Section 4.14

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

Section 4.15

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

Section 4.16

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

Section 4.17

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

Section 4.18

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

Traffic Engineering Consultants, P.C. 1999. Letter from Kamyar Fattahi, PE, to Ray Brown, American Electric Power, RE: Traffic Signal Modification Project, D.C. Cook Nuclear Plant. November 30.

Section 4.19

AEC (U.S. Atomic Energy Commission). 1973. *Final Environmental Statement related to operation of Donald C. Cook Nuclear Plant Units 1 and 2*. Indiana & Michigan Electric Company and Indiana & Michigan Power Company. Docket Nos. 50-315 and 50-316. August.

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

Chapter 5

Assessment of New and Significant Information

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5.1 Discussion

NRC

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

NRC regulations do not require an applicant's environmental report to contain analyses of the impacts of Category 1 issues but do require an applicant to identify any new and significant information of which the applicant is aware that would negate any of the generic findings that the NRC has codified or evaluated in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996a). The purpose of this requirement is to alert the NRC staff to such information so the staff can determine whether to seek the Commission's approval to waive or suspend application of the rule with respect to the affected generic analysis. The NRC has explicitly indicated, however, that an applicant is not required to perform a site-specific validation of GEIS conclusions (NRC 1996b).

I&M expects that new and significant information would include:

- Information that identifies a significant environmental issue not covered in the GEIS and codified in the regulation, or

- Information that was not covered in the GEIS analyses and that leads to an impact finding different from that codified in the regulation.

The NRC does not specifically define the term "significant." For the purpose of its review, I&M used guidance available in Council on Environmental Quality (CEQ) regulations. The National Environmental Policy Act authorizes CEQ to establish implementing regulations for federal agency use. The NRC requires license renewal applicants to provide it with input, in the form of an environmental report that the NRC will use to meet National Environmental Policy Act requirements as they apply to license renewal (10 CFR 51.10). CEQ guidance provides that federal agencies should prepare environmental impact statements for actions that would significantly affect the environment (40 CFR 1502.3), focus on significant environmental issues (40 CFR 1502.1), and eliminate from detailed study issues that are not significant [40 CFR 1501.7(a)(3)]. The CEQ guidance includes a lengthy definition of "significantly" that requires consideration of the context of the action and the intensity or severity of the impact(s) (40 CFR 1508.27). I&M expects that moderate or large impacts, as defined by the NRC, would be significant. Chapter 4 presents the NRC definitions of "moderate" and "large" impacts.

The new and significant assessment process that I&M used during preparation of this environmental report included:

(1) Interviewing I&M subject matter experts on the validity of the conclusions in the GEIS as they relate to CNP,

(2) Reviewing documents related to environmental issues at CNP,

(3) Discussions with state and federal agencies to determine if the agencies had concerns with their areas of expertise, as addressed in the environmental report,

(4) Maintaining interfaces with the nuclear power industry to ensure current knowledge of events at other plants that could potentially affect environmental issues,

(5) Reviewing other license renewal applications for pertinent issues, and

(6) Crediting the oversight provided by inspections of plant facilities by state and federal regulatory agencies.

I&M is aware of no new and significant information regarding the plant's environment or operations that would:

- Make a generic conclusion codified by the NRC for Category 1 issues no longer applicable to CNP,
- Alter regulatory or GEIS statements regarding Category 2 issues, or
- Suggest any other measure of environmental impacts due to license renewal.

5.2 References

NRC (U.S. Nuclear Regulatory Commission). 1996a. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)*, Volumes 1 and 2, NUREG-137, Washington, DC, May.

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

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Chapter 6

Summary of License Renewal Impacts and Mitigating Actions

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6.1 License Renewal Impacts

I&M has reviewed the environmental impacts of renewing the CNP operating licenses and has concluded that all impacts would be SMALL and would not require mitigation. This environmental report documents the basis for I&M's conclusion. Chapter 4 incorporates by reference the NRC findings for the 50 Category 1 issues that apply to CNP, all of which have impacts that are SMALL (Table 4-2). The rest of Chapter 4 also analyzes Category 2 issues, all of which are either not applicable or have impacts that would be SMALL. Table 6-1 identifies the impacts that CNP license renewal would have on resources associated with Category 2 issues.

The CNP license renewal application assumes throughout that the activities to be authorized by the renewed CNP licenses will be conducted in accordance with the current licensing basis. Any changes made to the current licensing basis will be made in accordance with the Atomic Energy Act of 1954, as amended, and the Commission's regulations, consistent with 10 CFR 54.29(a).

6.2 Mitigation

NRC

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

"…The environmental report shall include an analysis that considers and balances…alternatives available for reducing or avoiding adverse environmental effects…." 10 CFR 51.45(c) as incorporated by 10 CFR 51.53(c)(2) and 10 CFR 51.53(c)(3)(iii)

All impacts of license renewal are SMALL and would not require mitigation. Current operations include mitigation and monitoring activities that would continue during the term of the license renewal. I&M performs routine mitigation and monitoring activities to ensure the safety of workers, the public, and the environment. These activities include:

- The Radiological Environmental Monitoring Program
- Emissions monitoring
- Effluent chemistry monitoring

6.3 Unavoidable Adverse Impacts

NRC

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

This environmental report adopts by reference NRC findings for applicable Category 1 issues, including discussions of any unavoidable adverse impacts (Table 4-2). I&M examined 21 Category 2 issues and identified the following unavoidable adverse impacts of license renewal. However, none of these impacts result from license renewal but are a continuation of impacts initially analyzed for the licensing of CNP.

- Waste heat from operation of CNP is discharged to Lake Michigan and would continue to affect the distribution and abundance of plankton, benthos, and fish in the immediate vicinity of the discharge. The waste heat also slightly increases the consumption of Lake Michigan water, due to increased evaporation accompanying the added heat load.

- Some juvenile and adult fish and migratory waterfowl would continue to be impinged on the intake traveling screens.

- Some larval fish and shellfish would continue to be entrained at the intake structures.

6.4 Irreversible and Irretrievable Resource Commitments

NRC

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

The continued operation of CNP for the license renewal term will result in irreversible and irretrievable resource commitments, including the following:

- Nuclear fuel, which is consumed in the reactor and converted to radioactive waste;
- The land required to dispose of spent nuclear fuel, low-level radioactive wastes generated as a result of plant operations, and solid and sanitary wastes generated from normal industrial operations;
- Elemental materials that will become radioactive; and
- Materials used for the normal industrial operations of the plant that cannot be recovered or recycled or that are consumed or reduced to unrecoverable forms.

6.5 Short-Term Use Versus Long-Term Productivity of the Environment

NRC

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

The current balance between short-term use and long-term productivity at CNP was established when the plant began operating in the mid-1970s. The CNP Final Environmental Statement (AEC 1973) evaluated the impacts of constructing and operating CNP on the shore of Lake Michigan in Berrien County, Michigan. Approximately 650 acres were acquired for the plant and buffer areas, in addition to that needed for transmission line corridors. The property was determined to be an attractive site for a new generating plant due to:

- Adequate cooling water supply
- Easy access by air, road, and rail
- Relative isolation from population centers and other industry
- Proximity to major elements of the electrical transmission grid

After CNP operations cease, the site could be used for other industrial purposes, including electrical generation from sources other than nuclear power. Neither the long-term productivity of the terrestrial and aquatic habitats nor the value of important recreational assets in the vicinity of CNP is adversely affected by the plant. Continued operations for an additional 20 years would not alter this conclusion.

Table 6-1. Category 2 Environmental Impacts Related to License Renewal at CNP.

No.	Issue	Environmental Impact
Surface Water Quality, Hydrology, and Use (for all plants)		
13	Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	**None.** CNP operates with a once-through cooling system. Therefore, this issue does not apply.
Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)		
25	Entrainment of fish and shellfish in early life stages	**SMALL.** CNP has a current NPDES permit which constitutes compliance with CWA Section 316(b) requirements.
26	Impingement of fish and shellfish in early life stages	**SMALL.** CNP has a current NPDES permit which constitutes compliance with CWA Section 316(b) requirements.
27	Heat shock	**SMALL.** CNP has a current NPDES permit which constitutes compliance with CWA Section 316(a) requirements.
Groundwater Use and Quality		
33	Groundwater use conflicts (potable and service water, and dewatering; plants that use > 100 gpm)	**None.** CNP does not withdraw groundwater at a rate greater than 100 gpm. Therefore, this issue does not apply.
34	Groundwater use conflicts (plants using cooling towers or cooling ponds that withdraw make-up water from a small river)	**None.** CNP does not use cooling ponds or cooling towers. Therefore, this issue does not apply.
35	Groundwater use conflicts (Ranney wells)	**None.** CNP does not use Ranney wells. Therefore, this issue does not apply.
39	Groundwater quality degradation (cooling ponds at inland sites)	**None.** CNP does not use a cooling water pond. Therefore, this issue does not apply.
Terrestrial Resources		
40	Refurbishment impacts	**None.** No impacts are expected because CNP will not undertake refurbishment.
Threatened or Endangered Species		
49	Threatened or endangered species	**SMALL.** I&M does not plan to alter current operations over the license renewal period. Neither I&M nor natural resource agencies have identified any concerns about impacts of current operations.
Air Quality		
50	Air quality during refurbishment (nonattainment and maintenance areas)	**None.** No impacts are expected because CNP will not undertake refurbishment.

Table 6-1. Category 2 Environmental Impacts Related to License Renewal at CNP. (Continued)

No.	Issue	Environmental Impact
Human Health		
57	Microbiological organisms (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	**None.** CNP does not use a cooling pond, lake, or canal, and does not discharge to a small river. Therefore, this issue does not apply.
59	Electric shock from transmission line-induced currents	**SMALL.** The largest modeled induced current under the CNP transmission lines is 5.0 milliamperes, which meets the National Electric Safety Code standard for preventing electric shock from induced current.
Socioeconomics		
63	Housing impacts	**SMALL.** CNP is located in a high population area that does not have growth control measures. Therefore, in accordance with NRC standards, housing impacts would be small.
65	Public services: public utilities	**SMALL.** Because I&M plans to increase plant employment by no more than one or two employees during the license renewal term and there is excess capacity in water supply, impacts are expected to be small.
66	Public services: education (refurbishment)	**None.** No impacts are expected because CNP will not undertake refurbishment.
68	Offsite land use (refurbishment)	**None.** No impacts are expected because CNP will not undertake refurbishment.
69	Offsite land use (license renewal term)	**SMALL.** No plant-induced changes to offsite land use are expected from license renewal. Impacts from continued operation would be positive.
70	Public services: transportation	**SMALL.** Traffic congestion in the vicinity of CNP is heavy, largely due to factors unrelated to CNP operations. The addition of one or two employees for the license renewal term would produce only a small incremental change.
71	Historic and archaeological resources	**SMALL.** Continued operation of CNP would not require construction at the site or in transmission line corridors. Therefore, I&M concludes that license renewal would not adversely affect historic or archaeological resources.
Postulated Accidents		
76	Severe accidents	**SMALL.** The cost-benefit analysis did not identify any aging-related severe accident mitigation alternatives that would avert public risk.

6.6 References

AEC (U.S. Atomic Energy Commission). 1973. *Final Environmental Statement related to the operation of Donald C. Cook Nuclear Plant Units 1 & 2*, Docket Nos. 50-315 and 50-316, Directorate of Licensing, Washington, DC, August.

Chapter 7

Alternatives to the Proposed Action

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NRC

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

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

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

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

Chapter 7 addresses alternatives to CNP license renewal. This chapter evaluates the following considerations:

- What might happen if NRC did not renew the plant operating licenses
- Which alternative actions might be undertaken
- Which alternatives are not reasonable and why
- For reasonable alternatives, what the associated environmental impacts might be

Chapter 8 compares these impacts to those associated with license renewal.

In determining the level of detail and analysis that it should provide in this chapter, I&M relied on the NRC decision-making standard for license renewal:

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

I&M has determined that the environmental report would support NRC decision making so long as the document provides sufficient information to clearly indicate whether an alternative would have a smaller, comparable, or greater environmental impact than the proposed action. Providing additional detail or analysis serves no function if it only brings to light, for example, additional adverse impacts of alternatives to license renewal. This approach is consistent with regulations of the CEQ, which provide that the consideration of alternatives (including the proposed action) should enable reviewers to evaluate their comparative merits (40 CFR 1500 - 1508).

I&M believes that this chapter provides sufficient detail about alternatives to establish the basis for necessary comparisons to the Chapter 4 discussion of impacts from the proposed action.

7.1 No-Action Alternative

I&M is using the term "no-action alternative" to refer to a scenario in which the NRC does not renew the CNP operating licenses. Components of this alternative include decommissioning the facility and replacing the generating capacity of CNP, as described below.

7.1.1 Decommissioning

Regardless of whether the NRC renews the CNP operating licenses, and regardless of which alternatives are undertaken should the NRC not renew the licenses, I&M must comply with NRC requirements for decommissioning a nuclear power plant.

The GEIS (NRC 1996a) defines decommissioning as the safe removal of a nuclear facility from service, the reduction of residual radioactivity to a level that permits release of the property for unrestricted use, and termination of the license. NRC-evaluated decommissioning options include the following:

- Immediate decontamination and dismantlement (DECON); and
- Safe storage of the stabilized and defueled facility (SAFSTOR) for a period of time, followed by decontamination and dismantlement.

Regardless of the option chosen, decommissioning must be completed within 60 years of permanent cessation of plant operation. Under the no-action alternative, I&M would continue operating each CNP unit until its current license expires, and then initiate decommissioning activities for each in accordance with NRC requirements.

The GEIS describes decommissioning activities based on an evaluation of an example reactor. The "reference" pressurized-water reactor is the 1,175 megawatts-electrical (MWe) Trojan Nuclear Plant. This description is comparable to decommissioning activities that I&M would conduct at CNP, although I&M notes that the CNP units are smaller than the referenced reactor.

As the GEIS notes, the NRC has evaluated environmental impacts from decommissioning. NRC-evaluated impacts include occupational and public radiation dose, impacts of waste management, impacts to air and water quality, ecological, economic, and socioeconomic impacts. In its GEIS on decommissioning, the NRC indicated that the environmental effects of greatest concern (i.e., radiation dose and releases to the environment) are substantially less than the same effects resulting from reactor operations (NRC 2002). I&M adopts by reference the NRC conclusions regarding environmental impacts of decommissioning.

I&M notes that decommissioning activities and their impacts are not discriminators between the proposed action (license renewal) and the no-action alternative. I&M is required to decommission CNP; license renewal would only postpone decommissioning for another 20 years. The NRC has established in the GEIS that the timing of decommissioning operations does not substantially influence the environmental impacts of decommissioning. I&M adopts by reference NRC findings (10 CFR 51 Appendix B, Table B-1, Decommissioning) to the effect that delaying decommissioning until after the license renewal term would have small environmental impacts. The discriminators between the proposed action and the no-action alternative lie within the choice of options for replacing CNP capacity. Section 7.2.2 analyzes the impacts from these options.

I&M concludes that the decommissioning impacts under the no-action alternative would not be substantially different from those occurring following license renewal, as identified in the GEIS (NRC 1996a) and in the decommissioning GEIS (NRC 2002). These impacts would be temporary and would occur at the same time as the impacts from meeting system generating needs.

7.1.2 Replacement Capacity

In the year 2001, CNP provided approximately 15.43 terawatt-hours of electricity[1] (EIA 2002). This is approximately 52 percent of the energy (29.845 terawatt-hours) that I&M provided in 2001 to its 1.4 million customers in northern Indiana and southwestern Michigan (I&M 2002). I&M believes that any alternative that did not include replacing this capacity would be unreasonable. Replacement could be accomplished by either:

(1) building new generating capacity,

(2) purchasing power from outside the AEP system, or

(3) reducing power requirements through demand reduction.

Section 7.2.1 describes each of these possibilities in detail; Section 7.2.2 describes environmental impacts from feasible alternatives.

[1] A terawatt hour is one billion kilowatt hours.

7.2 Alternatives that Meet System Generating Needs

7.2.1 Alternatives Considered

7.2.1.1 Selection Considerations

Existing Technologies

Although CNP is located in Michigan, most of the power generated by CNP is sold to I&M customers in Indiana. Therefore, power generation in both states is of interest for this evaluation. The current mix of power generation options in these states is one indicator of what have been considered feasible choices for electric generation technology within the I&M service area. I&M evaluated electric generation capacity and utilization characteristics for Michigan and Indiana. "Capacity" is the quantification of the various installed technology choices. "Utilization" is the degree to which each choice is actually used.

In 2000, Michigan's electric industry had a total installed generating capacity of 26,181 MWe. As Figure 7-1 indicates, this capacity includes units fueled by coal (45.8 percent), gas (22.0 percent), nuclear (15.0 percent), hydroelectric (8.2 percent), oil[2] (7.1 percent), and other fuel sources (1.9 percent) (EIA 2002a, EIA 2002b).

Indiana's electric industry had a total installed generating capacity of 24,334 MWe in 2000. As shown in Figure 7-2, this capacity includes units fueled by coal (79.9 percent), gas (16.6 percent), oil[2] (3.1 percent), hydroelectric (0.2 percent) and other fuel sources (0.1 percent) (EIA 2002a, EIA 2002b).

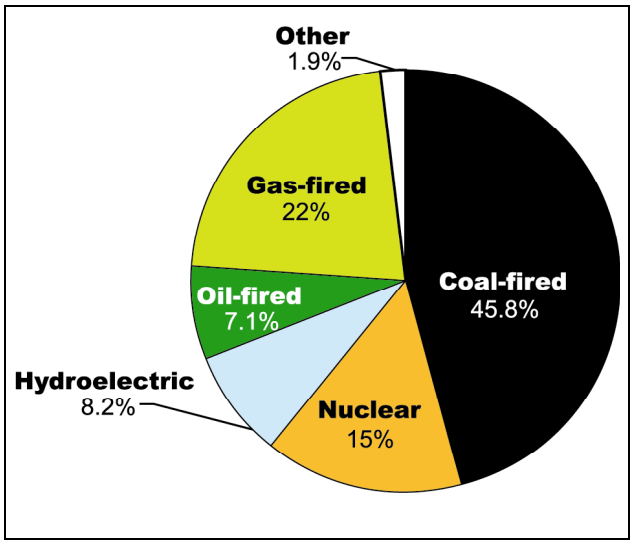

Figure 7-1. Michigan Electric Industry Generating Capability, 2000

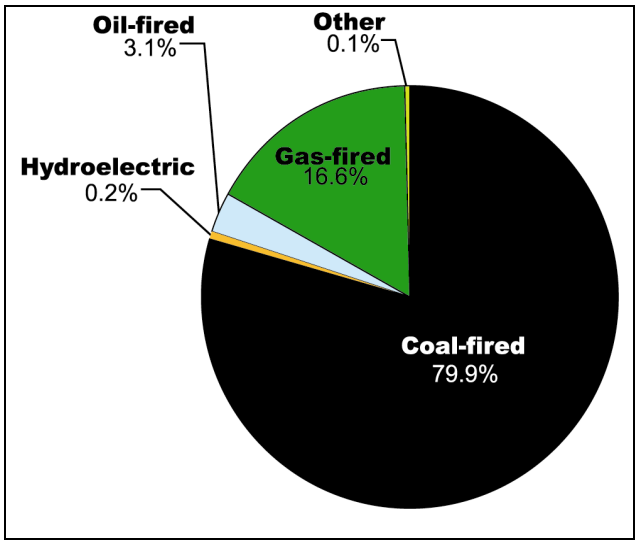

Figure 7-2. Indiana Electric Industry Generating Capability, 2000

[2] Includes oil and natural gas used as a fuel combination.

In 2000, Michigan's electric industry generated 104 terawatt-hours of electricity. As Figure 7-3 depicts, industries' generation utilization in Michigan was primarily from coal (65.6 percent), followed by nuclear (18.1 percent), gas (12.3 percent), other fuel sources (2.5 percent), oil (1.1 percent), and hydroelectric (0.4 percent) (EIA 2001b).

In 2000, Indiana's electric industry generated 128 terawatt-hours of electricity. As Figure 7-4 depicts, utilities' generation utilization in Indiana was primarily from coal (94.5 percent), followed by gas (4.3 percent), oil (0.7 percent) hydroelectric (0.5 percent), and other fuel sources (0.1 percent) (EIA 2001b). There are no nuclear power plants in Indiana.

The difference between capacity and utilization is the result of preferential usage. For example, in 2000, Indiana's coal-fired plants represented 79.9 percent of the State's installed capacity, but they produced 94.5 percent of the electricity generated. This reflects a preference in Indiana for reliance on coal as a base-load generating source. Michigan normally exhibits a preference for reliance on nuclear as a base-load generating source. However, in 2000, three of the four nuclear power reactors located in Michigan experienced extended outages. Consequently, in 2000, coal-fired units were the primary source for base-load generation.

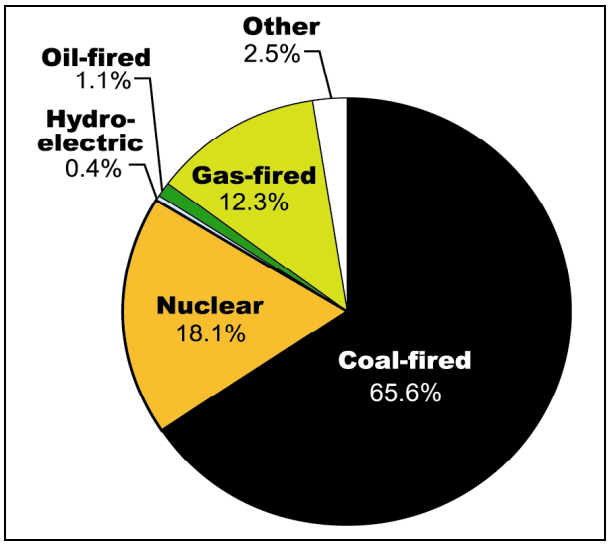

Figure 7-3. Michigan Electric Industry Generation Utilization, 2000

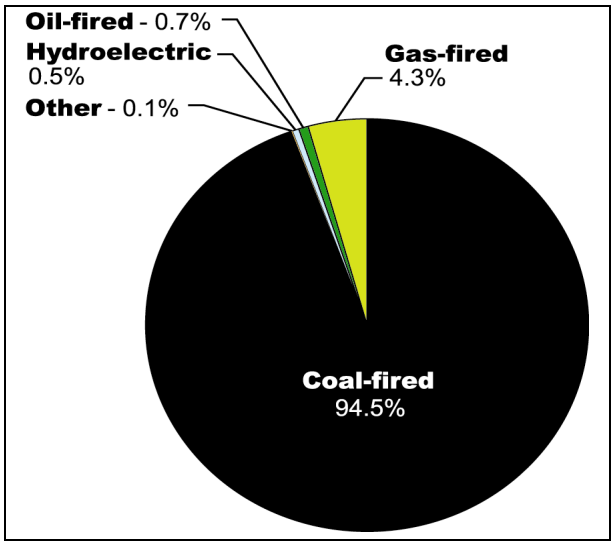

Figure 7-4. Indiana Electric Industry Generation Utilization, 2000

Effects of Deregulation

Nationally, the electric power industry has been undergoing transition from a regulated monopoly structure to a competitive market environment. Efforts to deregulate the electric utility industry began with passage of the National Energy Policy Act of 1992. Provisions of this Act required electric utilities to allow open access to their transmission lines and encouraged development of a competitive wholesale market for electricity. The Act did not mandate competition in the retail market, leaving that decision to the states (CRS 2002).

Over the past few years, deregulation of the electric utility industry has received considerable attention at the state level. In June 2000, the State of Michigan began the process of restructuring its retail electricity market (i.e., deregulation) by enacting Public Acts 141 and 142 (collectively known as the Customer Choice and Reliability Act). The Customer Choice and Reliability Act gave the Michigan Public Service Commission the authority to implement restructuring and retail competition, and allows all consumers in the State to purchase electricity from their choice of suppliers. As a result of the Act, electric generation supply in Michigan is now based on customers' needs and preferences. Market forces are expected to spur innovation, attract competition, drive the appropriate supply/demand balance, and attract new power suppliers to the State (MPSC 2000).

The Indiana General Assembly has been studying the issue of electric power industry restructuring since 1996. Some restructuring bills have been introduced, but no legislation has been passed, due to ongoing energy issues, high natural gas prices, low energy costs within the State, and a lack of public pressure on legislators to address this issue. Although the Indiana Utility Regulatory Commission does not have the authority to mandate retail competition, the Indiana General Assembly has enacted a law that allows electric utilities to file alternative regulatory plans. This law allows for flexible regulation in the increasingly competitive environment in which utilities operate; and provides utilities with considerable latitude regarding the types of proposals that are permissible, including retail competition proposals. The Indiana Utility Regulatory Commission has the authority to approve (or disapprove) proposed alternative regulatory plans, but cannot amend the proposal without approval of the utility (NARUC 1999).

Potential federal legislation, market shifts, changes in neighboring states, and new technology will continue to impact decision-making in the I&M service area. Consequently, it is not clear whether I&M or another supplier would construct new generating units to replace those at CNP, if its licenses were not renewed. However, regardless of which entities construct and operate the replacement power supply, certain environmental parameters would be constant among these alternative power sources. Therefore, this chapter discusses the impacts of reasonable alternatives to CNP license renewal without regard to whether they would be implemented by I&M.

Mixed Generation

The NRC indicated in the GEIS that, while many methods are available for generating electricity and a huge number of combinations or mixes can be assimilated to meet system needs, such expansive consideration would be too unwieldy, given the purposes of the alternatives analysis. Therefore, the NRC determined that a reasonable set of alternatives should be limited to analysis of single discrete electrical generation sources and only those electric generation technologies that are technically feasible and commercially viable (NRC 1996a). Consistent with the NRC determination, I&M has not evaluated mixes of generating sources. The impacts from coal- and gas-fired generation presented in this chapter would bound the impacts from any generation mixture of the two technologies.

7.2.1.2 Fossil-Fuel-Fired Generation

I&M analyzed locating hypothetical new coal- and gas-fired units at the existing CNP site. Using an existing site could minimize environmental impacts by building on previously disturbed land and by making the most use possible of existing facilities such as transmission lines, roads and parking areas, office buildings, and the cooling system. Locating hypothetical units at the existing site has, therefore, been applied to the coal- and gas-fired units.

I&M notes that the U.S. Environmental Protection Agency has revised requirements that could affect the design of cooling water intake structures for new facilities (EPA 2001) and has proposed requirements that could affect modifications at existing facilities (EPA 2002). These requirements could necessitate construction of cooling towers for the coal- and gas-fired alternatives if surface water were used for cooling.

It must be emphasized that these are hypothetical scenarios. I&M does not have plans for such construction at the CNP site.

Coal-Fired Generation

The NRC has evaluated coal-fired generation alternatives for the Calvert Cliffs Nuclear Power Plant (NRC 1999a) and for the Oconee Nuclear Station (NRC 1999b). For Oconee, the NRC analyzed 2,500 MWe of coal-fired generation capacity. I&M has reviewed the NRC analysis, believes it to be sound, and notes that it analyzed more generating capacity than the 2,161 MWe discussed in this analysis. In defining the CNP coal-fired alternative, I&M has used site- and Michigan-specific input and has scaled from the NRC analysis, where appropriate.

I&M defined the CNP coal-fired alternative as consisting of three 624-MWe (net) units having a total capacity of 1,872 MWe. I&M chose this configuration to be equivalent to the gas-fired alternative described below. This equivalency makes impact characteristics most comparable, facilitating impact analysis. Like the gas-fired plant described below, this capacity is less than the capacity of CNP, which precludes the potential for overestimating the environmental impacts from the alternatives.

Table 7-1 describes assumed basic operational characteristics of the coal-fired units. I&M based its emission control technology and percent-control assumptions on alternatives that the EPA has identified as being available for minimizing emissions (EPA 1998). For the purposes of analysis, I&M has assumed that coal and lime (calcium oxide) would be delivered by rail after upgrading the existing rail spur into CNP.

Gas-Fired Generation

I&M has chosen to evaluate gas-fired generation, using combined-cycle turbines, because it has determined that the technology is mature, economical, and feasible. A scenario, for example, of three units with a net capacity of approximately 690 MWe each could be assumed to replace the 2,161 MWe CNP total net capacity. However,

I&M's experience indicates that, although customized unit sizes can be built, using standardized sizes is more economical. Existing manufacturers' standard-sized units include a gas-fired combined-cycle plant of 468-MWe net capacity, consisting of two 154.5-MWe gas turbines and 159 MWe of heat recovery capacity (i.e., Siemens Westinghouse V94.2).

I&M assumed four 468-MWe units, having a total capacity of 1,872 MWe, as the gas-fired alternative at the CNP site. Although this provides less capacity than the existing units (1,872 MWe for this alternative versus 2,161 MWe for existing capacity), it ensures against overestimating environmental impacts from the alternatives. The shortfall in capacity could be replaced by other methods, such as importing power. However, for the reasons discussed in Section 7.2.1.1, I&M did not analyze a mixture of these alternatives and imported power.

Table 7-2 describes assumed basic operational characteristics of the gas-fired units. As for the coal-fired alternative, I&M based its emission control technology and percent-control assumptions on alternatives that the EPA has identified as being available for minimizing emissions (EPA 2000a). For the purposes of analysis, I&M has assumed that it would ensure gas availability through AEP Resources, Inc.

7.2.1.3 Purchased Power

I&M has evaluated conventional and prospective power supply options that could be reasonably implemented before the current CNP licenses expire. AEP has entered into long-term purchase contracts with several entities to provide firm capacity and energy. Because these contracts are part of AEP's current and future capacity, I&M does not consider these power purchases to be a feasible option for the purchased power alternative.

Michigan is a net importer of power, whereas Indiana is a net exporter. In 1999, Michigan imported approximately 41 terawatt-hours of electricity, while Indiana exported around 63 terawatt-hours of electricity (EIA 2001d). Therefore, the net result is that in 1999, approximately 22 terawatt-hours of electricity were exported from the two-state region.

Some of this exported power may be the result of purchase contracts, which would prevent I&M from using this power to replace CNP generation. However, I&M cannot rule out the possibility that power would be available for purchase as an alternative to CNP license renewal. Therefore, I&M has analyzed purchased power as a reasonable alternative.

I&M assumes that the generating technology used to produce purchased power would be one of those that the NRC analyzed in the GEIS. For this reason, I&M is adopting by reference the GEIS description of the alternative generating technologies as representative of the purchased power alternative.

7.2.1.4 Demand-Side Management

I&M has a demand-side management (DSM) program that reduces generation needs through a combination of energy conservation, efficiency, and load management programs (I&M 2002). I&M's DSM programs fall into the following categories:

Conservation Programs

- Educational programs that encourage the wise use of energy

Energy Efficiency Programs

- Discounted residential rates for Good Cents homes and homes that meet specific energy efficiency standards
- Incentive programs that encourage customers to replace old, inefficient appliances or equipment with new high-efficiency appliances or equipment
- Load-based pricing that encourages customers to use electricity more efficiently
- Government partnerships that assist federal facilities in meeting mandated energy efficiency goals through design and installation of high-efficiency lighting systems and computerized energy management.

Load Management Programs

- Standby Generator Program that encourages customers to let I&M switch loads to the customer's standby generators during periods of peak demand
- Interruptible Service Program that encourages customers to allow blocks of their loads to be interrupted during periods of peak demand
- Real-Time Pricing that encourages customers to reduce usage during specific times
- Time-of-Use Pricing that encourages customers to discontinue usage during periods of peak demand.

I&M annually projects both the summer and winter peak power (in megawatts [MW]), annual energy requirements (in gigawatt-hours), and impacts of DSM. Projections for future DSM show substantial decreases in DSM initiatives that were in effect during past years. Market conditions, which provided the initial support for utility-sponsored conservation and load management efforts during the late 1970s and early 1980s, can be broadly characterized by:

- Increasing long-term marginal prices for capacity and energy production resources,

- Forecasts projecting increasing demand for electricity across the nation,
- General agreement that the two above market conditions would continue for the foreseeable future,
- Limited competition in the generation of electricity,
- Economies of scale in the generation of electricity, which supported the construction of large central power plants, and
- The use of average embedded cost as the basis for setting electricity prices within a regulated context.

These market and regulatory conditions would undergo dramatic changes in a deregulated market. Changes that have significantly impacted the cost effectiveness of utility-sponsored DSM can be described as follows:

(1) A decline in generation costs, due primarily to technological advances that have reduced the cost of constructing new generating units (e.g., combustion turbines); and

(2) National energy legislation, which has encouraged wholesale competition through open access to the transmission grid, as well as state legislation designed to facilitate retail competition.

Consistent with (1) and (2) above, the utility planning environment features lower capacity and lower energy prices than during earlier periods, shorter planning horizons, lower reserve margins, and increased reliance on market prices to direct utility resource planning. These have greatly reduced the number of cost-effective DSM alternatives.

Other significant changes include the following:

- The adoption of increasingly stringent national appliance standards for most major energy-using equipment and the adoption of energy-efficiency requirements in state building codes. These mandates have further reduced the potential for cost-effective, utility-sponsored measures.
- In states that are currently transitioning into deregulation, third parties are increasingly providing energy services and products in competitive markets at prices that reflect their value to the customer. Market conditions can be expected to continue this shift among providers of cost-effective load management.

For these reasons, I&M determined that the remaining DSM programs, which are primarily directed toward load management, are not an effective substitute for any of its large base-load units (such as CNP) that operate at high-capacity factors.

7.2.1.5 Other Alternatives

This section identifies alternatives that I&M has determined are not reasonable and the I&M basis for this determination. I&M accounted for the fact that CNP is a base-load generator and that any feasible alternative to CNP would also need to be able to generate base-load power. In performing this evaluation, I&M relied heavily upon the NRC's GEIS (NRC 1996a).

Wind

Wind power, by itself, is not suitable for large base-load capacity. As discussed in Section 8.3.1 of the GEIS, wind has a high degree of intermittence, and average annual capacity factors for wind plants are relatively low (less than 30 percent). Wind power, in conjunction with energy storage mechanisms, might serve as a means of providing base-load power. However, current energy storage technologies are too expensive for wind power to serve as a large base-load generator.

According to the Wind Energy Resource Atlas of the United States (NREL 1986), areas suitable for wind energy applications must be wind power class 3 or higher. Current maps indicate that Indiana does not have sufficient wind resources for wind energy applications. Michigan, on the other hand, has good wind resources along the exposed coastal and offshore areas of Lakes Erie, Huron, Michigan, and Superior. However, the wind power class attenuates rapidly to class 2 inland from the Great Lakes coastline. Michigan also has good wind resources in the northern part of the Lower Peninsula. These areas, however, are confined to exposed hilltops and ridge crests, which makes them unsuitable for utility-scale wind energy applications. Further, land-use conflicts such as urban development, farmland, and environmentally sensitive areas minimize the amount of land suitable for wind energy applications (NREL 1986).

The GEIS estimates a land use of 150,000 acres per 1,000 MWe for wind power. Therefore, replacement of CNP generating capacity with wind power, even assuming ideal wind conditions, would require dedication of about 480 square miles. Based on the lack of sufficient wind speeds inland and the amount of land needed to replace CNP generating capacity, the wind alternative would require large greenfield sites along the coastline, which would result in a large environmental impact. Additionally, wind plants have aesthetic impacts, generate noise, and harm birds.

I&M has concluded that, due to the limited availability of area in Michigan having suitable wind speeds and also due to the amount of land needed (approximately 480 square miles), wind power is not a reasonable alternative to CNP license renewal.

Solar

By its nature, solar power is intermittent. In conjunction with energy storage mechanisms, solar power might serve as a means of providing base-load power. However, current energy storage technologies are too expensive to permit solar power to serve as a large base-load generator. Even without storage capacity, solar power technologies (photovoltaic and thermal) cannot currently compete with conventional

fossil-fueled technologies in grid-connected applications, due to high costs per kilowatt of capacity. (NRC 1996a).

Solar power is not a technically feasible alternative for utility-scale applications in I&M's service area. As illustrated by Figure 8.2 in the GEIS, Michigan and Indiana receive between 2.8 and 3.3 kilowatt hours per square meter per day, while areas of the West, such as California, which are most promising for solar technologies receive 5 to 7.2 kilowatt hours per square meter per day in (NRC 1996a).

Finally, according to the GEIS, land requirements for solar plants are high, at 35,000 acres per 1,000 MWe for photovoltaic and 14,000 acres per 1,000 MWe for solar thermal systems. Therefore, replacement of CNP generating capacity with solar power would require dedication of about 110 square miles for photovoltaic and 45 square miles for solar thermal systems. Neither type of solar electric system would fit at the approximately 1 square mile CNP site, and either would have large environmental impacts at a greenfield site.

I&M has concluded that, due to the high cost, limited availability of sufficient incident solar radiation, and amount of land needed (approximately 45 to 110 square miles), solar power is not a reasonable alternative to CNP license renewal.

Hydropower

The total hydroelectric generating capability in Michigan and Indiana is approximately 2,200 MW (4.3 percent of the two-state region's total industry capability), but utilization is only 0.95 terawatt-hours (0.4 percent of the region's total industry utilization). This difference between utilization and capability reflects a preference for other power generating technologies. As the GEIS points out in Section 8.3.4, hydropower's percentage of United States generating capacity in the two-state region is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern over flooding, destruction of natural habitat, and alteration of natural river courses. According to the *U.S. Hydropower Resource Assessment for Michigan* (INEL 1998), there are no remaining sites in Michigan that would be environmentally suitable for a large hydroelectric facility. Similarly, the *U.S. Hydropower Resource Assessment for Indiana* (INEL 1995), indicates that there are no environmentally suitable sites remaining in Indiana that could be used for a large hydroelectric facility.

The GEIS (Section 8.3.4) estimates land use of 1,600 square miles per 1,000 MWe for hydroelectric power. Based on this estimate, replacement of CNP generating capacity would require flooding more than 3,300 square miles, resulting in a large impact on land use. Further, operation of a hydroelectric facility would alter aquatic habitats above and below the dam, which would impact existing aquatic communities.

I&M has concluded that, due to the lack of suitable sites in the two-state region and the amount of land needed (approximately 3,300 square miles), hydropower is not a reasonable alternative to CNP license renewal.

Geothermal

As illustrated by Figure 8.4 in the GEIS, geothermal plants might be located in the western continental United States, Alaska, and Hawaii, where hydrothermal reservoirs are prevalent. However, because there are no high-temperature geothermal sites in Michigan or Indiana, I&M has concluded that geothermal is not a reasonable alternative to CNP license renewal.

Wood Energy

As discussed in the GEIS (NRC 1996a), the use of wood waste to generate electricity is largely limited to states with significant wood resources. The pulp, paper, and paperboard industries in states with adequate wood resources generate electric power by consuming wood and wood waste for energy, benefiting from the use of waste materials that could otherwise represent a disposal problem. The largest wood waste power plants, however, are 40 to 50 MW in size.

According to the Department of Energy (DOE), both Michigan and Indiana have good wood resources. DOE estimates that the total amount of wood residue available for energy uses in Michigan is approximately 3,720,000 dry tons per year (DOE 2002a). The estimated amount of wood residue available for energy uses in Indiana is approximately 1,700,000 dry tons per year (DOE 2002b).

The National Renewable Energy Laboratory (NREL) estimates that one dry ton of wood residue can produce 1,100 kilowatt-hours (kW-h) of electricity (NREL 2002). Therefore, wood residues could be used to generate an estimated 4.1 terawatt-hours and 1.9 terawatt-hours of electricity in Michigan and Indiana, respectively.

However, as discussed in Section 8.3.6 of the GEIS, construction of a wood-fired plant would have an environmental impact that would be similar to that for a coal-fired plant, although facilities using wood waste for fuel would be built on smaller scales. Like coal-fired plants, wood-waste plants require large areas for fuel storage, processing, and waste (i.e., ash) disposal. Additionally, operation of wood-fired plants has environmental impacts, including impacts on the aquatic environment and air. Wood has a low heat content, which makes it unattractive for base-load applications. It is also difficult to handle and has high transportation costs.

While the combined wood resources in Michigan and Indiana are adequate, I&M has concluded that, due to the lack of a significant environmental advantage and the obvious disadvantages of low heat content, handling difficulties, and high transportation costs, wood energy is not a reasonable alternative to CNP license renewal.

Municipal Solid Waste

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

The decision to burn municipal solid waste to generate energy is usually driven by the need for an alternative to landfills, rather than by energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term; however, it is unlikely that many landfills will begin converting waste to energy because of unfavorable economics, particularly with electricity prices declining.

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

I&M has concluded that, due to the high costs and lack of significant environmental advantages, burning municipal solid waste to generate electricity is not a reasonable alternative to CNP license renewal.

Other Biomass-Derived Fuels

In addition to wood and municipal solid waste fuels, there are several other concepts for fueling electric generators, including burning energy crops, converting crops to a liquid fuel such as ethanol (primarily used as a gasoline additive), and gasifying energy crops (including wood waste). As discussed in Section 8.3.8 of the GEIS, none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a base-load plant such as CNP.

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

I&M has concluded that, due to the high costs and lack of significant environmental advantage, burning other biomass-derived fuels is not a reasonable alternative to CNP license renewal.

Oil

The total generating capability of oil-fired units in Michigan and Indiana is approximately 2,620 MW (5.2 percent of the two-state region's total industry capability), but oil utilization is only 2.04 terawatt-hours (0.9 percent of the region's total industry utilization). Similar to hydroelectric power, this difference reflects Michigan's preference for other energy sources, especially coal, nuclear, and gas. The cost of oil-fired operation is more expensive than these favored fuels. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. The high cost of oil has prompted a steady decline in its use for electricity generation. Nationally, from 1990 to 1999, production of electricity by oil-fired plants dropped by 19 percent; 6 percent of this drop occurred from 1998 to 1999

(EIA 2000a). From 1998 to 1999, the industry reduced production of electricity by oil-fired plants by about 20 percent in Michigan and 6 percent in Indiana (EIA 2001b).

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

I&M has concluded that, due to the high costs and lack of significant environmental advantage, oil-fired generation is not a reasonable alternative to CNP license renewal.

Fuel Cells

Phosphoric acid fuel cells are the most mature fuel cell technology, but they are only in the initial stages of commercialization. Approximately 200 turnkey plants have been installed in the United States, Europe, and Japan. Recent estimates suggest that a company would have to produce about 100 MW of fuel cell stacks annually to achieve a price of $1,000 to $1,500 per kilowatt. However, the current production capacity of all fuel cell manufacturers only totals about 75 MW per year. I&M believes that this technology has not matured sufficiently to support production for a facility the size of CNP.

I&M has concluded that, due to cost and production limitations, fuel cell technology is not a reasonable alternative to CNP license renewal.

Delayed Retirement

I&M has no plans for retiring any of its fleet of power plants in the region of CNP and expects to need additional capacity in the near future. Fossil plants slated for retirement tend to be ones that are old enough to have difficulty in meeting today's restrictions on air contaminant emissions. In the face of increasingly stringent restrictions, delaying retirement in order to compensate for a plant the size of CNP would appear to be unreasonable without major construction to upgrade or replace plant components.

I&M has concluded that the environmental impacts of such a scenario are bounded by its coal- and gas-fired alternatives.

7.2.2 Environmental Impacts of Alternatives

This section evaluates the environmental impacts from what I&M has determined to be reasonable alternatives to CNP license renewal: coal-fired generation, gas-fired generation, and purchased power.

In characterizing environmental impacts from alternatives, I&M has used the definitions of "small," "moderate," and "large" presented in the Chapter 4 Introduction.

7.2.2.1 Coal-Fired Generation

The NRC evaluated environmental impacts from coal-fired generation alternatives in the GEIS (NRC 1996a) and concluded that construction impacts could be substantial, due in part to the large land area required (which can result in natural habitat loss) and the large workforce needed. The NRC pointed out that siting a new coal-fired plant where an existing nuclear plant is located would reduce many construction impacts. The NRC identified major adverse impacts from operations, such as human health concerns associated with air emissions, waste generation, and losses of aquatic biota due to cooling water withdrawals and discharges.

The coal-fired alternative defined by I&M in Section 7.2.1.2 would be located at CNP.

Air Quality

Air quality impacts of coal-fired generation are considerably different from those of nuclear power. A coal-fired plant would emit the following regulated pollutants:

- Sulfur dioxide (SO_2 as SO_x surrogate)
- Oxides of nitrogen (NO_x)
- Particulate matter (PM)
- Carbon monoxide (CO)

As indicated in Section 7.2.1.2, I&M has assumed a plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. I&M estimates the coal-fired alternative emissions to be as follows:

- SO_x = 4,475 tons per year
- NO_x = 1,812 tons per year
- CO = 1,812 tons per year
- Particulates:

  PM = 243 tons per year

  Filterable PM_{10} (particulates having a diameter of less than 10 microns) = 56 tons per year

Table 7-3 shows how I&M calculated these emissions.

Coal combustion results in low emissions of the following:

- Heavy metals, such as mercury; and
- Hazardous air pollutants, such as benzene, polychlorinated dibenzo-p-dioxins, and polychlorinated dibenzofurans.

In 1999, emissions of SO_2 and NO_x from Michigan generators ranked 12th and 8th nationally, respectively (EIA 2001c). Two Michigan generators were cited in the Clean Air Act Amendments of 1990 to begin compliance in 1995 with stricter emission controls for SO_2 and NO_x. The acid rain requirements of the Clean Air Act Amendments capped the nation's SO_2 emissions from power plants. Each company having fossil-fuel-fired units was allocated SO_2 allowances. To be in compliance with the Act, the companies must hold enough allowances to cover their annual SO_2 emissions.

If this option was chosen over license renewal, AEP would use AEP Energy Services, which markets and trades SO_2 credits, to purchase credits to operate a fossil-fuel-burning plant at CNP. A company that has fossil units might also have the option of shutting down existing capacity and applying credits from that plant to the new one.

In 1998, the EPA promulgated the NO_x SIP (State Implementation Plan) Call regulation that required 22 states, including Michigan, to reduce their NO_x emissions by over 30 percent to address regional transport of ground-level ozone across state lines. The NO_x SIP Call imposes a NO_x "budget" to limit the NO_x emissions from each state. Implementation of the NO_x SIP Call rule was delayed while lawsuits against the EPA were being argued.

On March 26, 2002, the U.S Court of Appeals for the D.C. Circuit issued a ruling largely upholding the NO_x SIP Call. To operate a fossil-fuel-fired plant at the CNP site, I&M would need to obtain enough NO_x credits to cover annual emissions either from the set-aside pool or by buying NO_x credits from other sources. An emission offset is a reduction in emission rates below the emission required of the source. In Michigan, such offsets can be converted to discrete emission credits under an open market trading system.

The NRC did not quantify coal-fired emissions in the GEIS (NRC 1996a), but implied that air impacts would be substantial. The NRC noted that adverse human health effects from coal combustion have led to important federal legislation in recent years and that public health risks, such as cancer and emphysema, have been associated with coal combustion. The NRC also mentioned global warming and acid rain as potential impacts.

I&M concludes that federal legislation and large-scale concerns, such as global warming and acid rain, are indications of concerns about destabilizing important attributes of air resources. However, the following mitigation measures have been imposed by regulation:

- SO_2 emission allowances
- NO_x emission offsets
- Low NO_x burners
- Overfire air
- Fabric filters

- Selective catalytic reduction
- Selective noncatalytic reduction or electrostatic precipitators
- Scrubbers

I&M concludes that the coal-fired alternative would have MODERATE impacts on air quality. These impacts would be within the ambient air quality standards designated to protect health and welfare and would therefore not destabilize air quality in the area.

Waste Management

I&M concurs with the GEIS assessment that the coal-fired alternative would generate substantial solid waste. The coal-fired plant, using coal having an ash content of 6.7 percent, would annually consume approximately 7,250,000 tons of coal (Table 7-3). Particulate control equipment would collect most (99.9 percent) of this ash, approximately 485,000 tons per year.

I&M recycles approximately 26 percent of its coal ash (AEP 2001). Therefore, approximately 359,000 tons per year would be disposed of onsite. SO_2-control equipment, annually using about 78,000 tons of lime (calcium oxide), would generate another 232,000 tons per year of waste in the form of scrubber sludge. I&M estimates that ash and scrubber waste disposal over a 40-year plant life would require approximately 403 acres (approximately 4,190 × 4,190 feet). While only half this waste volume and land use would be attributable to the 20-year license renewal period alternative, the total numbers are pertinent as a cumulative impact. Table 7-4 shows how I&M calculated ash and scrubber waste volumes.

I&M believes that, with proper siting coupled with current waste management and monitoring practices, waste disposal would not destabilize any resources. There would be space within the site footprint for this disposal. After closure of the waste site and revegetation, the land would be available for other uses.

For these reasons, I&M believes that waste disposal for the coal-fired alternative would have MODERATE impacts; the impacts of increased waste disposal would be clearly noticeable, but would not destabilize any important resource and no further mitigation would be warranted.

Other Impacts

Construction of the power block and coal storage area would impact approximately 300 acres of land and associated terrestrial habitat. Because most of this construction would be in previously disturbed areas, impacts would be minimal. Visual impacts would be consistent with the industrial nature of the site. As with any large construction project, some erosion and sedimentation, and fugitive dust emissions could be anticipated, but would be minimized by using best construction management practices. Construction debris from clearing and grubbing could be disposed of onsite and municipal waste disposal capacity would be available.

Socioeconomic impacts from the construction workforce would be minimal because worker relocation would not be expected, due to the site's proximity to South Bend, Indiana (25 miles from CNP). However, socioeconomic impacts would result from the decrease in operational workforce from approximately 1200 permanent employees to approximately 350 for the coal-fired station. I&M believes that these impacts would be SMALL, due to the mitigating influence of the site's proximity to South Bend, Indiana.

Cultural resource impacts would be unlikely, due to the previously disturbed nature of the site; if needed, these impacts could be minimized by survey and recovery techniques.

Impacts to aquatic resources and water quality would be minimized due to the plant's use of the existing cooling water system. The new stacks, boilers, and rail deliveries would be an incremental addition to the visual impact from existing CNP structures and operations. Coal delivery would add noise and transportation impacts associated with unit-train traffic.

I&M believes that other construction and operation impacts would be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Due to the minor nature of these impacts, mitigation beyond that mentioned would not be warranted.

Design Alternatives

The CNP site location lends itself to coal delivery by barge, a common practice along Lake Michigan. This design alternative would necessitate construction of a barge offloading facility on Lake Michigan and a conveyor system to a new coal yard. These new facilities would result in greater construction impacts than upgrading the existing rail line. The alternative would trade barge traffic impacts for rail traffic impacts, a tradeoff that provides no obvious environmental benefit.

As previously noted, the U.S. Environmental Protection Agency has proposed regulations which would require the cooling water systems for new facilities to be closed-cycle (EPA 2001). Addition of this technology to the alternatives would involve constructing a natural draft cooling tower or mechanical draft cooling towers. At substantially reduced flow rates, the existing cooling water system could be modified to provide makeup to and discharge blowdown from the closed-cycle system. Impacts to aquatic resources and water quality would be minimal. Use of a closed-cycle system would reduce the effects of thermal discharge to the aquatic environment and the effects of the intake on entrainment and impingement of fish. However, a new natural draft cooling tower would increase visual impacts, and mechanical draft cooling towers would increase the ambient noise level at the site.

7.2.2.2 Gas-Fired Generation

The NRC evaluated environmental impacts from gas-fired generation alternatives in the GEIS, focusing on combined-cycle plants. Section 7.2.1.2 presents I&M's reasons for defining the gas-fired generation alternative as a combined-cycle plant on the CNP site. Land-use impacts from gas-fired units on the site would be less than those of the coal-fired alternative. Reduced land requirements, due to construction on the existing site and a smaller facility footprint, would reduce impacts to ecological, aesthetic, and cultural resources as well.

As discussed under "Other Impacts," a smaller workforce could have adverse socioeconomic impacts. Human health effects associated with air emissions would be of concern. Aquatic biota losses due to cooling water withdrawals would be offset by the concurrent shutdown of the nuclear generators. Because the heat input for the gas-fired alternative is less than that of the coal fired alternative (6,600 vs 10,200 Btu per kW-h), there would be less cooling water withdrawal for the gas-fired alternative.

The gas-fired alternative defined by I&M in Section 7.2.1.2 would be located at CNP.

Air Quality

Natural gas is a relatively clean-burning fossil fuel. Further, because the heat recovery steam generator does not receive supplemental fuel, the combined-cycle operation is highly efficient (52 percent vs. 33 percent for the coal-fired alternative). Therefore, the gas-fired alternative would release similar types of emissions, but in smaller quantities than the coal-fired alternative. Control technology for gas-fired turbines focuses on NO_x emissions. I&M estimates the gas-fired alternative emissions to be as follows:

- SO_x = 163 tons per year
- NO_x = 522 tons per year
- CO = 110 tons per year
- Filterable PM = 91 tons per year (all particulates are PM_{10})

Table 7-5 shows how I&M calculated these emissions.

The Section 7.2.2.1 discussion of regional air quality, Clean Air Act requirements, and the NO_x State Implementation Plan Call is also applicable to the gas-fired generation alternative. NO_x effects on ozone levels, SO_2 allowances, and NO_x emission offsets could all be issues of concern for gas-fired combustion. While gas-fired turbine emissions are less than coal-fired boiler emissions, the emissions are still substantial.

I&M concludes that emissions from a gas-fired alternative located at CNP would noticeably alter local air quality, but would not destabilize regional resources. Air quality impacts would therefore be MODERATE; however, these impacts would still be substantially smaller than those of coal-fired generation, and within ambient air quality health standards.

Waste Management

Gas-fired generation would result in almost no waste generation, producing minor (if any) impacts. I&M concludes that gas-fired generation waste management impacts would be SMALL.

Other Impacts

Similar to the coal-fired alternative, the ability to construct the gas-fired alternative on the existing CNP site would reduce construction-related impacts.

To the extent practicable, I&M would route the pipeline along previously disturbed rights-of-way to minimize impacts. However, this would still be a costly (approximately $1,000,000/mile) and potentially controversial action, with ecological impacts from installation of approximately 5 miles of buried 16-inch gas pipeline to CNP. The pipeline would require an additional 90 to 100 acres for an easement. I&M would mitigate the political impacts through public hearings and apply best management practices during construction, such as minimizing soil loss and restoring vegetation immediately after the excavation is backfilled.

The NRC estimated in the GEIS that 110 acres would be needed for a combined-cycle plant; this much previously disturbed acreage is available at CNP, reducing loss of terrestrial habitat. Aesthetic impacts, erosion and sedimentation, fugitive dust, and construction debris impacts would be similar to the coal-fired alternative, but smaller because of the reduced site size.

Socioeconomic impacts of construction would be minimal. The GEIS estimates a work force of 150 for gas operations; however, I&M would expect this number to be closer to 25 to 40 workers for a plant of this size. This reduction in the current work force would result in adverse socioeconomic impacts. I&M believes these impacts would be SMALL and would be mitigated by the site's proximity to South Bend, Indiana.

7.2.2.3 Purchased Power

As discussed in Section 7.2.1.3, I&M assumes that the generating technology used under the purchased power alternative would be one of those that the NRC analyzed in the GEIS. I&M is also adopting by reference the NRC analysis of these alternatives. Environmental impacts would still occur, but would be located elsewhere. For the purposes of analysis, I&M assumes that the new unit would be built at a remote location in Michigan. However, because Michigan is a net importer of electricity, I&M realizes that an in-state vendor is likely to prefer to use the new capacity to reduce imports to its service area.

The purchased power alternative would include constructing up to 400 miles of high-voltage (e.g., 345-kilovolt) transmission lines to get power from the remote locations in Michigan to the AEP network. I&M believes most of the transmission lines could be routed along existing corridors and assumes that the environmental impacts of transmission line construction would be moderate.

As indicated in the introduction to Section 7.2.1.2, the environmental impacts of construction and operation of new coal- or gas-fired generating capacity for purchased power at a previously-undisturbed greenfield site would exceed those of a coal- or gas-fired alternative located on the CNP site.

Table 7-1. Coal-Fired Alternative.

Characteristic	Basis
Unit size = 624 MW ISO rating net[a]	Set to match capacity of gas-fired alternative
Unit size = 661 MW ISO rating gross[a]	Calculated based on 6 percent onsite power
Number of units = 3	Provides a net total of 1,872 MWe, less than current CNP Units 1 & 2 total net capacity of 2,161 MWe
Boiler type = tangentially-fired, dry-bottom	Minimizes nitrogen oxides emissions (EPA 1998, Table 1.1-3).
Fuel type = bituminous, pulverized coal	Typical for coal used in Michigan
Fuel heating value = 10,392 Btu/lb	1999 value for coal used in Michigan (EIA 2000b, Table 28)
Fuel ash content by weight = 6.7 percent	1999 value for coal used in Michigan (EIA 2000b, Table 28)
Fuel sulfur content by weight = 0.65 percent	1999 value for coal used in Michigan (EIA 2000b, Table 28)
Uncontrolled NO_x emission = 9.7 lb/ton Uncontrolled CO emission = 0.5 lb/ton	Typical for pulverized coal, tangentially-fired, dry-bottom boiler, with low- NO_x burner (EPA 1998, Table 1.1-3)
Uncontrolled SO_x emission = 38S = 24.7 lb/ton Uncontrolled PM = 10 A = 67 lb/ton Uncontrolled PM_{10} = 2.3A = 15.4 lb/ton	Typical for pulverized coal, tangentially-fixed, dry-bottom boiler (EPA 1998, Table 1.1-4)
Heat rate = 10,200 Btu/kW-h	Typical for coal-fired, single-cycle steam turbines (EIA 2000b, pg. 108)
Capacity factor = 0.85	Typical for large coal-fired units (I&M experience)
NO_x control = low NO_x burners, overfire air and selective catalytic reduction (95 percent reduction)	Best available and widely demonstrated for minimizing NO_x emissions (EPA 1998, Table 1.1-2).
Particulate control = fabric filters (baghouse, 99.9 percent removal efficiency)	Best available for minimizing particulate emissions (EPA 1998, pp. 1.1-6 and -7)
SO_x control = Wet scrubber – lime (95 percent removal efficiency)	Best available for minimizing SO_x emissions (EPA 1998, Table 1.1-1)

a. The difference between "net" and "gross" is electricity consumed onsite.

Btu = British thermal unit
CO = carbon monoxide
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kW-h = kilowatt-hour
lb = pound
MW = megawatt
MWe = megawatts-electric
NO_x = nitrogen oxides
PM = particulate matter
PM_{10} = particulate matter nominally less than 10 microns diameter
SO_x = sulfur oxides

Table 7-2. Gas-Fired Alternative.

Characteristic	Basis
Unit size = 468 MW ISO rating net:[a] Two 154.5-MW combustion turbines and a 159-MW heat recovery boiler	Manufacturer's standard size gas-fired combined cycle plant
Unit size = 487-MW ISO rating gross:[a]	Calculated based on 4 percent onsite power
Number of units = 4	Provides a net total of 1,872 MWe, less than current CNP Units 1 & 2 net capacity of 2,161 MWe
Fuel type = natural gas	Assumed
Fuel heating value = 1,015 Btu/ft^3	1999 value for natural gas used in Michigan (EIA 2000b, Table 28)
Fuel sulfur content in percent = S = NA	See basis for uncontrolled SO_x emission when sulfur is not available
NO_x control = selective catalytic reduction (SCR) with steam/water injection	Best available for minimizing NO_x emissions (EPA 2000b)
Fuel NO_x content = 0.0109 lb/MMBtu	Typical for large SCR-controlled gas fired units with water injection (EPA 2000b)
Fuel CO content = 0.00226 lb/MMBtu	Typical for large SCR-controlled gas fired units (EPA 2000b)
Uncontrolled SO_x emission = 0.0034 lb/MMBtu	0.94S, use 0.0034 lb/MMBtu when sulfur content is not available (EPA 2000a, Table 3.1.2a)
Uncontrolled Filterable PM and PM_{10} emission = 0.0019 lb/MMBtu	Typical for large gas-fired units with water-steam injection (EPA 2000a, Table 3.1-2a)
Heat rate = 6,600 Btu/kW-h	Manufacturer's listed heat rate for this unit
Capacity factor = 0.85	Typical for large gas-fired base load units

a. The difference between "net" and "gross" is electricity consumed onsite.

NA = Not available
Btu = British thermal unit
ft^3 = cubic foot
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kW-h = kilowatt-hour
MM = million
MW = megawatt
MWe = megawatts-electric
NO_x = nitrogen oxides
PM = particulate matter
PM_{10} = particulate matter nominally less than 10 microns diameter
SO_x = sulfur oxides

Table 7-3. Air Emissions from Coal-Fired Alternative.

Parameter	Calculation	Result
Annual coal consumption	$3\ \text{units} \times \frac{661\ \text{MW}}{\text{unit}} \times \frac{10{,}200\ \text{Btu}}{\text{kW} \times \text{hr}} \times \frac{1{,}000\ \text{kW}}{\text{MW}} \times \frac{\text{lb}}{10{,}392\ \text{Btu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times 0.85 \times \frac{24\ \text{hr}}{\text{day}} \times \frac{365\ \text{day}}{\text{yr}}$	7,246,308 tons of coal per year
SO_x	$\frac{38 \times 0.65\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times (100 - 95/100) \times \frac{7{,}246{,}308\ \text{tons}}{\text{yr}}$	4,475 tons SO_x per year
NO_x	$\frac{10\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times (100 - 95/100) \times \frac{7{,}246{,}308\ \text{tons}}{\text{yr}}$	1,812 tons NO_x per year
CO	$\frac{0.5\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{7{,}246{,}308\ \text{tons}}{\text{yr}}$	1,812 tons CO per year
PM	$\frac{10 \times 6.7\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times (100 - 99.9/100) \times \frac{7{,}246{,}308\ \text{tons}}{\text{yr}}$	243 tons PM per year
PM_{10}	$\frac{2.3 \times 6.7\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times (100 - 99.9/100) \times \frac{7{,}246{,}308\ \text{tons}}{\text{yr}}$	56 tons PM_{10} per year

Source: EPA (1998).

NO_x = oxides of nitrogen
PM = particulate matter
PM_{10} = particulates having diameter less than 10 microns
SO_x = sulfur oxides
TSP = total suspended particulates

Table 7-4. Solid Waste from Coal-Fired Alternative.

Parameter	Calculation	Result
Annual SO_x generated[a]	$\frac{7{,}246{,}308\ \text{ton coal}}{\text{yr}} \times \frac{38\ \text{lbs}}{\text{ton coal}} \times \frac{\text{ton}}{2000\ \text{lb}} \times 0.65$	89,492 tons of SO_x per year
Annual SO_x removed	$\frac{89{,}492\ \text{ton } SO_2}{\text{yr}} \times (95/100)$	85,017 tons of SO_x per year
Annual ash generated	$\frac{7{,}246{,}308\ \text{ton coal}}{\text{yr}} \times \frac{6.7\ \text{ton ash}}{100\ \text{ton coal}} \times (99.9/100)$	485,017 tons of ash per year
Annual lime consumption[b]	$\frac{89{,}492\ \text{ton } SO_2}{\text{yr}} \times \frac{56.1\ \text{ton CaO}}{64.1\ \text{ton } SO_2}$	78,323 tons of CaO per year
Calcium sulfate[c]	$\frac{85{,}017\ \text{ton } SO_2}{\text{yr}} \times \frac{172\ \text{ton } CaSO_4 \bullet 2H_2O}{64.1\ \text{ton } SO_2}$	228,127 tons of $CaSO_4 \cdot 2H_2O$ per year
Annual scrubber waste[d]	$\frac{78{,}323\ \text{ton CaO}}{\text{yr}} \times \frac{(100-95)}{100} + 228{,}127\ \text{ton } CaSO_4 \bullet 2H_2O$	232,043 tons of scrubber waste per year
Total volume of scrubber waste[e]	$\frac{232{,}043\ \text{ton}}{\text{yr}} \times 40\ \text{yr} \times \frac{2{,}000\ \text{lb}}{\text{ton}} \times \frac{\text{ft}^3}{144.8\ \text{lb}}$	128,200,552 ft^3 of scrubber waste
Total volume of ash generated[f]	$\frac{485{,}017\ \text{ton}}{\text{yr}} \times 40\ \text{yr} \times \frac{2{,}000\ \text{lb}}{\text{ton}} \times \frac{\text{ft}^3}{73\ \text{lb}}$	531,525,479 ft^3 of ash
Total volume of solid waste disposed onsite[g]	128,200,552 ft^3 + (531,525,479 ft^3 × 0.75)	526,844,661 ft^3 of solid waste
Waste pile area (acres)	$\frac{526{,}844{,}661\ \text{ft}^3}{30\ \text{ft}} \times \frac{\text{acre}}{43{,}560\ \text{ft}^2}$	403 acres of solid waste
Waste pile area (ft × ft square)	$\sqrt{\frac{526{,}844{,}661\ \text{ft}^3}{30\ \text{ft}}}$	4,191 feet by 4,191 feet of solid waste

a. Calculations assume 100 percent combustion of coal.
b. Lime consumption is based on total SO_2 generated.
c. Calcium sulfate generation is based on total SO_2 removed.
d. Total scrubber waste includes scrubbing media carryover.
e. Density of $CaSO_4 \cdot 2H_2O$ is 144.8 lb/ft^3.
f. Density of coal bottom ash is 73 lb/ft^3 (AEP 2002).
g. Assume 85 percent of ash is recycled.

S = sulfur
SO_2 = sulfur dioxide
SO_x = sulfur oxides
CaO = calcium oxide (lime)
$CaSO_4 \cdot 2H_2O$ = calcium sulfate dihydrate

Table 7-5. Air Emissions from Gas-Fired Alternative.

Parameter	Calculation	Result
Annual gas consumption	$4\ \text{unit} \times \frac{487\ \text{MW}}{\text{unit}} \times \frac{6600\ \text{Btu}}{\text{kW} \times \text{hr}} \times \frac{1000\ \text{kW}}{\text{MW}} \times 0.85 \times \frac{\text{ft}^3}{1015\ \text{Btu}} \times \frac{8760\ \text{hr}}{\text{yr}}$	94,316,978,128 ft^3 per year
Annual Btu input	$\frac{94{,}316{,}978{,}128\ \text{ft}^3}{\text{yr}} \times \frac{1{,}015\ \text{Btu}}{\text{ft}^3} \times \frac{\text{MM Btu}}{10^6\text{Btu}}$	95,731,733 MMBtu per year
SO_x[a]	$\frac{0.0034\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{95{,}731{,}733\ \text{MMBtu}}{\text{yr}}$	163 tons SO_x per year
NO_x[b]	$\frac{0.0109\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{95{,}731{,}733\ \text{MMBtu}}{\text{yr}}$	522 tons NO_x per year
CO[b]	$\frac{0.0023\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{95{,}731{,}733\ \text{MMBtu}}{\text{yr}}$	110 tons CO per year
PM[a]	$\frac{0.0019\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{95{,}731{,}733\ \text{MMBtu}}{\text{yr}}$	91 tons filterable PM per year
PM_{10}[a]	$\frac{91\ \text{tons TSP}}{\text{yr}}$	91 tons filterable PM_{10} per year

a. EPA 2000b.
b. EPA 2000a.
Btu = British thermal units
CO = carbon monoxide
MM = million
NO_x = oxides of nitrogen
PM_{10}= particulates having diameter less than 10 microns
SO_x = sulfur oxides
TSP = total suspended particulates

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Chapter 8

Comparison of Environmental Impacts of License Renewal with the Alternatives

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NRC

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

8.1 Discussion

Chapter 4 analyzes environmental impacts of CNP license renewal; Chapter 7 analyzes environmental impacts from renewal alternatives. Table 8-1 summarizes environmental impacts of the proposed action (license renewal) and the alternatives, so the reader can compare them.

The environmental impacts compared in Table 8-1 are those that are either Category 2 issues for the proposed action (license renewal) or issues that the *Generic Environmental Impact Statement* (GEIS) (NRC 1996) identified as major considerations in an alternatives analysis. For example, although the NRC concluded that air quality impacts (Category 1) from the proposed action would be SMALL, the GEIS identified major human health concerns associated with air emissions from alternatives (Section 7.2.2). Therefore, Table 8-1 compares air impacts among the proposed action and the alternatives. Table 8-2 is a more detailed comparison of the alternatives.

Table 8-1. Impacts Comparison Summary.

Impact Category	Proposed Action (License Renewal)	Decommissioning	Alternatives		
			Coal-Fired Generation	Gas-Fired Generation	Purchased Power
Land Use	SMALL	SMALL	SMALL	SMALL	MODERATE
Water Quality	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	MODERATE	MODERATE	SMALL to MODERATE
Ecological Resources	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Threatened or Endangered Species	SMALL	SMALL	SMALL	SMALL	SMALL
Human Health	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Socioeconomics	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Waste Management	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Aesthetics	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Cultural Resources	SMALL	SMALL	SMALL	SMALL	SMALL

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource. 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3.

Table 8-2. Impacts Comparison Detail.

Proposed Action (License Renewal)	Decommissioning	Alternatives		
		Coal-Fired Generation	Gas-Fired Generation	Purchased Power
Alternative Descriptions				
CNP license renewal for 20 years, followed by decommissioning	Decommissioning following expiration of current CNP licenses. Adopting the GEIS description by reference (NRC 1996) as comparable to CNP decommissioning.	New construction at the CNP site.	New construction at the CNP site.	Would involve construction of new generation capacity in the state. Adopting by reference GEIS description of alternate technologies (Section 7.2.1.3)
		Use existing switchyard and transmission lines. Upgrade existing rail spur into CNP.	Use existing switchyard and transmission lines.	
			Construct 5 miles of gas pipeline along existing rights-of-way	Construct up to 400 miles of transmission lines
		Three 624 MW (net) tangentially-fired, dry-bottom units; capacity factor 0.85	Four 468-MW (net) units; each consisting of two 154.5 MW combustion turbines and a 159 MW heat recovery boiler; capacity factor 0.85	
		Existing CNP cooling water system	Existing CNP cooling water system	
		Pulverized bituminous coal, 10,392 Btu/pound; 10,200 Btu/kWh; 6.7% ash; 0.65% sulfur; 9.7 lb/ton nitrogen oxides; 7,250,000 tons coal/yr	Natural gas, 1,015 Btu/ft3; 6,600 Btu/kWh; 0.0034 lb SOx/MMBtu; 0.0109 lb NOx/MMBtu; 94,317,000,000 ft3 gas/yr	
		Low NOx burners, overfire air and selective catalytic reduction (95% NOx reduction efficiency).	Selective catalytic reduction with steam/water injection	

Table 8-2. Impacts Comparison Detail. (Continued)

Proposed Action (License Renewal)	Decommissioning	Alternatives: Coal-Fired Generation	Alternatives: Gas-Fired Generation	Alternatives: Purchased Power
Alternative Descriptions (Continued)				
		Wet scrubber – lime desulfurization system (95% SO_x removal efficiency); 78,000 tons lime/yr Fabric filters (99.9% particulate removal efficiency)		
1,200 permanent employees		350 workers (Section 7.2.2.1)	25 to 40 workers (Section 7.2.2.2)	
Land Use Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 52, 53)	SMALL – Not an impact evaluated by GEIS (NRC 1996)	SMALL – Construction at CNP would be in previously-disturbed areas. The plant would use existing transportation corridors. Twenty years of ash and scrubber waste disposal would require approximately 200 acres and construction of the power block and coal storage areas would impact 300 acres. (Section 7.2.2.1)	SMALL – 110 acres for facility at CNP location; pipeline could be routed along existing transmission line corridors and would require an additional 90 to 100 acres for easements. (Section 7.2.2.2)	MODERATE – Most transmission facilities could be constructed along existing transmission line corridors (Section 7.2.2.3), but up to 400 miles of corridor could be required. Adopting by reference GEIS description of land use impacts from alternate technologies (NRC 1996)
Water Quality Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 3, 5-12, 32).	SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 89).	SMALL – Construction impacts minimized by use of best management practices. Operational impacts minimized by use of existing cooling water system and by careful design of coal pile (Section 7.2.2.1).	SMALL – Reduced cooling water demands, inherent in combined-cycle design (Section 7.2.2.2) Construction of pipeline could cause temporary erosion and sedimentation in streams crossed by right of way (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of water quality impacts from alternate technologies (NRC 1996)

Table 8-2. Impacts Comparison Detail. (Continued)

		Alternatives		
Proposed Action (License Renewal)	**Decommissioning**	**Coal-Fired Generation**	**Gas-Fired Generation**	**Purchased Power**
Air Quality Impacts				
SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 51).	SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issue 88)	MODERATE – 4,475 tons SO_x/yr 1,812 tons NO_x/yr 1,812 tons CO/yr 243 tons TSP/yr 56 tons PM_{10}/yr (Section 7.2.2.1)	MODERATE – 163 tons SO_x/yr 522 tons NO_x/yr 110 tons CO/yr 91 tons PM_{10}/yr[a] (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of air quality impacts from alternate technologies (NRC 1996)
Ecological Resource Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 15-24, 45-48). CNP holds a current NPDES permit, which constitutes compliance with Clean Water Act Section 316(b) (Section 4.2, Issue 25; Section 4.3, Issue 26) and 316(a) (Section 4.4, Issue 27). One Category 2 issue not applicable (Section 4.9, Issue 40).	SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 90)	SMALL – Construction of the power block and coal storage areas and 20 years of ash/sludge disposal would impact approximately 500 acres of terrestrial habitat, displacing various species. (Section 7.2.2.1)	SMALL – Construction of combined-cycle plant would impact 300 acres, and the pipeline would impact up to 100 acres of terrestrial habitat, displacing various species. (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of ecological resource impacts from alternate technologies (NRC 1996)
Threatened or Endangered Species Impacts				
SMALL – No federally-listed threatened or endangered species are known to occur in the vicinity of the site or along transmission line corridors. (Section 4.10, Issue 49).	SMALL – Not an impact evaluated by GEIS (NRC 1996)	SMALL – Construction would occur at the CNP site, which would involve mitigation planning to minimize impacts to federally-listed species.	SMALL – Construction would occur at the CNP site, which would involve mitigation planning to minimize impacts to federally-listed species.	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats

Table 8-2. Impacts Comparison Detail. (Continued)

		Alternatives		
Proposed Action (License Renewal)	**Decommissioning**	**Coal-Fired Generation**	**Gas-Fired Generation**	**Purchased Power**
Human Health Impacts				
SMALL – Adopting by reference Category 1 issues (Table 4-2, Issues 58, 61, 62). The issue of microbiological organisms (Section 4.12, Issue 57) does not apply. Risk due to transmission-line-induced currents meets the National Electric Safety Code standard for preventing electric shock from induced current (Section 4.13, Issue 59)	SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 86)	MODERATE – Adopting by reference GEIS conclusion that risks such as cancer and emphysema from emissions are likely (NRC 1996)	SMALL – Adopting by reference GEIS conclusion that some risk of cancer and emphysema exists from emissions (NRC 1996)	SMALL to MODERATE – Adopting by reference GEIS description of human health impacts from alternate technologies (NRC 1996)
Socioeconomic Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 64, 67). Location in high population area without growth controls minimizes potential for housing impacts (Section 4.14, Issue 63). Plant contribution to county tax base is significant, and continued plant operation would benefit county. Given no more than 1 to 2 SMITTR employees, land use changes are not expected (Section 4.17.2, Issue 69). Capacity of public water supply and transportation infrastructure minimizes potential for related impacts (Section 4.15, Issue 65 and Section 4.18, Issue 70)	SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 91)	SMALL – Reduction in permanent work force at CNP to 350 workers would be mitigated by proximity to South Bend, Indiana (Section 7.2.2.1).	SMALL – Reduction in permanent work force at CNP to 25 to 40 workers would be mitigated by proximity to South Bend, Indiana (Section 7.2.2.2).	SMALL to MODERATE – Adopting by reference GEIS description of socioeconomic impacts from alternate technologies (NRC 1996)

Table 8-2. Impacts Comparison Detail. (Continued)

Proposed Action (License Renewal)	Decommissioning	Alternatives: Coal-Fired Generation	Alternatives: Gas-Fired Generation	Alternatives: Purchased Power
Waste Management Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 77 to 85)	SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 87)	MODERATE – 485,000 tons of coal ash per year and 232,000 tons of scrubber sludge per year would require approximately 200 acres over the 20-year license renewal term. (Section 7.2.2.1)	SMALL – Almost no waste generation (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of waste management impacts from alternate technologies (NRC 1996)
Aesthetic Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 73, 74)	SMALL – Not an impact evaluated by GEIS (NRC 1996)	SMALL – Visual impacts would increase from the existing industrial nature of the site due to smoke stacks and coal piles (Section 7.2.2.1)	SMALL – Visual impacts would increase from the existing industrial nature of the site due to smoke stacks (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of aesthetic impacts from alternate technologies (NRC 1996)
Cultural Resource Impacts				
SMALL – Operation of these same generation and transmission facilities will not impact cultural resources (Section 4.19, Issue 71)	SMALL – Not an impact evaluated by GEIS (NRC 1996)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site (Section 7.2.2.1)	SMALL – Impacts would be small due to developed nature of the site and use of existing pipeline/ transmission rights-of-way (Section 7.2.2.2)	SMALL – Adopting by reference GEIS description of cultural resource impacts from alternate technologies (NRC 1996)

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource. 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3.

Btu = British thermal unit
ft^3 = cubic foot
gal = gallon
GEIS = Generic Environmental Impact Statement (NRC 1996)
kW-h = kilowatt-hour
lb = pound
MM = million
MW = megawatt
NO_x = nitrogen oxide
PM_{10} = particulates having diameter less than 10 microns
SHPO = State Historic Preservation Officer
SO_x = oxides of sulfur
TSP = total suspended particulates
yr = year

a. All TSP for gas-fired alternative is PM_{10}.

8.2 References

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

Chapter 9

Status of Compliance

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9.1 Proposed Action

NRC

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

9.1.1 General

Table 9-1 lists environmental authorizations that I&M has obtained for current CNP operations. In this context, "authorizations" include any permits, licenses, approvals, or other entitlements. I&M expects to continue renewing these authorizations during the current license period and through the license renewal term. As indicated in Chapter 5, I&M has not identified any new and significant information that would suggest noncompliance with these authorizations or the applicability of additional authorizations.

Table 9-2 lists additional environmental authorizations and consultations related to NRC renewal of the CNP operating licenses. As indicated, I&M anticipates needing relatively few such authorizations and consultations. Sections 9.1.2 through 9.1.5 discuss some of these items in more detail.

9.1.2 Threatened or Endangered Species

Section 7 of the Endangered Species Act (16 USC 1531 et seq.) requires federal agencies to ensure that agency action is not likely to jeopardize any species that is listed or proposed for listing as endangered or threatened. Depending on the action involved, the Act requires consultation with the U.S. Fish and Wildlife Service (FWS) regarding effects on non-marine species; the National Marine Fisheries Service (NMFS) for marine species; or both. These agencies have issued joint procedural regulations that address consultation in 50 CFR 402, Subpart B; the FWS maintains the joint list of threatened and endangered species at 50 CFR 17.

Although not required of an applicant by federal law or NRC regulation, I&M invited comment from federal and state agencies regarding potential effects that CNP license renewal might have. Appendix C includes copies of I&M correspondence with the Fish and Wildlife Service, the Michigan Department of Natural Resources, and the Indiana Department of Natural Resources. I&M did not consult with the NMFS because no listed species under its auspices is known to be in the CNP vicinity.

Based on the I&M submittals and other information, as discussed in detail in Section 4.10, these agencies concur with the I&M conclusion that CNP license renewal would not adversely affect threatened or endangered species or critical habitat.

9.1.3 Coastal Zone Management Program Compliance

The Federal Coastal Zone Management Act (16 USC 1451 et seq.) imposes requirements on applicants for a federal license to conduct an activity that could affect a state's coastal zone (NRC 2001). The Act requires the applicant to certify to the licensing agency that the proposed activity would be consistent with the state's federally-approved Coastal Zone Management Program [16 USC 1456(c)(3)(A)]. The National Oceanic and Atmospheric Administration has promulgated implementing regulations that indicate that the requirement is applicable to renewal of federal licenses for activities not previously reviewed by the state [15 CFR 930.51(b)(1)]. The regulation requires that the license applicant provide its certification to the federal licensing agency and a copy to the applicable state agency [15 CFR 930.57(a)].

Participation in the National Oceanic and Atmospheric Administration Coastal Zone Management Program is voluntary. Federal assistance is given to states willing to develop and implement a comprehensive Coastal Management Program (DOE 1996). Michigan has a Coastal Zone Management Program and CNP is in compliance with that program's requirements. The CNP Dumont transmission corridor, which traverses the easternmost portion of the Indiana coastal area, will be consistent with the Indiana Lake Michigan Coastal Zone Program. The draft Coastal Zone Management Program Consistency Determination found in Appendix E of this environmental report details CNP's compliance with these programs. I&M submitted a copy of this draft consistency determination and a draft copy of this environmental report to the Michigan Department of Environmental Quality Federal Consistency Coordinator in fulfillment of the regulatory requirement.

9.1.4 Historic Preservation

Section 106 of the National Historic Preservation Act (16 USC 470 et seq.) requires federal agencies having the authority to license any undertaking to, prior to issuing the license, take into account the effect of the undertaking on historic properties; and to afford the Advisory Committee on Historic Preservation an opportunity to comment on the undertaking. Committee regulations provide for establishing an agreement with any State Historic Preservation Officer (SHPO) to substitute state review for Committee review (35 CFR 800.7). Although not required of an applicant by federal law or NRC regulation, I&M has chosen to invite comment by the Michigan SHPO. Appendix D includes copies of I&M correspondence with the SHPO regarding potential effects that CNP license renewal might have on historic or cultural resources.

To date, the Michigan SHPO has not formally provided comments or concurrence with I&M's conclusion that CNP license renewal would not affect known historic or archaeological properties.

9.1.5 Water Quality (401) Certification

Federal Clean Water Act Section 401 requires applicants for a federal license to conduct an activity that might result in a discharge into navigable waters to provide the licensing agency a certification from the state that the discharge will comply with applicable Clean Water Act requirements (33 USC 1341). The NRC has indicated in its *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants* (GEIS) that issuance of a National Pollutant Discharge Elimination System (NPDES) permit implies certification by the state (NRC 1996).

I&M is applying to the NRC for license renewal to continue CNP operations. Consistent with the GEIS, CNP is providing an approved NPDES permit as evidence of state water quality (401) certification. Appendix B contains the excerpts from the current CNP NPDES permit issued September 21, 2000.

9.2 Alternatives

NRC

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

The coal, gas, and purchased power alternatives discussed in Section 7.2.1 probably could be constructed and operated to comply with all applicable environmental quality standards and requirements. I&M notes that increasingly stringent air quality protection requirements could make the construction of a large fossil-fueled power plant infeasible in many locations. I&M also notes that the U.S. Environmental Protection Agency has revised requirements (EPA 2001) that could affect the design of cooling water intake structures for new facilities and has proposed requirements that would affect modifications at existing facilities (EPA 2002). As drafted, the requirements may necessitate construction of cooling towers for the coal- and gas-fired alternatives.

Table 9-1. Environmental Authorizations for Current Operations.

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011, et seq.), 10 CFR 50.10	License to operate	DPR – 58 - Unit 1	Issued 10/25/74 Expires 10/25/14	Operation of Units 1 and 2
			DPR – 74 - Unit 2	Issued 12/23/77 Expires 12/23/17	
U. S. Department of Transportation	49 USC 5108	Registration	052703 013 027L	Issued 05/28/03 Expires 06/30/04	Hazardous materials shipments
Michigan Department of Environmental Quality	Clean Water Act (33 USC Section 1251 et seq.), Michigan Act 451. Public Acts of 1994, as amended, Parts 31 and 41, et. al.	NPDES permit (surface water)	MI0005827	Issued 09/21/00 Expires 10/01/03*	Plant discharges to Lake Michigan
Michigan Department of Environmental Quality	Federal Water Pollution Act (33 USC Section 1251 et seq.), Michigan Act 451. Public Acts of 1994, as amended, Parts 31, et. al.	NPDES permit (stormwater)	Part I.A.10 and 11 of NPDES permit	Issued 09/21/00 Expires 10/01/03*	Plant discharges to Lake Michigan
Michigan Department of Environmental Quality	Michigan Act 451. Public Acts of 1994, as amended, Parts 31 and 41, et. al.	Groundwater discharge permit	M 00988	Issued 09/29/00 Expires 09/01/05	Plant discharges to the State of Michigan groundwater and Lake Michigan
Michigan Department of Environmental Quality	Federal Clean Air Act (42 USC 7661, et seq.), IRS Ch.111-1/2, Sec.1039	Exemption to the federally-enforceable state operating permit	AQD ID B4252	Renewed annually via Rule 208a annual renewal registration submittal.	Exemption of air emissions from paint shop, boilers, and emergency generators
Michigan Department of Environmental Quality	Michigan Act 451. Public Acts of 1994, as amended, Part 325	Dredging permit	98-12-0414	Issued 9/30/98 Expires 12/31/03	Dredging near water intake

* Renewed application submitted to Michigan Department of Environmental Quality (MDEQ) on March 17, 2003 (I&M 2003); current NPDES permit is valid until a new permit is issued by MDEQ.

Table 9-1. Environmental Authorizations for Current Operations. (Continued)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Michigan Department of Environmental Quality	Michigan Act 368. Public Acts of 1978, as amended, Part 135	Registration and inspection of radioactive materials	Not applicable	Not applicable	Radioactive materials handling
MDEQ – Geological and Land Management Division	Michigan Act 451. Public Acts of 1994, as amended, Parts 353 and 325	Critical dunes permit	02-11-0045-P	Expires 04/23/04	Security upgrades near critical dunes
MDEQ – Geological and Land Management Division	Michigan Act 451. Public Acts of 1994, as amended, Parts 353 and 325	Critical dunes permit	02-11-0111-P	Expires 12/31/04	North security fence upgrade near critical dunes
MDEQ – Geological and Land Management Division	Michigan Act 451. Public Acts of 1994, as amended, Part 325	Critical dunes permit	01-11-0069-P	Expires 12/31/03	Beach nourishment near critical dunes
MDEQ – Geological and Land Management Division	Michigan Act 451. Public Acts of 1994, as amended, Part 325	Submerged land permit	98-12-0414-P	Expires 12/31/03	Beach nourishment in submerged lands
MDEQ – Geological and Land Management Division	Michigan Act 451. Public Acts of 1994, as amended, Part 353	Critical dunes permit	94-BR-0321-C	Not applicable	Vegetation control near critical dunes
MDEQ – Geological and Land Management Division	Michigan Act 451. Public Acts of 1994, as amended, Part 353	Critical dunes permit	03-11-0096-P	Expires 05/08/04	Installation of fish avoidance system
Berrien County	Part 91 NREPA - Soil Erosion and Sedimentation Control of Natural Resources and Environmental Protection Act	Soil and erosion permit	3535R	Expires 04/16/04	Security upgrades
Berrien County	Part 91 NREPA - Soil Erosion and Sedimentation Control of Natural Resources and Environmental Protection Act	Soil and erosion permit	3448R	Expires 10/10/03	North security fence upgrades

Table 9-1. Environmental Authorizations for Current Operations. (Continued)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Berrien County	Part 91 NREPA - Soil Erosion and Sedimentation Control of Natural Resources and Environmental Protection Act	Soil and erosion permit	3449R	Expires 10/10/03	Construction of beach ramp
Berrien County	Part 91 NREPA - Soil Erosion and Sedimentation Control of Natural Resources and Environmental Protection Act	Soil and erosion permit	3690	Expires 08/05/04	Installation of fish avoidance system
Berrien County	Part 91 NREPA - Soil Erosion and Sedimentation Control of Natural Resources and Environmental Protection Act	Soil and erosion permit	3585	Expires 09/29/03	Concrete removal in vicinity of dunes
U. S. Army Corps of Engineers	Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403) Section 404 of the Clean Water Act (33 USC 1344) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 USC 1413)	U. S. Army Corps of Engineers permit	69-056-004-7	Expires 12/31/09	Beach nourishment

Table 9-1. Environmental Authorizations for Current Operations. (Continued)

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
U. S. Army Corps of Engineers	Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403) Section 404 of the Clean Water Act (33 USC 1344) Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 (33 USC 1413)	U. S. Army Corps of Engineers permit	03-056-043-1	Expires 08/06/04	Installation of fish avoidance system
South Carolina Department of Health and Environmental Control	South Carolina Radioactive Waste Transportation and Disposal Act (S.C. Code of Laws 13-7-110 et seq.)	Radioactive waste transport permit	0055-21-03X	Issued 01/01/03 Expires 12/31/03	Transportation of radioactive waste in South Carolina
Tennessee Department of Environment and Conservation	Tennessee Code Annotated 68-202-206	License to ship radioactive material	T-MI001-L03	Issued 12/23/02 Expires 12/31/03	Shipments of radioactive material to processing facility in Tennessee

CFR - Code of Federal Regulations
MDEQ - Michigan Department of Environmental Quality
NPDES - National Pollutant Discharge Elimination System
USC - United States Code

Table 9-2. Environmental Authorizations for License Renewal.[a]

Agency	Authority	Requirement	Remarks
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011 et seq.)	License renewal	Environmental Report submitted in support of license renewal application
U.S. Fish and Wildlife Service	Endangered Species Act, Section 7 (16 USC 1536)	Consultation	Requires federal agency issuing a license to consult with FWS (Appendix C)
Michigan State Historic Preservation Office	National Historic Preservation Act, Section 106 (16 USC 470f)	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with State Historic Preservation Officer (Appendix D)
Michigan Department of Environmental Quality	Clean Water Act, Section 401 (33 USC 1341)	Certification	Requires State certification that proposed action would comply with Clean Water Act standards
	Coastal Zone Management Act (16 USC 1451 et seq.)	Certification	Requires applicant to certify to federal agency issuing a license that proposed action would comply with the Act (Appendix E)

a. No license renewal-related requirements identified for local or other agencies.

9.3 References

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