Applicant's Environmental Report – Operating License Renewal Stage

Point Beach Nuclear Plant, Units 1 and 2

Docket Nos. 50-266 and 50-301

License Nos. DPR-24 and DPR-27

February 2004

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ACRONYMS AND ABBREVIATIONS

AQCR	Air Quality Control Region
ATC	American Transmission Company
CAAA	Clean Air Act Amendments
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CT	combustion turbine
CWA	Clean Water Act
FES	Final Environmental Statement
FWS	U.S. Fish and Wildlife Service
GEIS	Generic Environmental Impact Statement
gpd	gallons per day
gpm	gallons per minute
IGCC	Integrated coal gasification combustion turbines
IPA	integrated plant assessment
IPE	Individual Plant Examination
IPP	Independent power producers
ISFSI	Independent Spent Fuel Storage Installation
km	kilometer
KNPP	Kewaunee Nuclear Power Plant
kV	kilovolt
MACCS	Melcor Accident Consequences Code System
MW	megawatts
MWe	megawatts-electrical
MWt	megawatts-thermal
NEPA	National Environmental Policy Act
NESC	National Electrical Safety Code
NMC	Nuclear Management Company, LLC
NMFS	National Marine Fisheries Service
NO_x	nitrogen oxides (oxides of nitrogen)
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
PBNP	Point Beach Nuclear Plant, Units 1 and 2
PC	(supercritical) pulverized coal (units)
PRA	Probabilistic Risk Assessment
PSA	Probabilistic Safety Assessment
PSCW	Public Service Commission of Wisconsin
SAMA	severe accident mitigation alternative

SAMDA	severe accident mitigation design alternative
SCPC	supercritical pulverized coal
SHPO	State Historic Preservation Officer
SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping
SO_x	sulfur oxides
USGS	U.S. Geological Survey
WDNR	Wisconsin Department of Natural Resources
WDOA	Wisconsin Department of Administration
WEC	Wisconsin Energy Corporation
WEPCO	Wisconsin Electric Power Company
WPDES	Wisconsin Pollutant Discharge Elimination System

1.0 INTRODUCTION

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. Nuclear Management Company, LLC (NMC), operates Point Beach Nuclear Plant Units 1 and 2 (PBNP) pursuant to NRC Operating Licenses DPR-24 and DPR-27, respectively. The Unit 1 license will expire on October 5, 2010, and the Unit 2 license will expire on March 8, 2013.

NMC has prepared this environmental report in conjunction with its application to NRC to renew the PBNP Units 1 and 2 operating licenses, as provided by the following NRC regulations:

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

NRC has defined the purpose and need for the proposed action, the renewal of the operating licenses for nuclear power plants such as PBNP, 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, pg. 28472)

The renewal operating license would allow for an additional 20 years of plant operation beyond the current PBNP licensed operating period of 40 years.

1.2 Environmental Report Scope and Methodology

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*. This appendix to the PBNP license renewal application fulfills that requirement. In determining what information to include in the PBNP environmental report, NMC has relied on NRC regulations and the following supporting documents that provide additional insight into the regulatory requirements:

- NRC supplemental information in the *Federal Register* (NRC 1996a, pp. 28467-28497; NRC 1996b, pp. 39555-39556; NRC 1996c, pp. 66537-66554; and NRC 1999a, pp. 48496-48507).
- *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996d and NRC 1999b)
- *Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses* (NRC 1996e)
- Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response (NRC 1996f)

NMC 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 in the document is prefaced with the regulatory language and applicable language from supporting documents.

1.3 Point Beach Nuclear Plant Licensee and Ownership

PBNP is owned by Wisconsin Electric Power Company (WEPCO) and operated by NMC. WEPCO is doing business as We Energies, and is a wholly owned subsidiary of Wisconsin Energy Corporation (WEC). In August 2000, WEPCO transferred operating authority for PBNP to NMC in order to improve the overall safety and efficiency of the plant. Although WEPCO still owns the assets and retains exclusive rights to the energy generated, NMC now holds the plant's operating licenses (DPR-24 for Unit 1 and DPR-27 for Unit 2) and is responsible for the plant's operation and maintenance (WEC 2003a).

NMC currently operates PBNP under the environmental policies and standards established by WEPCO. NMC's staff at PBNP is accountable for plant environmental impacts, ensuring compliance with environmental protection requirements. NMC line management organizations are responsible for implementing PBNP environmental management programs. Within WEPCO, the Environmental Department is the line management organization responsible for most PBNP implementing programs that have environmental activities, providing environmental leadership, oversight, and services. The WEPCO Environmental Department is also responsible for environmental strategy and support of environmental communications, regulatory interface coordination, compliance strategy and assurance, risk management, environmental permitting, and identification of new and enhanced means of benefiting the environment.

In 1999, the Wisconsin legislature passed Act 9 "Reliability 2000", which encouraged utilities with service areas in the State to transfer ownership and operation of transmission assets to an independent transmission company in exchange for equity interests in the company (ATC 2001). In response to the Act, WEPCO transferred ownership of its transmission lines to the American Transmission Company (ATC). ATC is a for-profit, multi-state, transmission-only company, which owns, plans, maintains, monitors, and operates electric transmission equipment (ATC 2001). ATC owns and is responsible for the four 345-kilovolt lines running from the first PBNP switchyard disconnect. The disconnect blades are owned by ATC and the housing receptacles are owned by WEPCO. ATC provides the interconnection service.

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 Impacts of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(d)	9.0	Status of Compliance
10 CFR 51.53(c)(2) and 10 CFR 51.45(e)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.3	Unavoidable Adverse Impacts
10 CFR 51.53(c)(3)(ii)(A)	4.1	Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a Small River with Low Flow)
	4.6	Groundwater Use Conflicts (Plants Using Cooling Towers 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

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)(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 or Endangered Species
10 CFR 51.53(c)(3)(ii)(F)	4.11	Air Quality During Refurbishment
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
10 CFR 51.53(c)(3)(iv)	6.2	Mitigation
	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

\> = greater than.
gpm = gallons per minute.

2.0 SITE AND ENVIRONMENTAL INTERFACES

2.1 Location and Features

Point Beach Nuclear Plant (PBNP) is a two-unit pressurized-water reactor power plant located on the western shore of Lake Michigan in Manitowoc County, Wisconsin, approximately 30 miles southeast of Green Bay and 15 miles north-northeast of Manitowoc (PBNP 2002, pg. 2.1-1). Figures 2-1 and 2-2 are PBNP 50-mile and 6-mile vicinity maps, respectively.

The PBNP site boundary encompasses approximately 1,260 acres, all owned by Wisconsin Electric Power Company (WEPCO) (Figure 2-3). Structures and parking lots occupy about 70 acres. Approximately 1,050 acres are used for agriculture. The balance remains in a natural mixture of woods, wetlands, and open areas. The site includes approximately two miles of continuous frontage on the western shore of Lake Michigan. Site structures include: two reactor containments and associated auxiliary, service, turbine, and office buildings; switchyard, pumphouse, cooling water intake and

Point Beach Nuclear Plant

discharge structures; and spent fuel storage (WEPCO 1991). One former residence (now unoccupied) is located onsite. Section 3.1 describes key features of PBNP.

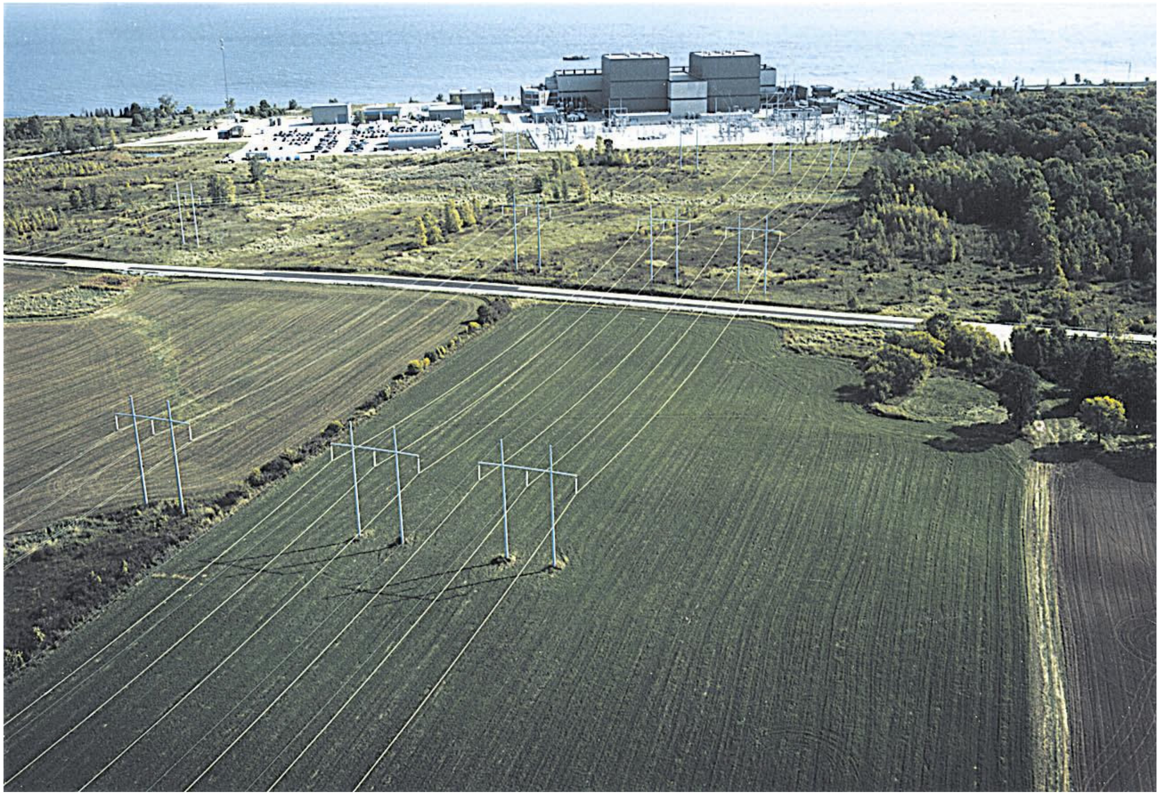
The area within six miles of PBNP includes portions of Manitowoc and Kewaunee Counties and is largely rural, characterized by farmland, woods, and small residential communities. The nearest town is Two Creeks, approximately one mile north-northwest of the site (Figure 2-2). Besides the Cities of Green Bay and Manitowoc, PBNP is approximately 6 miles east-northeast of Mishicot, 8 miles north of Two Rivers, and 11 miles south of Kewaunee (Figure 2-1). The Oneida Indian Reservation is located on the western edge of Green Bay approximately 35 miles northwest of the plant. The international boundary between Canada and the United States is approximately 200 miles northeast of the site.

The local terrain is gently rolling to flat, with elevations varying from 5 to 60 feet above the normal level of Lake Michigan. The land surface slopes gradually toward the lake from higher glacial moraine areas west of the site. Low bluffs face the Lake Michigan shore, with evidence of marked erosion near the center of the PBNP site. At this point, the beach is narrow (ranging in width from 20 to 50 feet), with bare mud slopes showing active erosion due to lake storms. Historically, shoreline recession has ranged from 2.5 to 5 feet per year in this area. PBNP has provided riprap to control further recession of the shoreline at the site (PBNP 2002, pg. 2.2-1).

The Point Beach State Forest is located approximately three miles south of the PBNP property and offers fishing, boating, hiking, camping, and picnicking. The Rahr Memorial School Forest, about one mile south of PBNP, offers a wide range of educational and outdoor activities. Two Creeks Town Park, just north of the PBNP property also provides some lakeside recreation. Figure 2-2 shows the locations of these recreational areas.

PBNP was built on the eastern edge an area where a vast forest was buried by the Valderan glacier about 12,400 years ago. The buried forest is not unique to the plant site. The Two Creeks Buried Forest unit of the Ice Age National Scientific Reserve is located approximately two miles north of the PBNP property. The Reserve is a national park system affiliated area, and provides public access to remnants of the buried forest. Figure 2-2 shows the location of the Two Creeks Buried Forest.

A few industrial areas are located south of the plant site in the towns of Two Rivers and Manitowoc and to the west in the Fox River Valley. The nearest industrial site is the Kewaunee Nuclear Power Plant (KNPP), located approximately five miles north of PBNP. Figure 2-2 shows the location of the KNPP site and Section 2.12 provides additional information about the KNPP site.



PBNP transmission lines crossing adjacent agricultural area

2.2 Aquatic Ecological Communities

Overview of Lake Michigan Ecosystem

PBNP lies on the western shore of Lake Michigan, the only Great Lake that lies entirely within the boundaries of the United States. Lake Michigan is the second largest of the Great Lakes by volume [4,900 cubic kilometers $(km)^3$] and third largest by area [57,800 square kilometers (km^2)]. It drains an area of 45,600 square miles (134,100 km^2) (Environment Canada 1995). Major tributaries of Lake Michigan include the Fox-Wolf, Grand, 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 that drains into Green Bay. Green Bay receives wastes from the world's largest concentration of pulp and paper mills. The southern part of Lake Michigan is among the most urbanized areas in the Great Lakes region, containing 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. While major point sources of pollutants have been curtailed since the enactment of the Clean Water Act, the lake continues to receive pollutants such as PCBs and mercury from the atmosphere. The United States 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 been made (e.g., reduction of point-source pollutants entering the basin and protection and restoration of wetlands), but notes that other areas still need improvement (e.g., deposition of toxic air pollutants in the watershed and non-point source pollutants). The Lake Michigan Lakewide Management Plan may be the most comprehensive source of information available on the current state of "health" of the Lake Michigan ecosystem.

Aquatic Communities

The *Final Environmental Statement Related to Operation of Point Beach Nuclear Plant Units 1 and 2* (FES) (AEC 1972) describes the aquatic communities of Lake Michigan, a deep oligotrophic lake with relatively low primary productivity. It also summarizes monitoring studies conducted in the PBNP vicinity in the 1960s and 1970s. The reader is referred to the FES as a source of site-specific historical information, which will be discussed only briefly in this environmental report in the context of long-term changes in Lake Michigan aquatic communities.

The FES (AEC 1972, pg. II-16) described benthic communities in the PBNP area as "depauperate," presumably because the Lake Michigan substrate in the area of PBNP is characterized by coarse, shifting sand and gravel overlying hard clay and is unsuitable for colonization. The FES suggested that macroinvertebrate communities in Lake Michigan were generally dominated by four groups: amphipods, oligochaetes (aquatic worms), sphaeriids (clams), and tendipeds (midge larvae).

Since that time, nearshore benthic communities in Lake Michigan have undergone dramatic changes as a result of reductions in nutrient loads (phosphorus in particular) and the establishment of the non-native 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 National Pollutant Discharge Elimination System programs that reduced point and non-point source pollutants in the 1970s and 1980s, produced declines in oligochaetes and sphaeriids throughout southern Lake Michigan. Historically high densities of the amphipod *Diporeia*, an important food for lake whitefish (*Coregonus clupeaformis*) and a number of forage 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.

Makarewicz, Lewis, and Bertram (1994) examined trends in phytoplankton abundance in Lake Michigan from 1983-1992 (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 zooplankter *Daphnia* resulted in increasing abundance of colonial algae and filamentous algae, while low numbers of *Daphnia* were associated with small, unicellular forms.

Makarewicz, Lewis, and Bertram (1994) also noted that large zooplankton (large cladocerans, calanoid copepods, and cyclopoid copepods) became more abundant in 1983-1985 after a "sharp decline" in the abundance of the planktivorous alewife (*Alosa pseudoharengus*) in 1982 and 1983. The reduction in alewife predation pressure also may have 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 1987-1992 (Makarewicz, Lewis, and Bertram 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, a full century after the first Welland Canal was completed. 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. They 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 weak link in the life cycle of the lamprey is the larval stage. Ammocoetes larvae are restricted to streams, where they may be killed by lampricides. Chemicals that were effective in controlling lamprey larvae were developed in the 1950s and 1960s, chief among them 3-triflouromethyl-4-nitrophenol (TFM), discovered in 1957. These chemicals, combined with physical and electrical barriers to spawning streams, have been effective in controlling sea lampreys in the Great Lakes and have permitted the partial recovery of some fish populations previously reduced to near-extinction. Although TFM is largely non-toxic to other fish and wildlife, resource agencies continue to search for alternatives, because of the high cost of lampricides and public concern about the use of chemical pesticides.

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 exploded 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 on to 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 sport fishery, American and Canadian fish and game agencies in the mid-1960s began stocking several Pacific trout and salmon species (steelhead, coho salmon, 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 large 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 in states bordering Lake Michigan began reducing, in 1999, the numbers of Chinook Salmon stocked. 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 non-native 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 1973-1981 period, was markedly lower over the 1982-1986 period, spiked in 1987 (reaching levels seen in the 1970s), and fluctuated from 1988-1999 (Fleischer et al. 2000, Figure 2). 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. Abundance of bloaters was extremely high in Lake Michigan in the late 1980s, but 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 the closely-related slimy sculpin (*Cottus cognatus*) are eaten by juvenile lake trout and burbot.

Taken as a group, biomass of Lake Michigan forage (prey) fishes increased from the 1970s to the late 1980s, peaked in 1989, and appear to have declined steadily since 1989 (Fleischer et al. 2000, Figure 8). The overall decline in forage fish biomass over the 1990s is due primarily to the decline in abundance of a single species, the bloater.

Although the top of the Lake Michigan food chain is now dominated by introduced species of trout and salmon, two top 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 numbers have declined in recent years (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 by 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.

As noted previously, non-native fish species have exerted a profound “top-down” effect on Lake Michigan and its 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 Indian 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). Zebra mussels first appeared in the immediate vicinity of PBNP in 1991 (Lee 1991), and are now common, particularly in areas with firm, stable substrate.

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, water clarity increases and plankton populations tend to decline precipitously. Secondary impacts can be positive (increased water clarity and increased light transmissivity allows submerged aquatic vegetation to become established in deeper waters) or negative (some species of fish and waterfowl feed heavily on zebra mussels, which bioconcentrate contaminants).

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 prefer live unionids to dead unionids or rocks, which tends to focus and magnify the 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 often move (or are carried) into an area and eliminate native unionid mussels in two to three years (Schloesser, Nalepa, and McKie 1996).

Although not aquatic organisms in the strictest sense, waterfowl are often found in the vicinity of PBNP, especially during their seasonal migrations. During September 1990, double-crested cormorant carcasses began to be discovered on the travelling water screens and in the forebay. WEPCO immediately notified WDNR and FWS, and since then, WEPCO has worked with FWS to find solutions to keep cormorants and other birds from entering the intake structure. Mortalities since 1990 have consisted almost exclusively of cormorants. The intake structure is located 1,750 feet from the shoreline in a water depth of 22 feet. It has an outside diameter of 100 feet, an inside diameter of

60 feet, and (until May 2001) extended 8 feet above the water surface. Cormorants are abundant in the area during spring and fall migrations, and are attracted to schools of fish in the vicinity of, and within, the intake structure. Initially, cormorants would enter the interior of the intake structure, and since cormorants must run along the surface for a substantial distance to become airborne, they were unable to fly out.

After a meeting with FWS in 1990, netting was installed that covered the top of the intake structure. This initially appeared to solve the problem, since no dead birds were seen in 1991. The problem reoccurred, however, in 1992. Netting was then added that covered the above-water portion of the outside surface of the intake structure to prevent cormorants from entering the intake crib through passageways between the rock riprap that comprises the structure walls. Netting was eventually installed to a depth of 6-10 feet under the waterline. The side netting proved to only temporarily solve the problem, however, as high winds and wave action during storms would eventually cause the netting to tear. Several netting materials were used in nets that were custom-fitted for the PBNP intake structure, but the nets would eventually tear during storm conditions that were strong enough to cause the riprap to shift.

As discussed in Section 3.1.2, the intake structure was modified in May 2001 so that the structure no longer extends above the water surface. Specifically, the top of the intake structure is now approximately 11 feet above the lake bottom, and is covered by a steel superstructure with a trash rack made of high-density polyethylene having approximately 7-inch by 18-inch openings (PBNP 2001). No carcasses of any cormorant species have been found in the forebay, travelling water screens, or in any part of the intake system subsequent to these modifications (WEPCO 2002, NMC 2003).

2.3 Groundwater Resources

Most of Wisconsin is covered by unconsolidated material, primarily glacial till varying in thicknesses up to 600 feet (UWEX 1983). Boring records at the industrialized part of PBNP indicate a depth of approximately 110 feet (WEPCO 1983a). The glacial material at PBNP is primarily clay with some sand, silt, and gravel. The uppermost bedrock material is Silurian-age Niagara Dolomite. Underlying the Silurian-age deposits are relatively uniform layers of Ordovician-age formations. Figure 2-4 is an approximate geologic section in the vicinity of PBNP. It shows the Silurian Formation, Ordovician-age formations and groups, and underlying Cambrian-age sandstone followed by Precambrian-age quartzite and granite (UWEX 1995). The Silurian-, Ordovician-, and Cambrian-age formations dip gently from inland outcrops to the eastern Wisconsin border at the west bank of Lake Michigan (PBNP 2002). Table 2-1 presents descriptions of these formations as well as the overlying Quaternary-age deposits and the predominate underlying Precambrian material.

Potable water in the vicinity of PBNP is drawn primarily from Lake Michigan. This includes Two Rivers (12 miles south), Manitowoc (13 miles south-southwest), Sheboygan (40 miles south), and Green Bay (intake 13 miles north). Groundwater provides potable water for smaller towns and rural residences in the vicinity. Wells in use on PBNP and within six miles of PBNP include six wells on PBNP, two wells on KNPP, and two wells in the town of Mishicot. Table 2-2 lists these wells, their names, depths, average daily use, and aquifer used.

As shown in Figure 2-3, PBNP has six domestic water wells; however, only five currently supply water to the plant. The main well was built in 1967, and drilled to a depth of 257 feet through 109 feet of glacial till and into the Niagara Dolomite of the Silurian aquifer (Figure 2-4). The depth from grade to normal water level in the well is 12 feet (WEPCO 1983a), which indicates an artesian characteristic of the Silurian aquifer. The artesian condition of the Silurian aquifer is confirmed by U.S. Geological Survey (USGS) information for well MN-0028 in Manitowoc County (USGS 2002). The PBNP main pump capacity is 65 gallons per minute (gpm) and its average withdrawal from 1997 through 2000 is 7,707 gallons per day (gpd) or 5.4 gpm. A well was also installed at the North Gate during the original construction. This building is primarily used for storage, however, the well does supply limited domestic water to the facility.

In 1983, WEPCO installed two wells with 20-gpm pumps to supply the site boundary control center and the lakeside training complex (WEPCO 1983a,b). Wisconsin Department of Natural Resources' (WDNR's) listed normal pumpage for each well is 1,000 gpd (0.7 gpm). The lakeside training complex well was installed primarily for construction and is currently inactive. The fifth PBNP domestic water well was constructed in 1998 and is located at the Energy Information Center. The design capacity of the wastewater system for this building is 810 gpd; therefore, the maximum groundwater withdrawal cannot exceed 810 gpd or approximately 0.6 gpm. This facility is accessible by limited public tours. The well provides domestic water for members of these tours and approximately six PBNP employees. Estimating 15 gallons of water per person each day for the full-time employees (Metcalf & Eddy 1991), the groundwater withdrawal from this well is 90 gpd or 0.06 gpm. The presence of occasional tour groups would not appreciably increase water consumption from this well. The main plant well, the site boundary control center well, and the Energy Information Center well combined give PBNP a domestic water pumping capacity of 85.6 gpm and an average pumping rate of 8,797 gpd or 6.11 gpm (WDNR 2001a; WEPCO 2003).

Originally, each of six onsite residences was equipped with wells having a pumping capacity of 10 gpm and an average supply of 500 gpd (less than 0.35 gpm). Five of these residences have been removed and their wells have been abandoned in accordance with WDNR requirements. The remaining residence is used periodically by plant security, but there is negligible, if any, withdrawal from the well.

2.4 Critical and Important Terrestrial Habitats

PBNP is situated on 1,260 acres on the Lake Michigan shore, approximately 30 miles southeast of Green Bay and 90 miles north of Milwaukee, in Manitowoc County, Wisconsin (WEPCO 1971; AEC 1972). The site and surrounding area consist mainly of agricultural land and forest. Approximately 104 acres of the site were converted from cropland and pasture to industrial use during construction of the facility. The site also contains approximately two miles of continuous shoreline on Lake Michigan (AEC 1972). Additionally, the Point Beach State Forest is located about 3 miles south of the plant and a small community park is located north of the plant.

The PBNP property consists of land leased for farming and several woodlots ranging in size up to 47 acres. The scattered woodlots total approximately 100 acres, or 9 percent of the PBNP property (WEPCO 1971, pg. 3-21). The plant communities in these woodlots include a variety of trees, such as aspen, blue beech, hemlock, and maples forming an overlapping crown at the top of the forest canopy (AEC 1972, pg. 13; WEPCO 1971, pg. 3-21). The woodlots are left in a natural state by WEPCO and are not actively managed. The woods provide food, cover, and nesting sites for a variety of wildlife species.

The shoreline of Lake Michigan on the PBNP property consists mostly of narrow (20-to-100-feet-wide depending on lake level) bare beaches leading from the water's edge to low bluffs created by years of erosion. WEPCO placed riprap along the edges of the bluffs to reduce the effects of erosion, which was occurring at a rate of 2.5 to 5 feet per year (AEC 1972, pg. 12). The shoreline on the PBNP property does not contain any sand dunes.

The terrestrial wildlife that occurs at PBNP and the surrounding areas are those typically found in similar habitats throughout Wisconsin. Common mammals include white-tailed deer (*Odocileus virginianus),* cottontail rabbit (*Sylvilagus floridanus*), raccoon (*Procyon lotor*), gray fox (*Urocyon cinereoargenteus*), gray squirrel (*Sciurus carolinensis*), eastern chipmunk (*Tamias striatus*), and masked shrew (*Sorex cinereus*) (AEC 1972; WEPCO 1971). Numerous upland bird species, such as the ring-necked pheasant (*Phasianus colchicus*), wild turkey (*Meleagris gallopavo*), American goldfinch (*Carduelis tristis*), eastern bluebird *(Sialia sialis),* blue jay *(Cyanocitta cristata*), and eastern meadowlark *(Sturnella magna*) occur on the property, as do several waterfowl species, including Canada goose (*Branta canadensis*) and the wood duck (*Aix sponsa)* (AEC 1972; WDNR 2001b). Additionally, several common amphibian and reptile species, including the tiger salamander (*Ambystoma tigrinum*), northern leopard frog (*Rana pipiens*), American toad (*Bufo americanus)*, and the painted turtle (*Chrysemys picta*) occur in the PBNP area.

The piping plover (*Charadrius melodus)* is the only federally listed species known to have designated critical habitat in Wisconsin (FWS 2001a). The piping plover critical habitat encompasses roughly 5 miles of Lake Michigan shoreline within the Point Beach State Forest (FWS 2001b), approximately 3 miles south of PBNP in Manitowoc County. The five miles of shoreline within the Point Beach State Forest designated as critical habitat for the endangered piping plover are considered a critical unit, necessary for the species' conservation and recovery (FWS 2001b). Solitary piping plovers are occasionally observed in the Point Beach State Forest area in the spring, but no breeding pairs have been observed in a half-century.

Section 3.1.5 describes the transmission lines that WEPCO built to connect PBNP to the transmission grid system. As discussed in Section 1.3, ATC is the new owner and operator of those transmission lines. At the time of construction, the transmission corridors passed "solely through farmlands" (AEC 1972). A WEPCO review has determined that the principal land use categories of the areas crossed by transmission lines are agricultural, wooded lots, and bottomland forest and the corridors do not cross any State or federal parks, wildlife refuges, or wildlife management areas. The Holland State Wildlife Area in the southwest portion of Brown County lies approximately 1 mile south of the L-151 line.

2.5 Threatened or Endangered Species

Based on a WEPCO review of information on the State of Wisconsin Natural Heritage Inventory database, no State- or federally listed species are known to occur on the PBNP site or within/along the associated transmission corridors. Several State- and Federally listed birds are known to occur in Brown and Manitowoc Counties, however, and cannot be ruled out as occasional visitors to the PBNP site. These include a number of songbirds, shorebirds, wading birds, and birds of prey (see Table 2-3).

There are 16 federally listed threatened or endangered species in the State of Wisconsin (FWS 2001b). Although none of these federally listed species are known to occur in the vicinity of the PBNP site, three have been recorded in Manitowoc County: the bald eagle (*Haliaeetus leucocephalus*), the piping plover (*Charadrius melodus*) and the dune (or pitcher's) thistle (*Cirsium pitcheri).* The dwarf lake iris (*Iris lacustris*), another federally listed species, is found in Brown County, through which a portion of the L-151 line passes (see Section 3.1.5).

The bald eagle, once imperiled by shooting, poisoning, habitat loss, and organochlorine pesticides in the food chain, has made a dramatic comeback since the 1970s. Bald eagle populations in the lower 48 states began to recover in the 1980s and 1990s as a result of the protection afforded by the Endangered Species Act and the banning of DDT. Regional bald eagle populations in the northwest, Great Lakes, Chesapeake Bay, and Florida increased 5-fold between 1979 and 1999 (64 FR 36453-36464, 7/6/99).

As a consequence, in 1995 the U.S. Fish and Wildlife Service (FWS) changed the classification of the bald eagle from “endangered” to “threatened” in the lower 48 states (60 FR 35999-36010, 7/12/95). The bald eagle was removed from the State of Wisconsin’s list of threatened and endangered wildlife in 1997. On July 6, 1999, the U.S. Fish and Wildlife Service published a Proposed Rule that would remove the bald eagle in the lower 48 states from the List of Endangered and Threatened Wildlife (64 FR 36453-36464, 7/6/99). This was based on the fact that the species had recovered, meaning that recovery goals had been met across the species’ range and the species was no longer in danger of extinction. To date, there has been no change in the bald eagle’s status vis-à-vis the Endangered Species Act, however, and the species continues to be fully protected.

Bald eagle numbers in Wisconsin mirrored national trends, increasing steadily over the last several decades. In 1973, there were 108 nesting pairs of bald eagles in Wisconsin. By 1997, there were 645. In the summer of 2002, 831 pairs of eagles nested in Wisconsin, with most pairs nesting along the shores of inland lakes and rivers, including the Chippewa, Wisconsin, Wolf, and Mississippi (WDNR 2003a; WDNR undated).

Piping plovers are small shorebirds approximately seven inches long, with sand-colored plumage on their backs and crown and white underparts. They breed only in North America in three geographic regions: the Atlantic Coast, the Northern Great Plains, and the Great Lakes. Great Lakes piping plovers breed on sparsely vegetated beaches, cobble pans, or sand spits along the Great Lakes shorelines.

Piping plover populations were listed under the Endangered Species Act in 1985. The Northern Great Plains and Atlantic Coast populations are threatened, and the Great Lakes population is endangered (FWS 2001b). Piping plovers are considered threatened throughout their wintering range. According to the last complete breeding census, in 1996, the Northern Great Plains population was the largest of the three breeding populations, numbering approximately 1,398 breeding pairs. The Atlantic Coast population consisted of 1,372 breeding pairs, and the Great Lakes population had only 32 breeding pairs (FWS 2001b).

According to the Wisconsin Department of Natural Resources (WDNR), the only piping plover nesting in Wisconsin in recent years has occurred along the shores of Lake Superior (WDNR 2001c). Piping plovers have not nested successfully along the Wisconsin shore of Lake Michigan since 1948 (WDNR 2001c). A pair of piping plovers attempted to nest near Marinette, Wisconsin, in the spring of 2001, but the nest site was disturbed and none of the eggs hatched (Dingledine 2002). As noted in the previous section, individual birds are occasionally observed in the spring along the Point Beach State Forest shoreline, 3 miles south of PBNP.

The endangered dune thistle has deeply dissected blue-green leaves with a downy surface and is less prickly than other thistles. During the first few years of life, this dune plant bears only a rosette of leaves at the surface of the dune. Once the plant matures, it produces a tall stalk (approximately three feet tall) that produces pinkish-tan flowers. The preferred site for the dune thistle is the area between a sandy beach and a fully vegetated dune next to the shorelines of the Great Lakes (WDNR 2001d). There is no suitable habitat for this species on the PBNP site.

The dwarf lake iris (*Iris lacustris*) is a small blue wildflower endemic to the northern shores of Lake Michigan and Lake Huron, growing nowhere else in the world (MNFI 2001). The dwarf lake iris is found in association with a geological feature known as the Niagara Escarpment, a limestone formation that extends from the Door Peninsula of Wisconsin through Michigan and Ontario to New York (MNFI 2001). In Wisconsin, this species is found primarily along the northwestern shore of Lake Michigan and the eastern shore of Green Bay (the Door Peninsula) in Brown and Door Counties (WDNR 2001e).

The dwarf lake iris is typically found growing in dense colonies in forest glades and clearings that lie near Great Lakes shorelines. Dwarf lake iris is almost invariably associated with northern white cedar, though white spruce, balsam fir, and trembling aspen may also be present in the overstory (MNFI 2001). Occasionally this species extends out into open dune ridges in association with other rare plants, such as the dune thistle and Huron tansy (*Tanacetum huronense*). Since *Iris lacustris* is largely restricted to Great Lakes shores, it is highly vulnerable to shoreline development and intensive recreation. This species, which has very specific habitat requirements and a limited distribution in Wisconsin, has not been documented in the vicinity of the PBNP site.

The only threaten or endangered species known to occur in the vicinity of the PBNP site is the state-listed (threatened) fish species, the greater redhorse (*Moxostoma valenciennesi*). This species occurs in the East Twin River, 5 to 6 miles from the PBNP site. The greater redhorse, which as an adult reaches approximately 18 inches in length, is the largest of the redhorses. It prefers clear waters of medium- to large-sized rivers, reservoirs, and large lakes at depths of less than three feet over sand, gravel, or boulders (WDNR 2001f).

The WEPCO review of the Natural Heritage Inventory database revealed that the greater redhorse occurs in the major streams and rivers of eastern Manitowoc County crossed by the PBNP transmission corridors. These include the Branch River, Neshota River, West Twin River, and East Twin River. The only threatened or endangered terrestrial species believed to occur in the vicinity of the PBNP transmission corridors is the snow trillium, *Trillium nivale*, which is found in Southern (Wisconsin) Mesic Forests, sugar maple-basswood-beech forest communities that occur in areas with well-drained soils (WDNR 2001g, h). Snow trillium populations are known to occur in mesic forests in the Kriwanek Creek drainage, which is crossed by the L-121 transmission corridor and the Devil's River drainage, which is crossed by the L-151 transmission corridor. They are not known to occur in the transmission corridors, however.

2.6 Regional Demography and Minority and Low-Income Populations

2.6.1 General

The *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants* (GEIS) presents a population characterization method that is based on two factors: "sparseness" and "proximity" (NRC 1996d, Section C.1.4). "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 1996d.

"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 1996d.

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

GEIS Sparseness and Proximity Matrix

Proximity

Sparseness		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 1996d, pg. C-159.

Nuclear Management Company, LLC (NMC) used 2000 census data from the U.S. Census Bureau website (U.S. Census Bureau 2000a) and geographic information system software (ArcView®) to determine demographic characteristics in the PBNP vicinity. The Census Bureau provides updated annual projections, in addition to decennial data, for selected portions of its demographic information.

As derived from 2000 U.S. Census Bureau information, 82,196 people live within 20 miles of PBNP. Applying the GEIS sparseness measures, PBNP has a population density of 135 persons per square mile within a 20-mile radius 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 U.S. Census Bureau information, 727,969 people live within 50 miles of PBNP. This equates to a population density of 181 persons per square mile within a 50-mile radius. The largest city within 50 miles of PBNP is Green Bay, with a population of 226,778 people (U.S. Census Bureau 2000b). Applying the GEIS proximity measures, PBNP is classified as Category 3 (having one or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles). According to the GEIS sparseness and proximity matrix, the PBNP ranks of sparseness, Category 4, and proximity, Category 3, result in the conclusion that PBNP is located in a high population area.

All or parts of 12 counties and the City of Green Bay are located within 50 miles of PBNP (Figure 2-1). Approximately 81 percent of the employees live in Manitowoc County. The remaining 19 percent are distributed across 12 counties, with numbers ranging from 1 to 73 employees per county.

Historical and Present Population Data

In 2000, the State of Wisconsin reported a population count of almost 5.4 million (5,363,675), or 1.9 percent of the nation's population (U.S. Census Bureau 2000c). From 1990 to 2000, Wisconsin had an average annual growth rate of approximately 1.0 percent (U.S. Census Bureau 2000c). Manitowoc County's average for the same period was 0.3 percent. In order to provide the broadest perspective when presenting population growth information, the United States data has been included in this analysis. The United States reported a 2000 population total exceeding 280 million (281,421,906) with an average annual growth rate of 1.3 percent from 1990 to 2000 (U.S. Census Bureau 2000c). As can be seen, Manitowoc County's average growth rate is relatively slow when compared with the State of Wisconsin and the United States growth rates.

Population Projections

By the year 2030, Wisconsin's population is projected to be 6.2 million people, growing at an average rate of 0.5 percent. By the same year, Manitowoc County's population is projected to be 84,750, growing at an average annual rate of 0.07 percent. And, by 2030, the total United States population is expected to be 349,789,000, growing at an average annual rate of 0.8 percent.

Table 2-4 shows estimated populations and average annual growth rates for Manitowoc County (the County with the greatest potential to be socioeconomically affected by license renewal activities at PBNP), the State of Wisconsin, and the United States. The table is based on U.S. Census Bureau data for 1980, 1990, and 2000, State of Wisconsin Department of Administration projections through 2020, U.S. Census Bureau projections for Wisconsin and the United States, and Tetra Tech NUS projections to 2030, which are based on linear regression techniques. Figure 2-1 shows the location of Manitowoc County.

2.6.2 Minority and Low-Income Populations

Background

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

NMC used Environmental Systems Research Institute Inc.'s ArcView® geographic information system software to combine U.S. Census Bureau TIGER line data with U.S. Census Bureau 2000 census data to determine the minority and low income characteristics on a block group level. NMC included all block groups if any of their area lay within 50 miles of PBNP. The 50-mile radius includes 571 block groups. NMC defines the geographic area for PBNP as the entire State of Wisconsin.

2.6.2.1 Minority Populations

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

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

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

NMC used 2000 census data from the U.S. Census Bureau website (U.S. Census Bureau 2000a) in determining the percentage of the total population within Wisconsin for each minority category, and in identifying minority populations within 50 miles of PBNP.

NMC divided U.S. 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 571 block groups within 50 miles of PBNP, NMC 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 or not minority populations exist in an area. U.S. Census Bureau data (U.S. Census Bureau 2000a) for Wisconsin characterizes 0.90 percent as American Indian or Alaskan Native, 1.70 percent Asian, 0.0 percent Native Hawaiian or other Pacific Islander, 5.70 percent Black races, 1.60 percent all other single minorities, 1.20 percent multi-racial, 11.07 percent aggregate of minority races, and 3.60 percent Hispanic ethnicity. As defined by the U.S. Census Bureau, people who claim Hispanic ethnicity may be of any race. Persons claiming Hispanic ethnicity are not included in the aggregate of minority races since most are already counted for their minority race in other racial groups.

Based on the "more than 20 percent" or the "exceeds 50 percent" criteria, no Native Hawaiian or other Pacific Islander, other single minorities, or multi-racial minorities exist in the geographic area. Table 2-5 presents the numbers of block groups within each county that exceed the threshold for determining the presence of minority populations.

Based on the "more than 20 percent" criterion, American Indian or Alaskan Native minority populations exist in five block groups (Table 2-5). Three of these block groups are found in Outagamie County, Wisconsin, and the other two are in Brown County, Wisconsin. These block groups fall within or around the boundary of the Oneida Indian Reservation, which was established under U.S. Law in 1937 and is displayed on Figure 2-1. The American Indian or Alaskan Native minority block groups are displayed on Figure 2-5. A number of people who are not members of this minority group live within the boundary of the Oneida Indian Reservation. Consequently the American Indian or Alaskan Native minority block groups do not correspond to the boundary of the Reservation.

Based on the "more than 20 percent" criterion, the Asian minority populations exist in a single block group (Table 2-5). Figure 2-6 displays the location of this minority block group in Brown County, Wisconsin.

Based on the "more than 20 percent" criterion, the Black races minority populations exist in a single block group (Table 2-5). Figure 2-7 displays the location of this minority block group in Brown County, Wisconsin.

Based on the "more than 20 percent" criterion, the aggregate of minority races populations exist in 16 block groups (Table 2-5). Thirteen of these block groups are found in Brown County and the other three are in Outagamie County, Wisconsin. The aggregate of minority races minority block groups are displayed on Figure 2-8.

Based on the “more than 20 percent” criterion, the Hispanic ethnicity minority populations exist in six block groups (Table 2-5). Figure 2-9 displays the locations of these minority block groups in Brown County, Wisconsin.

2.6.2.2 Low-Income Populations

NRC guidance defines “low-income” by using U.S. Census Bureau statistical poverty thresholds (NRC 2001, Appendix D). NMC divided U.S. Census Bureau 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 block group. U.S. Census Bureau data (U.S. Census Bureau, 2003a) characterize 8.7 percent of Wisconsin households as low-income. A low-income population is considered to be present if:

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

2. The percentage of households below the poverty level in an environmental impact area is significantly greater (typically at least 20 percentage points) than the low-income population percentage in the geographic area chosen for comparative analysis.

Based on the “more than 20 percentage points” criterion, two block groups contain a low-income population. Both are found in Brown County, Wisconsin (U.S. Census Bureau 2003b). Figure 2-10 displays the location of the low-income household block groups, while Table 2-5 includes the Brown County low-income block groups in the overall identification of PBNP minority and low income block groups.

2.7 Taxes

Utility Taxes and the Wisconsin Shared Revenue Fund

In the State of Wisconsin, public utilities are exempt from local property taxation and, instead, are taxed by the State. These utilities pay Gross Revenue taxes to the State in lieu of property taxes. Gross Revenue taxes paid by utilities become part of the State's general purpose revenue, which goes to fund the Wisconsin Shared Revenue Program.

The State's Shared Revenue Program provides aid to municipalities and counties. It is the largest aid payment for municipalities and an important source of revenue for counties. The Wisconsin Shared Revenue Program was started in 1911 with the enactment of the state income tax. Originally, income tax law required that 70 percent of the tax revenues be paid to the municipality and 20 percent to the county where the tax payer resided. These percentages were changed over time to reflect changes in State and local fiscal needs. In keeping with the precedent set by the income tax law, when other State taxes were enacted, a percentage of their proceeds was also shared with local governments on a return-to-origins basis (Seeley 2001a).

By the late 1960s, however, most observers agreed that return-to-origins tax sharing was increasing local fiscal disparities. Communities with high levels of economic activity and/or high-income residents received ever-increasing State aid payments, allowing them to provide substantial levels of services at low (or no) property tax rates. Communities with little economic activity and/or low-income individuals experienced a stagnation or decline in State aid payments, resulting in low levels of services at high and often increasing property tax rates. Fiscal disparities thus kept increasing with economic growth focused on high aid/low tax rate communities (Seeley 2001a).

The present Shared Revenue Program was developed to shift the focus of State aids from a return-to-origins basis to a distribution-based-on-need basis. The current program has three broad policy goals:

1. Property tax relief – By using shared revenues to finance spending, municipalities and counties reduce their need to levy property taxes to finance spending.
2. Equalize revenue-raising ability among local governments – For local governments with equal per capita spending, units with lower per capita values receive relatively more aid than units with higher per capita values. In addition, for local governments with equal value, units with higher per capita spending receive relatively more aid than units with lower per capita spending levels.

3. Compensation for utility property – Payments compensate local governments for the disamenities attributable to certain types of power company property that is not taxable locally (Seeley 2001a).

The Shared Revenue Program has five separate payment types: Per Capita, Utility, Aidable Revenues, Minimum Payment – Maximum Adjustment, and County Mandate Relief. Of the five types, only the Shared Revenue *Utility* payments are proportionally distributed to the host county and municipality. The other four payments are distributed throughout the State based on a formula that is independent of utility valuation or location. The *Utility* payment consists of three components: Annual Ad Valorem, Spent Nuclear Fuel Storage, and the Minimum Payment (Seeley 2001a). The Minimum Payment component does not apply to PBNP.

The Annual Ad Valorem payment is based on the net book value (original cost less depreciation) of certain qualifying properties (production plants, substations, and general structures, but excluding land) of electric and gas utilities. For payment purposes, the total value of qualifying property in a municipality (and county for property in that municipality) may not exceed $125 million per utility company or, in the case of a jointly owned power plant, $125 million for the plant. The total payment may not exceed $300 per capita for municipalities and $100 per capita for counties (Seeley 2001a). The property cap and the per capita cap are considered outdated and are currently under review (Zeuske 2001).

The Spent Nuclear Fuel Storage payment is $50,000 and is made to the municipality and county in which spent nuclear fuel is stored as of December 31 of the year prior to the payment. If the nuclear fuel storage facility is located within one mile of another municipality, the municipality where the fuel is stored receives $40,000 and the nearby municipality receives $10,000. This payment is not subject to the $300/$100 per capita payment limits (Seeley 2001a). A spent nuclear fuel storage facility is located on PBNP property.

WEPCO Taxes

In lieu of property tax on its electrical generating plants and other facilities, WEPCO pays, to the State of Wisconsin, a lump sum gross revenue tax. WEPCO can not allocate its gross revenue tax payment to its generating plants because the tax is not levied on the plants. Additionally, there is no direct correlation between the taxes paid by WEPCO (to the State of Wisconsin) and the distribution of four of the five Shared Revenue payments (i.e., Per Capita, Aidable Revenues, Minimum Payment – Maximum Adjustment, and County Mandate Relief) to the local taxing jurisdictions. Therefore, the only analysis that may be meaningful for license renewal is the comparison between the local taxing jurisdictions' total tax revenues and the Shared Revenue *Utility* payments they've received. The Town of Two Creeks and Manitowoc County are the recipients of the Shared Revenue *Utility* payments attributable to PBNP. Tables 2-6 and 2-7 list the Town of Two Creeks' and Manitowoc County's total tax revenues and the Shared Revenue *Utility* payments from the State of Wisconsin. As is presented in the tables, the Shared Revenue *Utility* payments attributable to PBNP represent approximately 14 to 20 percent (excluding the 1999 payment) of the Town of Two Creeks' total tax revenues. Additionally, the Shared Revenue *Utility* payments attributable to PBNP represent approximately 1.4 to 2.0 percent of Manitowoc County's total tax revenues.

2.8 Land Use Planning

A majority of the PBNP permanent workforce (approximately 81 percent) resides in Manitowoc County. The County occupies roughly 380,934 acres and is rural in nature, with over 73 percent of its area utilized for agriculture. Two percent of the County is classified as urban or developed, while forests, grasslands, and wetlands constitute approximately one-quarter of the land area (WDNR 2001i). The State of Wisconsin established a statute outlining the development of farmland preservation areas to help decrease urban sprawl. Tax incentives are given to farmers to maintain lands identified as prime agricultural (Two Rivers City Council 1988). Manitowoc County has yet to compose a comprehensive land use plan and development is governed by the Manitowoc County zoning ordinances.

Therefore, this section focuses on the City of Manitowoc, the City of Two Rivers, the Town of Two Creeks, and the Village of Mishicot, which in total contain 79 percent of the PBNP employees. The Cities of Manitowoc and Two Rivers both have comprehensive plans to guide development and contain 47 percent and 19 percent of the employee population, respectively. Both cities have experienced some growth over the last several decades and their comprehensive plans reflect planning efforts and public involvement in the planning process. Land use planning tools, such as zoning, guide future growth and development. Both plans share the goals of encouraging growth and development in areas where public facilities, such as water and sewer systems, exist or are planned. The Village of Mishicot and the Town of Two Creeks, which contain 13 percent of the PBNP employee population, have not completed their comprehensive plans so the discussion of their land use planning will be limited to zoning ordinances and information from local planning officials.

City of Manitowoc

The City of Manitowoc occupies roughly 10,124 acres. Over three-quarters of the land area in the City is developed, primarily for residential uses (35 percent). The remaining developed land is divided among commercial (5 percent), industrial (9 percent), institutional/public (12 percent), transportation (9 percent), and park/recreational (8 percent) uses. Undeveloped land comprises 22 percent of the City of Manitowoc's land area, with more than half available for development (1,283 acres) (Manitowoc Common Council and Plan Commission 1999).

The City of Manitowoc has experienced a steady rate of new housing construction since 1990, averaging approximately 70 new single-family homes and 63 multi-family units per year. This rate of new housing construction is a reversal of trends that occurred in the 1980s when housing construction was severely depressed due to high interest rates, poor economic conditions, and a declining population. The current rate of housing construction is comparable to the rates the City experienced in the 1970s. Most residential development in the last 20 years has occurred in the northern and western parts of the City. In 1997, the City had 164 platted lots available for construction in residential subdivisions (Manitowoc Common Council and Plan Commission 1999).

Over the next 20 years, the majority of new single-family housing will be built in the north, northwest, and west sides of the City on vacant lands zoned residential. Another source of future residential growth is the infilling of vacant platted lots in existing neighborhoods. A high priority of the land use plan is annexing towns and land adjacent to the City of Manitowoc and servicing these areas with public utilities. A 20-year "Urban Service Area" has been delineated to guide this growth. The plan also encourages the conversion of vacant, industrially-zoned parcels into residential areas. The combination of these policies will insure available housing for residential growth over the next twenty years (Manitowoc Common Council and Plan Commission 1999).

Since the last comprehensive land use inventory was completed in 1978, industrial and commercial land used have increased from 925 acres to 1,393 acres. Much of this expansion has occurred in planned business and industrial park settings on the west side. The general westward shift of new development is expected to continue through the next 20-year planning period. There are five key commercial and mixed-use redevelopment sites outside the downtown area addressed by the Comprehensive Plan for special planning and design consideration. The goals are improving the efficiency and appearance of these areas to increase their marketability and the City's tax base (Manitowoc Common Council and Plan Commission 1999).

City of Two Rivers

The *Comprehensive Plan for the City of Two Rivers* was adopted in 1988. Land use change has been slow in the City and surrounding areas and little urban development has occurred outside the City limits. The City of Two Rivers has experienced declines in both economic strength and population since the early 1980s. This economic decline resulted from the loss of manufacturing companies and the impact was intensified by the City's reliance on this sector. A primary goal of the Comprehensive Plan is to increase the population of Two Rivers through the expansion of economic opportunities (Two Rivers City Council 1988).

The City of Two Rivers has limited land available for development within its City limits. Poor soils, preservation areas, and Lake Michigan also constrain expansion into some areas adjacent to the City. The Comprehensive Plan encourages the extension of utilities to vacant land for residential development and notes that residential growth will require the necessary conversion of prime agricultural land. The City plans to market annexation to adjacent towns to accommodate growth on the City's fringe. For additional residential lands, the Plan proposes that the City extend utilities to the first proposed subdivision that meets the City's requirements (Two Rivers City Council 1988). Two tracts of land, 50 and 80 acres, are currently planned for residential development, with 8 acres potentially zoned as commercial (Two Rivers Economic Development 2001).

The City of Two Rivers owns 140 acres of industrial-zoned property that is available for development (Two Rivers Economic Development 2001). The Comprehensive Plan recommends the purchase and annexation of new lands for industry as needed. Commercial and industrial land use will be expanded by creating a "Redevelopment Authority" for downtown and obsolete industrial properties. The rebuilding efforts will include aesthetic and pedestrian improvements to make the area more attractive to businesses (Two Rivers City Council 1988).

The goals of the Comprehensive Plan will be accomplished through economic development, land acquisition, zoning, subdivision control, capital budgeting for public improvements, and community development. The Plan notes that Two Rivers has little non-conforming or blighting land uses as a result of years of effective zoning ordinances and enforcement. In general, Two Rivers has experienced minimal land use change in the past few years. The City handled previous growth sensibly; therefore, the land use base that Two Rivers will use to plan future development is excellent (Two Rivers City Council 1988).

The Town of Two Creeks

The Town of Two Creeks occupies approximately 10,680 acres. The Town is largely rural and, in a recent future land use survey conducted by Town land use planning officials, residents expressed an interest in preserving the Town's current state (Sheley 2002). The Town does not have a land use plan, but does use zoning to preserve it's rural character. The Town has experienced relatively little land use change over the last several decades (Sheley 2002). WEPCO is one of the largest land-owners in the town.

Village of Mishicot

The Village of Mishicot is a small, primarily residential community with 1,422 inhabitants (U.S. Census Bureau 2001). The main change in land use from the 1970s is an expansion of commercial land uses. There has been a large increase in the amount of land used for golf courses and condominium development. Approximately 50 percent of the Village's land area is proposed for single-family residential development. Mishicot anticipates continued growth in resort land use and continued single- and two-family residential development (Village of Mishicot 2001).

The Village of Mishicot is in the final draft stage of a comprehensive plan. Along with the zoning code, current development is guided through its subdivision ordinance, its comprehensive plan, and official map ordinance. The only restrictions to residential growth in the zoning code are lot size limitations for different residential use categories. All subdivisions are subject to review by the Village Plan Commission and final approval by the Village Board (Village of Mishicot 2001).

2.9 Social Services and Public Facilities

2.9.1 Public Water Supply

PBNP pumps groundwater for use as potable water and is not connected to a municipal system. At the present time, the water supply systems in Manitowoc County are operating below their maximum capacities. This level of operation demonstrates that each community could absorb new employees without jeopardizing water supplies. Table 2-8 identifies the major water suppliers in Manitowoc County, their average daily output, and their maximum daily capacity.

2.9.2 Transportation

PBNP has a northern and a southern entrance; however, the northern entrance was closed following the events of September 11, 2001. Employees enter the southern entrance by traveling east on Nuclear Road to Lakeshore Road (see Figure 2-2). Nuclear Road intersects State Route 42 approximately 1 mile west of the plant. State Route 42 has a north-south orientation and is used by the majority of employees who travel from the Manitowoc, Two Rivers, and Mishicot areas south of PBNP. Residents of Mishicot connect to State Route 42 via County Route V, which runs east-west. Traffic count data for each of these State and County routes is shown in Table 2-9; however, traffic count data for rural roads is not available (WDOT 2001). The State of Wisconsin does not make Level of Service determinations in rural non-metropolitan areas unless it has been deemed necessary. None of the roads listed have had Level of Service determinations calculated by the Wisconsin Department of Transportation (WDOT 2001).

2.10 Meteorology and Air Quality

Appendix F, Section F.1.2.3 contains meteorological information relevant to the severe accident mitigation alternatives analysis. PBNP is located in Manitowoc County, Wisconsin, which is part of the Lake Michigan Intrastate Air Quality Control Region (AQCR). This AQCR is currently in attainment for all criteria pollutants (EPA 2003).

The Milwaukee-Racine metropolitan area (in the Southeastern Wisconsin AQCR), approximately 70 miles from PBNP, is the closest non-attainment area and is designated as Severe-17 under the one-hour ozone standard (EPA 2003). In 1997 EPA adopted an eight-hour ozone standard. Monitoring data has indicated that ten Wisconsin counties, including Manitowoc County, may be designated non-attainment under the eight-hour ozone standard (Doyle 2003). EPA will make final eight-hour non-attainment designations by April 15, 2004.

In 1997 EPA adopted new annual arithmetic mean and 24-hour standards for fine particulate matter with diameters of 2.5 microns or less ($PM_{2.5}$). Monitoring results from the last three years indicate that no county in Wisconsin currently exceeds either the annual arithmetic mean or the 24-hour average $PM_{2.5}$ standard. EPA designations of non-attainment areas under the $PM_{2.5}$ standards are anticipated in 2007.

The closest non-attainment areas for other criteria pollutants are:

- Carbon monoxide – Pittsburgh, Pennsylvania, approximately 500 miles from PBNP (in the Southwest Pennsylvania Intrastate AQCR)
- Particulate matter with diameters of 10 microns or less (PM_{10}) – Cook County, Illinois, approximately 170 miles from PBNP (in the Metropolitan Chicago Interstate AQCR)
- Sulfur dioxide – Lake County, Indiana, approximately 190 miles from PBNP (in the Metropolitan Chicago Interstate AQCR).

2.11 Historic and Archaeological Resources

Area History in Brief

Glaciers last flowed into Wisconsin roughly 25,000 years ago and reached their greatest extent 14,000 to 16,000 years ago, covering approximately two-thirds of the State. The retreat of the ice front was interrupted a number of times by re-advances, but the last glacier touched Wisconsin approximately 10,000 years ago. Historic records indicate that, at that time, Paleo Indians entered Wisconsin as they hunted woolly mammoth, mastodon, and bison. These large mammals lived on the abundant vegetation that began to grow as the glaciers retreated northward. Approximately 8,000 years ago, during the Archaic Period, the climate grew warmer and dryer and the large Ice Age mammals were replaced by the animals presently found in the State. People lived in small family groups in caves, rock shelters, along rivers, and around lakes and wetlands. They harvested wild plants, nuts, and acorns and hunted smaller animals, such as elk and deer. Approximately 3,000 years ago, during the Woodland Period, people lived in large villages and began to use bows and arrows to hunt. It was during this time period that many mounds, including effigies or mounds built in the shapes of turtles, birds, and bears were built throughout the State. The mounds served the dual purposes of being both sacred areas and burial sites. The Mississippian Period began approximately 1,000 years ago. Wisconsin inhabitants during this period were called the Oneota Indians and they lived in villages and planted gardens to grow crops such as corn, beans, and squash. They had a complex trade network that extended to both the Atlantic and Gulf coasts (UI 2001). The Historic Period began in the early 1600s with the Ho Chunk (Winnebago), Potawatomi, Menominee, and Chippewa Indians inhabiting the region as the first European explorers arrived (WHS 2001).

Jean Nicolet, a French explorer, arrived in Green Bay, Wisconsin, in 1634. Green Bay was one of the first French settlements, and there was a flourishing fur trade in the area. The region was lost to the English during the French and Indian Wars, but later regained during the American Revolution. However, the official transfer of ownership was completed only after the War of 1812.

Scattered Indian trading posts were established during the 1700s. By 1800, there were approximately 200 settlers and fewer than 15,000 Indians in Wisconsin. In the 1830s, the region was heavily forested and significant settlement began when lumbering was started and the streams were dammed for water power. The vast forests of pine and larchwood led to shipbuilding. In 1848, Wisconsin became a state. Toward the end of the 19th century, farm settlement in the region followed the lumber industry (WEPCO 1972). Agriculture persists today as the principal land use (PSCW 1994).

Pre-Operation Historic/Archaeological Analysis

The *Final Environmental Statement Related to Operation of Point Beach Nuclear Plant Units 1 and 2* (WEPCO 1972) stated that the PBNP property had no known historical significance and there were no national historic sites located in the immediate vicinity of the plant. An Indian burial site north of the plant property line was identified, but was not disturbed during plant construction (WEPCO 1972).

Additionally, the PBNP site is situated over a vast forested area that was buried by the Valderan Glacier approximately 12,400 years ago. The forest extends for many miles and is not unique to the plant site. Excavation during construction of the plant permitted collections of samples for study by federal and State agencies, without having a significant detrimental effect on the future value of the buried forest (WEPCO 1972).

Current Historic/Archaeological Analysis

As of 2001, 19 properties in Manitowoc County and 8 properties in Kewaunee County have been listed in the National Register of Historic Places. Of these 27 properties, only one, the Rawley Point Light Station, falls within a 6-mile radius of PBNP (DOI 2001).

The Rawley Point Light Station was built in 1874 on the western shore of Lake Michigan in an area that is presently the Point Beach State Forest. The 1.5-story wooden structure is still used as a navigation aid and U.S. Coast Guard housing. The Light Station was listed in the National Register of Historic Places in 1975 (NPS 2001a). See Figure 2-2 for location.

In 1995, the Great Lakes Archaeological Research Center, Inc., conducted an examination of the archaeological site files and maps maintained by the State Historical Society of Wisconsin prior to construction of the PBNP Independent Spent Fuel Storage Installation. The examination covered a 3-mile radius and resulted in the discovery of 11 prehistoric camp sites, 4 unknown camps, 1 Middle Woodland camp, 1 ancient village, and Jean Vieau’s landing place at Two Creeks. Jean Vieau, an employee of the Northwest Fur Company, is thought to have landed there in 1795 for the purpose of establishing trading posts in the region (WI-SHPO 1995). None of the sites identified would be impacted by continued operation of PBNP or the PBNP ISFSI.

Of note, the National Park Service established the Two Creeks Buried Forest Unit of the Ice Age National Scientific Reserve approximately two miles north of PBNP property (Figure 2-2). The Reserve is a national park system affiliate and provides public access to the Ice Age National Scenic Trail and remnants of a prehistoric buried forest. The Ice Age National Scenic Trail is 1,200 miles long and covers the entire length of the moraines marking the furthest advance of the last glacier in Wisconsin (NPS 2001b).

A fisherman's shed located on PBNP property is of indeterminate age, but is most likely more than 50 years old. It has not been submitted to the National Register of Historic Places for eligibility. An independent analysis determined that the shed is not eligible for the National Register of Historic Places based on its architectural significance. A formal Determination of Eligibility would be necessary to determine if its historic significance makes it eligible, but the report suggests that the building does not satisfy the eligibility criterion (Van Dyke 2003). However, a verbal agreement with the former landowner was reached and the shed is being preserved in its present state by NMC. Should future PBNP construction activities be proposed that could potentially affect the structure, an eligibility determination will be completed.

Fisherman's shed on PBNP property

2.12 Known or Reasonably Foreseeable Projects in the PBNP Vicinity

2.12.1 Kewaunee Nuclear Power Plant

KNPP is located on the western shore of Lake Michigan in Kewaunee County, Wisconsin, approximately five miles north of PBNP. KNPP is a single-unit 535-megawatts-electrical pressurized-water reactor (NMC 2001), with a thermal power rating of 1,650 MW (WPSC 1972). The KNPP site consists of approximately 908 acres, jointly owned by Wisconsin Public Service Corporation and Alliant Energy. Under an arrangement similar to that of PBNP, NMC holds the operating license for KNPP and is responsible for plant operation and maintenance.

At KNPP, a maximum of 420,000 gpm of cooling water and up to 25,000 gpm for in-plant use are drawn from Lake Michigan and discharged to the lake as a once-through system. Groundwater from an onsite well is used as the source for potable and sanitary water. Hydrologic characteristics of this portion of Lake Michigan indicate that the discharge heat of KNPP does not interact with the discharge heat of PBNP (WPSC 1972).

View of Kewaunee Nuclear Power Plant from PBNP

NMC conducts a radiological surveillance program on and in the vicinity of KNPP. A total of 17 parameters are measured, including four air samples (e.g., airborne particulates), nine terrestrial samples (e.g., well water), and four aquatic samples (e.g., fish). Radionuclide concentrations from the surveillance program are compared to levels measured at control locations and in pre-operational studies. These comparisons indicated background-level radioactivity in all samples collected in the year 2000 (NMC 2001).

2.12.2 PBNP Combustion Turbine

PBNP has a 20-megawatt oil-fired combustion turbine, used for spinning reserve, alternate power supply during plant blackouts, and peaking purposes. The combustion turbine is fully capable of operating independently of the remainder of the plant (PBNP 2002, pg. 8.9-1). PBNP operates the combustion turbine pursuant to Chapter 285 of the Wisconsin Statutes and the plant's air pollution control operation permit.

Table 2-1. Geologic Formations in Eastern Wisconsin.

Geologic Age	Geologic Name	Description
Quaternary	Recent deposits	Sand, silt, peat, and gravel
	Pleistocene deposits	Glacial drift, mostly till, clay silt, sand, gravel, and boulders
Silurian	Niagara Dolomite	Dolomite, thin-bedded to massive, some coral reefs. Some chert.
Ordovician	Maquoketa Shale	Shale and dolomitic shale
	Sinnipee Group (Galena Dolomite Decorah formation Plattevillte formation)	Dolomite. Some shale and limestone.
	St. Peter Sandstone	Sandstone, with some lime-stone shale and conglomerate
	Prairie du Chien Group	Dolomite with some sandstone and shale
Cambrian	Trempealean Formation Franconia Sandstone Dresbach Group	Sandstone, fine to coarse grained, dolomitic. Some shale and dolomite beds.
Precambrian	Undifferentiated	Granite and quartzite

Source: UWEX 1995.

Table 2-2. Groundwater Wells On and Within Six Miles of PBNP.

Well Name	Depth (ft)	Aquifer	Average Daily Use (gal)
Site Wells			
PBNP – Main	257	Silurian	7,707[a]
PBNP – Site Boundary Control Center	300	Silurian	1,000[b]
PBNP – Lakeside Training Center	480	Sinnippe	0[c]
PBNP – Energy Information Center	262	Silurian	90 (Metcalf & Eddy 1991)
PBNP – Abandoned Residence	N/A[d]	N/A[d]	500
PBNP – North Gate	300	Silurian	Negligible
Off Site Wells			
KNPP – WI Unique Well No: BE601	N/A[d]	Limestone or Dolomite	5,100[e]
KNPP – WI Unique Well No: BE602	N/A[d]	Limestone or Dolomite	4,300[e]
Mishicot – WI Unique Well No: BG243	130	Silurian[f]	Part of 150,000 total
Mishicot – WI Unique Well No: KY566	372	Sinnippe[f]	Part of 150,000 total

Source: WDNR 2001a; WDNR 2001j

a. Latest Record, 1987-2000.
b. DNR listed normal pumpage.
c. Inactive.
d. N/A = not available.
e. Latest Record, 1977-1989.
f. Assumed based on depth of well.

Table 2-3. Threatened and Endangered Species Recorded in Brown and Manitowoc Counties.

Common Name	Scientific Name	State Status	Federal Status
Plants			
Bog bluegrass	*Poa paludigena*	Threatened	---
Clustered broomrape	*Orobanche fasciculata*	Threatened	---
Dune thistle	*Cirsium pitcheri*	Threatened	Threatened
Dwarf lake iris	*Iris lacustris*	Threatened	Threatened
Early anemone	*Anemone multifida var*	Endangered	
Fairy slipper	*Calypso bulbosa*	Threatened	---
Handsome sedge	*Carex formosa*	Threatened	---
Heart-leaved plantain	*Plantago cordata*	Endangered	---
Lake-cress	*Armoracia lacustris*	Endangered	---
March valerian	*Valeriana sitchensis ssp*	Threatened	
Pale green orchid	*Platanthera flava* var *herbiola*	Threatened	---
Prairie white-fringed orchid	*Platanthera leucophaea*	Endangered	Threatened
Purple false oats	*Trisetum melicoides*	Endangered	---
Ram's-head lady's slipper	*Cypripedium arietinum*	Threatened	
Round-leaved orchis	*Amerorchis rotundifolia*	Threatened	
Sand dune willow	*Salix cordata*	Endangered	---
Sand reed-grass	*Calamovilfa longifolia* var *magna*	Threatened	---
Seaside crowfoot	*Ranunculus cymbalaria*	Threatened	---
Shore sedge	*Carex lenticularis*	Threatened	---
Snow trillium	*Trillium nivale*	Threatened	---
Sticky false-asphodel	*Tofieldia glutinosa*	Threatened	---
Thickspike	*Elymus lanceolatus* ssp *psammophilus*	Threatened	---
Yellow gentian	*Gentiana alba*	Threatened	---
Birds			
Acadian flycatcher	*Empidonax virescens*	Threatened	---
American peregrine falcon	*Falco peregrinus anatum*	Endangered	---
Bald eagle	*Haliaeetus leucocephalus*	---	Threatened
Barn owl	*Tyto alba*	Endangered	---
Caspian tern	*Sterna caspia*	Endangered	---
Cerulean warbler	*Dendroica cerulea*	Threatened	---
Common tern	*Sterna hirundo*	Endangered	---
Forster's tern	*Sterna forsteri*	Endangered	---
Great egret	*Ardea alba*	Threatened	---
Hooded warbler	*Wilsonia citrina*	Threatened	---

Table 2-3. Threatened and Endangered Species Recorded in Brown and Manitowoc Counties. (Continued)

Common Name	Scientific Name	State Status	Federal Status
Osprey	*Pandion haliaetus*	Threatened	---
Piping plover	*Charadrius melodus*	Endangered	Endangered
Red-shouldered hawk	*Buteo lineatus*	Threatened	---
Snowy egret	*Egretta thula*	Endangered	---
Fish			
Greater redhorse	*Moxostoma valenciennesi*	Threatened	---
Longear sunfish	*Lepomis megalotis*	Threatened	---
Redfin shiner	*Lythrurus umbratilis*	Threatened	---
Mussels			
Ellipse	*Venustaconcha ellipsiformis*	Threatened	---
Monkeyface	*Quadrula metanevra*	Threatened	
Slipershell mussel	*Alasmidonta virdis*	Threatened	
Amphibia			
Blanchard's cricket frog	*Acris crepitans blanchardi*	Endangered	---
Snails			
Cherrystone drop	*Hendersonia occulta*	Threatened	---
Midwestern pleistocene vertigo	*Vertigo hubrichti*	Endangered	---
Reptiles			
Blanding's turtle	*Emydoidea blandingii*	Threatened	---
Wood turtle	*Clemmys insculpta*	Threatened	---

Source: WDNR 2003b.

Table 2-4. Estimated Populations and Annual Growth Rates in Manitowoc County, Wisconsin, and the United States from 1980 to 2030.

Population and Average Annual Growth Rate in the Previous Decade						
	Manitowoc County		Wisconsin		United States	
Year	Number	Percent	Number	Percent	Number	Percent
1980	82,918[a]	0.08	4,705,767[a]	0.7	226,545,805[a]	1.1
1990	80,421[a]	-0.3	4,891,769[a]	0.4	248,709,873[a]	1.0
2000	82,887[b]	0.3	5,363,675[b]	1.0	281,421,906[b]	1.3
2010	84,625[c]	0.2	5,600,694[e]	0.4	298,710,000[d]	0.6
2020	84,421[c]	-0.02	5,903,077[e]	0.5	323,724,000[d]	0.8
2030	84,750[e]	0.03	6,205,461[e]	0.6	349,789,000[d]	0.8

a. U.S. Census Bureau 1995.
b. U.S. Census Bureau 2000c.
c. WDOA 1993.
d. U.S. Census Bureau 2000e.
e. Tetra Tech NUS calculations.

Table 2-5. Minority and Low-Income Population Census Block Groups.

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
Brown	WI	168	2	1	0	1	0	0	13	6	2
Calumet	WI	27	0	0	0	0	0	0	0	0	0
Door	WI	21	0	0	0	0	0	0	0	0	0
Fond Du Lac	WI	7	0	0	0	0	0	0	0	0	0
Kewaunee	WI	16	0	0	0	0	0	0	0	0	0
Manitowoc	WI	75	0	0	0	0	0	0	0	0	0
Marinette	WI	3	0	0	0	0	0	0	0	0	0
Oconto	WI	15	0	0	0	0	0	0	0	0	0
Outagamie	WI	111	3	0	0	0	0	0	3	0	0
Shawano	WI	5	0	0	0	0	0	0	0	0	0
Sheboygan	WI	65	0	0	0	0	0	0	0	0	0
Winnebago	WI	58	0	0	0	0	0	0	0	0	0
Total		571	5	1	0	1	0	0	16	6	2

State Averages

State	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
Wisconsin	0.90%	1.70%	0.00%	5.70%	1.60%	1.20%	11.07%	3.60%	8.7%

Table 2-6. Town of Two Creeks -- Total Tax Revenues and Shared Revenue Utility Payments from the State of Wisconsin.

Year	Total Tax Revenues[a]	Shared Revenue Utility Payment on behalf of PBNP[b]	Percent of Total Tax Revenues
1996	$982,600	$190,100	19.3
1997	$1,026,300	$191,900	18.7
1998	$937,200	$193,400	20.1
1999	$270,500[c]	$194,600	72.0
2000	$1,420,800	$194,600	13.7

a. Treviranus 2002.
b. Seeley 2001b.
c. The Town of Two Creeks' 1999 interest income was negative due to market fluctuations.

Table 2-7. Manitowoc County -- Total Tax Revenues and Shared Revenue Utility Payments from the State of Wisconsin.

Year	Total Tax Revenues[a]	Shared Revenue Utility Payment on behalf of PBNP[b]	Percent of Total Tax Revenues
1996	$40,129,000	$800,000	2.0
1997	$41,556,900	$800,000	1.9
1998	$47,112,400	$800,000	1.7
1999	$51,694,700	$800,000	1.5
2000	$55,931,600	$800,000	1.4

a. Treviranus 2002.
b. Seeley 2001b.

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

Water Supplier	Average Daily Use (Gallons per day)	Maximum Daily Capacity (Gallons per day)
Cleveland Waterworks	120,000	1,150,000
Kellnersville Waterworks	320,000	500,000
Kiel Waterworks	415,000	2,660,000
Manitowoc Waterworks	8,000,000	11,000,000[a]
Maribel Waterworks	25,000	720,000
Mishicot Waterworks	150,000	1,200,000
Reedsville Waterworks	45,000	1,000,000
St. Nazianz Waterworks	60,000	1,000,000
Two Rivers Waterworks	1,300,000	4,000,000
Valders Waterworks	120,000	1,440,000
Whitelaw Waterworks	55,000	720,000

a. Manitowoc pumps surface water, but can supplement its capacity with groundwater.
Source: WDNR 2001a, WDNR 2001k.

Table 2-9. Traffic Counts for Roads in the Vicinity of PBNP

Route No.	Vicinity of	Est. AADT[a]
State Route 42	North of County Route V	4,100
	South of County Route V	3,800
County Route V	East of State Route 42	460
	West of State Route 42	1,200

AADT = Annual Average Daily Traffic volumes – all for 1999.
a. WDOT 2001.

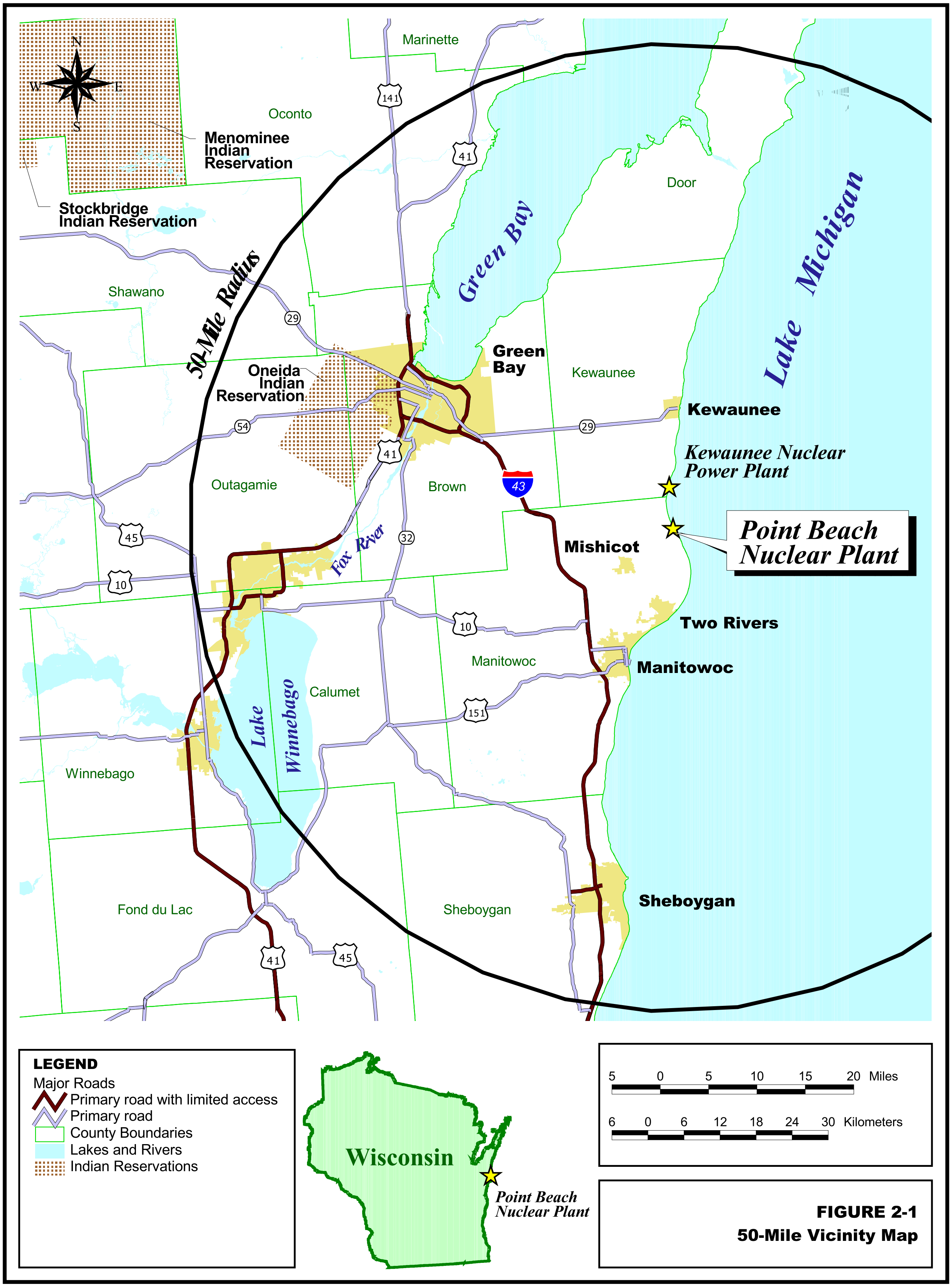


FIGURE 2-1
50-Mile Vicinity Map

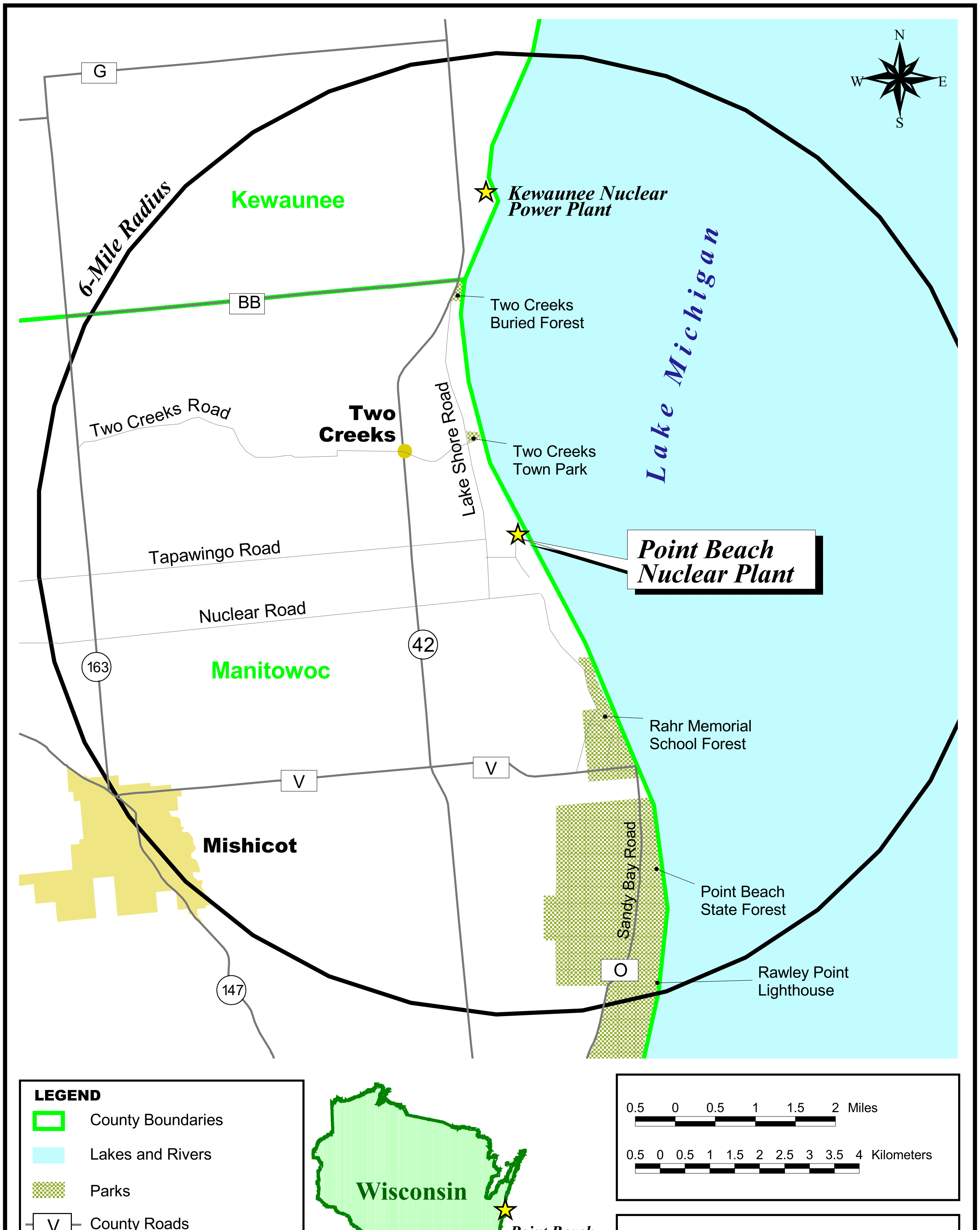


FIGURE 2-2
6-Mile Vicinity Map

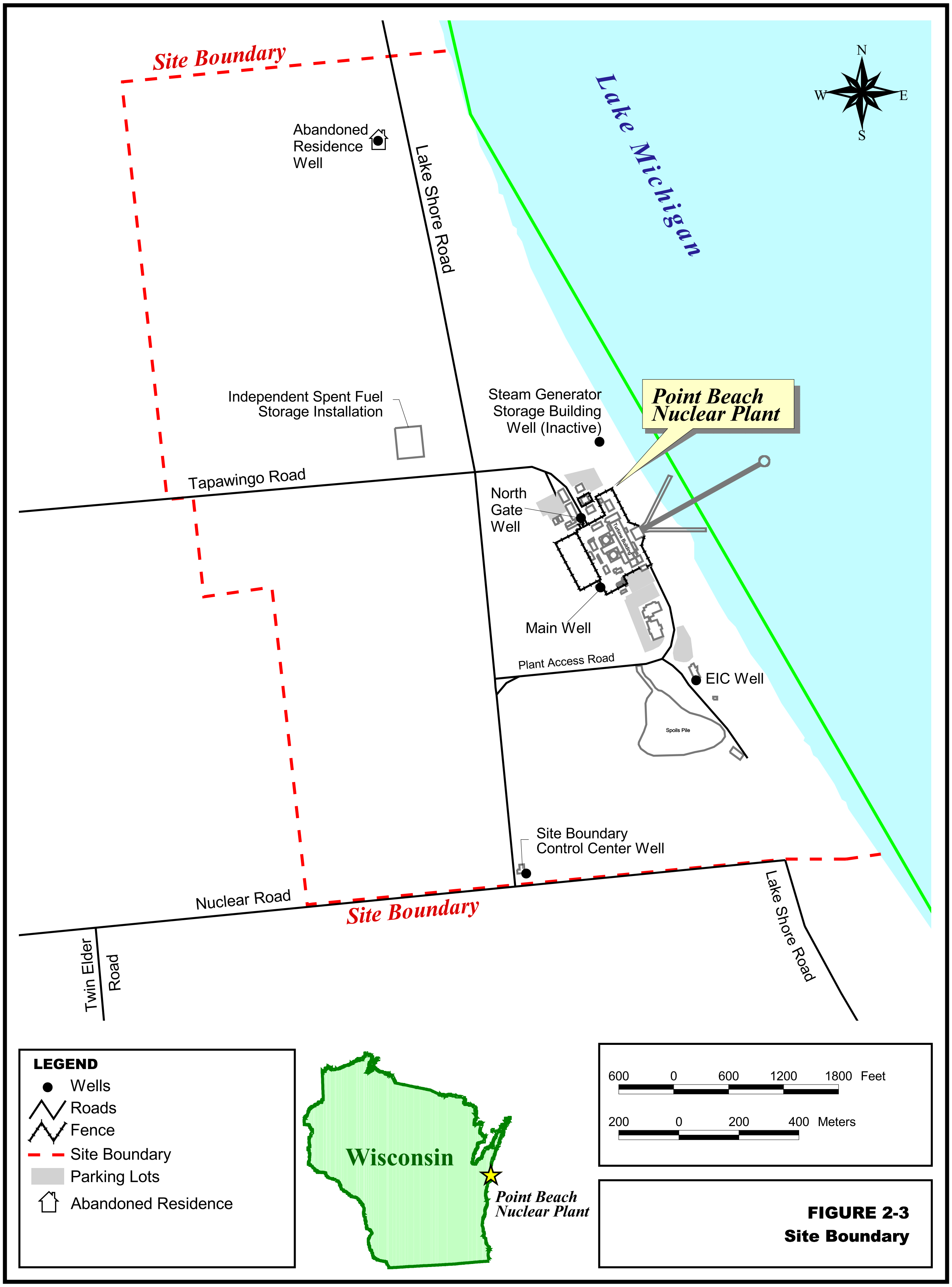


FIGURE 2-3
Site Boundary

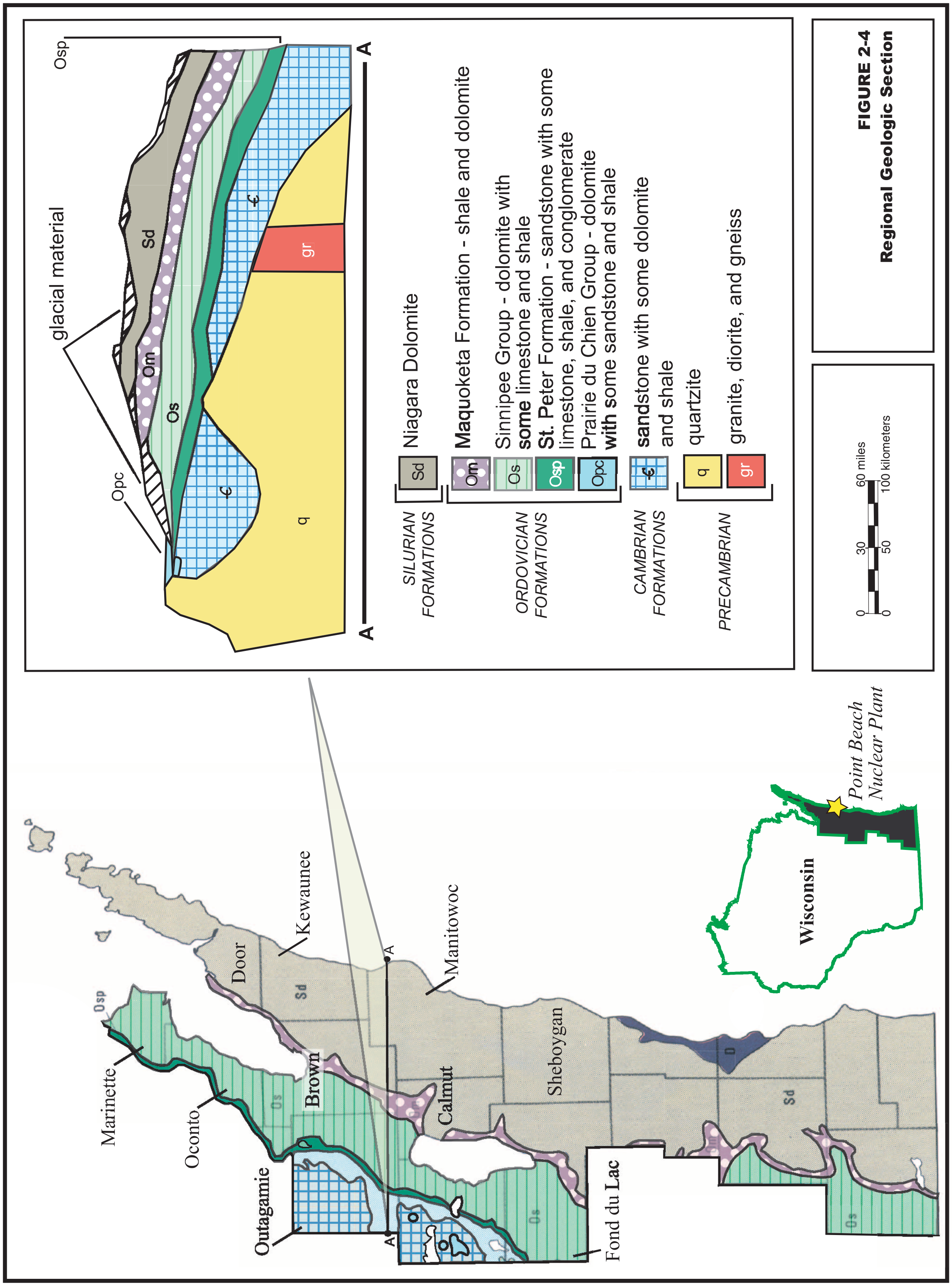


FIGURE 2-4
Regional Geologic Section

Utility\Point Beach\regional geologic section_templated.ai

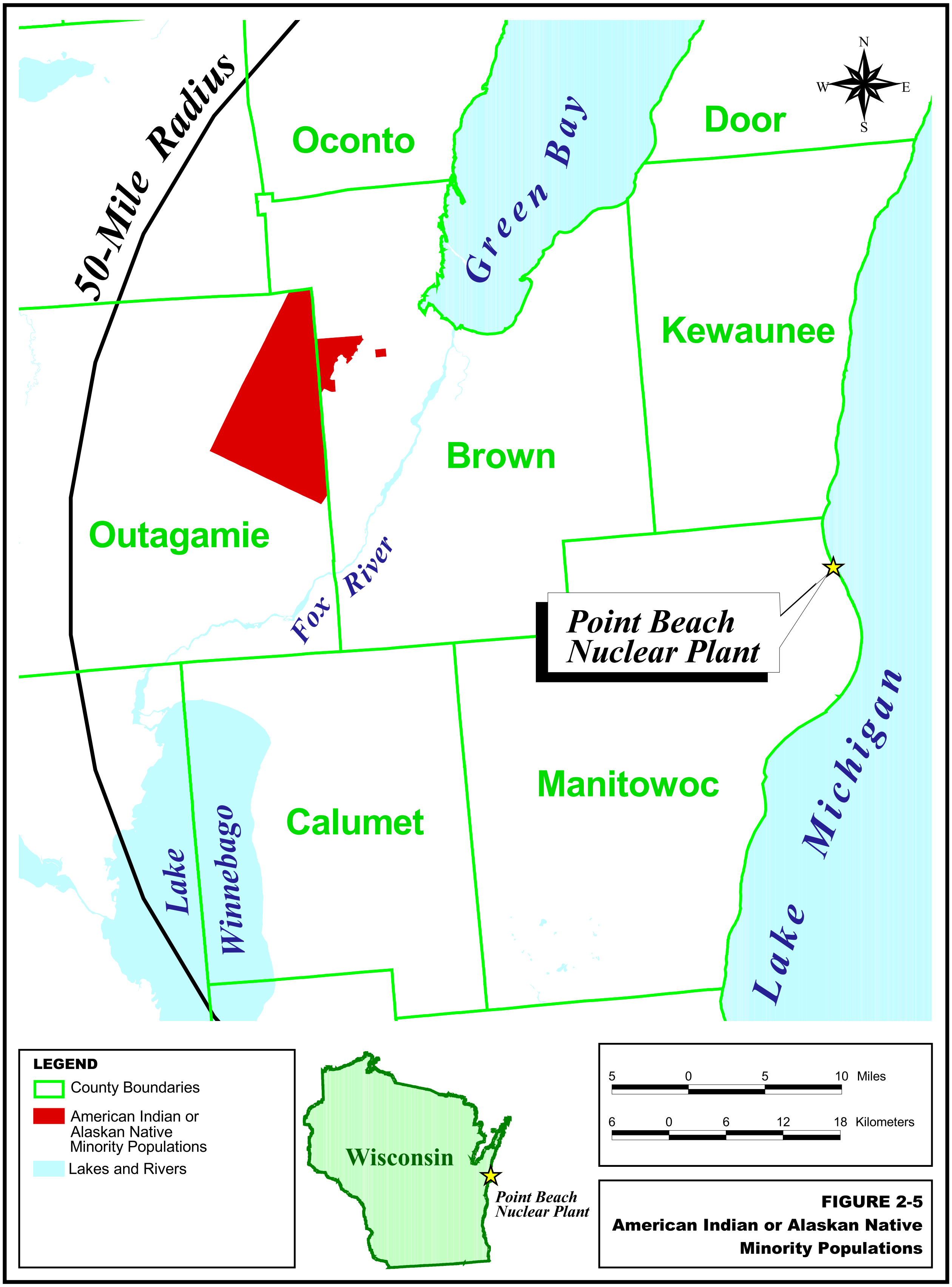


FIGURE 2-5
American Indian or Alaskan Native Minority Populations

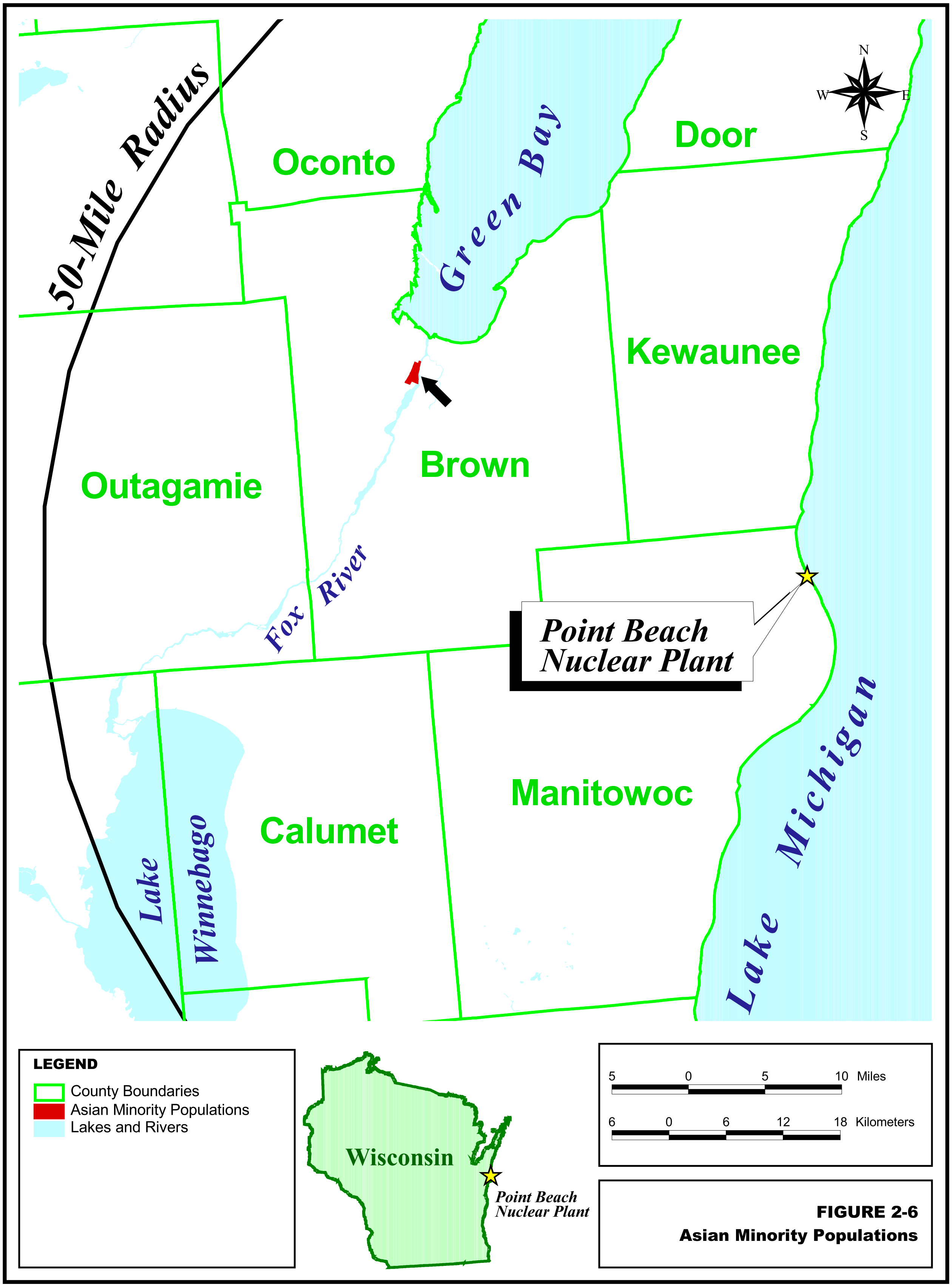


FIGURE 2-6
Asian Minority Populations

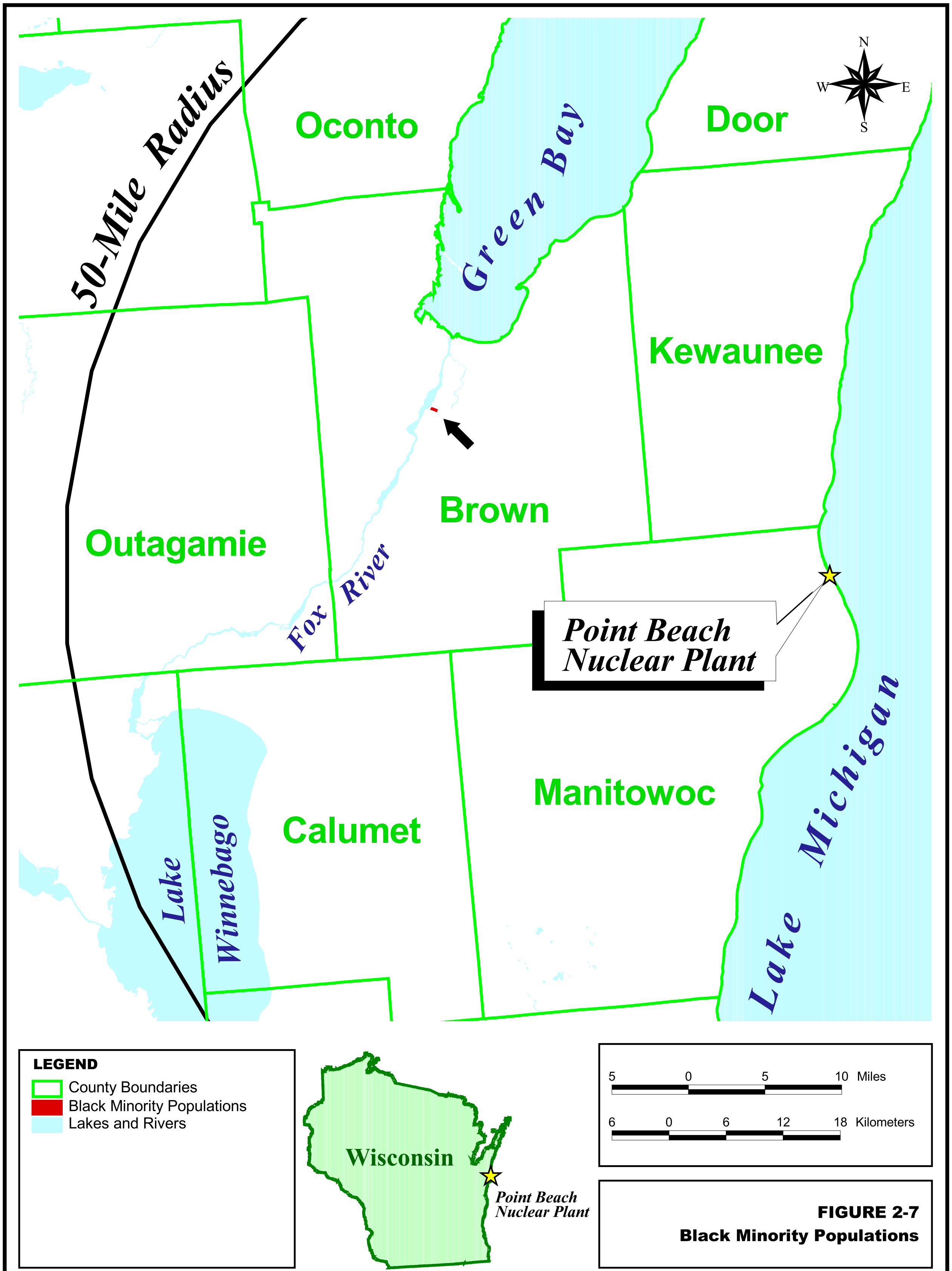


FIGURE 2-7
Black Minority Populations

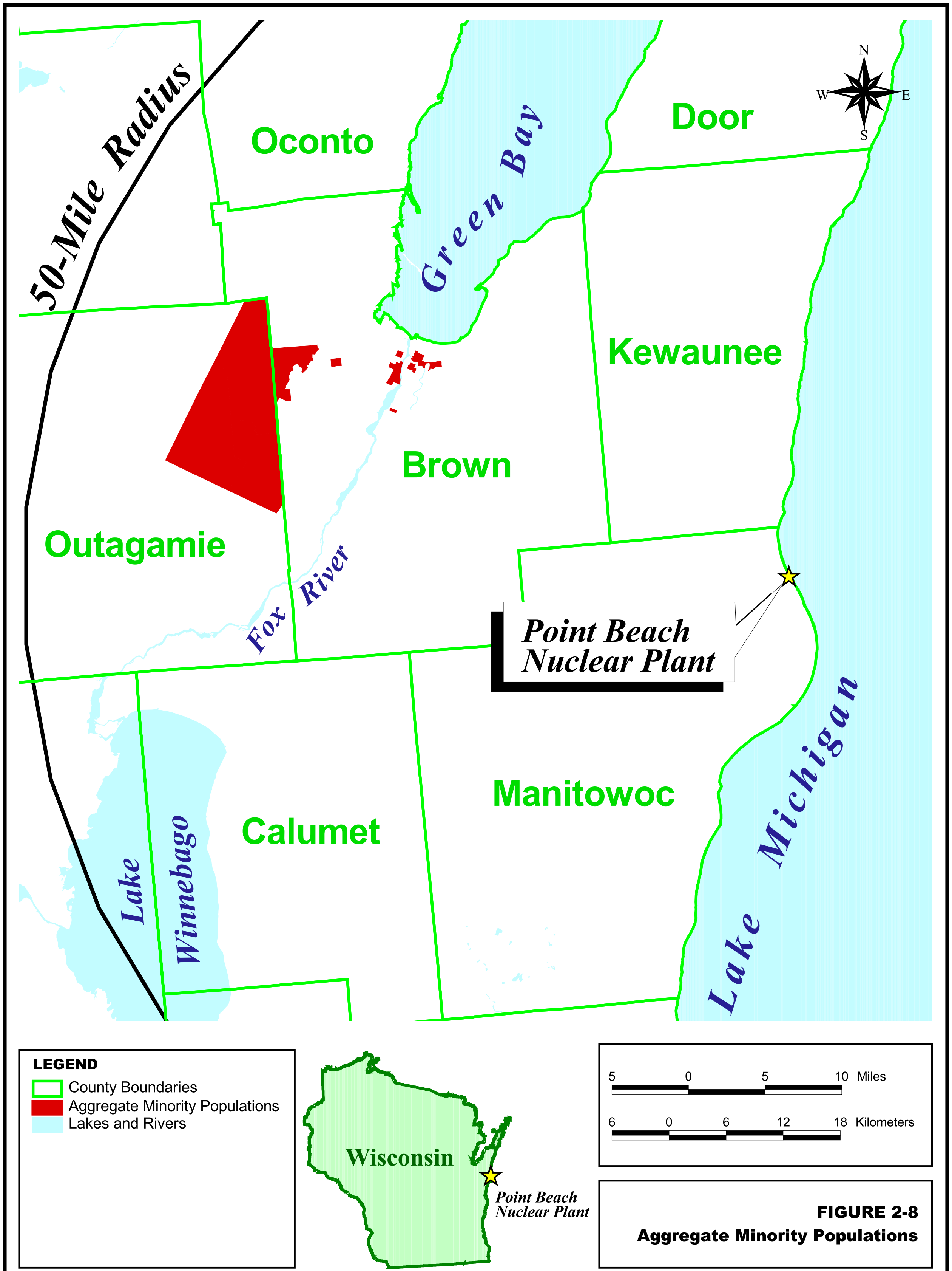


FIGURE 2-8
Aggregate Minority Populations

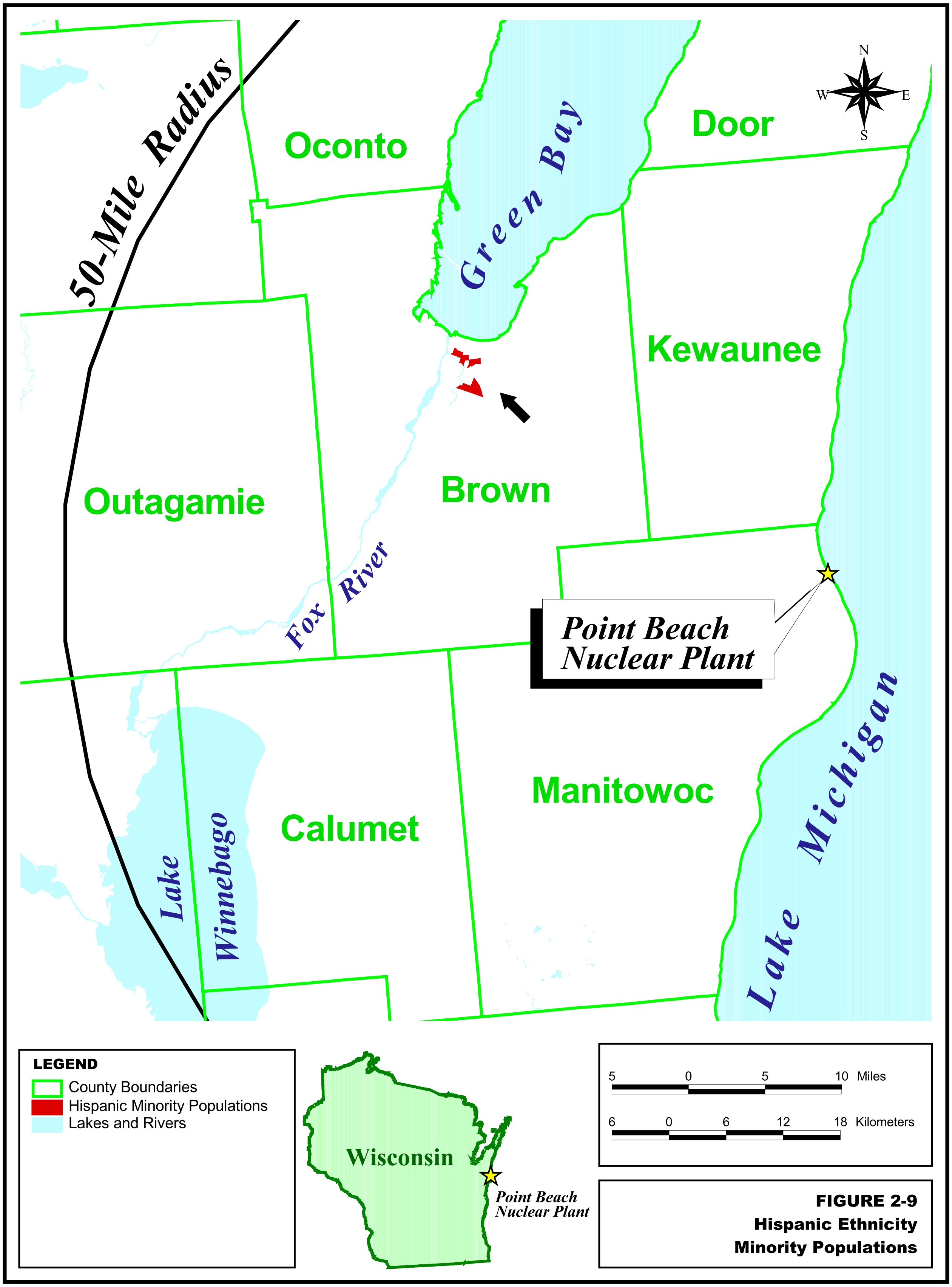


FIGURE 2-9
Hispanic Ethnicity
Minority Populations

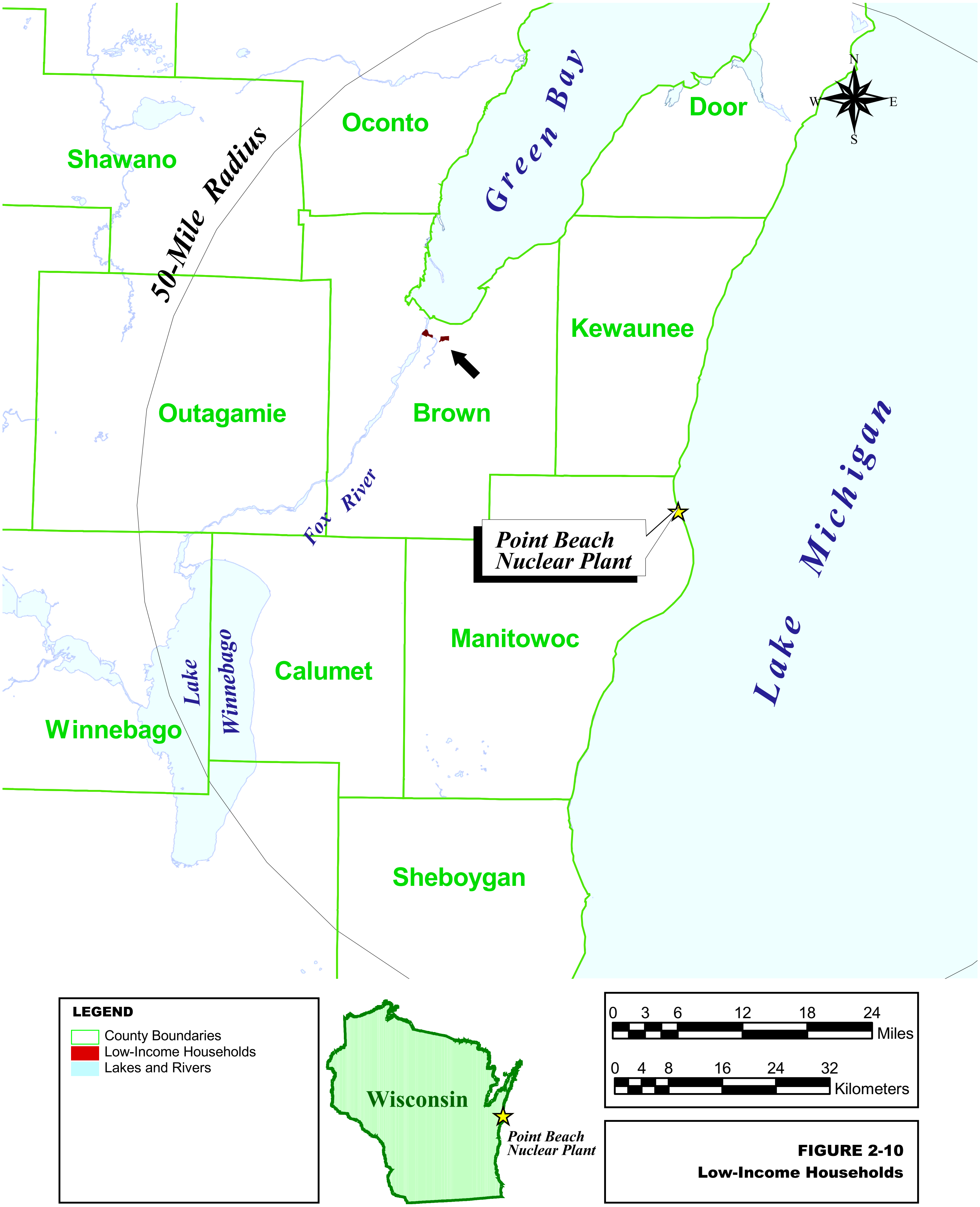


FIGURE 2-10
Low-Income Households

3.0 PROPOSED ACTION

NRC

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

Nuclear Management Company, LLC (NMC) proposes that the U.S. Nuclear Regulatory Commission (NRC) renew the operating license for the Wisconsin Electric Power Company (WEPCO)-owned Point Beach Nuclear Plant (PBNP) for an additional 20 years beyond the current license expiration dates of October 5, 2010, for Unit 1 and March 8, 2013, for Unit 2. Renewal would give NMC, WEPCO, and the State of Wisconsin the option of relying on PBNP to meet future electricity needs. Section 3.1 contains a discussion of the major plant features. Sections 3.2 through 3.4 address potential changes that license renewal could effect.

3.1 General Plant Information

General information about PBNP is available in several documents. In 1972, the U.S. Atomic Energy Commission, the predecessor agency of NRC, prepared a *Final Environmental Statement Related to Operation of Point Beach Nuclear Plant Units 1 and 2* (AEC 1972). The NRC *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996d, pg. A-76) describes PBNP features. In accordance with NRC requirements, NMC maintains an updated Final Safety Analysis Report for PBNP (PBNP 2002). NMC has referred to each of these documents while preparing this environmental report for license renewal.

3.1.1 Reactor and Containment Systems

PBNP Units 1 and 2 reactors are Westinghouse pressurized light-water moderated and cooled systems. Each unit was originally designed to produce a reactor thermal output of 1,518.5 megawatts-thermal (MWt). All steam and power conversion equipment, including each turbine generator, was originally designed to permit generation of 523.8 megawatts (MW) of gross electrical power. Unit 1 achieved commercial operation in December 1970 and Unit 2 achieved commercial operation in October 1972. Since being placed into commercial operation, each unit underwent a low-pressure turbine retrofit modification that increased the unit design output to 537.96 megawatts-electric (MWe) (PBNP 2002, pg. 1.0-1). In 2003, PBNP underwent a 1.4 percent uprate which increased the rated thermal output to 1,540 MWt and increased the gross electrical power to 545 MWe (518 MWe net) (NRC 2002a, 2002b). New PBNP fuel is slightly enriched to a nominal 5.0 weight percent uranium-235, with an average burnup for the peak rod of 45,000 megawatt days per metric ton uranium (PBNP 2002, Table 3.2-1).

Each reactor and its primary cooling system is housed in a containment building, together with the associated steam generators and circulation system. The reactor containment structure is a steel-lined, reinforced concrete cylinder with a hemispheric dome and a flat reinforced concrete foundation mat. The containment is designed to withstand an internal pressure of 60 pounds per square inch above atmospheric pressure. The plant design provides a common gallery containing the principal radioactive waste systems and the control room between the two units, which lie north and south of the common gallery in a single structure. The containment structures are enclosed in vinyl-coated steel buildings that are colored to blend with the green and brown Wisconsin countryside (AEC 1972). The facility layout is depicted in Figure 3-1.

3.1.2 Cooling and Auxiliary Water Systems

PBNP utilizes a once-through cooling system for both units that draws water from and discharges to Lake Michigan. The cooling system removes waste heat from the condensers, as well as other plant equipment, and discharges through separate flumes for each unit. At peak capacity, water is circulated at a maximum rate of 350,000 gallons per minute (gpm) (783 cubic feet per second [cfs]) through each condenser, then returned to the lake. The primary circulation of the cooling system is first through the intake structure to the forebay, then to the condensers and other equipment. Finally, cooling water exits the plant via flumes back to Lake Michigan.

Lake water is provided to the forebay through two 14-foot-diameter pipes buried beneath the lakebed. Water enters these pipes at the offshore intake structure. The intake structure is a cylinder of steel pilings filled with limestone blocks that stands upright on the lakebed 1,750 feet offshore in 22 feet of water. As originally designed, the structure had a top elevation of 8 feet above water level. As discussed in Section 2.2, the original structure attracted a large number of birds during the spring and fall migration and contributed to a number of bird mortalities. In May 2001, the intake structure was reconfigured to resolve the bird mortality issue. As modified, the structure stands approximately 11 feet tall above the lake floor, has an outside diameter of 110 feet, and an inside chamber with a diameter of 60 feet. The top is covered with a steel super structure and with a trash rack made of high-density polyethylene having approximately 7-inch by 18-inch openings (PBNP 2001).

Water enters the chamber through the trash rack as well as through void spaces around the limestone blocks and through 30-inch pipes that penetrate the blocks in a ring 5 feet above the lakebed. The pipes are covered with 1-3/16-inch by 2-inch bar grating to prevent debris and large fish from entering the intake system. In 1980, the original intake structure was modified to reduce problems with ice formation. Modifications consisted of the installation of four 6.5-foot-square concrete pipes near the lake bottom in the south half of the intake crib. The pipes are covered with a ¼-square-inch grating that is hinged for lowering in the winter months (usually December 1 to March 1) to prevent the formation of frazzle ice on the grate and the subsequent restriction of water flow. The modification was also designed to lower the velocity of water approaching the intake structure. Three of the four pipes were retained during the May 2001 modification.

Bar gates and traveling screens with 3/8-square-inch mesh are located in the forebay, where small debris and trapped fish can be removed before they enter the circulating water system.

Water is then circulated through the condensers and is returned to the lake via two steel piling troughs extending in opposite directions (30-degree angle from the plant centerline) approximately 200 feet out into Lake Michigan. The momentum of the discharge velocity is sufficient to create a high degree of mixing with the lake surface water in the immediate vicinity.

The system was designed to control the formation of needle ice within the intake structure during the winter months by use of warm water feedback. The feedback of effluent flow back through the pumphouse forebay reduces the net water withdrawn from the lake to 160,000 gpm (353 cfs) for each unit.

3.1.3 Wastewater Retention Pond

PBNP constructed a wastewater retention pond in 1968 to collect process wastewaters and sewage treatment plant effluent to settle the suspended solids (GeoSyntec Consultants 2002). Originally pond water was released to a creek via surface discharge. However, in the mid-1970’s the pond, creek, and adjacent soils were slightly contaminated with low levels of radionuclides, resulting in levels of contamination exceeding original expectations. As a result, the wastewater retention pond discharges were routed into the plant, monitored, and released to Lake Michigan with the cooling water discharges (Johansen et al. 1999).

Active wastewater treatment in the pond ended in 2002, and WEPCO subsequently closed the wastewater retention pond as prescribed by state regulations. The pond has been dewatered, and the sediments have been strengthened in place and covered with layers of soil. Soils outside the pond basin that were contaminated with low levels of cesium and cobalt-60 were removed and disposed of at a licensed off-site disposal facility. Confirmation testing ensured that any residual radionuclides were at concentrations below those required for NRC decommissioning. The site has been restored to its pre-excavation grades and planted with native plant species (GeoSyntec Consultants 2002).

3.1.4 Independent Spent Fuel Storage Installation

The Independent Spent Fuel Storage Installation (ISFSI) is located 2,500 feet northwest of the Unit 2 containment structure (Figure 2-3). The major structures of the ISFSI are two storage pads, each capable of storing 576 spent fuel assemblies in 24 casks (assuming 24 assemblies per cask), an instrumentation shack, and a perimeter fence with a dedicated security system. The minimum distance between the cask centerline and the site boundary is 2,800 ft. The distances to the lake and closest residence are

1,960 ft and 3,500 ft, respectively. The ISFSI is designed to store PBNP-generated spent fuel (WEPCO 1991).

The system used for spent fuel storage is the Ventilated Storage Cask design, which holds 24 assemblies and is designated the VSC-24. The VSC-24 is a second generation dry storage system utilizing a concrete storage cask and a steel, seal-welded basket to safely store irradiated nuclear fuel. The multi-assembly sealed basket is stored in the central cavity of the concrete cask. The cask is ventilated by internal air flow paths that allow the decay heat to be removed by natural circulation around the metal basket wall (WEPCO 1991).

The PBNP ISFSI was constructed and is operated under the provisions of Title 10 CFR Part 72, subpart K, General License for Storage of Spent Fuel at Power Reactors. The general license is limited to that spent fuel which NMC is authorized to possess at the site under the PBNP site license. Also, spent fuel must be stored in casks that have been approved by NRC under the provision of 10 CFR 72, subpart L, Approval of Spent Fuel Storage Casks. In addition, the general license for each storage cask expires 20 years after the date the particular cask was first used by PBNP for the storage of spent fuel. If the cask design is re-certified under the provision of 10 CFR 72.240, the general license for the use of the cask will be extended (WEPCO 1991).

3.1.5 Transmission Facilities

In its supplement to the environmental report for PBNP Unit 2 (WEPCO 1971, Appendix D), WEPCO identified three 345-kilovolt (kV) transmission lines that were built to connect PBNP to the electric grid. A fourth 345-kV transmission line (Q-303) was constructed by Wisconsin Public Service Corporation (WPSC) to connect the Kewaunee Nuclear Power Plant to the substation at PBNP. The WEPCO and WPSC have transferred ownership of their transmission lines to the American Transmission Company (ATC) (see Section 1.3). The four transmission lines are described below.

- Line L-111 connects to the Granville Substation via a previously existing line. The tie point is in the southwest quarter of Section 16, Township of Franklin. The route to the tie point is 20 miles long.
- Line L-121 connects to the Arcadian Substation via a previously existing line. The tie point is in the southwest quarter of Section 9, Township of Franklin. The route to the tie point is 18 miles long.

- Line L-151 connects to the North Appleton Substation via a previously existing line. The tie point is in the northwest quarter of Section 7, Township of Wrightstown. The route to the tie point is 29.7 miles long.
- Line Q-303 line runs 5.6 miles in a northerly direction to the switchyard at Kewaunee Nuclear Power Plant.

Each transmission corridor is 220 feet wide. Figure 3-2 shows the transmission system of interest. This does not include an additional line that was built to connect a previously existing line to the Milwaukee area (AEC 1972, Figure 3, page 21).

In total, for the specific purpose of connecting PBNP to the transmission system, ATC, owner and operator of the transmission lines, has approximately 73.3 miles of transmission lines that occupy approximately 1,955 acres on easement. The corridors pass through land that is primarily rolling hills covered in forests or farmland. The areas are mostly remote, with low population densities. The lines cross numerous State and U.S. highways, including Wisconsin Highways 42 and 147, and Interstate 43. Corridors that pass through farmlands generally continue to be used in this fashion. ATC plans to maintain these transmission lines indefinitely, as they are integral to the larger transmission system. The transmission lines are expected to remain a permanent part of the regional transmission system after PBNP is decommissioned.

The transmission lines were designed and constructed in the late 1960s and early 1970s, in accordance with the Wisconsin Electrical Code and industry guidance that was current when the lines were built. ATC has implemented a right-of-way inspection and maintenance program to ensure continued conformance of the transmission facilities to design standards. This program includes routine aerial patrols of all corridors to check for encroachments, broken conductors, broken or leaning structures, and signs of trees burning, any of which would be evidence of clearance problems. In addition, ground inspections are performed to examine clearances at questionable locations, observe the integrity of structures, and identify dead or diseased trees that might fall on the transmission lines. Problems noted during any inspection are brought to the attention of the appropriate organization(s) for corrective action. ATC also has a vegetation management program that involves trimming and clearing to remove incidental tall growing trees and invasive plants along transmission rights-of-way (ATC undated). Clearing activities are dependent on the type and amount of vegetation within a given area and may include tractor mowing, manual chainsaw clearing, and application of herbicides by a state-licensed commercial applicator. Trimming is typically performed every 5 to 7 years, based on the vegetation growth rates in a given area.

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 1996d, Section 2.6.3.1)

NMC has addressed refurbishment activities in this environmental report in accordance with NRC regulations and complementary information in the NRC GEIS for license renewal (NRC 1996d, Section 2.6.2). NRC requirements for the renewal of operating licenses for nuclear power plants include the preparation of an integrated plant assessment (IPA) (10 CFR 54.21). The IPA must identify and list systems, structures, and components subject to an aging management review. Items that are subject to aging and might require refurbishment include, for example, the reactor vessel, piping, supports, and pump casings (see 10 CFR 54.21 for details), as well as those that are not subject to periodic replacement.

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

The GEIS (NRC 1996d) provides helpful information on the scope and preparation of refurbishment activities to be evaluated in this environmental report. It describes major refurbishment activities that utilities might perform for license renewal that would necessitate changing administrative control procedures and modifying the facility. The GEIS analysis assumes that an applicant would begin any major refurbishment work shortly after NRC grants a renewed license and would complete the activities during five outages, including one major outage at the end of the 40th year of operation. The GEIS refers to this as the refurbishment period.

GEIS Table B.2 lists license renewal refurbishment activities that NRC anticipated utilities might undertake. In identifying these activities, the GEIS intended to encompass actions that typically take place only once, if at all, in the life of a nuclear plant. The GEIS analysis assumed that a utility would undertake these activities solely for the purpose of extending plant operations beyond 40 years, and would undertake them during the refurbishment period. The GEIS indicates that many plants will have undertaken various refurbishment activities to support the current license period, but that some plants might undertake such tasks only to support extended plant operations.

The PBNP IPA that NMC and WEPCO conducted under 10 CFR 54 has not identified the need to undertake any major refurbishment or replacement actions to maintain the functionality of important systems, structures, and components during the PBNP license renewal period or any other facility modifications associated with license renewal. NMC has included the IPA as part of this application.

3.3 Programs and Activities for Managing the Effects of Aging

NRC

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

"…The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories: (1) SMITTR actions, most of which are repeated at regular intervals, and (2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item." NRC 1996d, Section 2.6.3.1, pg. 2-41. ("SMITTR" is defined in NRC 1996d, Section 2.4, pg. 2-30, 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 PBNP. These programs are described in the *Application for Renewed Operating Licenses, Point Beach Nuclear Plant,* Appendix B. Other than implementation of the programs and inspections identified in the IPA, there are no planned modifications of PBNP administrative control procedures associated with license renewal.

3.4 Employment

Current Workforce

NMC employs a nuclear-related permanent workforce of approximately 740 employees and an additional 231 contract employees at the two unit PBNP. This is less than the range of 600 to 800 personnel per reactor unit (or 1,200 to 1,600 per two units) estimated in the GEIS (NRC 1996d, Section 2.3.8.1). Approximately 81 percent of the employees live in Manitowoc County. The remaining 19 percent is distributed across 12 counties, with numbers ranging from 1 to 73 employees per county.

PBNP Units 1 and 2 are each on an 18-month refueling cycle. During refueling outages, nuclear-related site employment increases above the 740 permanent workforce by approximately 300 workers for temporary (30 to 40 days) duty. These numbers are within the GEIS range of 200 to 900 additional workers per reactor outage.

License Renewal Increment

Performing the license renewal activities described in Sections 3.2 and 3.3 would necessitate increasing PBNP staff workload by some increment. The size of this increment would be a function of the schedule within which NMC must accomplish the work and the amount of work involved. Having determined that major refurbishment of replacement activities are unnecessary for license renewal (Section 3.2), NMC focused its analysis of license renewal employment increment on programs and activities for managing the effects of aging (Section 3.3).

The GEIS (NRC 1996d, Section 2.6.2.7) assumes that NRC would renew a nuclear power plant license for a 20-year period, plus the duration remaining on the current license, and that NRC would issue the renewal approximately 10 years prior to license expiration. In other words, the renewed license would be in effect for approximately 30 years. The GEIS further assumes that the utility would initiate SMITTR activities at the time of issuance of the new license and would conduct license renewal SMITTR activities throughout the remaining 30-year life of the plant, sometimes during full-power operation (NRC 1996d, Section B.3.1.3), but mostly during normal refueling and the 5-and 10-year in-service refueling outages (NRC 1996d, Table B.4).

NMC has determined that the GEIS scheduling assumptions are reasonably representative of PBNP incremental license renewal workload scheduling. Many PBNP license renewal SMITTR activities would have to be performed during outages. Although some PBNP 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 C.3.1.2 uses this approach in order to "...provide a realistic upper bound to potential population-driven impacts…."

NMC has identified no need for significant new aging management programs or significant modifications to existing programs. NMC expects that existing "surge" capabilities for routine activities will enable NMC to perform the increased SMITTR workload with existing staff. Therefore, no more than one or two additional non-outage employees would be required to support PBNP operations during the license renewal term. This additional staffing is within normal employment variances at PBNP. Refueling and maintenance outages typically have a duration of approximately 30 to 40 days and, as described above, result in a large, temporary increase in employment at PBNP. NMC believes that increased SMITTR tasks can be performed within this schedule and employment level. Therefore, NMC has no plans to add outage employees for license renewal term outages.

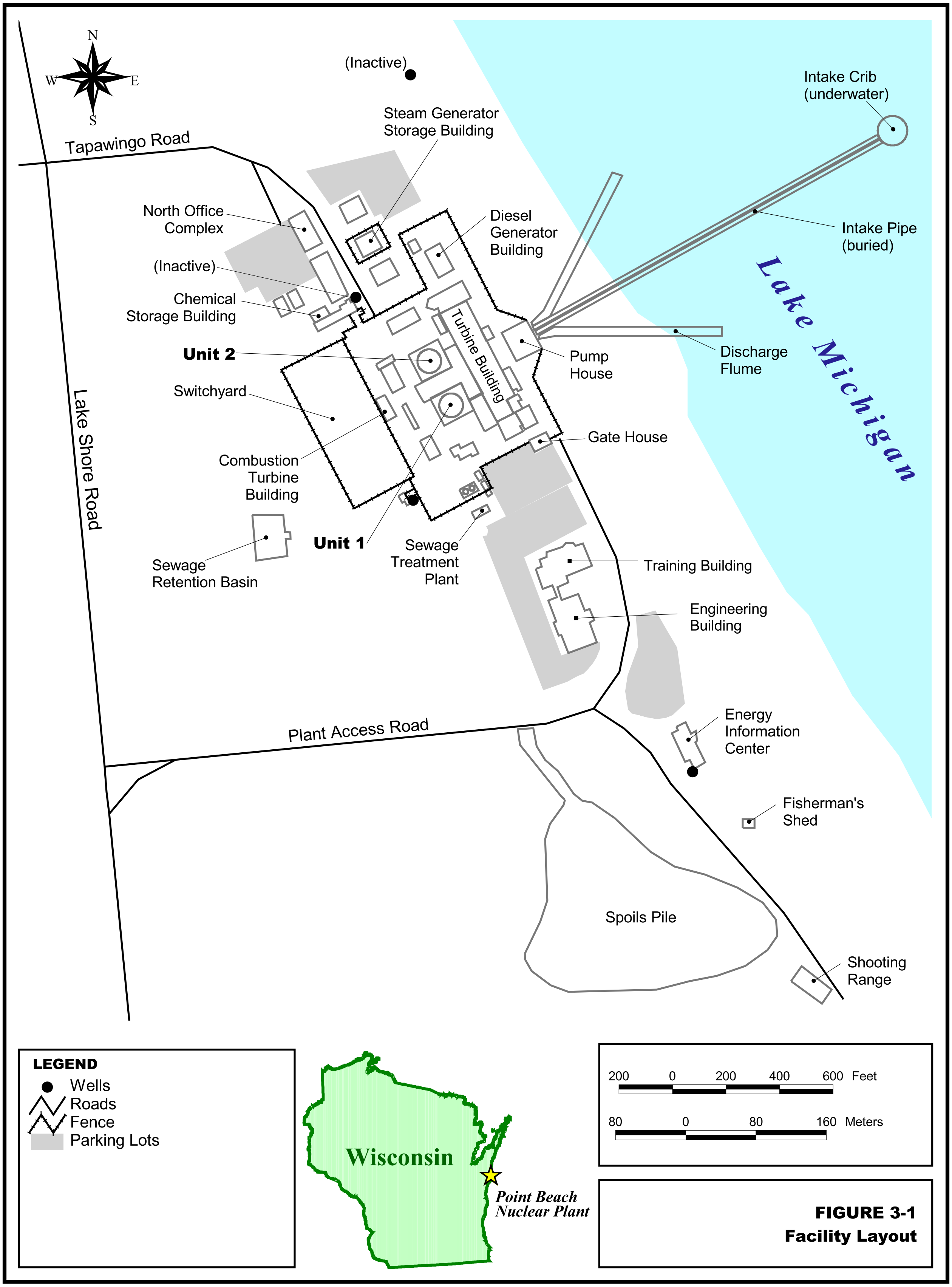


FIGURE 3-1
Facility Layout

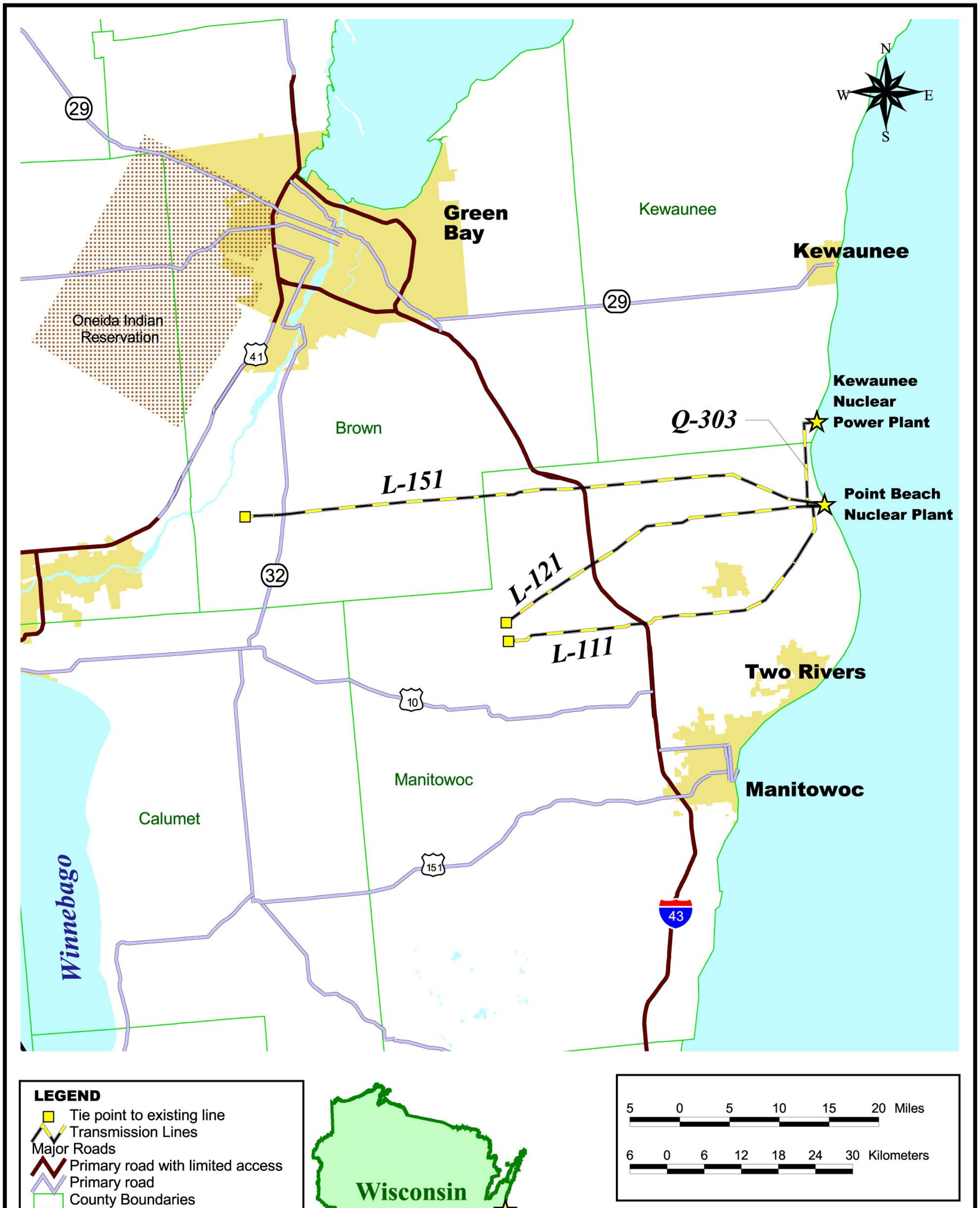


FIGURE 3-2
Transmission Line Map

4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS

NRC

"…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 Point Beach Nuclear Plant's (PBNP's) operating licenses. The assessment complements the U.S. Nuclear Regulatory Commission's (NRC's) *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996d), which identified and analyzed 92 environmental issues that NRC considered to be associated with nuclear power plant license renewal. In its analysis and rules, NRC designated each of the 92 issues as Category 1, Category 2, or NA (not applicable) and only requires plant-specific analysis of the Category 2 issues.

NRC designated an issue as Category 1 if, based on the result of its analysis, the following criteria were met:

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

NRC rules do not require analyses of Category 1 issues because NRC resolved them 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 designated as Category 2. NRC requires plant-specific analyses for Category 2 issues. NRC designated two issues as "NA" (Issues 60 and 92), signifying that the categorization and impact definitions do not apply to these issues. Appendix A of this report lists the 92 issues and identifies the environmental report section that addresses each issue.

Category 1 License Renewal Issues

NRC

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

"…[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, pg. 28483)

Nuclear Management Company, LLC (NMC) has determined that, of the 69 Category 1 issues, 13 do not apply to PBNP because they apply to design or operational features that do not exist at the facility. In addition, because NMC 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 20 issues and explains NMC's basis for determining that these issues are not applicable to PBNP.

Table 4-2 lists the 49 Category 1 issues that NMC has determined to be applicable to PBNP (plus the 2 "NA" issues for which NRC came to no generic conclusion). The table includes the findings that NRC codified and references to the supporting GEIS analysis. As discussed in Chapter 5, NMC is aware of no new and significant information that would make the NRC findings inapplicable to PBNP. Therefore, NMC adopts by reference the NRC findings for these Category 1 issues.

Category 2 License Renewal Issues

NRC

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

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

NRC designated 21 issues as Category 2, Sections 4.1 through 4.20 address each of these issues, beginning with a statement of the issue. As is the case with Category 1 issues, some Category 2 issues apply to operational features that PBNP does not have. In addition, some Category 2 issues apply only to refurbishment activities. If the issue does not apply to PBNP, the section explains the basis for inapplicability.

For the 12 Category 2 issues that NMC has determined to be applicable to PBNP, analyses are provided. These analyses include conclusions regarding the significance of the impacts relative to the renewal of the operating license for PBNP and, when applicable, discuss potential mitigative alternatives to the extent required. NMC has identified the significance of the impacts associated with each issue as either small, moderate, or large, consistent with the criteria that NRC established in 10 CFR 51, Appendix B, Table B-1, Footnote 3, as follows:

> SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.
>
> MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource.
>
> LARGE - Environmental effects are clearly noticeable and are sufficient to destabilize any important attributes of the resource.

In accordance with National Environmental Policy Act practice, NMC 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).

<u>"NA" License Renewal Issues</u>

NRC determined that its categorization and impact-finding definitions did not apply to two issues (Issues 60 and 92); however, NMC included these issues in Table 4-2. Applicants currently do not need to submit information on chronic effects from electromagnetic fields (10 CFR 51, Appendix B, Table B-1, Footnote 5). For environmental justice, NRC does not require information from applicants, but noted that it will be addressed in individual license renewal reviews (10 CFR 51, Appendix B, Table B-1, Footnote 6). NMC 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, Appendix B, Table B-1, Issue 13

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

As discussed in Section 3.1.2, PBNP withdraws cooling water from Lake Michigan and, in a once-through system, returns it directly to Lake Michigan. Therefore, this issue does not apply because PBNP does not use cooling towers or cooling ponds and does not withdraw water from a small river. There is minimal or no net loss to Lake Michigan and no additional impact on other users of the lake in the vicinity of the plant.

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, Appendix B, Table B-1, Issue 25

NRC made impacts on fish and shellfish resources resulting from entrainment a Category 2 issue because it could not assign a single significance level (small, moderate, or large) to the issue. The impacts of entrainment are small at many facilities, but may be moderate or large at others. Also, ongoing restoration efforts may increase the number of fish susceptible to intake effects during the license renewal period (NRC 1996d, Section 4.2.2.1.2). Information needing to be ascertained includes (1) type of cooling system (whether once-through or cooling pond), and (2) status of Clean Water Act (CWA) Section 316(b) determination or equivalent state documentation.

As Section 3.1.2 describes, PBNP has a once-through heat dissipation system. As described below, PBNP has state documentation equivalent to a CWA 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(b)]. Entrainment through the condenser cooling system of fish and shellfish in the early life stages is one of the potential adverse environmental impacts that can be minimized by use of the best available technology.

As a condition of the Wisconsin Pollutant Discharge Elimination System (WPDES) Permit, WI-0000957, PBNP was required to perform a one-year intake monitoring study to determine impact(s) to the environment by the PBNP cooling water intake system (WEPCO 1976). Following completion of this study, Wisconsin Electric Power Company (WEPCO) determined that the effect on the environment from operation of the intake system was minimal and submitted the study to the Wisconsin Department of Natural Resources (WDNR) (WEPCO 1976). Based on review of the study, WDNR determined that the location and operation of the PBNP intake structure has minimal environmental impact (WDNR 1978). Issuance of the PBNP WPDES permit by WDNR indicates the State's conclusion that PBNP, by operating in conformance with the permit, would be in compliance with the CWA requirements. NMC concludes that the PBNP WPDES permit constitutes the CWA 316(b) determination. NMC also 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, Appendix B, Table B-1, Issue 26

NRC made impacts on fish and shellfish resources resulting from impingement a Category 2 issue, because it could not assign a single significance level to the issue. Impingement impacts are small at many facilities, but might be moderate or large at other plants (NRC 1996d, Section 4.2.2.1.3). Information that needs 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 Section 3.1.2 describes, PBNP has a once-through heat dissipation system. Section 4.2 discusses the CWA 316(b) determination for PBNP, indicating compliance with the use of the best available technology. Impingement of fish and shellfish on the intake screens is one of the adverse impacts that is minimized by use of the best available technology. NMC concludes that any environmental impact from impingement of fish and shellfish is small and does not require further 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, Appendix B, Table B-1, Issue 27

NRC made impacts on fish and shellfish resources resulting from heat shock a Category 2 issue, because of continuing concerns about thermal discharge effects and the possible need to modify thermal discharges in the future in response to changing environmental conditions (NRC 1996d, Section 4.2.2.1.4). 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, PBNP has a once-through heat dissipation system that uses water from Lake Michigan for condenser cooling. As discussed below, PBNP received Permit No. WI-0000957-6 to discharge under the WPDES, which has been approved by the Administrator of the U.S. Environmental Protection Agency pursuant to Section 402(b) of the Federal Water Pollution Control Act Amendments of 1972 [33 USC 1342 (b)].

Section 316(a) of the CWA establishes a process whereby a thermal effluent discharger can demonstrate that thermal discharge limitations are more stringent than necessary to protect a balanced indigenous population of fish and wildlife and obtain facility-specific thermal discharge limits (33 USC 1326). On October 6, 1975, WEPCO submitted an Application for Exemption from Thermal Standards [equivalent to a CWA Section 316(a) demonstration] for PBNP to the State of Wisconsin Department of Natural Resources (WDNR) pursuant to NR 102.07 of the Wisconsin Administrative Code. This demonstration concluded that no appreciable harm has resulted from the thermal component of the plant's discharge to fish and wildlife and has not disturbed the balanced indigenous community. WDNR approved exemption from the Thermal Standards on the ground that the existing thermal discharge from the facility will not endanger the propagation of a balanced, indigenous population of shellfish, fish, and wildlife in the receiving water (WDNR 1976). The current PBNP WPDES Permit (No. WI-0000957-6) does not contain thermal effluent limitations to assure the protection and propagation of a balanced indigenous community of shellfish, fish, and wildlife in Lake Michigan. Therefore, NMC concludes that the PBNP WPDES permit constitutes acceptance of the exemption from thermal standards.

NMC concludes that impacts to fish and shellfish from heat shock are small and warrant no additional 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, Appendix B, Table B-1, Issue 33

NRC made this groundwater use conflict a Category 2 issue because overuse of an aquifer could exceed the natural recharge. While this has been observed in a sandstone aquifer in another location in Wisconsin, the PBNP wells are in the Silurian aquifer, which remains in its full, artesian condition. Locally, at a withdrawal rate of more than 100 gallons per minute (gpm), a cone of depression could extend offsite. This could inhibit the withdrawal capacity of nearby offsite users.

As described in Section 2.3 (Groundwater Resources), the total capacity of the 5 active domestic supply wells at PBNP is 105 gpm. However, actual usage, excluding the North Gatewell, is much lower and averages 9,297 gallons per day, or 6.5 gpm. Therefore, NMC concludes that impacts to the Silurian aquifer and nearby groundwater users are small.

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, Appendix B, Table B-1, Issue 34

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.

As indicated in Section 3.1.2, this issue does not apply to PBNP because its cooling system does not include 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, Appendix B, Table B-1, Issue 35

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

This issue of groundwater use conflicts does not apply to PBNP because the plant does not use Ranney wells. As Section 3.1.2 describes, PBNP draws its cooling water from Lake Michigan and, as indicated in Section 2.3, standard wells drilled deeply (e.g., 257 feet below grade) into the Silurian aquifer are used to withdraw small amounts (average flow of 6.7 gpm) of domestic water used at the plant.

4.8 Degradation of Groundwater Quality

NRC

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

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

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

The issue of groundwater degradation does not apply to PBNP because the plant does not use cooling water ponds and is not an inland site. As Section 3.1.2 describes, PBNP employs a once-through cooling system that withdraws from and discharges to Lake Michigan.

4.9 Impacts of Refurbishment on Terrestrial Resources

NRC

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

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

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

NRC made impacts to terrestrial resources from refurbishment a Category 2 issue because the significance of ecological impacts cannot be determined without considering site- and project-specific details (NRC 1996d, Section 3.6). 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.

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

4.10 Threatened or 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, Appendix B, Table B-1, Issue 49

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

Section 2.5 discusses Federally threatened or endangered species that may occur in the region, although none are known to occur at PBNP or along associated transmission line corridors. As discussed in Section 3.2, NMC has no plans for refurbishment or license renewal-related construction at PBNP during the license renewal period. Therefore, there would be no impacts to threatened and endangered species from these activities and no further analysis of refurbishment-related impacts is applicable.

License renewal will not result in operational changes at PBNP that would alter current natural resource management practices. PBNP and its transmission lines have been in existence for more than 40 years, long enough for operational impacts to have stabilized. Further, vegetation management practices in transmission corridors could actually be working to the benefit of plant species that depend on open, prairie-like conditions, such as the clustered broomrape (a dry prairie species) and the yellow gentian (a mesic prairie species).

WEPCO has completed a review of the WDNR Natural Heritage Database with particular emphasis on species that might be adversely affected by continued operations over the license renewal term. Based on this review, NMC has determined that three federally listed species occur in Manitowoc County: the bald eagle (*Haliaeetus leucocephalus*), the piping plover (*Charadrius melodus*) and the dune (or pitcher's) thistle (*Cirsium pitcheri*). The dwarf lake iris (*Iris lacustris*), another federally listed species, is found in Brown County, through which a portion of the L-151 transmission line passes. It should be emphasized, however, that none of these species has actually been observed on the PBNP site or along associated rights-of-way, and none would be affected by operation of PBNP over the license renewal term.

The WEPCO review of the Natural Heritage Inventory database revealed that the greater redhorse (*Moxostoma valenciennesi*), a state-listed species, occurs in the major streams and rivers of eastern Manitowoc County crossed by the PBNP transmission corridors. These include the Branch River, Neshota River, West Twin River, and East Twin River. The only state-listed terrestrial species believed to occur in the vicinity of the PBNP transmission corridors is the snow trillium, *Trillium nivale*, which is found in Southern (Wisconsin) Mesic Forests, sugar maple-basswood-beech forest communities that occur in areas with well-drained soils (WDNR 2001g, h). Snow trillium populations are known to occur in mesic forests in the Kriwanek Creek drainage, which is crossed by the L-121 transmission corridor and the Devil's River drainage, which is crossed by the L-151 transmission corridor. They are not found in the transmission corridors, however, and would not be affected by vegetation management in the transmission corridor over the period of license renewal.

NMC concludes that adverse impacts to threatened or endangered species from license renewal, if any, would be small, because NMC has no plans to alter current natural resource management practices and resources Renewal of the PBNP licenses is not expected to result in the taking of any threatened or endangered species, and is not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of any critical habitat.

4.11 Air Quality During Refurbishment

NRC

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

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

NRC made impacts to air quality during refurbishment a Category 2 issue because vehicle exhaust emissions could be cause for some concern, and a general conclusion about the significance of the potential impact could not be drawn without considering the compliance status of each site and the number of workers expected to be employed during an outage (NRC 1996d, Section 3.3). 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.

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

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 × 10^{12}ft^3/year (9 × 10^{10}m^3/year), an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided." 10 CFR 51.53(c)(3)(ii)(G)

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

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

The issue of thermophilic organisms does not apply to PBNP because the plant does not use a cooling pond, lake, or canal that discharges to a small river. As described in Section 3.1.2, PBNP uses a once-through heat dissipation system that withdraws from and discharges water to Lake Michigan.

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, Appendix B, Table B-1, Issue 59

NRC made impacts of electric shock from transmission lines a Category 2 issue because, without a review of each plant's transmission line conformance with the National Electrical Safety Code (NESC) (Institute of Electrical and Electronics Engineers 1997) criteria, NRC could not determine the significance of the electrical shock potential.

Although WEPCO undertook a series of full-scale tests under its first operating 345-kilovolt (kV) line in order to determine the potential for electric shock resulting from transmission-line-induced currents (WEPCO 1971), there have been no previous NRC or National Environmental Policy Act analyses of transmission-line-induced current hazard on PBNP lines. Therefore, this section provides an analysis of the plant's transmission lines' conformance with the NESC standard. The analysis is based on computer modeling of induced current under the lines.

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

- the strength of the electric field which, in turn, depends on the voltage of the transmission line as well as its height and geometry

- the size of the charged object on the ground
- the extent to which the object is grounded.

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

As described in Section 3.1.5, there are three 345-kV lines that were specifically constructed to distribute power from PBNP to the electric grid, and one 345-kV line that connects Kewaunee Nuclear Power Plant and PBNP. NMC's analysis of these transmission lines began by identifying the limiting case road crossing 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, NMC calculated the electric field strength for each transmission line, then calculated the induced current.

NMC calculated electric field strength and induced current using a computer code called ACDCLINE (Version 3.0), produced by the Electric Power Research Institute (EPRI 1992). The results of this computer program have been field-verified through actual electric field measurements by several utilities. The input parameters included the design features of the limiting-case scenario, the NESC requirement that line sag be determined at 120 degrees Fahrenheit conductor temperature, and the maximum vehicle size under the lines. The maximum size vehicle was modeled as a tractor-trailer truck.

The analysis determined that none of the transmission lines has the capacity to induce more than five milliamperes in a tractor-trailer truck parked beneath the lines. Therefore, the PBNP transmission line designs conform to the NESC provisions for preventing electric shock from induced current. The results for each transmission line are provided in Table 4-3. Details of the analysis, including the input parameters for each line's limiting case, can be found in TtNUS (2002).

American Transmission Company, which owns and operates the transmission lines, has a surveillance and maintenance program to assure that design ground clearances will not change. This program is described in Section 3.1.5.

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

NMC's assessment under 10 CFR 51 concludes that electric shock is of small significance for the PBNP transmission lines. Due to the small significance of the issue, mitigation measures, such as installing warning signs at road crossings or increasing clearances, are not warranted. This conclusion would remain valid into the future, provided there are no changes in line use, voltage, current, and maintenance practices and no changes in land use under the lines – conditions over which ATC has control.

4.14 Housing Impacts

NRC

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

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

"...[S]mall impacts result when no discernible change in housing availability occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversion occurs…." (NRC 1996a, Section 4.7.1.1, pp. 4-101 to 4-102)

NRC made housing impacts a Category 2 issue because impact magnitude depends on local conditions that NRC could not predict for all plants at the time of GEIS publication (NRC 1996d, Section 3.7.2). 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, NMC does not plan to perform refurbishment. NMC concludes that there would be no refurbishment-related impacts to area housing and no analysis is therefore required. Accordingly, the following discussion focuses on impacts of continued operations on local housing availability.

As described in Section 2.6, PBNP is located in a high population area. As noted in Section 2.8, the area of interest is not subject to growth control measures that limit housing development. In 10 CFR 51, Subpart A, Appendix B, Table B-1, NRC concluded that impacts to housing are expected to be of small significance at plants located in "high" population areas where growth control measures are not in effect. Therefore, NMC expects housing impacts to be 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)(I)

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

"Impacts on public utility services are considered small if little or no change occurs in the ability to respond to the level of demand and thus there is no need to add capital facilities. Impacts are considered moderate if overtaxing of facilities during peak demand periods occurs. Impacts are considered large if existing service levels (such as quality of water and sewage treatment) are substantially degraded and additional capacity is needed to meet ongoing demands for services." (NRC 1996a, Section 3.7.4.5, pg. 3-19)

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 1996d, Section 4.7.3.5). Local information needed would include: (1) a description of water shortages experienced in the area, and (2) an assessment of the public water supply system's available capacity.

NRC's analysis of impacts to the public water supply system considered both plant demand and plant-related population growth demands on local water resources. As stated in Section 3.4, NMC anticipates no more than two additional employees attributable to license renewal. Section 2.6 describes the PBNP 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 PBNP and no refurbishment impacts are therefore expected.

PBNP does not use water from a municipal system; therefore, PBNP operations do not affect local water supplies. At this time, there is excess capacity in all of these systems and two additional families in the region would not stress capacity limits. NMC has identified no changes during the PBNP license renewal term that would require PBNP to use municipal water.

Because PBNP does not use municipal water and employment increases would not stress capacity, NMC concludes that impacts on the public water supply would be small and 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)(I)

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

"…[S]mall impacts are associated with project-related enrollment increases of 3 percent or less. Impacts are considered small if there is no change in the school systems' abilities to provide educational services and if no additional teaching staff or classroom space is needed. Moderate impacts 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 1996a, Section 3.7.4.1, pg. 3-15)

NRC made impacts to education a Category 2 issue because site- and project-specific factors determine the significance of impacts (NRC 1996d, Section 3.7.4.2). 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 PBNP because, as Section 3.2 discusses, NMC has no plans for refurbishment at PBNP.

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)(I)

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

"…[I]f plant-related population growth is less than 5 percent of the study area's total population, off-site land-use changes would be small, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 persons per square mile (2.6 km^2), and at least one urban area with a population of 100,000 or more within 80 km (50 miles)…." (NRC 1996a, Section 3.7.5, pg. 3-21)

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 PBNP because, as Section 3.2 discusses, NMC has no plans for refurbishment at PBNP.

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)(I)

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

"…[I]f plant-related population growth is less than 5 percent of the study area's total population, off-site land-use changes would be small…." (NRC 1996a, Section 3.7.5, pg. 3-21)

"…[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 1996a, Section 4.7.4.1, pg. 4-108)

NRC made impacts to offsite land use during the license renewal term a Category 2 issue, because land-use changes may be perceived as beneficial by some community members and adverse by others. Therefore, NRC could not assess the potential significance of site-specific offsite land-use impacts (NRC 1996d, Section 4.7.4.1). Site-specific factors to consider 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 1996d, Section 4.7.4.1).

Population-Related Impacts

Based on the GEIS case-study analysis, NRC concluded that all new population-driven land-use changes during the license renewal term at all nuclear plants would be small. This is based on the fact that population growth caused by license renewal would represent a "much smaller percentage" of the local areas total population than has operations-related growth (NRC 1996d, Section 4.7.4.2).

Tax-Revenue-Related Impacts

NRC Guidance

- NRC has determined that the significance of tax payments as a source of local government revenue would be small if the payments are less than 10 percent of the taxing jurisdiction's revenue, moderate if payments are 10 to 20 percent, and large if payments represent greater than 20 percent of revenue.
- NRC defined the magnitude of land-use changes as follows (NRC 1996d, Section 4.7.4):

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

  Moderate - considerable new development and some changes to land-use pattern

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

PBNP Status with Regard to NRC Guidance

Taxes

As noted in Section 2.7, Wisconsin Electric Power Company pays a lump sum gross revenues tax to the State of Wisconsin in lieu of a property tax on its generating plants and other facilities. The taxes are combined, in the Shared Revenue Fund, with all other taxes paid statewide. With the exception of the Share Revenue Utility payment, one of the five major payments made from the fund, there is no direct correlation between Shared Revenue Fund payments and the sources of those funds. Therefore, it is not possible to accurately determine the exact level of fiscal impact PBNP has had on surrounding communities.

However, it is possible to compare the size of the Shared Revenue *Utility* payment to the local taxing jurisdictions' total tax revenues. Tables 2-6 and 2-7 provide a comparison of the Shared Revenue *Utility* tax payments made, on behalf of PBNP, to the Town of Two Creeks and Manitowoc County and the annual total tax revenues of those entities. For the five-year period from 1996 through 2000, PBNP-related Shared Revenue *Utility* payments to the Town of Two Creeks represented approximately 14 to 20 (excluding the 1999 payment, see Table 2-6 footnotes) percent of the Town's total annual property tax revenues. Using NRC's criteria, PBNP's tax payments are of medium to large significance to the Town of Two Creeks. For the same period, PBNP-related Shared Revenue *Utility* payments to Manitowoc County represented only 1.4 to 2 percent of the

County's total annual property tax revenues. Using NRC's criteria, PBNP's tax payments are of small significance to Manitowoc County.

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

Land Use

As described in Section 2.8, Manitowoc County has experienced relatively minimal land use change, overall, during the last several decades. The County occupies approximately 380,934 acres and is rural in nature, with over 73 percent of its area utilized for agriculture. Two percent of the County is classified as urban or developed, while forests, grasslands, and wetlands constitute the remaining 25 percent of the land area (WDNR 2001i).

Land use change has been slow in the City of Two Rivers and surrounding areas and little urban development has occurred outside the City limits. The City of Two Rivers has experienced declines in both economic strength and population since the early 1980s.

The Town of Two Creeks has also experienced relatively little land use change over the last several decades. The Town does not currently have a land use plan, but does use zoning to preserve it's rural character.

In the Village of Mishicot, the major change in land use since the 1970s is an expansion of commercial land uses. There has been a large increase in the amount of land used for golf courses and condominium development. Approximately 50 percent of the Village's land area is proposed for single-family residential development. Mishicot anticipates continued growth in resort land use and continued single- and two-family residential development.

The City of Manitowoc has experienced a steady rate of new housing construction since 1990, averaging approximately 70 new single-family homes and 63 multi-family units per year. This rate of new housing construction is a reversal of trends that occurred in the 1980s when housing construction was severely depressed due to high interest rates, poor economic conditions, and a declining population.

While steady growth continues to occur in selected areas, widespread land use conversion in Manitowoc County does not appear to be the case. With the exception of the Village of Mishicot, land use plans are in place in urban areas to guide development and plan for the provision of infrastructure to accommodate future expansion.

Conclusion

Because NMC stated that it will not conduct any refurbishment activities for PBNP, there will be no anticipated changes in plant valuations. Additionally, because the Shared Revenue Fund payments (excluding the Shared Revenue *Utility* payment) to the local taxing jurisdictions are calculated using a state-developed formula that is independent of plant location or valuation, the tax payments to the local taxing jurisdictions may not be attributable to any specific source. The current Shared Revenue *Utility* payments, which are attributable to PBNP, are small in relation to Manitowoc County's annual revenues. The payments are considered medium to large, in relation to the Town of Two Creeks' annual revenues. However, the Town of Two Creeks has not reported a marked change in land use trends over the last several decades and no new major land use changes are planned. The majority of the Utility payments are used for property tax relief for the residents. Therefore, NMC concludes that land-use impacts would be small. Mitigation for land-use impacts during the license renewal term does not appear to be 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, Appendix B, Table B-1, Issue 70

Small impacts would be associated with U.S. Transportation Research Board Level of Service A, having the following condition: "…Free flow of the traffic stream; users are unaffected by the presence of others." and Level of Service B, having the following condition: "…Stable flow in which the freedom to select speed is unaffected but the freedom to maneuver is slightly diminished…." (NRC 1996a, Section 3.7.4.2, pp. 3-18 and 3-19)

NRC made impacts to transportation a Category 2 issue because impact significance is determined primarily by road conditions existing at the time of the project, which NRC could not forecast for all facilities (NRC 1996d, Section 3.7.4.2). Local road conditions to be ascertained are: (1) level of service conditions, and (2) incremental increases in traffic associated with refurbishment activities and license renewal staff.

As described in Section 3.2, no major refurbishment is planned and no refurbishment impacts to local transportation are therefore anticipated. As described in Section 3.4, no more than one or two additional employees are expected during the license renewal term. Therefore, NMC expects license-renewal impacts to transportation to be small.

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, Appendix B, 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 1996a, Section 3.7.7, pg. 3-23)

NRC made impacts to historic and archaeological resources a Category 2 issue because determinations of impacts to historic and archaeological resources are site-specific in nature, and the National Historic Preservation Act mandates that impacts must be determined through consultation with the State Historic Preservation Officer (SHPO) (NRC 1996a, Section 4.7.7.3).

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

As described in Section 2.11, the *Final Environmental Statement Related to Operation of Point Beach Nuclear Plant Units 1 and 2* (WEPCO 1972) stated that the PBNP property had no known historical significance and there were no national historic sites located in the immediate vicinity of the plant. WEPCO did not perform an archaeological survey prior to PBNP construction. However, WEPCO did contact the SHPO, who stated that the operation of PBNP would not impact any known historical site(s). In 1995, the Great Lakes Archaeological Research Center, Inc., conducted an examination of the archaeological site files and maps maintained by the State Historical Society of Wisconsin prior to construction of the PBNP Independent Spent Fuel Storage Installation. The examination resulted in the conclusion that construction and operation of the ISFSI would not impact any known historical site (WI-SHPO 1995).

Beneath the PBNP site is a portion of a vast forested area that was buried by the Valderan Glacier approximately 12,400 years ago. The forest extends for many miles and is not unique to the plant site. Excavation during construction of the plant permitted collections of samples for study by federal and state agencies, without having a significant detrimental effect on the future value of the buried forest. Also, an Indian burial site is located north of the plant property, but was not disturbed during plant construction (WEPCO 1972). Section 2.11 lists the National Historic Register sites of significance and the State Historical Society of Wisconsin archaeological sites located within a six-mile and three-mile radius, respectively.

A fisherman's shed on PBNP property is of indeterminate age, but is most likely more than 50 years old. It has not been submitted to the National Register of Historic Places for eligibility. A preliminary analysis suggests that the shed is not eligible for listing. However, a verbal agreement with the former landowner was reached and the shed is being preserved in its present state by NMC. Should future PBNP construction activities have the potential to affect the structure, an eligibility determination will be done. Section 2.11 lists the National Historic Register sites of significance and the State Historical Society of Wisconsin archaeological sites located within a six-mile and three-mile radius of PBNP, respectively.

WEPCO is not currently aware of any historic or archaeological sites that are being or have been impacted by PBNP operations, facility, or transmission line right-of-way management. NMC does not expect current practices to change as a result of license renewal.

Based on the information accumulated at this time, NMC concludes that the continued use of facilities, transmission lines, and rights-of-way is projected to cause little or no impact on historic sites over the license renewal term.

4.20 Severe Accident Mitigation Alternatives

4.20.1 Methodology Overview

The methodology used to perform the PBNP SAMA analysis was based on the handbook used by the NRC to analyze benefits and costs of its regulatory activities, "Regulatory Analysis Technical Evaluation Handbook," NUREG/BR-0184, January 1997, subject to Point Beach-specific considerations.

Environmental impact statements and environmental reports are prepared using a sliding scale approach to analyses in which impacts of greater concern and mitigative measures of greater potential value receive more detailed analysis than impacts of less concern and mitigative measures of less potential value. Accordingly, the NMC used less detailed feasibility investigative and cost estimation techniques for SAMAs having disproportionately high costs and low benefits and more detailed evaluations for the most viable candidates.

Initial input for the PBNP SAMA benefits analysis was the PBNP Probabilistic Safety Assessment (PSA) model, which is the Point Beach internal events risk model. This model is an updated version (May 2002) of the Individual Plant Examination. Therefore, the SAMA analysis is based on Point Beach modeling.

The following is a brief outline of the approach taken in the SAMA analysis:

- Establish the base case – Use NUREG/BR-0184 to evaluate severe accident impacts:
  - Offsite exposure costs – Monetary value of consequences (dose) to offsite population;

    Use the PBNP PSA model to determine total accident frequency (core damage frequency and containment release frequency); Melcor Accident Consequences Code System (MACCS2) to convert release input to public dose; and NUREG/BR-0184 methodology to convert dose to present worth dollars (based on valuation of $2,000 per person-rem and a present worth discount factor of 7 percent).

  - Offsite economic costs – Monetary value of damage to offsite property;

    Use the PBNP PSA model to determine total accident frequency (core damage frequency and containment release frequency); MACCS2 to convert release input to offsite property damage; and NUREG/BR-0184 methodology to convert offsite property damage to present worth dollars.

- Onsite exposure costs – Monetary value of dose to workers;

  Use the Point Beach PSA model to determine total core damage frequency, and use the NUREG/BR-0184 best-estimate occupational-dose values for immediate and long-term dose, then apply NUREG/BR-0184 methodology to convert dose to present worth dollars (based on valuation of $2,000 per person-rem and a present worth discount factor of 7 percent).

- Onsite economic costs – Monetary value of damage to onsite property;

  Use the PBNP PSA model to determine total core damage frequency, and use the NUREG/BR-0184 best-estimate cleanup-and-decontamination costs, then apply NUREG/BR-0184 methodology to convert onsite property damage estimate to present worth dollars. It is assumed that, subsequent to a severe accident, the plant would not be restored to operation, therefore replacement/refurbishment costs are not included in onsite costs. Replacement power costs are included directly in this analysis.

- SAMA identification – Identify potential SAMAs from the following sources:
  - Severe Accident Mitigation Design Alternative (SAMDA) analyses submitted in support of original licensing activities for other operating nuclear power plants and advanced light water reactor plants;
  - NRC and industry documentation discussing potential plant improvements; and
  - Documented insights provided by the PBNP staff.

- Preliminary screening – Eliminate non-viable candidates, based upon:
  - SAMA improvements that modify features not applicable to PBNP; or
  - SAMA improvements that have already been implemented at PBNP.

- Final screening of remaining SAMAs – Using cost-benefit analysis, screen out SAMAs that do not provide an adequate level of benefit based on:
  - Implementation of SAMA would require extensive plant reconstruction, or the cost of implementing SAMA would exceed maximum benefit for the base case evaluation; or

- Benefit/Cost Evaluation – Evaluate benefits and costs of implementing the SAMA:
  - Benefit calculation – Estimate benefits of implementing each SAMA individually;
    - Existing Level 2 modeling used
    - SAMA impacts – Calculate impacts (i.e., on-site/off-site dose and damages) by manipulating the Point Beach model to simulate revised plant risk following implementation of each individual SAMA
    - Averted SAMA impacts – Calculate benefits for each SAMA in terms of averted consequences. Averted consequences are the arithmetic differences between the calculated impact for the base case and revised impact following implementation of each individual SAMA.
    - SAMA benefits – Calculate total benefit for each SAMA
  - Cost estimate – Estimate cost of implementing each evaluated SAMA. The detail of the cost estimate must be commensurate with the benefit; if a benefit is very low, it is not necessary to perform a detailed cost estimate to determine that the SAMA is not cost beneficial – expert judgement can be applied.

- Sensitivity Analysis – Determine the effect that changing certain inputs, including averted onsite costs and discount rate, would have on the cost-benefit calculation.
- Conclusions – Identify SAMAs that are cost beneficial, if any, and implementation plans or provide a basis for not implementing.

The NMC's SAMA analysis for PBNP is presented in the following sections. These sections provide a detailed discussion of the process presented above.

4.20.2 Establishing the Base Case

The purpose of establishing the base case is to provide the baseline for determining the risk reductions that would be attributable to the implementation of potential SAMAs. This severe accident risk, based on the PBNP PSA model, is calculated through use of the Individual Plant Examination (IPE) Level 2 and the MACCS2 Level 3 model, based upon site-specific meteorology, population characteristics, and economic information.

The primary source of data relating to the base case is the PBNP PSA model. The PBNP model is based upon the latest modeling information available for PBNP, and uses PSA techniques to:

- Develop an understanding of severe accident behavior;
- Understand the most likely severe accident consequences;
- Gain a quantitative understanding of the overall probabilities of core damage and fission product releases; and
- Evaluate hardware and procedure changes to assess the overall probabilities of core damage and fission product releases.

The Point Beach PSA model includes internal events (e.g., loss of feedwater event, loss of coolant accident) and is more advanced than the IPE. The Point Beach PSA model is periodically updated as a result of:

- Equipment performance – As data collection progresses, estimated failure rates and system unavailabilities change.
- Plant configuration changes – There is a time lag between changes to the plant and incorporation of those changes into the Point Beach PSA model.
- Modeling changes – The Point Beach PSA model is refined to incorporate the latest knowledge.

The Point Beach PSA model describes the results of the first two levels of analysis of the PSA for Point Beach. Level 1 determines core damage frequencies based on system analyses and human-factor evaluations and Level 2 determines the physical and chemical phenomena that affect the performance of the containment and other radiological release mitigation features to quantify accident behavior and release of fission products to the environment.

Using the results of these analyses, the next step is to perform a Level 3 Probabilistic Risk Assessment (PRA) analysis, which calculates the hypothetical impacts of severe accidents on the surrounding environment and members of the public. MACCS2 is used for determining the offsite impacts for the Level 3 analysis, whereas the magnitude of the onsite impacts (in terms of clean up and decontamination costs and occupational dose) are based on information provided in NUREG/BR-0184. The principal phenomena analyzed are atmospheric transport of radionuclides; mitigative actions (i.e., evacuation, condemnation of contaminated crops and milk) based on dose projection; dose accumulation by a number of pathways, including food and water ingestion; and economic costs. Input for the Level 3 analysis includes the Point Beach core radionuclide inventory, source terms from the IPE (as applied to the Point Beach PSA model), site meteorological data, projected population distribution (within 50-mile radius) for the year 2035, emergency response evacuation modeling, and economic data.

The Level 3 analysis looks at the source term for each of five different release modes associated with endstates of the containment event tree. Because the analysis is based on probabilistic risk input, the analytical results relate the frequency of an impact to the magnitude of the impact (i.e., frequency versus risk). In general, severe accidents which have a greater predicted impact have a lower predicted probability of occurrence.

Appendix F contains detailed information on the SAMAs and has the following sections:

- F.1 – Melcor Accident Consequences Code System Modeling
- F.2 – Evaluation of Candidate SAMAs
- F.3 – References

Offsite Exposure Costs[3]

The Level 3 base case analysis shows an annual offsite exposure risk of 1.83 person-rem. This calculated value is converted to a monetary equivalent (dollars) via application of the NRC's conversion factor of $2,000 per person-rem from NUREG/BR-0184. This monetary equivalent was then discounted to present value using the NRC's formula from NUREG/BR-0184:

$$APE = \left(F_S D_{P_S} - F_A D_{P_A}\right) R \frac{1 - e^{-rt_f}}{r} \qquad (1)$$

where:

APE = monetary value of accident risk avoided due to population doses, after discounting

R = monetary equivalent of unit dose, ($2,000/person-rem)

F = accident frequency (events/yr)

D_P = population dose factor (person-rems/event)

3 Calculated values presented in this and subsequent subsections were calculated using a spreadsheet and may differ slightly from values calculated from the numbers provided; this is due to rounding performed on the numbers presented in this document.

S = status quo (current conditions)

A = after implementation of proposed action

r = real discount rate = 7 percent (as a fraction, 0.07)

t_f = years remaining until end of facility life = 20 years.

Using a 20-year period for remaining plant life and a 7 percent discount rate results in the monetary equivalent value of $39,308 (Table 4-4).

Offsite Economic Costs

The Level 3 analysis shows an annual offsite economic risk monetary equivalent of $2,594. Calculated values of offsite economic costs caused by severe accidents must also be discounted to present value. Discounting is performed in the same manner as for the public health risks in accordance with the following equation:

$$AOC = \left(F_S P_{D_S} - F_A P_{D_A}\right)\frac{1-e^{-rt_f}}{r}$$

AOC = monetary value of accident risk avoided due to offsite property damage, after discounting

P_D = offsite property loss factor (dollars/event)

The resulting monetary equivalent of $27,916 (Table 4-4).

Onsite Exposure Cost

Values for occupation exposure associated with severe accidents are not derived from the Point Beach PSA model, but, instead, are obtained from information published by the NRC in NUREG/BR-0184. The values for occupational exposure consist of "immediate dose" and "long-term dose." The best-estimate value provided by the NRC for immediate occupational dose is 3,300 person-rem, and long-term occupational dose is 20,000 person-rem (over a ten-year clean-up period). The following equations are applied to these values to calculate monetary equivalents:

Immediate Dose

For a currently operating facility, NUREG/BR-0184 recommends calculating the immediate dose present value with the following equation:

Equation (1):

$$W_{IO} = \left(F_S D_{IO_S} - F_A D_{IO_A}\right) R \frac{1-e^{-rt_f}}{r} \quad (1)$$

where:

W_{IO} = monetary value of accident risk avoided due to immediate doses, after discounting

IO = subscript denoting immediate occupational dose

R = monetary equivalent of unit dose, ($/person-rem)

F = accident frequency (events/yr)

D_{IO} = immediate occupational dose (person-rems/event)

S = status quo (current conditions)

A = after implementation of proposed action

r = real discount rate

t_f = years remaining until end of facility life.

The values used in the Point Beach analysis are:

R = $2,000/person-rem

r = 0.07

D_{IO} = 3,300 person-rems /accident (best estimate)

The license extension time of 20 years is used for t_f.

For the basis discount rate, assuming F_A is zero, the bounding monetary value of the immediate dose associated with PBNP's accident risk is:

$$W_{IO} = \left(F_S D_{IO_S}\right) R \frac{1 - e^{-rt_f}}{r}$$

$$= 3300 * F * \$2000 * \frac{1 - e^{-.07*20}}{.07}$$

For the core damage frequency for the base case, 3.59E-05/year,

$$W_{IO} = \$2550$$

Long-Term Dose

For a currently operating facility, NUREG/BR-0184 recommends calculating the long-term dose present value with the following equation:

Equation (2):

$$W_{LTO} = \left(F_S D_{LTO_S} - F_A D_{LTO_A}\right) R * \frac{1 - e^{-rt_f}}{r} * \frac{1 - e^{-rm}}{rm} \tag{2}$$

where:

W_{LTO} = monetary value of accident risk avoided long term doses, after discounting, ($)

LTO = subscript denoting long-term occupational dose

m = years over which long-term doses accrue

The values used in the Point Beach analysis are:

R = $2,000/person-rem

r = .07

DLTO = 20,000 person-rem /accident (best estimate)

m = “as long as 10 years”

The license extension period of 20 years is used for t_f.

For the basis discount rate, assuming F_A is zero, the bounding monetary value of the long-term dose associated with PBNP’s accident risk is:

$$W_{LTO} = \left(F_S D_{LTO_S}\right) R * \frac{1 - e^{-rt_f}}{r} * \frac{1 - e^{-rm}}{rm}$$

$$= \left(F_S \times 20000\right) \$2000 * \frac{1 - e^{-.07*20}}{.07} * \frac{1 - e^{-.07*10}}{.07*10}$$

For the core damage frequency for the base case, 3.59E-05/year,

$$W_{LTO} = \$11{,}113$$

Total Occupational Exposures

Combining equations (1) and (2) above, using delta (Δ) to signify the difference in accident frequency resulting from the proposed actions, and using the above numerical values, the long term accident related onsite (occupational) exposure avoided (AOE) is:

$$AOE = \Delta W_{IO} + \Delta W_{LTO} \ (\$)$$

The bounding value for occupational exposure (AOE_B) is:

$$AOE_B = W_{IO} + W_{LTO} = \$2,550 + \$11,113 = \$13,663$$

The resulting monetary equivalent of $13,663 (Table 4-4).

Onsite Economic Costs

Clean-up/Decontamination

The total cost of clean-up/decontamination of a power reactor facility subsequent to a severe accident is estimated in NUREG/BR-0184 at $1.5E+9; this same value was adopted for these analyses. Considering a 10-year cleanup period, the present value of this cost is:

$$PV_{CD} = \left(\frac{C_{CD}}{m}\right)\left(\frac{1 - e^{-rm}}{r}\right)$$

where:

PV_{CD} = present value of the cost of cleanup/decontamination

CD = subscript denoting clean-up/decontamination

C_{CD} = total cost of the cleanup/decontamination effort, $1.5E+9

m = cleanup period (10 years)

r = discount rate (7 percent).

Therefore:

$$PV_{CD} = \left(\frac{\$1.5E + 9}{10}\right)\left(\frac{1 - e^{-.07*10}}{.07}\right)$$

where:

PV_{CD} = present value of the cost of clean-up/decontamination

$$PV_{CD} = \$1.079E + 9$$

This cost is integrated over the term of the proposed license extension as follows:

$$U_{CD} = PV_{CD}\,\frac{1 - e^{-rt_f}}{r}$$

where:

U_{CD} = total cost of clean-up/decontamination over the life of the plant

Based upon the values previously assumed:

$$U_{CD} = \$1.161E + 10$$

Replacement Power Costs

The analysis was performed including consideration of replacement power costs, modeled in accordance with the guidance provided in NUREG/BR-0184.

The present value of replacement power is calculated as follows:

$$PV_{RP} = \left(\frac{(\$1.2E + 8)\frac{(Ratepwr)}{(910MWe)}}{r} \right) \left(1 - e^{-rt_f}\right)^2$$

where:

PV_{RP}	=	Present value of the cost of replacement power for a single event.
t_f	=	years remaining until end of facility life (20 years).
r	=	Discount rate (7 percent).
Ratepwr	=	Rated power of each unit (including the planned power uprate) (564 Mwe).

The \$1.2E+8 value has no intrinsic meaning but is a substitute for a string of non-constant replacement power costs that occur over the lifetime of a "generic" reactor after an event (from Reference F.2-23 in Appendix F). This equation was developed per NUREG/BR-0184 for discount rates between 5 percent and 10 percent only.

For discount rates between 1 percent and 5 percent, NUREG/BR-0184 indicates that a linear interpolation is appropriate between present values of \$1.2E+9 at 5 percent and \$1.6E+9 at 1 percent. So for discount rates in this range the following equation was used to perform this linear interpolation.

$$PV_{RP} = \left\{ (\$1.6E + 9) - \left(\frac{[(\$1.6E + 9) - (\$1.2E + 9)]}{[5\% - 1\%]} * [r_s - 1\%] \right) \right\} * \left\{ \frac{Ratedpwr}{910MWe} \right\}$$

where:

r_s = Discount rate (small), between 1 percent and 5 percent.

Ratepwr = Rated power of each unit (including the planned power uprate)

To account for the entire lifetime of the facility, U_{RP} was then calculated from PV_{RP}, as follows:

$$U_{RP} = \frac{PV_{RP}}{r}\left(1 - e^{-rt_f}\right)^2$$

where:

U_{RP} = Present value of the cost of replacement power over the life of the facility.

Again, this equation is only applicable in the range of discount rates from 5 percent to 10 percent. NUREG/BR-0184 states that for lower discount rates, linear interpolations for U_{RP} are recommended between \$1.9E+10 at 1 percent and \$1.2E+10 at 5 percent. The following equation was used to perform this linear interpolation:

$$U_{RP} = \left\{(\$1.9E+10) - \left(\frac{[(\$1.9E+10) - (\$1.2E+10)]}{[5\% - 1\%]} * [r_s - 1\%]\right)\right\} * \left\{\frac{Ratedpwr}{910MWe}\right\}$$

where:

r_s = Discount rate (small), between 1 percent and 5 percent.

Ratepwr = Rated power of each unit (including the planned power uprate)

For the base case, U_{RP} = *\$4.9E+9*.

Repair and Refurbishment

It is assumed that the plant would not be repaired.

Total Onsite Property Damage Costs

The total averted onsite damage costs is, therefore:

$$AOSC = F * (U_{CD} + U_{RP})$$

where:

F = Annual frequency of the event.

For the core damage frequency for the base case, 3.59E-05/year, *AOSC = $592,290*

The resulting monetary equivalent of $592,290 (Table 4-4).

4.20.3 SAMA Identification and Screening

The NRC and the nuclear industry have documented methods to mitigate severe accident impacts for existing and new plants designs and for in-system evaluations. Appendix F lists documents from which the NMC gathered descriptions of candidate SAMAs. In addition, the NMC, in preparing the PBNP IPE, gained insight into possible PBNP-specific improvements that could reduce severe accident risks. Table F.2-1 of Appendix F lists the 202 candidate SAMAs that the NMC identified for analysis and identifies the source of the information. The first step in the analysis was to eliminate non-viable SAMAs through preliminary screening.

Preliminary Screening

The purpose of the preliminary SAMA screening was to eliminate from further consideration enhancements that were not viable for implementation at Point Beach. Screening criteria include:

- Enhancements not applicable to Point Beach (e.g., applicable only to boiling water reactors); and
- Enhancements that have already been implemented at Point Beach (e.g., alternate AC sources already installed [additional diesel generators and gas turbine] to cope with losses of offsite power).

Table F.2-1 of Appendix F provides a brief discussion of each candidate SAMA and its disposition, whether eliminated from further consideration as not applicable, as already implemented, or designated for further analysis. Based on this preliminary screening, 137 candidate SAMAs were eliminated, and 65 of the original SAMAs were designated for further analysis.

Final Screening/Cost-Benefit Analysis

The NMC estimated the costs of implementing each SAMA through the application of engineering judgment, estimates from other licensee's submittals, and site-specific cost estimates. Evaluation was performed based on a single nuclear unit implementation basis. The cost estimates did not include the cost of replacement power during extended outages required to implement the modifications, nor did they include contingency costs associated with unforeseen implementation obstacles. Estimates based on modifications that were implemented or estimated in the past were presented in terms of dollar values at the time of implementation (or estimation), and were not adjusted to present-day dollars. Therefore, the cost estimates were conservative.

Screening based on level of benefit achieved was carried out in two steps. The first step involved calculating the maximum benefit that could possibly be provided by any one SAMA or combination of SAMAs. This maximum theoretical benefit is based upon the elimination of all plant risk and equates to the previously calculated base case risk. As shown in Table 4-4, the monetized value of this risk is approximately $673,000. Therefore, any SAMA having an estimated single nuclear unit cost of implementation exceeding this value would not be considered cost-beneficial and was screened from further consideration.

The next step involved performing a benefits analysis on the remaining SAMAs. The methodology for determining if a SAMA is beneficial consists of determining whether the benefit provided by implementation of the SAMA exceeds the expected cost of implementation. Because Point Beach does not have an external events PSA model, the expected cost of each unscreened SAMA was compared with a benefit equivalent to the internal risk benefit increased by the ratio of the sum of internal and external risk to internal risk (for Point Beach this ratio was approximately 2, effectively doubling the benefit related to internal risk only). The benefit is defined as the reduction in the sum of the dollar equivalents for each severe accident impact (offsite exposure, offsite economic costs, occupational exposure, and onsite economic costs) resulting from the implementation of the SAMA.

The result of implementation of each SAMA would be a change in the Point Beach severe accident risk (i.e., a change in frequency or consequence of severe accidents). The methodology for calculating the magnitude of these changes is straightforward. First, the Point Beach severe accident risk after implementation of each SAMA is calculated using the same methodology as for the base case. The results of the Level 2 model were combined with the Level 3 model to calculate these post-SAMA risks. Next, the difference between the monetized value of the risk of the base case (before implementation of the SAMA) and the value of the risk after implementation of the SAMA was calculated; this represents the benefit of a specific SAMA. The results of the benefit analyses for each of the SAMAs are presented in Table F.2-2 of Appendix F.

The SAMA evaluations were, in general, performed in a bounding fashion. Bounding evaluations were performed to address the generic nature of the initial SAMA concepts. Such bounding calculations overestimate the benefit and thus are conservative calculations. SAMAs were evaluated by making relatively simple, bounding changes to one or more system models and quantifying the full model. This resulted in a new set of plant damage state frequencies which where analyzed to determine the impact on public risk. For example, one SAMA deals with providing an additional service water pump to reduce the contribution to core damage frequency from loss of service water (alternatively, this could be interpreted as increasing the reliability of the existing service water pumps); the bounding calculation to estimate the benefit of this improvement was to determine the impact of perfectly reliable service water pumps. Such a calculation obviously overestimates the benefit, but if the inflated benefit indicates that the SAMA is not cost-beneficial then the purpose of the analysis is satisfied.

As described above for the base case, values for avoided public and occupational health risk were converted to a monetary equivalent (dollars) via application of the NRC’s conversion factor of $2,000 per person-rem and discounted to present value. Values for avoided offsite economic costs were also discounted to present value. The formula for calculating net value for each SAMA is as follows:

Net value = ($APE + $AOC + $AOE + $AOSC) – COE

Where $APE = monetized value of averted public exposure ($)

$AOC = monetized value of averted offsite costs ($)

$AOE = monetized value of averted occupational exposure ($)

$AOSC = monetized value of averted onsite costs ($)

COE = cost of enhancement ($)

If the net value of a SAMA is negative, the cost of the enhancement is greater than the benefit and the SAMA is not cost beneficial. Because the total value for potential risk reduction at PBNP is based upon internal, at-power risk, the NMC took the approach of comparing the expected cost of the SAMAs with the sum of the internal risk benefit and an estimate of other risk contributions. The expected cost of each SAMA (COE) was determined either by utilizing applicable cost estimates published in NRC submittals from other licensees or by expert judgement by knowledgeable Point Beach staff. The first step in the process was to review previous licensee SAMDA submittals (e.g., the Watts Bar Nuclear Plant SAMDA evaluation). If these previous submittals contained costs for a specific SAMDA, the SAMDA description was reviewed to determine if the cost estimate could reasonably be applied to Point Beach, based on Point Beach’s design and licensing bases and knowledge of implementing plant modifications. If the previous licensee submittals did not contain cost estimates or if these cost estimates could not be applied to Point Beach, a review of the benefit was performed to determine whether the SAMA could be implemented for a cost equivalent to twice the benefit. Specific detailed cost estimates were not necessary to disposition the list of SAMAs. In addition, an expert panel review was performed to provide additional insights and opinion into the costs and benefits associated with some of the SAMAs that were clearly not cost beneficial. This expert panel also provided additional insights into the expected benefit from the SAMAs in relation to other parameters (i.e. external events, current procedures, training, etc.).

The cost-benefit comparison and disposition of each remaining SAMA are presented in Table F.2-2 of Appendix F.

4.20.4 Sensitivity Analyses

NUREG/BR-0184 recommends using a 7 percent real (i.e., inflation-adjusted) discount rate for value-impact analysis and notes that a 3 percent discount rate should be used for sensitivity analysis to indicate the sensitivity of the results to the choice of discount rate. This reduced discount rate takes into account the additional uncertainties (i.e., interest rate fluctuations) in predicting costs for activities that would take place several years in the future. Analyses presented in Section 4.20.2 used the 7 percent discount rate in calculating benefits of all the unscreened SAMAs. The NMC also performed a sensitivity analysis by substituting the lower discount rate and recalculating the benefit of the candidate SAMAs

Other sensitivities were performed; each of the sensitivities produced an additional benefit result for each of the SAMAs analyzed in the cost-benefit analysis. In addition to the discount rate sensitivity discussed above, the sensitivities performed include:

- Calculation of the benefit assuming a conservative discount rate (3 percent).
- Calculation of the benefit assuming a discount rate that is realistic for the NMC (8.95 percent).

The benefits calculated for each of these sensitivities are presented in Appendix F Table F.2-3.

4.20.5 Consideration of Alternatives for Reducing Adverse Impacts

The NMC analyzed 202 conceptual alternatives for mitigating PBNP severe accident impacts. Preliminary screening eliminated 137 SAMAs from further consideration, based on inapplicability to PBNP's design or features that have already been incorporated into PBNP's current design and/or procedures and programs. During the final disposition, 56 remaining SAMA candidates were eliminated because the cost was expected to exceed their benefit. The remaining nine SAMA candidates required further evaluation; it was determined through further evaluation that these nine SAMA candidates also were not cost beneficial.

After all evaluations were completed, no SAMA candidate was found to be cost beneficial.

Using the 7 percent real discount rate recommended by NUREG/BR-0184, 65 SAMA candidates for which the evaluation was completed were determined not to be cost-beneficial. The sensitivities performed for each of the SAMAs indicated that the results of the analysis are significantly impacted by the discount rate that is assumed. A very conservative discount rate (3 percent) results in a large increase in the calculated benefit of the SAMAs. However, the NMC believes that the 7 percent discount rate is actually conservative and that a more realistic discount rate of 8.95 percent is appropriate, which would result in benefits that are much lower than that on which this analysis is based.

In summary, based on the results of this SAMA analysis, the NMC has determined that there are no new SAMA candidates that are cost beneficial.

Table 4-1. Category 1 Issues That Are Not Applicable to PBNP.[a]

Issues	Basis for Inapplicability to PBNP
Surface Water Quality, Hydrology, and Use (for all plants)	
1. Impacts of refurbishment on surface water quality	Issue applies to refurbishment, which PBNP will not undertake.
2. Impacts of refurbishment on surface water use	Issue applies to refurbishment, which PBNP will not undertake.
4. Altered salinity gradients	Issue applies to discharge to a natural water body that has a salinity gradient to alter. PBNP discharges to inland fresh waters.
Aquatic Ecology (for all plants)	
14. Refurbishment	Issue applies to refurbishment, which PBNP will not undertake.
Aquatic Ecology (for plants with cooling-tower-based heat dissipation systems)	
28. Entrainment of fish and shellfish in early life stages	Issue applies to plants with cooling-tower-based heat dissipation systems; PBNP has a once-through cooling system.
29. Impingement of fish and shellfish	Issue applies to plants with cooling-tower-based heat dissipation systems; PBNP has a once-through cooling system.
30. Heat shock	Issue applies to plants with cooling-tower-based heat dissipation systems; PBNP has a once-through cooling system.
Groundwater Use and Quality	
31. Impacts of refurbishment on groundwater use and quality	Issue applies to refurbishment, which PBNP will not undertake.
32. Groundwater use conflicts (potable and service water; plants that use < 100 gpm)	Issue applies to plants that use < 100 gpm. PBNP capability is > 100 gpm.
36. Groundwater quality degradation (Ranney wells)	Issue applies to a plant feature, Ranney wells, that PBNP does not have.
37. Groundwater quality degradation (saltwater intrusion)	Issue applies to plants in coastal areas, not inland sites such as PBNP.
38. Groundwater quality degradation (cooling ponds in salt marshes)	Issue applies to cooling ponds[b] in salt marshes, not inland sites such as PBNP.
Terrestrial Resources	
41. Cooling tower impacts on crops and ornamental vegetation	Issue applies to plants with cooling-tower-based heat dissipation systems; PBNP has a once-through cooling system.
42. Cooling tower impacts on native plants	Issue applies to plants with cooling-tower-based heat dissipation systems; PBNP has a once-through cooling system.
43. Bird collisions with cooling towers	Issue applies to plants with cooling-tower-based heat dissipation systems; PBNP has a once-through cooling system.
44. Cooling pond impacts on terrestrial resources	Issue applies to plants with cooling-pond-based heat dissipation systems; PBNP has a once-through cooling system.

Table 4-1. Category 1 Issues That Are Not Applicable to PBNP.[a] (Continued)

Issues	Basis for Inapplicability to PBNP
Human Health	
54. Radiation exposures to the public during refurbishment	Issue applies to refurbishment, which PBNP will not undertake.
55. Occupational radiation exposures during refurbishment	Issue applies to refurbishment, which PBNP will not undertake.
56. Microbiological organisms (occupational health)	Issue applies to plants with cooling-tower-based heat dissipation systems; PBNP has a once-through cooling system.
Socioeconomics	
72. Aesthetic impacts (refurbishment)	Issue applies to refurbishment, which PBNP will not undertake.

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

b. NRC has defined “cooling pond” as “a manmade impoundment that does not impede the flow of a navigable system and that is used primarily to remove waste heat from condenser water prior to recirculating the water back to the main condenser....” (NRC 1996d, Section 4.4.1.1, pg. 4-51).

< = less than

> = greater than

NRC = U.S. Nuclear Regulatory Commission

Table 4-2. Category 1 and “NA” Issues That Are Applicable to PBNP.[a]

Issue	NRC Findings[b]	GEIS Section/Page
Surface Water Quality, Hydrology, and Use (for all plants)		
3. Altered current patterns at intake and discharge structures	SMALL. Altered current patterns have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.	4.2.1.2.1/4-4 4.3.2.2/4-31 4.4.2/4-52
5. Altered thermal stratification of lakes	SMALL. Generally, lake stratification has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.	4.2.1.2.3/4-6 4.4.2.2/4-53
6. Temperature effects on sediment transport capacity	SMALL. These effects have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.	4.2.1.2.3/4-6 4.4.2.2/4-53
7. Scouring caused by discharged cooling water	SMALL. Scouring has not been found to be a problem at most operating nuclear power plants and has caused only localized effects at a few plants. It is not expected to be a problem during the license renewal term.	4.2.1.2.3/4-6 4.4.2.2/4-53
8. Eutrophication	SMALL. Eutrophication has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.	4.2.1.2.3/4-6 4.4.2.2/4-53
9. Discharge of chlorine or other biocides	SMALL. Effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term.	4.2.1.2.4/4-10 4.4.2.2/4-53
10. Discharge of sanitary wastes and minor chemical spills	SMALL. Effects are readily controlled through NPDES permit and periodic modifications, if needed, and are not expected to be a problem during the license renewal term.	4.2.1.2.4/4-10 4.4.2.2/4-53
11. Discharge of other metals in waste water	SMALL. These discharges have not been found to be a problem at operating nuclear power plants with cooling-tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. They are not expected to be a problem during the license renewal term.	4.2.1.2.4/4-10 4.3.2.2/4-31 4.4.2.2/4-53
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 contaminants has been a concern at a few nuclear power plants, but has been satisfactorily mitigated by replacing copper alloy condenser tubes with those of another metal. It is not expected to be a problem during the license renewal term.	4.2.1.2.4/4-10 4.3.3/4-33 4.4.2.2/4-53 4.4.3/4-56
16. Entrainment of phytoplankton and zooplankton	SMALL. Entrainment of phytoplankton and zooplankton has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.	4.2.2.1.1/4-15 4.3.3/4-33 4.4.3/4-56

Table 4-2. Category 1 and "NA" Issues That Are Applicable to PBNP.[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
	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
46. Bird collision with power lines	SMALL. Impacts are expected to be of small significance at all sites.	4.5.6.2/4-74

Table 4-2. Category 1 and "NA" Issues That Are Applicable to PBNP.[a] (Continued)

Issue	NRC Findings[b]	GEIS Section/Page
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 rights-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 rights-of-way	SMALL. Ongoing use of power line rights-of-way 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

Table 4-2. Category 1 and "NA" Issues That Are Applicable to PBNP.[a] (Continued)

Issue	NRC Findings[b]	GEIS Section/Page
	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)
67. Public services, education (license renewal term)	SMALL. Only impacts of small significance are expected.	4.7.3.1/4-106
	Aesthetics	
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. NRC staff has concluded that the environmental impacts of design basis accidents are of small significance for all plants.	5.3.2/5-11 5.5.1/5-114 (summary)
	Uranium Fuel Cycle and Waste Management	
77. Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste)	SMALL. Offsite impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 of this part. Based on information in the GEIS, impacts on individuals from radioactive gaseous and liquid releases including radon-222 and technetium-99 are small.	6.2.4/6-27 6.6/6-87
78. Offsite radiological impacts (collective effects)	The 100-year environmental dose commitment to the U.S. population from the fuel cycle, high-level waste, and spent fuel disposal is calculated to be about 14,800 person rem, or 12 cancer fatalities, for each additional 20-year power reactor operating term. Much of this, especially the contribution of radon releases from mines and tailing piles, consists of tiny doses summed over large populations. This same dose calculation can theoretically be extended to include many tiny doses over additional thousands of years as well as doses outside the U.S. The result of such a calculation would be thousands of cancer fatalities from the fuel cycle, but this result assumes that even tiny doses have some statistical adverse health effect, which will not ever be mitigated (for example, no cancer cure in the next thousand years), and that these dose projections over thousands of years are meaningful. However, these assumptions are questionable. In particular, science cannot rule out	Not in GEIS.

Table 4-2. Category 1 and "NA" Issues That Are Applicable to PBNP.[a] (Continued)

Issue	NRC Findings[b]	GEIS Section/Page
	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.	
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 $3x10^{-3}$ (SIC). 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	Not in GEIS.

Table 4-2. Category 1 and "NA" Issues That Are Applicable to PBNP.[a] (Continued)

Issue	NRC Findings[b]	GEIS Section/Page
	repository in the year of closure, after 1,000 years, after 100,000 years, and after 100,000,000 years. Subsequently, 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 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)

Table 4-2. Category 1 and "NA" Issues That Are Applicable to PBNP.[a] (Continued)

Issue	NRC Findings[b]	GEIS Section/Page
81. Low-level waste storage and disposal	SMALL. The comprehensive regulatory controls that are in place, and the low public doses being achieved at reactors, ensure that the radiological impacts to the environment will remain small during the term of a renewed license. The maximum additional onsite land that may be required for low-level waste storage during the term of a renewed license and associated impacts will be small. Nonradiological impacts on air and water will be negligible. The radiological and nonradiological environmental impacts of long-term disposal of low-level waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient low-level waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.	6.4.2/6-36 ("low-level" definition) 6.4.3/6-37 (low-level volume) 6.4.4/6-48 (renewal effects) 6.6/6-90 (conclusion)
82. Mixed waste storage and disposal	SMALL. The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal will not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small. In addition, the Commission concludes that the 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)
83. Onsite 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	Addendum 1

Table 4-2. Category 1 and "NA" Issues That Are Applicable to PBNP.[a] (Continued)

Issue	NRC Findings[b]	GEIS Section/Page
	applicant must submit an assessment of the implications for the environmental impact values reported in §51.52.	
	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 PBNP.[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.	Not in GEIS

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

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

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

CFR = Code of Federal Regulations
EPA = U.S. Environmental Protection Agency
GEIS = Generic Environmental Impact Statement (NRC 1996d)
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

Table 4-3. Results of Induced Current Analysis.

Transmission Line	Voltage (kV)	Limiting Case Induced Current (milliamperes)[a]
Q-303 – Kewaunee Nuclear Plant	345	4.3
L-111 – East Forest Junction (South Route)	345	4.0
L-121 – East Forest Junction (Middle Route)	345	2.2
L-151 – Greenleaf (North Route)	345	2.7

a. Values are for the limiting case road crossing. As a conservative check, the lowest clearance location without a road crossing was also calculated to ensure the limit was not exceeded.

Table 4-4. Estimated Present Dollar Value Equivalent for Severe Accidents at PBNP (Internal).

Parameter	Present Dollar Value ($)
Offsite population dose	$39,308
Offsite economic costs	$27,916
Onsite occupational dose	$13,663
Onsite economic costs	$592,290
Total	$673,180

5.0 ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION

NRC

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

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants and provides for license renewal, requiring a license renewal application that includes an environmental report (10 CFR 54.23). NRC regulations at 10 CFR 51 prescribe the environmental report content and identify the specific analyses the applicant must perform. In an effort to streamline the environmental review, NRC has resolved most of the environmental issues generically (Category 1) and only requires an applicant's analysis of the remaining issues (Category 2).

While NRC regulations do not require an applicant's environmental report to contain analyses of the impacts of Category 1 issues, the regulations [10 CFR 51.53(c)(3)(iv)] do require that an applicant identify any new and significant information of which the applicant is aware that would negate any of the generic findings that NRC has codified or evaluated in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996d). The purpose of this requirement is to alert NRC staff to such information, so the staff can determine whether to seek the Commission's approval to waive or suspend application of the rule with respect to the affected generic analysis. NRC has explicitly indicated, however, that an applicant is not required to perform a site-specific validation of GEIS conclusions (NRC 1996f, pg. C9-13, Concern Number NEP.015).

Nuclear Management Company, LLC (NMC) 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 of a particular environmental issue and that leads to an impact finding different from that codified in the regulation.

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

National Environmental Policy Act requirements as they apply to license renewal (10 CFR 51.10). CEQ guidance provides that federal agencies should prepare environmental impact statements for actions that would significantly affect the environment (40 CFR 1502.3), focus on significant environmental issues (40 CFR 1502.1), and eliminate from detailed study issues that are not significant [40 CFR 1501.7(a)(3)]. The CEQ guidance includes a lengthy definition of “significantly” that requires consideration of the context of the action and the intensity or severity of the impact(s) (40 CFR 1508.27). NMC expects that moderate or large impacts, as defined by NRC, would be significant. Chapter 4 presents the NRC definitions of “moderate” and “large” impacts.

NMC conducted an assessment for new and significant information as part of its preparation of the environmental report for the license renewal of PBNP. The License Renewal Project Environmental Review Lead directed the following actions: (1) interviews with NMC, WEPCO, and ATC subject experts on information related to the conclusions in the GEIS as they relate to PBNP, (2) review of NMC and WEPCO environmental management systems and PBNP’s environmental management matrix for how current programs manage potential impacts and/or provide mechanisms for NMC staff to become aware of new and significant information, (3) correspondence with state and federal regulatory agencies to determine if the agencies had concerns, (4) review of documents related to environmental issues at PBNP and regional environs, (5) credit for oversight provided by inspections of plant facilities and environmental monitoring operations by state and federal regulatory agencies, and (6) NMC contracted with industry experts on license renewal environmental impacts to provide an independent review of plant-related information.

As a result of this assessment, NMC is aware of no new and significant information regarding the environmental impacts of PBNP license renewal and continued operation that would make a generic conclusion modified by NRC for Category 1 issues not applicable for PBNP, that would alter regulatory or GEIS statements regarding Category 2 issues, or that would suggest any other measure of environmental impacts due to license renewal.

6.0 SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 License Renewal Impacts

Nuclear Management Company, LLC (NMC) has reviewed the environmental impacts of renewing the Point Beach Nuclear Plant (PBNP) operating licenses and has concluded that all impacts would be small and would not require mitigation. This environmental report documents the basis for NMC's conclusion. Chapter 4 incorporates by reference U.S. Nuclear Regulatory Commission (NRC) findings for the 49 Category 1 issues that apply to PBNP (and for the 2 "NA" issues for which NRC came to no generic conclusion), all of which have impacts that are small (Table 4-2). The rest of Chapter 4 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 PBNP license renewal would have on resources associated with Category 2 issues.

6.2 Mitigation

NRC

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

"…The environmental report shall include an analysis that considers and balances…alternatives available for reducing or avoiding adverse environmental effects.…" 10 CFR 51.45(c) as incorporated by 10 CFR 51.53(c)(2) and 10 CFR 51.53(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 license renewal term. NMC performs routine mitigation and monitoring activities to ensure the safety of workers, the public, and the environment. These activities include the ongoing radiological effluent control program, radiological environmental monitoring program, continuous air emissions monitoring, effluent chemistry monitoring, and monitoring of Lake Michigan water quality in the vicinity of PBNP.

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). NMC examined 21 Category 2 issues and identified the following unavoidable adverse impacts of license renewal:

- Waste heat that results from operation of the plant is discharged to Lake Michigan and locally affects its thermal pattern. The additional heat loading could cause a small increase or reduction in productivity of fish, phytoplankton, and benthos near the shoreline.
- Disposal of sanitary, chemical, and radioactive wastes have adverse impacts on land commitments. PBNP waste disposal procedures are intended to reduce adverse impacts from these sources to acceptably low levels. The generation of electricity results in spent nuclear fuel, a highly radioactive waste that has no permanent disposal option.
- Operation of PBNP results in a very small increase in radioactivity in the air and water. However, fluctuations in natural radiation background may be expected to exceed the small incremental dose increase to the local population. Operation of PBNP also establishes a very low probability risk of accidental radiation exposure to inhabitants of the area.
- Some fish are impinged on the traveling screens at the intake structures.
- Some larval fish and shellfish are 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)

Continued operation of PBNP 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 sanitary wastes generated from normal industrial operations
- elemental materials that will become radioactive, and
- materials used for the normal industrial operations of PBNP that cannot be recovered or recycled or that are consumed or reduced to unrecoverable forms.

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

NRC

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

The current balance between short-term use and long-term productivity at the PBNP site was established when the plant began operating in the early 1970s. The *Final Environmental Statement* (AEC 1972) evaluated the impacts of constructing and operating PBNP in Manitowoc County, Wisconsin. The area surrounding the plant site is agricultural. The PBNP site consists of approximately 1,260 acres. Structures and parking lots occupy about 70 acres. Approximately 1,050 acres are leased to local farmers for agricultural use. The remainder of the land is a natural mixture of woodlands, wetlands, and open areas (PSCW 1994). No other significant alteration of resources use or productivity is evident.

After decommissioning of the plant and the ISFSI, the land could be restored to terrestrial habitat, or used for other industrial purposes. Thus, the "trade-off" between the production of electricity and small changes in the local environment is reversible. The long-term productivity of the terrestrial and aquatic habitats in the vicinity of PBNP is not adversely affected by the plant. Continued operations for an additional 20 years would not alter this conclusion.

Table 6-1. Environmental Impacts Related to License Renewal at PBNP.

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 makeup water from a small river with low flow)	**None.** This issue does not apply because PBNP does not use cooling ponds or cooling towers withdrawing water from a small river.
		Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)
25	Entrainment of fish and shellfish in early life stages	**Small.** PBNP has a current WPDES permit which constitutes compliance with CWA Section 316(b) requirements.
26	Impingement of fish and shellfish	**Small.** PBNP has a current WPDES permit which constitutes compliance with CWA Section 316(b) requirements.
27	Heat shock	**Small.** PBNP has a current WPDES 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)	**Small.** PBNP has three active high-capacity wells, plus one inactive residential well, that are capable of pumping a total of 116 gpm. Actual use is approximately 6.5 gpm.
34	Groundwater use conflicts (plants using cooling towers or cooling ponds withdrawing makeup water from a small river)	**None.** This issue does not apply because PBNP does not use cooling ponds or cooling towers withdrawing water from a small river.
35	Groundwater use conflicts (Ranney wells)	**None.** This issue does not apply because PBNP does not use Ranney wells.
39	Groundwater quality degradation (cooling ponds at inland sites)	**None.** This issue does not apply because PBNP does not use cooling ponds.
		Terrestrial Resources
40	Refurbishment impacts	**None.** No impacts are expected because PBNP will not undertake refurbishment.
		Threatened or Endangered Species
49	Threatened or endangered species	**Small.** No Federally threatened or endangered species are known to occur at the site or along transmission corridors. Agency correspondence is ongoing.
		Air Quality
50	Air quality during refurbishment (non-attainment and maintenance areas)	**None.** No impacts are expected because PBNP will not undertake refurbishment.

Table 6-1. Environmental Impacts Related to License Renewal at PBNP. (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.** The issue does not apply because PBNP does not use a cooling pond, lake, or cooling tower that discharges to a small river.
59	Electric shock from transmission-line-induced currents	**Small.** The largest modeled induced current under the PBNP transmission lines would be less than 5.0 milliamperes, which is the National Electric Safety Code standard for preventing electric shock from induced current.
		Socioeconomics
63	Housing impacts	**Small.** NMC anticipates no more than 2 additional employees attributable to license renewal.
65	Public services: public utilities	**Small.** NMC anticipates no additional plant water use and no more than 2 additional employees attributable to license renewal.
66	Public services: education (refurbishment)	**None.** No impacts are expected because PBNP will not undertake refurbishment.
68	Offsite land use (refurbishment)	**None.** No impacts are expected because PBNP 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.
70	Public services: transportation	**Small.** NMC anticipates no more than 2 additional employees attributable to license renewal.
71	Historic and archaeological resources	**Small.** No cultural resource impact is identified. SHPO correspondence is ongoing.
		Postulated Accidents
76	Severe accidents	**Small.** The benefit/cost analysis identified no severe accident mitigation alternatives that would avert public risk.

> = more than
gpm = gallons per minute
WPDES = Wisconsin Pollutant Discharge Elimination System
CWA = Clean Water Act
NMC = Nuclear Management Company, LLC

7.0 ALTERNATIVES TO THE PROPOSED ACTION

NRC

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

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

"…While many methods are available for generating electricity, and a huge number of combinations or mixes can be assimilated to meet a defined generating requirement, such expansive consideration would be too unwieldy to perform given the purposes of this analysis. Therefore, NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable.…" (NRC 1996a, Section 8.1, pg. 8-1).

"…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, Section II.H, page 66541, Column 3).

Chapter 7 evaluates alternatives to the Point Beach Nuclear Plant (PBNP) Units 1 & 2 license renewal. The chapter identifies actions that the owner of PBNP, Wisconsin Electric Power Company (WEPCO), might take, and associated environmental impacts, if the U.S. Nuclear Regulatory Commission (NRC) did not renew the plant operating licenses. Chapter 7 also identifies alternative actions that the Nuclear Management Company, LLC (NMC) evaluated, but determined to be unreasonable, and presents the information upon which NMC based those determinations.

NMC divided its alternatives discussion into two categories, "no action" and "alternatives that meet system generating needs." In considering the level of detail and analysis that it should provide for each category, NMC 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)].

NMC has determined that the environmental report would support NRC decision making, as long as the document provides sufficient information to clearly indicate whether an alternative would have a smaller, comparable, or greater environmental impact than the proposed action. Providing additional detail or analysis serves no function if it only brings to light additional adverse impacts of alternatives to license renewal. This approach is consistent with regulations of the Council on Environmental Quality, which provide that the consideration of alternatives (including the proposed action) should enable reviewers to evaluate their comparative merits (40 CFR 1500-1508). NMC believes that Chapter 7 provides sufficient detail about alternatives to establish the basis for necessary comparisons to the Chapter 4 discussion of impacts from the proposed action.

In characterizing environmental impacts from alternatives, NMC has used the same definitions of “small,” “moderate,” and “large” that are presented in the Chapter 4 Introduction.

7.1 No-Action Alternative

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

In the year 2002, PBNP Units 1 & 2 provided approximately 8.0 terawatt hours of electricity (WEC 2003a). A terawatt hour is one billion kilowatt hours. This is approximately 25 percent of the energy that WEPCO provides to its 1.08 million customers (WEC 2003b).

NMC believes that any alternative would be unreasonable if it did not include replacing the capacity of PBNP Units 1 & 2. Replacement could be accomplished by (1) building new generating capacity, (2) purchasing power from outside NMC system, or (3) reducing power requirements through demand reduction. Section 7.2.1 describes each of these possibilities in detail, and Section 7.2.2 describes environmental impacts from feasible alternatives.

The *Generic Environmental Impact Statement* (GEIS) (NRC 1996d, pg. 7-1) defines decommissioning as the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license(s). NRC-evaluated decommissioning options include 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 a 60-year period. Under the no-action alternative, NMC would continue operating PBNP until the current license expires, then initiate decommissioning activities 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 NMC would conduct at PBNP, although NMC notes that the PBNP units are smaller than the referenced reactor.

As the GEIS notes, 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; and ecological, economic, and socioeconomic impacts. In Section 4.3.8 of its *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities; Supplement 1* (2002c), 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. NMC adopts by reference the NRC conclusions regarding environmental impacts of decommissioning.

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

NMC 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 1996d) and in the decommissioning GEIS (NRC 2002c). These impacts would be temporary and would occur at the same time as the impacts from meeting system generating needs.

7.2 Alternatives That Meet System Generating Needs

Decisions regarding reasonable alternatives for meeting electrical demands in Wisconsin are made primarily by two entities, the utilities and the Public Service Commission of Wisconsin (PSCW). The current mix of power generation options in Wisconsin is one indicator of what these entities believe to be feasible alternatives within the State. In 2001, Wisconsin's electric utility industry had a total installed electric generating capacity of 12,248 MWe. As Figure 7-1 indicates, this capacity includes units fueled by coal (58.5 percent), dual fired (e.g., oil and gas) (14.7 percent) nuclear (12.3 percent), oil (7.4 percent), hydroelectric (3.7 percent), gas (2.8 percent), and renewable (i.e., solar, wind, biomass) (0.6 percent). Approximately 1,856 MWe (13.2 percent of the State's generating capability) were from non-utility sources (EIA 2003, Table 4). Non-utility generators in the State also use a variety of energy sources.

In 2001, Wisconsin's utility companies generated approximately 55.0 terawatt hours of electricity. Based on 2001 generation data, and as shown in Figure 7-2, Wisconsin utilities' utilization of generating capacity was dominated by coal (73.1 percent), followed by nuclear (20.9 percent), hydroelectric (3.4 percent), gas (1.6 percent), renewable (0.6 percent), and oil (0.3 percent) (EIA 2003, Table 5).

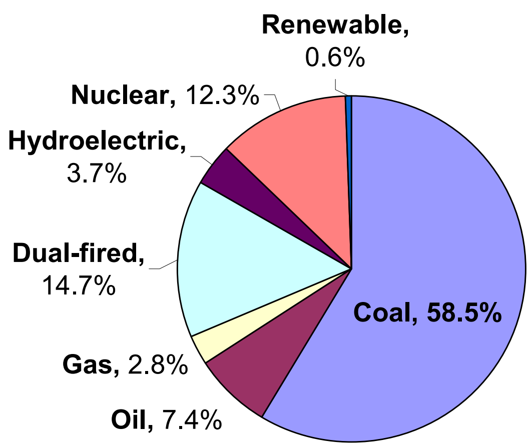


Figure 7-1. Wisconsin Utility Generating Capability, 2002.

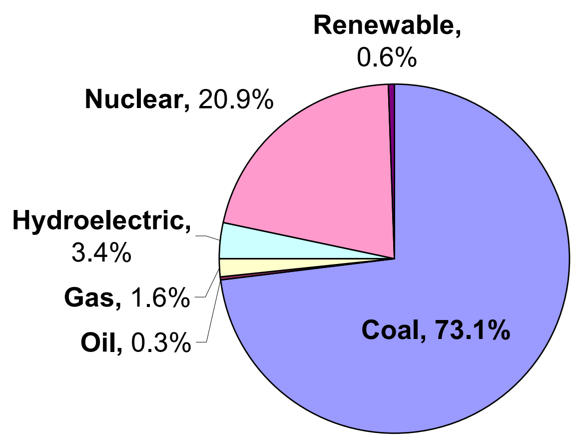


Figure 7-2. Wisconsin Utility Generating Utilization, 2002.

The differences between capacity and utilization are a reflection of preferential usage, as influenced by economic considerations in dispatching the various types of generating units. Coal-fired units, for example, represent 58.5 percent of the total installed capacity, but produced nearly 73.1 percent of the electric power generated in Wisconsin in 2001. Similarly, nuclear-powered units comprised 12.3 percent of the State-wide capacity in 2001, but provided 20.9 percent of the electric power generated in that year. This reflects the State of Wisconsin's preferential reliance on coal and nuclear energy as the least costly base-load generating sources. Figures 7-1 and 7-2 illustrate Wisconsin's utility generating capabilities and utilization, respectively.

WEPCO, owner of the PBNP assets, has a generation mix that is slightly different than the State-wide composite. Figure 7-3 presents WEPCO's generation mix for the year 2002. As shown in this figure, 61.4 percent of WEPCO's capacity comes from coal, 19.0 percent from gas, 17.9 percent from nuclear, 1.6 percent from hydroelectric, and 0.1 percent from renewables. The energy supplied by these units in 2002 (excluding purchases) was 27.6 terawatt hours. Figure 7-4 illustrates the WEPCO utilization mix for 2002. Coal power generated 67.1 percent, nuclear 27.5 percent, gas 4.2 percent, hydroelectric 0.2 percent, and 1.0 percent was generated by renewables (WEC 2003a).

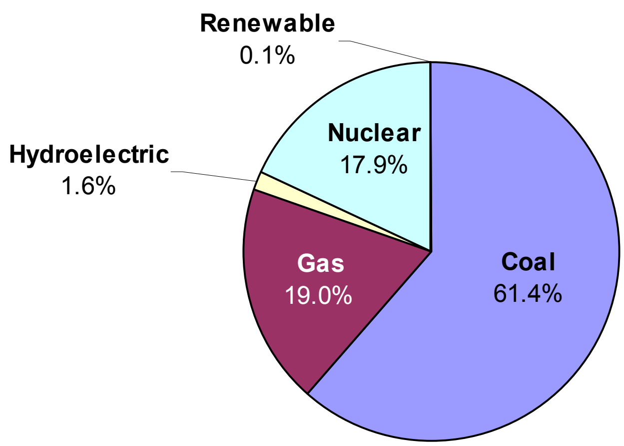


Figure 7-3. WEPCO Generating Capability, 2002.

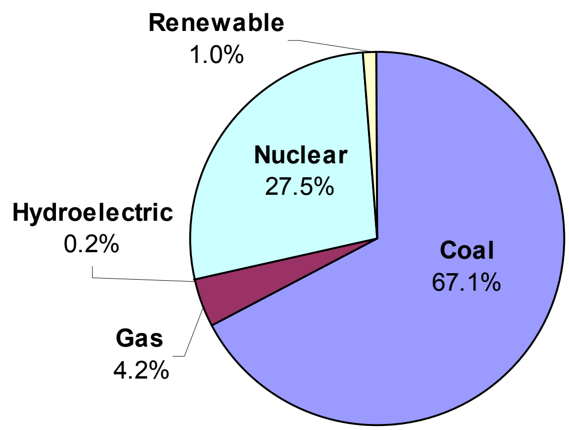


Figure 7-4. WEPCO Generation by Fuel Type, 2002.

7.2.1 Alternatives Considered

Technology Choices

For the purposes of this environmental report, NMC conducted evaluations of alternative generating technologies to identify candidate technologies that would be capable of replacing the net base-load capacity (1,036 MWe) of the nuclear units at PBNP. In performing these evaluations, NMC relied heavily on technical and economic studies performed by WEPCO in support of its “Power the Future” initiative.

The WEPCO studies identified commercially and technologically viable alternatives for PBNP: natural gas-fired combined-cycle combustion turbines and two advanced technology coal-fired options – integrated coal gasification combined-cycle (IGCC) units and supercritical pulverized coal (SCPC) units (WEC 2002a). Therefore, NMC has concluded that new plant systems that could replace the capacity of the PBNP nuclear unit are limited to natural gas-fired combined-cycle combustion turbines, IGCC, and SCPC units.

Utility Regulation

Nationally, the electric power industry has been undergoing transition. Efforts to restructure the electric utility industry began with passage of the National Energy Policy Act of 1992. Provisions of this Act required electric utilities to allow open access to their transmission lines and encouraged development of a competitive wholesale market for electricity. The Act did not mandate competition in the retail market, leaving that decision to the states (NEI 2000).

Over the past few years, restructuring of the electric utility industry has received considerable attention at the state level. Some states have opted for large-scale industry restructuring, with mixed results. Wisconsin, however, has adopted an incremental approach to restructuring that focuses on reliability and improving the State’s electric infrastructure while maintaining regulatory oversight of the state’s electric utilities (McCallum 2001).

Wisconsin has enacted two reliability laws that have made major changes to the State’s utility industry. In 1997, Wisconsin Act 204, the Electric Reliability Act, streamlined the approval process for new plant construction and authorized new merchant power plants to be built and to sell wholesale power in the State. The Act also required utilities to transfer control and operation of their transmission lines to an Independent System Operator. In 1999, Wisconsin Act 9, “Reliability 2000,” established deadlines for the transfer of transmission assets to what has become the American Transmission

Company (ATC), and transferred responsibility and funding of energy efficiency programs to the State. "Reliability 2000" also mandated that renewable resources produce 2.2 percent of the State's retail electricity sales by the year 2012 (McCallum 2001).

Potential federal legislation, market shifts, changes in neighboring states, and new technology will continue to impact decision making in Wisconsin. It is not clear whether WEPCO or another supplier would construct new generating units to replace those at PBNP, if its licenses were not renewed. Regardless of which entities construct and operate the replacement power supply, certain environmental parameters would be constant among these alternative power sources. Therefore, this report discusses the impacts of reasonable alternatives to PBNP without regard to whether they would be owned by WEPCO.

Mixture

NRC indicated in the GEIS that, while many methods are available for generating electricity and a huge number of combinations or mixes can be assimilated to meet system needs, such expansive consideration would be too unwieldy, given the purposes of the alternatives analysis. Therefore, NRC determined that a reasonable set of alternatives should be limited to analysis of single discrete electrical generation sources and only those electric generation technologies that are technically reasonable and commercially viable (NRC 1996d, pg. 8-1). Consistent with the NRC determination, WEPCO has not evaluated mixes of generating sources. In general, the impacts of a mixture of generating sources are larger than the environmental consequences of license renewal.

Alternatives

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

7.2.1.1 Construct and Operate Fossil-Fuel-Fired Generation

NMC analyzed locating hypothetical new coal- and gas-fired units at the existing PBNP site and at an undetermined greenfield site. NMC concluded that PBNP is the preferred site for new construction because this approach 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 components of the cooling system. Locating hypothetical units at the existing site has, therefore, been applied to the coal- and gas-fired units.

It must be emphasized that these are hypothetical scenarios. Neither NMC nor WEPCO has plans for such construction at PBNP.

Coal-Fired Generation

As noted above, NMC has determined that two advanced coal-fired technology options, SCPC and IGCC, are feasible alternatives to PBNP generation. It would not be economical to use trucks to haul coal and limestone from existing docks in Manitowoc or existing rail lines. Therefore, a railroad connection to existing rail lines or a receiving dock would be required. For the purposes of analysis, NMC has assumed that coal and limestone would be delivered by constructing a rail spur to the existing rail line that runs between Manitowoc and Green Bay. The new spur would be 10 to 15 miles in length, and would use 60 to 90 acres for right-of-way.

SCPC plants boost efficiency by operating at higher pressures and temperatures. They use state-of-the-art technology for improved emission control – selective catalytic reduction technology for nitrogen oxides (NO_x), wet scrubbers for control of sulfur oxides, and fabric filter baghouse for particulate matter. Table 7.1 presents the characteristics of an SCPC being considered for construction by WEPCO. The unit size is 670 MW ISO rating gross, or 615 MW ISO rating net (WEC 2002b). The output from one SCPC unit would be substantially less than the two existing units at PBNP, which have a net generation capacity of 1,036 MW. Two such units, however, exceed that generation capacity – 1,230-MW net versus 1,036-MW net. The expected annual capacity factor for the SCPC unit is about 85 percent, so the total annual generation output would be similar to that expected from PBNP. Therefore, the NMC analysis of two 670-MW SCPC units does not overstate the resulting environmental impacts.

IGCC plants use a combination of chemical processes at elevated pressures and a variety of fuels to create a gas fuel cleansed of sulfur and mercury. IGCC units also reduce the amount of solid waste produced from the combustion process and produce energy with NO_X emissions levels equivalent to controlled levels from pulverized coal plants. Table 7.2 provides a summary of the characteristics of an IGCC plant that may be constructed to replace lost generation at PBNP, should license renewal not occur. In this case, the unit size is 660 MW ISO rating gross, or 600 MW ISO rating net (WEC 2002b). Two such IGCC units would match closely for providing makeup power for the loss of PBNP generation in the absence of license renewal.

Natural-Gas-Fired Generation

As noted above, NMC has determined that natural-gas-fired combined-cycle units are a feasible alternative to PBNP generation. WEPCO submitted the requisite engineering plan and permit application forms to construct two new 545-MW natural-gas-fired combined-cycle combustion turbine (CT) units on the site of its existing Port Washington generating station. The plan has been approved and the first plant is under construction. Each 545-MW combined-cycle unit will include two CTs, two heat recovery steam generators, and one steam turbine generator (WEC 2002c).

The configuration of the natural gas-fired units proposed for Port Washington produces a net generation capacity of approximately 1,090 MW. Similar units could replace lost generation at PBNP, should the operating licenses for those units not be renewed. The CTs would be large frame-type CTs. Each of the four CTs would burn natural gas and have a generating capacity of approximately 165 MW. Each CT would have a heat recovery steam generating unit and supplemental duct firing capabilities. Each pair of heat recovery steam generators would power a steam turbine generator with a generation capacity of 215 MW (WEC 2002c).

The PBNP site has sufficient land available to accommodate the new gas-fired units proximate to the existing nuclear units. A new natural gas transmission line of approximately 40 miles in length would be required to provide natural gas supplies to the site in sufficient quantities. The existing 345-kilovolt (kV) transmission network presently extending from the PBNP site would be capable of handling the power transmittal to the grid.

Table 7.3 provides the principal design characteristics for the natural-gas-fired alternative.

7.2.1.2 Purchased Power

NMC has evaluated conventional and prospective power supply options that could be reasonably implemented before the current PBNP licenses expire. To supplement generation to meet customer demand, WEPCO purchases about 600 MW through long-term contracts with independent power producers and buys several hundred more megawatts from other interconnected utilities. In the year 2002, WEPCO purchased about 8 percent of its total generation demand (WEC 2003a). Because these contracts are part of WEPCO's current and future capacity, however, NMC does not consider these power purchases to be a feasible option for the purchased power alternative.

Before 1987, Wisconsin was a net exporter of electric power. Since that time, however, Wisconsin has imported more electric power than it has exported. In 2002, Wisconsin imported 11.4 terawatt-hours of electricity (WDOA 2003). Although Wisconsin is a net importer of power, NMC assumes that in-state power and additional out-of-state power may be available for purchase. However, in order to purchase replacement capacity for PBNP (1,036 MWe net), new construction would probably be required. NMC assumes that the generating technology used to produce purchased power would be one of those that NRC analyzed in the GEIS. For this reason, NMC is adopting by reference the GEIS description of the alternative generating technologies as representative of the purchased power alternative.

Wisconsin utilities are divided into two reliability councils. Western Wisconsin utilities are part of the Mid-America Power Pool. Eastern Wisconsin utilities, including WEPCO, are part of the Mid-America Interconnected Network. One result of having two reliability councils in the State is that there are relatively few interconnection points between the western utilities and the eastern utilities. Moreover, with the physiographic constraints imposed by Lake Michigan and the other Great Lakes, the lack of transmission facilities enabling long-range power transfers from the north and east makes the eastern portion of Wisconsin an “energy island”. In recent years, the eastern utilities’ transmission system has been able to support only about 1,000 MW of electric power imports (PSCW 2000).

Over the past few years, several transmission studies have been conducted for the region comprised of eastern Wisconsin and the adjacent portion of Michigan’s Upper Peninsula and commonly referred to as the Wisconsin-Upper Michigan System. These studies have all concluded that the existing transmission system places serious constraints on any additional power transfers into the Wisconsin-Upper Michigan System beyond existing reservations (PSCW 2000).

In January 2001, Wisconsin utilities transferred ownership of all their transmission facilities to ATC. ATC presently has responsibility for the operation of the existing transmission network, and for all future enhancements to the system (PSCW 2000). ATC plans to implement several system upgrades to eliminate current and future constraints on power transfers.

7.2.1.3 Reduce Demand

WEPCO has historically maintained a demand-side management program to implement energy efficiency services and load management activities. With the passage of Wisconsin Act 9 “Reliability 2000”, responsibility for the design and implementation of conservation measures has, in large part, passed from the individual electric utilities to the Wisconsin Department of Administration (WDOA). Under Reliability 2000, WDOA becomes responsible for such activities as energy efficiency programs, low-income energy assistance programs, renewable resource and environmental research, and development programs. This WDOA effort is financed by the transfer of funds from Wisconsin utilities at a level identified by the PSCW. The PSCW also identifies a level of funding to be retained by the individual utilities to be used for appropriate customer service and load management programs (PSCW 2000).

In 1999, spending on conservation management programs by Wisconsin electric utilities was approximately $65 million. These expenditures reduced demand by about 67 MW and resulted in State-wide energy savings of approximately 393,000 megawatt-hours (PSCW 2000).

WEPCO has prepared electric power demand forecasts that indicated a need for more than 4,000 MW of new generation in eastern Wisconsin by the year 2010. This forecast includes the assumption that PBNP will continue to operate at least through the present licensing period. To replace the PBNP generating capacity, an additional 1,000 MW of net generation would be required soon after the year 2010 (WEC 2002a). In order to supply energy for the projected demand through conservation management, annual energy savings in the State would need to increase by about 750 percent. Therefore, NMC has determined that conservation management is not a reasonable alternative to license renewal.

7.2.1.4 Other Alternatives

This section identifies alternatives that NMC has determined are not reasonable its bases for these determinations. NMC accounted for the fact that PBNP is a base-load generator and that any feasible alternative to PBNP would also need to be able to generate base-load power. In performing this evaluation, NMC relied heavily upon NRC’s GEIS (NRC 1996d, Section 8.3).

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.

The Wisconsin Energy Division, in cooperation with Wisconsin's regulated utilities, has completed a three-year wind energy study. The results indicated that large areas of northeastern Wisconsin have wind speeds high enough, under certain conditions, to economically produce electricity from modern wind machines. Annual average wind speeds in this region are 14 to 16 miles per hour at 200 feet above ground. According to the U.S. Department of Energy (DOE), if all this wind potential was developed with utility-scale turbines, the power produced each year would equal 70 terawatt hours (DOE 2002a). Since April 1998, 55 utility-scale wind turbines have been installed at five locations in the State (McCallum 2001). Each of these wind turbines is rated for 660 kilowatts (WDOA 2001).

The GEIS estimates a land use requirement of 150,000 acres per 1,000 MWe for wind power. Therefore, replacement of PBNP generating capacity with wind power, even assuming ideal wind conditions, would require dedication of about 235 square miles. Based on the lack of sufficient wind speeds and the amount of land needed to replace PBNP, the wind alternative would require a large greenfield site, which would result in a large environmental impact. Additionally, wind plants have aesthetic impacts, generate noise, and harm birds.

NMC has concluded that, due to the large amount of land needed (approximately 235 square miles) and the high degree of intermittence, combined with the lack of economical storage technologies, wind power is not a reasonable alternative to PBNP 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 1996d, Sections 8.3.2 and 8.3.3).

Solar power is not a technically feasible alternative in Wisconsin. The State receives about 3 kilowatt hours of solar radiation per square meter per day, compared with 5 to 7.2 kilowatt hours per square meter per day in areas of the West, such as California, which are most promising for solar technologies (NRC 1996d, Sections 8.3.2 and 8.3.3).

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 PBNP generating capacity with solar power would require dedication of about 55 square miles for photovoltaic and 22 square miles for solar thermal systems. Neither type of solar electric system would fit at the PBNP site, and both would have large environmental impacts at a greenfield site.

NMC has concluded that, due to the high cost, limited availability of sufficient incident solar radiation, and amount of land needed (approximately 22 to 55 square miles), solar power is not a reasonable alternative to PBNP license renewal.

Hydropower

Wisconsin has approximately 540 MW of generating capacity in place at 150 sites (McCallum 2001). As the GEIS points out in Section 8.3.4, hydropower's percentage of United States generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern over flooding, destruction of natural habitat, and destruction of natural river courses. According to the *U.S. Hydropower Resource Assessment for Wisconsin* (INEL 1996), there are no remaining sites in Wisconsin that would be environmentally suitable for a large hydroelectric facility. However, a small amount of generating capacity (about 50 MW) could be developed in Wisconsin by increasing the capacity of dams currently producing power, and by installing generating equipment at existing dams that have energy potential (McCallum 2001).

The GEIS (Section 8.3.4) estimates land use of 1,600 square miles per 1,000 MWe for hydroelectric power. Therefore, replacement of PBNP generating capacity would require flooding approximately 1,800 square miles. This would result in a large impact on land use and associated habitat. Further, operation of a hydroelectric facility would alter aquatic habitats above and below the dam, which would impact existing aquatic species.

NMC has concluded that, due to the lack of suitable sites in Wisconsin and the amount of land needed (approximately 1,800 square miles), hydropower is not a reasonable alternative to PBNP 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 Wisconsin, NMC concludes that geothermal is not a reasonable alternative to PBNP license renewal.

Wood Energy

Wood is one of Wisconsin's most abundant renewable energy resources. A large volume of wood can be found in the State's forests in the form of waste from forestry operations. Additional supplies exist in residues from Wisconsin's wood product industries and from urban sources. DOE estimates that the total amount of wood residue available for energy uses in Wisconsin is approximately 3,670,000 dry tons per year (DOE 2002b). The National Renewable Energy Laboratory (NREL) estimates that one dry ton of wood residue can produce 1,100-kWh of electricity (NREL 2002). Therefore, wood residues could be used to generate an estimated 4.0 terawatt hours of electricity in Wisconsin. Currently, Wisconsin burns almost two million tons of wood annually in over 180 commercial and industrial wood energy systems and two retrofitted coal boilers owned by electric utilities (McCallum 2001). The largest wood waste power plants, however, are 40 to 50 MW in size. A recent study estimated that approximately 130,000 acres of wood crops would be required to support a 150 MW wood energy facility. Based on this estimate, replacement of PBNP would require the dedication of about 1,550 square miles of forest area to energy production.

Further, 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 disposal (i.e., ash). 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 wood resources are abundant in Wisconsin, NMC has concluded that, due to the lack of an obvious environmental advantage, low heat content, handling difficulties, high transportation costs, and the large impact on land use, wood energy is not a reasonable alternative to PBNP 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.

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 PBNP license renewal.

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

Other Biomass-Derived Fuels

In addition to wood and municipal solid waste fuels, there are several other concepts for fueling electric generators, including burning energy crops, converting crops to a liquid fuel such as ethanol (ethanol is primarily used as a gasoline additive), and gasifying energy crops (including wood waste). As discussed in 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 PBNP.

DOE estimates that energy crops in Wisconsin could produce approximately 6,114,000 dry tons per year (DOE 2002b). In addition, a recent study estimated that approximately 130,000 acres of wood crops would be required to support a 150-MW wood energy facility (EPS 2000). Based on this estimate, replacement of PBNP generating capacity would require dedication of about 1,550 square miles to wood energy crops. This would result in a large impact on land use.

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.

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

Oil

Wisconsin has several oil-fired units; however, they generate less than one percent of the State's power. The cost of oil-fired operation is more expensive than nuclear or coal-fired operation. 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.

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.

NMC has concluded that, due to the high costs and lack of obvious environmental advantage, oil-fired generation is not a reasonable alternative to PBNP 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. More than two hundred 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. NMC believes that this technology has not matured sufficiently to support production for a facility the size of PBNP. NMC has concluded that, due to the cost and production limitations, fuel-cell technology is not a reasonable alternative to PBNP license renewal.

Delayed Retirement

Delaying retirement in order to compensate for a plant the size of PBNP would appear to be unreasonable without major construction to upgrade or replace plant components. NMC concludes 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 have been determined to be feasible alternatives to PBNP license renewal: coal- and natural-gas-fired generation at the existing PBNP site and purchased power. The coal-fired generation alternative includes the development of both SCPC and IGCC units.

7.2.2.1 Coal-Fired Generation

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

The coal-fired generation options that NMC considers as feasible alternatives to license renewal of PBNP – SCPC and IGCC – would be located at the existing PBNP site. The existing PBNP site is proximate to a large metropolitan area (the City of Green Bay), and construction impacts would thereby be reduced. Moreover, the location of the existing PBNP site on the shore of Lake Michigan, and the proximity of existing rail lines, would enable ready transport of required coal supplies by barge or rail with little construction or operational impacts. The presence of the existing 345-kV transmission line system emanating from the PBNP site, and the existing water intake and discharge structures, and other existing facilities and structures further serve to diminish ancillary environmental impacts at that location. Therefore, NMC has limited its detailed evaluation to air emissions and associated waste generation in the form of ash and scrubber waste.

WEPCO has recently received approval to build two SCPC units in Oak Creek, Wisconsin.

Air Quality

Air quality impacts of coal-fired generation differ substantially from those of nuclear power. Coal-fired power plants would emit all criteria and regulated pollutants to varying extents. As discussed in Section 7.2.1.1, NMC has assumed plant designs for both the SCPC and IGCC options that minimize air emissions through a combination of innovative technology selection and post-combustion pollutant controls. NMC estimates that the SCPC option would emit the following level of air emissions:

Sulfur oxides = 6,590 tons per year

Nitrogen oxides = 3,075 tons per year

Particulates = 791 tons per year

Similarly, NMC has estimated that the air pollutant emissions from the IGCC option to be:

Sulfur oxides = 876 tons per year

Nitrogen oxides = 2,046 tons per year

Particulates = 321 tons per year

Table 7.4 summarizes the calculations underlying the pollutant emission estimates for the SCPC option, and Table 7.5 provides the calculations for the IGCC option.

PBNP is located in Manitowoc County, which has been designated as in attainment for all criteria air pollutants, with the exception of ozone. Specifically, Manitowoc County has been designated as an ozone maintenance area. Nitrogen oxides play a significant role in the formation and scavenging of ozone in the lower troposphere. The exact impact that a new major source of nitrogen oxides would have on ozone formation in Manitowoc County and areas upwind has not yet been determined. Such analysis would be required prior to the issuance of any construction permit for a new coal-fired unit. Mitigation measures may be required before the regulatory agencies would approve the construction of a new coal-fired facility in this area. Moreover, Wisconsin fossil-fuel-fired units are subject to the emission reduction requirements of Phase II of the U.S. Environmental Protection Agency's Acid Rain Reduction Program that took effect on January 1, 2000.

In addition, the 1990 Clean Air Act Amendments (CAAA) require that new fossil fuel generating units obtain sulfur dioxide emission allowances in order to maintain a national cap on the overall release of this pollutant species. One allowance is equal to one ton of sulfur dioxide released from a source in a given year. To be in compliance with the CAAA, WEPCO must hold sufficient sulfur dioxide allowances to cover the annual emission levels from the new facility. If WEPCO could not generate enough allowances internally to account for the new sulfur dioxide emissions, it would be required to purchase additional allowances on the open market. Similarly, nitrogen oxides emissions are also controlled under the CAAA for acid rain reduction purposes.

NRC did not quantify the level of emissions from coal-fired power plants, but implied that the air impacts would be substantial. NRC noted that adverse human health effects from coal combustion have led to important federal legislation in recent years, and that public health risks have been associated with coal combustion. NRC also mentioned global warming and acid rain as potential impacts. NMC concludes that federal legislation and large-scale issues are indications of important attributes of air resources, and that sulfur dioxide emission allowances, and extensive air pollution control equipment are regulatorily imposed mitigation measures. As such, NMC concludes that the coal-fired alternative impacts on air quality would be moderate; the impacts would be clearly noticeable, but would not destabilize air quality in the area.

Waste Management

NMC concurs with the NRC GEIS assessment that the coal-fired alternative would generate substantial solid waste. Assuming an 85 percent capacity factor the SCPC coal-fired option would be expected to generate approximately 82,600 tons of fly ash, 19,300 tons of bottom ash, and 124,400 tons of flue gas desorption waste (synthetic gypsum) annually (WEC 2002b). WEPCO experience indicates that full utilization of coal combustion products is achievable within 10 years of initial operation of the SCPC units. Assuming 100 percent utilization of these materials 10 years after initial start-up, the total landfill requirement for the SCPC units would be approximately 849,000 cubic yards (WEC 2002b). Based on a standard 30-foot high waste pile, NMC estimates that the required storage footprint would cover about 177 acres.

The IGCC coal-fired option generates substantially less solid waste on a total per unit basis than the SCPC option. Gasifier slag produced in the IGCC process is a vitrified glass-like product. This material has a wide variety of beneficial uses including use in production of roof shingles, as a blasting grit, as a chip seal material for roads and parking lots or use as an alternative sand, gravel or crushed stone for pavements, parking lots or foundation bases. Assuming a 78 percent capacity factor, approximately 100,000 tons per year of slag would be produced by the IGCC coal-fired option. The IGCC coal-fired option would also produce elemental sulfur. The quantity of elemental sulfur generated annually is estimated to be about 18,000 tons per year. Assuming 100 percent utilization of these materials within 10 years of initial operation, the total landfill requirement for the IGCC units would be about 1.4 million cubic yards (WEC 2002c). Based on a standard 30-foot high waste pile, NMC estimates that the required storage footprint would cover about 188 acres.

NMC 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, NMC 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 further mitigation would be unwarranted.

Other Impacts

NMC estimates that construction of the powerblock and coal storage area would impact 600 acres of land and associated terrestrial habitat. Because most of this construction would be in agricultural areas, impacts would be moderate. As with any large construction project, some erosion and sedimentation and fugitive dust emissions could be anticipated, but would be minimized by using best management practices. Construction debris from clearing and grubbing could be disposed of onsite and municipal waste disposal capacity would be available. NMC estimates that 500-600 persons would be employed during the construction period. Socioeconomic impacts from the construction workforce would be minimal because worker relocation would not be expected, due to the site's proximity to the Green Bay metropolitan area. However, NMC estimates a workforce of 200 for operations. The reduction in workforce would result in some adverse socioeconomic impacts. Cultural resource impacts would be small, due to the assumed previously disturbed nature of the site.

Impacts to aquatic resources and water quality would be minimal, due to the plant's use of the existing cooling water system that withdraws from and discharges to Lake Michigan. The SCPC option would include two 600- to 700-foot-high stacks, and the IGCC option would require two 200- to 300-foot-high stacks. A flare of about 200 feet would also be required for the IGCC option. The additional stacks, boilers, and rail deliveries would increase the visual impact of the existing site. These visual impacts would be noticeable but they would be consistent with the industrial nature of the site.

NMC notes the EPA has revised requirements that could affect the design of cooling water intake structures for new facilities (EPA 2001) and proposed requirements that would affect modifications at existing facilities (EPA 2002). As drafted, the requirements would require the coal-fired alternative cooling system at a greenfield site to be closed-cycle. Addition of this technology to the alternative would involve constructing a natural draft cooling tower or mechanical cooling towers. Recirculation would reduce cooling water intake volume by approximately 90 percent. The need for closed-cycle cooling at the existing site would not be determined without further analysis following EPA finalization of its requirements.

NMC 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 other impacts, mitigation would not be warranted beyond that previously mentioned.

7.2.2.2 Natural Gas-Fired Generation

NRC evaluated environmental impacts from gas-fired generation alternatives in the GEIS, focusing on combined-cycle plants. Section 7.2.1.1 presents NMC's reasons for defining the gas-fired generation alternative as a combined-cycle plant located at the existing PBNP site. As with the coal-fired options, the construction of a combined-cycle plant at the existing PBNP site would allow the new facility to use certain infrastructure, such as the water intake and discharge pipes, already present on the site.

Air Quality

Natural gas is a relatively clean-burning fuel, and the gas-fired alternative would release similar types of emissions, but in lesser quantities than the coal-fired options, with the exception of particulate matter. Control technology for gas-fired turbines focuses on nitrogen oxides emissions. NMC estimates the gas-fired combined-cycle alternative to have the following emissions:

Sulfur oxides = 17.5 tons per year

Nitrogen oxides = 2,982 tons per year

Particulates = 492 tons per year

Table 7.6 indicates the basis for the foregoing emission estimates.

The discussion in Section 7.2.2.1 of regional air quality conditions and applicable CAAA requirements for coal-fired plants in Manitowoc County is the same for this gas-fired generation alternative. The influence of nitrogen oxides emissions on ambient ozone levels and the need to procure sulfur dioxide allowances and nitrogen oxides offsets would also be issues of concern for gas-fired combustion. While gas-fired turbine emissions are generally less than from a similarly sized coal-fired unit, and the regulatory requirements are generally less stringent, the emissions from such units may be substantial. Site-specific numerical air quality simulation modeling would be necessary to determine whether the expected emissions would noticeably impact upon local ambient air quality. In the absence of such simulation modeling, and in order to avoid overstating the potential impacts, NMC concludes that the air quality impacts would be moderate, though smaller than a coal-fired unit of the same generation capacity.

Waste Management

Gas-fired generation would result in almost no waste generation, producing minor, if any, environmental impacts. NMC concludes, therefore, that gas-fired solid 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 PBNP site would reduce construction-related impacts. A new gas pipeline would be required for the four 165-MW combustion turbine generators in this alternative. To the extent practicable, the pipeline would be routed along existing, previously disturbed rights-of-way to minimize impacts. However, this would still be a potentially controversial action, with ecological impacts from installation of approximately 40 miles of buried 24-inch-diameter gas pipeline to PBNP. The pipeline could require an additional 200 acres for an easement. Political impacts would be mitigated through public hearings and the use of best management practices during construction, such as minimizing soil loss and restoring vegetation immediately after an excavation is backfilled.

NMC notes that the EPA has revised requirements that could affect the design of cooling water intake structures for new facilities (EPA 2001) and proposed requirements that would affect modifications at existing facilities (EPA 2002). As drafted, the requirements would probably necessitate construction of cooling towers for the gas-fired alternative at a greenfield site.

NMC estimates that 50 acres would be needed for a plant site; this much previously disturbed acreage is available at PBNP, reducing loss of terrestrial habitat. The plant would include four 200- to 250-foot-high stacks (two for each unit). 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. NMC estimates a construction workforce of 300, so socioeconomic impacts of construction would be minimal. However, NMC estimates a workforce of 30 for gas-fired operations. The reduction in workforce would result in adverse socioeconomic impacts. NMC believes these impacts would be moderate and would be mitigated by the site's proximity to the Green Bay metropolitan area.

7.2.2.3 Purchased Power

As discussed in Section 7.2.1.2, NMC assumes that the generating technology employed under the purchased power alternative would be one of those that NRC analyzed in the GEIS. NMC is also adopting by reference the NRC analysis of the environmental impacts from those technologies. Under the purchased power alternative, therefore, environmental impacts would still occur, but would be located elsewhere within the State.

As also indicated in Section 7.2.1.2, the Wisconsin/Upper Michigan System transmission network can only support power transfers on the order of 1,000 MW at the present time. Whereas this transfer level may allow for the short-term replacement of lost generation at PBNP should that facility's license not be renewed, use of the existing transmission network for that purpose would preclude any additional transfers to accommodate either generation outages or meet peaking power needs. Long-term power purchases, therefore, would require the construction of additional transmission capacity.

Additions and changes to the present transmission network would occur on previously undisturbed land either along existing transmission line rights-of-way or along new transmission corridors. NMC concludes that the land use impact of such transmission line additions would be small to moderate. In general, land use changes would be so minor that they would neither destabilize nor noticeably alter any important land use resources. Given the potential length of new transmission corridors into eastern Wisconsin, it is reasonable to assume that, in some cases, land use changes would be clearly noticeable, a characteristic of an impact that is moderate.

Table 7-1. Coal-Fired Alternative – Supercritical Pulverized Coal.[a]

Physical Characteristics	Air Emissions	Waste Characteristics
Unit size = 670 MW ISO rating gross[b]	Sulfur oxides (controlled) = 0.15 lb/mmBtu = 1.32 lb/net-MWh	Fly ash collected = 22,186 lb/hr = 242 lb/net-MWh
Unit size = 615 MW ISO rating net[b]	Nitrogen oxides (controlled) = 0.07 lb/mmBtu = 0.616 lb/net-MWh	Bottom ash = 5,184 lb/hr = 56.5 lb/net-MWh
Number of units = 2	Particulate (controlled) = 0.018 lb/mmBtu = 0.158 lb/net-MWh	FGD waste = 33,414 lb/hr = 19.4 lb/net-MWh
Fuel type = bituminous, pulverized coal	Carbon monoxide (uncontrolled) = 0.12 lb/mmBtu = 1.06 lb/net-MWh	Total solid waste = 60,784 lb/hr = 663 lb/net-MWh
Net plant heat rate, HHV = 8800 Btu/net-kWh		
Primary fuel feed rate = 225 tons/hr.		
Full load heat input to boiler = 5900 mmBtu's/hr.		
Annual capacity factor = 85 percent		

a. All data supplied by WEPCO.
b. The difference between "net" and "gross" is electricity consumed onsite.
Btu = British thermal unit.
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59º F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
kWh = kilowatt hour
lb = pound
MW = megawatt
MWh = megawatt hour

Table 7-2. Coal-Fired Alternative – Integrated Coal Gasification.[a]

Physical Characteristics	Air Emissions	Waste Characteristics
Unit size = 660 MW ISO rating gross[b]	Sulfur oxides (controlled) = 0.030 lb/mmBtu = 0.285 lb/net-MWh	Fly ash collected = Not applicable
Unit size = 600 MW ISO rating net[b]	Nitrogen oxides (controlled) = 0.070 lb/mmBtu = 0.665 lb/net-MWh	Gasifier slag = 11,400 lb/hr = 108,300 lb/net-MWh
Number of units = 2	Particulate (controlled) = 23 lb/hr = (0.011 lb/mmBtu) = (0.105 lb/net-MWh)	Sulfur = 4,110 lb/hr = 39,045 lb/net-MWh
Fuel type = gasified bituminous coal	Carbon monoxide (uncontrolled) = 15 ppm = (0.030 lb/mmBtu) = (0.285 lb/net-MWh)	Total solid waste = 15,510 lb/hr = 147,345 lb/net-MWh
Net plant heat rate, HHV = 9,500 Btu/net-kWh		
Primary fuel feed rate = 163 tons/hr.		
Full load heat input to gasifier = 4,278 mmBtu's/hr.		
Annual capacity factor = 78 percent		

a. All data supplied by WEPCO.
b. The difference between "net" and "gross" is electricity consumed onsite.

Btu = British thermal unit
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59º F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
hr = hour
kWh = kilowatt hour
lb = pound
MW = megawatt
MWh = megawatt hour
ppm = parts per million

Table 7-3. Natural Gas-Fired Unit Characteristics.[a]

Parameter	Combustion Turbine	Heat Recovery Steam Generator	Gas Heater	Emergency Diesel Generator
Output	165 MW	215 MW	10 MBtu	725 kW
Exhaust temperature	180°F	180°F	215°F	960°F
Operating hours	8,760	8,760	8,760	500
Fuel	Natural gas	Natural gas	Natural gas	Diesel fuel
Heat input	1,557 mmBtu/hr	191 mmBtu/hr	10 mmBtu/hr	7.35 mmBtu/hr
Sulfur oxides	1.17 lbs/hr	[b]	0.006 lb/hr	1.16 lb/hr
Particulates	33.0 lbs/hr	[b]	0.076 lb/hr	1.88 lb/hr
Nitrogen oxides	200 lbs/hr	[c]	0.5 lb/hr	20.0 lb/hr

a. All data supplied by WEPCO.
b. Emissions from the duct burners are included in the combustion turbine emission factor.
c. Nitrogen oxide emissions during startup are estimated to be 279 lb/hr.

Btu = British thermal unit
F = Fahrenheit
hr = hour
kW = kilowatt
lb = pound
MW = megawatt
mmBtu = million British thermal units

Table 7-4. Air Emissions from Supercritical PC-Fired Alternative.[a]

Parameter	Calculation	Result
Annual coal consumption	2 units x 225 tons/hr max coal feed rate x 8,760 hrs/yr x 0.85 capacity factor	3,350,700 t/yr
SO_x	2 units x 5,900 mmBtu/hr x 0.15 lb SOx/mmBtu x 8,760 hrs/yr x 0.85 capacity factor x 1 ton/2000 lb	6,590 t/yr
NO_x	2 units x 5,900 mmBtu/hr x 0.07 lb NOx/mmBtu x 8,760 hrs/yr x 0.85 capacity factor x 1 ton/2000 lb	3,075 t/yr
PM	2 units x 5,900 mmBtu x 0.018 lb PM/mmBtu x 8,760 hrs/yr x 0.85 capacity factor x 1 ton/2000 lb	791 t/yr

a. All emissions data supplied by WEPCO. See Table 7-1.
hr = hour
lb = pound
mmBtu = million of British thermal units
NO_x = nitrogen oxides
PM = particulate matter
SO_x = sulfur oxides
t/yr = tons per year

Table 7-5. Air Emissions from IGCC-Fired Alternative.[a]

Parameter	Calculation	Result
Annual coal consumption	2 units x 163 tons/hr max coal feed rate x 8,760 hrs/yr x 0.78 capacity factor	2,227,493 t/yr
SO_x	2 units x 4,278 mmBtu/hr x 0.030 lb SOx/mmBtu x 8,760 hrs/yr x 0.78 capacity factor x 1 ton/2000 lb	876 t/yr
NO_x	2 units x 4,278 mmBtu/hr x 0.070 lb NOx/mmBtu x 8,760 hrs/yr x 0.78 capacity factor x 1 ton/2000 lb	2,046 t/yr
PM	2 units x 4,278 hr x 0.011 lb PM/mmBtu x 8,760 hrs/yr x 0.78 capacity factor x 1 ton/2000 lb	321 t/yr

a. All emissions data supplied by WEPCO. See Table 7-2.
hr = hour
lb = pound
mmBtu = million of British thermal units
NO_x = nitrogen oxides
PM = particulate matter
SO_x = sulfur oxides
t/yr = tons per year

Table 7-6. Air Emissions from Natural Gas-Fired Alternative.[a]

Parameter	Calculation	Result
Annual gas consumption	[(4 CT units x 1,557 mmBtu/hr) + (2 gas heaters x 10mmBtu/hr/ 1007 (btu/scf)[b])] x 0.85 capacity factor x 8760 hr/yr	46,200 mmscf/yr
SO_x	[(4 CT units x 1.17 lb SOx/hr) + (2 gas heaters x 0.006 lb SOx/hr)] x 8760 hrs/yr x 0.85 capacity factor/1 ton/ 2000 lb	17.5 t/yr
NO_x	[(4 CT units x 200 lb NOx/hr) + (2 gas heaters x 0.5 lb NOx/hr)] x 8760 hrs/yr x 0.85 capacity factor/1 ton/2000 lb	2,982 t/yr
PM	[(4 CT units x 33.0 lb PM/hr + (2 gas heaters x 0.076 lb PM/hr)] x 8760 hrs/yr x 0.85 capacity factor/1 ton/2000 lb	492 t/yr

a. All emissions data supplied by WEPCO. See Table 7-3.
b. 1999 value for gas in Wisconsin = 1007 Btu/scf (EIA 2000, Table 28)
hr = hour
lb = pound
mmBtu = million of British thermal units
NO_x = nitrogen oxides
PM = particulate matter
SO_x = sulfur oxides
t/yr = tons per year
scf = standard cubic foot

8.0 COMPARISON OF ENVIRONMENTAL IMPACTS OF LICENSE RENEWAL WITH THE ALTERNATIVES

NRC

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

Chapter 4 analyzes environmental impacts of Point Beach Nuclear Plant (PBNP) license renewal and Chapter 7 analyzes 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 are issues that the Generic Environmental Impact Statement (GEIS) (NRC 1996d) identified as major considerations in an alternatives analysis. For example, although the U. S. Nuclear Regulatory Commission (NRC) concluded that air quality impacts from the proposed action would be small (Category 1), the GEIS identified major human health concerns associated with air emissions from alternatives (Section 7.2.2). Therefore, Table 8-1 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	Proposed Action (License Renewal)	No-Action Alternative			
		Base (Decommissioning)	With Coal-Fired Generation[a]	With Gas-Fired Generation	With Purchased Power
Land Use	SMALL	SMALL	MODERATE	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	MODERATE	SMALL to MODERATE
Waste Management	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Aesthetics	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Cultural Resources	SMALL	SMALL	SMALL	SMALL	SMALL

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource. 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3.
a. Includes both supercritical pulverized coal and integrated coal gasification combined cycle options.

Table 8-2. Impacts Comparison Detail.

		No Action Alternative			
		With Coal-Fired Generation			
Proposed Action (License Renewal)	**Base (Decommissioning)**	**Supercritical Pulverized Coal (SCPC)**	**Integrated Coal Gasification Combined-Cycle (IGCC)**	**With Natural Gas-Fired Generation**	**With Purchased Power**
		Alternative Descriptions			
PBNP License Renewal for 20 years, followed by decommissioning	Decommissioning following expiration of current PBNP licenses. Adopting by reference, as bounding PBNP decommissioning, GEIS description (NRC 1996d, Section 7.1)	New construction at the PBNP site	New construction at the PBNP site	New construction at the PBNP site	Would involve construction of new generating capacity in the State. Adopting by reference GEIS description of alternate technologies (NRC 1996d, Section 7.2.1.2)
		Construct 10 to 15 miles of railroad track	Construct 10 to 15 miles of railroad track	Construct 40 miles of gas pipeline.	
		Use existing switchyard and transmission lines	Use existing switchyard and transmission lines	Use existing switchyard and transmission lines	Construct up to 200 miles of transmission lines.
		Two 670-MW SCPC units. Capacity factor = 0.85.	Two 660-MW IGCC units. Capacity factor = 0.78.	Two 545-MW combined cycle units. Each unit, consisting of two 165- MW gas-fired combustion turbines, two heat recovery steam generators, and one 215-MW steam turbine. Capacity Factor = 0.85.	
		Use existing PBNP intake/discharge canal system	Use existing PBNP intake/discharge canal system	Use existing PBNP intake/discharge canal system	
		Pulverized bituminous coal, 8,800 Btu/kWh; 5.1% ash; 0.15 lb SO_x/MMBtu; 0.07 lb NO_x/MMBtu; 3,350,700 tons coal/yr	Gasified bituminous coal; 0.030 lb SO_x/MMBtu; 9,500 Btu/kWh; 6.3% ash; 0.070 lb NO_x/MMBtu; 2,227,493 tons coal/yr	Natural gas, 1,007 Btu/ft^3; 1,557 MMBtu/hr; 1.17 lb SO_x/hr; 23.75 lb No_x/hr; 46,200,000,000 ft^3 gas/yr	
		Selective catalytic reduction for NO_x control.	Selective catalytic reduction for NO_x control.	Selective catalytic reduction for NO_x control.	
		Wet scrubber – limestone desulfurization system for SO_x control	Chemical desulfurization in gasification process		
		Fabric filter baghouse for particulate control.	Fabric filter baghouse for particulate control.		

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

		No Action Alternative			
		With Coal-Fired Generation			
Proposed Action (License Renewal)	**Base (Decommissioning)**	**Supercritical Pulverized Coal (SCPC)**	**Integrated Coal Gasification Combined-Cycle (IGCC)**	**With Natural Gas-Fired Generation**	**With Purchased Power**
Current workforce of 740 permanent employees plus 1 or 2 additional employees for the license renewal term (Section 3.4).		200 permanent employees (Section 7.2.2.1).	200 permanent employees (Section 7.2.2.1).	30 permanent employees.	
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 1996d, Section 7.3)	MODERATE – 600 acres of agricultural land for facility at PBNP location; up to 90 acres for rail spur (Section 7.2.2.1).	MODERATE – 600 acres of agricultural land for facility at PBNP location; up to 90 acres for rail spur (Section 7.2.2.1).	SMALL – 50 acres for facility at PBNP location; 200 acres for pipeline (Section 7.2.2.2).	MODERATE – most transmission facilities could be constructed along existing transmission corridors (Section 7.2.2.3) Adopting by reference GEIS description of land use impacts from alternate technologies (NRC 1996d, Section 8.2)
Water Quality Impacts					
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 3, 5-12). Three Category 2 groundwater issues not applicable (Section 4.6, Issue 34; Section 4.7, Issue 35; and Section 4.8, Issue 39).	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 the existing cooling water system that withdraws from and discharges to Lake Michigan (Section 7.2.2.1)	SMALL– Construction impacts minimized by use of best management practices. Operational impacts minimized by use of the existing cooling water system that withdraws from and discharges to Lake Michigan (Section 7.2.2.1)	SMALL – Reduced cooling water demands, inherent in combined-cycle design (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of water quality impacts from alternate technologies (NRC 1996d, Section 8.2)
Air Quality Impacts					
SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 51). Category 2 issue not applicable (Section 4.11, Issue 50).	SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issue 88)	MODERATE – 6,590 tons SO_x/yr 3,075 tons NO_x/yr 791 tons PM/yr (Section 7.2.2.1)	MODERATE – 876 tons SO_x/yr 2,046 tons NO_x/yr 321 tons PM/yr (Section 7.2.2.1)	MODERATE – 17.5 tons SO_x/yr 2,982 tons NO_x/yr 492 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 1996d, Section 8.2)

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

		No Action Alternative			
		With Coal-Fired Generation			
Proposed Action (License Renewal)	Base (Decommissioning)	Supercritical Pulverized Coal (SCPC)	Integrated Coal Gasification Combined-Cycle (IGCC)	With Natural Gas-Fired Generation	With Purchased Power
Ecological Resource Impacts					
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 15-24, 45-48). One Category 2 issue not applicable (Section 4.9, Issue 40). PBNP holds a current WPDES 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)	SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 90)	SMALL – 177 acres of agricultural land could be required for ash/sludge disposal during the first 10 years of operation. 100 percent utilization of waste products assumed after 10 years of operation. Construction of the rail spur could alter habitat. (Section 7.2.2.1)	SMALL – 188 acres of agricultural land could be required for gasifier slag and sulfur disposal during the first 10 years of operation. 100 percent utilization of waste products assumed after 10 years of operation. Construction of the rail spur could alter habitat. (Section 7.2.2.1)	SMALL – Construction of the pipeline could alter habitat. (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of ecological resource impacts from alternate technologies (NRC 1996d, Section 8.2)
Threatened or Endangered Species Impacts					
SMALL – No federally threatened or endangered species are known at the site or along transmission corridors. Agency correspondence is ongoing. (Section 4.10, Issue 49)	SMALL – Not an impact evaluated by GEIS (NRC 1996d, Section 7.3)	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats
Human Health Impacts					
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 58, 60, 61, 62). One Category 2 issue not applicable (Section 4.12, Issue 57). Risk due to transmission-line induced currents is minimal due to conformance with consensus code (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 1996d, Section 8.3.9)	MODERATE – Adopting by reference GEIS conclusion that risks such as cancer and emphysema from emissions are likely (NRC 1996d, Section 8.3.9)	SMALL – Adopting by reference GEIS conclusion that some risk of cancer and emphysema exists from emissions (NRC 1996d, Table 8.2)	SMALL to MODERATE – Adopting by reference GEIS description of human health impacts from alternate technologies (NRC 1996d, Section 8.2)

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

		No Action Alternative			
		With Coal-Fired Generation			
Proposed Action (License Renewal)	**Base (Decommissioning)**	**Supercritical Pulverized Coal (SCPC)**	**Integrated Coal Gasification Combined-Cycle (IGCC)**	**With Natural Gas-Fired Generation**	**With Purchased Power**
Socioeconomic Impacts					
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 64 and 67). Two Category 2 issues are not applicable (Section 4.16, Issue 66 and Section 4.17, Issue 68). SMALL – Location in high population area with limited growth control minimizes potential for housing impacts (Section 4.14, Issue 63). Plant contribution to county tax base is small. Plant contribution to the Town of Two Creeks tax base is moderate to large. (Section 4.17.2, Issue 69). SMALL – 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 PBNP could adversely affect surrounding counties, but would be mitigated by PBNP's proximity to the Green Bay metropolitan area (Section 7.2.2.1).	SMALL – Reduction in permanent work force at PBNP could adversely affect surrounding counties, but would be mitigated by PBNP's proximity to the Green Bay metropolitan area (Section 7.2.2.1).	SMALL to MODERATE – Reduction in permanent workforce at PBNP could adversely affect surrounding counties, but would be mitigated by PBNP's proximity to the Green Bay metropolitan area (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of socioeconomic impacts from alternate technologies (NRC 1996d, Section 8.2)
Waste Management Impacts					
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 77-85)	SMALL – Adopting by reference Category 1 issue finding (Table 4-2, Issue 87)	MODERATE – 849,000 cubic yards of solid waste would require 177 acres over 20-year license renewal term. Industrial waste generated annually (Section 7.2.2.1)	MODERATE – 1.4 million cubic yards of solid waste would require 188 acres over 20-year license renewal term. Industrial waste generated annually (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 1996d, Section 8.2)

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

		No Action Alternative			
		With Coal-Fired Generation			
Proposed Action (License Renewal)	**Base (Decommissioning)**	**Supercritical Pulverized Coal (SCPC)**	**Integrated Coal Gasification Combined-Cycle (IGCC)**	**With Natural Gas-Fired Generation**	**With Purchased Power**
Aesthetic Impacts					
SMALL – Adopting by reference Category 1 issue findings (Table 4-2, Issues 73, 74)	SMALL – Not an impact evaluated by GEIS (NRC 1996d, Section 7.3)	MODERATE – The coal-fired power block and the exhaust stacks would be visible from Lake Michigan and from a moderate offsite distance (Section 7.2.2.1)	MODERATE – The coal-fired power block, the exhaust stacks, and the flare would be visible from Lake Michigan and from a moderate offsite distance (Section 7.2.2.1)	SMALL – Steam turbines and stacks would create visual impacts comparable to those from existing PBNP facilities (Section 7.2.2.2)	SMALL to MODERATE – Adopting by reference GEIS description of aesthetic impacts from alternate technologies (NRC 1996d, Section 8.2)
Cultural Resource Impacts					
SMALL – No cultural resource impact identified. SHPO correspondence is ongoing. (Section 4.19, Issue 71)	SMALL – Not an impact evaluated by GEIS (NRC 1996d, Section 7.3)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site. Fifteen miles of railroad construction in east-central Wisconsin could affect some cultural resources (Section 7.2.2.1)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site. Fifteen miles of railroad construction in east-central Wisconsin could affect some cultural resources (Section 7.2.2.1)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site. Forty miles of pipeline construction in east-central Wisconsin could affect some cultural resources (Section 7.2.2.2)	SMALL – Adopting by reference GEIS description of cultural resource impacts from alternate technologies (NRC 1996d, Section 8.2)

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 1996d)
kWh = kilowatt hour
lb = pound
MM = million
MW = megawatt
NO_X = nitrogen oxides
PM_{10} = particulates having diameter less than 10 microns
SHPO = State Historic Preservation Officer
SO_x = sulfur oxides
TSP = total suspended particulates
yr = year

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

9.0 STATUS OF COMPLIANCE

9.1 Proposed Action

NRC

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

9.1.1 General

Table 9-1 lists environmental authorizations that the WEPCO Environmental Department has obtained for current Point Beach Nuclear Plant Units 1 and 2 (PBNP) operations. In this context "authorizations" includes any permits, licenses, approvals, or other entitlements. The WEPCO Environmental Department expects to continue renewing these authorizations during the current license period and through the U.S. Nuclear Regulatory Commission (NRC) license renewal period. Based on the new and significant information identification process described in Chapter 5, NMC concludes that PBNP Units 1 and 2 are in compliance with applicable environmental standards and requirements.

Table 9-2 lists additional environmental authorizations and consultations related to NRC renewal of the PBNP licenses to operate. As indicated, NMC 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. FWS and NMFS have issued joint procedural regulations at 50 CFR 402, Subpart B, that address consultation, and FWS maintains the joint list of threatened and endangered species at 50 CFR 17.

Although not required of an applicant by federal law or NRC regulation, NMC has chosen to invite comment from both federal and state agencies regarding potential effects that PBNP license renewal might have on threatened and endangered species. Appendix C includes copies of NMC correspondence with FWS and the Wisconsin Department of Natural Resources. NMC did not consult with NMFS because species under the auspices of NMFS are not known to be in the PBNP vicinity.

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 indicating 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)].

The NRC office of Nuclear Reactor Regulation has issued guidance to its staff regarding compliance with the Act (NRC 2001). This guidance acknowledges that Wisconsin has an approved coastal zone management program. PBNP, located in Manitowoc County, is within the Wisconsin coastal zone (WDOA 2000). NMC submitted project-descriptive material and a draft certification to the Wisconsin Coastal Management Program. Appendix E is a copy of the certification.

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, NMC has chosen to invite comment by the Wisconsin SHPO. Appendix D includes copies of NMC correspondence with the SHPO regarding potential effects that PBNP license renewal might have on historic or cultural resources.

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). 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 1996d, pg. 4 4). The U.S. Environmental Protection Agency granted the State of Wisconsin authority to issue NPDES permits under its own program, the Wisconsin Pollutant Discharge Elimination System (WPDES). NMC is applying to NRC for license renewal to continue PBNP operations. Appendix B contains the first page of the PBNP WPDES permit, which authorizes plant discharges. Consistent with the GEIS, PBNP is providing evidence of its WPDES permit as evidence of state water quality (401) certification. This is consistent with correspondence that WEPCO has received from the state that indicates that the WPDES permit takes care of the water quality determination (WDNR 2003c).

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 can be constructed and operated to comply with all applicable environmental quality standards and requirements.

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 – 24 - Unit 1	Issued 10/05/70 Expires 10/05/10	Operation of Units 1 and 2
			DPR – 27 - Unit 2	Issued 11/16/71 Expires 03/08/13	
U.S. Department of Transportation	49 USC 5108	Registration	053003450005L	Issued 06/02/03 Expires 06/30/04	Hazardous materials shipments
U. S. Environmental Protection Agency	Federal Resource Conservation and Recovery Act (42 USC 6912), Ch. 101.09 Wisconsin Statues	Notification of Regulated waste Activity	EPA ID# WID093422657	NA	Hazardous Waste Generation/ Transport
Wisconsin Department of Natural Resources	Clean Water Act (33 USC Section 1251 et seq.), Ch. 283 Wisconsin Statutes	Individual WPDES permit	WI-0000957-6	Issued 04/12/99 Expires 03/31/04 (Remains in effect pending state review of renewal application)	PBNP discharges to Lake Michigan
Wisconsin Department of Natural Resources	Clean Water Act (33 USC Section 1251 et seq.), Ch. 283 Wisconsin Statutes	General WPDES Industrial Storm Water Discharge Permit (Tier 2)	WI-S067857-1	Issued 05/30/95 Expires 03/31/06	Storm water runoff from industrial facilities
Wisconsin Department of Natural Resources	Federal Clean Air Act (42 USC 7661-7671), Ch. 285 Wisconsin Statues	Renewed Air Pollution Control Operation Permit	436034500-F10	Issued 10/17/03 Expires 10/17/08	Air emissions from a gas turbine, boilers, generators, a fire pump, and a paint spray booth

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

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Wisconsin Department of Natural Resources	Ch. 280 Wisconsin Statues	Registration	ID# 436063430	NA	Non-transient non-community water supply registration for PBNP
Wisconsin Department of Natural Resources	Ch. 280 Wisconsin Statues	Registration	ID#s 43612602, 43601096, and 43603450	NA	Transient non-community water supply registrations for Energy Info. Center , North Gatehouse, and Site Boundary Control Center
Wisconsin Department of Natural Resources	Ch. 281 Wisconsin Statues	High-Capacity Well Approval	Approval #s 52824, 52825, 52826	NA	Approval for wells with combined capacity >100,000 gpd
Wisconsin Department of Natural Resources	Ch. 29.614 Wisconsin Statutes	Scientific Collecting Permit	SCP-LM-18-9397	Issued 01/13/02 Expires 12/31/03 (Remains in effect pending state review of renewal application.)	Collection of fish for radioactivity analysis
Wisconsin Department of Commerce	Federal Resource Conservation and Recovery Act (42 USC 6912), Ch. 101.09 Wisconsin Statues	Underground Storage Tank Registration	Owner ID: 382951 Site ID: 118971 Tank IDs: 764837, 764843 285454, 930217 and 930224	Registration Date: 10/20/95 10/01/92 08/25/03	Storage of flammable materials in underground tanks

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

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Wisconsin Department of Commerce	Ch. 101.09 Wisconsin Statues	Aboveground Storage Tank Registration	Owner ID: 382951 Site ID: 118971 Tank IDs: 206578, 206579, 206580, 206581, 206582, 206583, 206584, 455264, 455274 206615, 206616 206690	Registration Date: 10/01/92 10/20/95 10/19/95	Storage of flammable materials in aboveground tanks
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	0060-48-03	Issued 01/12/04 Expires 12/31/04	Transportation of radioactive waste to disposal facility in South Carolina
Tennessee Department of Environment and Conservation	Tennessee Code Annotated 68-202-206	License to ship radioactive material	T-WI002-L03	Issued 01/01/04 Expires 12/30/04	Shipments of radioactive material to processing facility in Tennessee

> - greater than
gpd - gallons per day
NA - Not Applicable: one-time registration
USC - United States Code
WPDES - Wisconsin Pollutant Discharge Elimination System

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 (FWS)	Endangered Species Act, Section 7 (16 USC 1536)	Consultation	Requires federal agency issuing a license to consult with FWS (Appendix C)
Wisconsin Department of Natural Resources	Clean Water Act, Section 401 (33 USC 1341)	NA	Requires State certification that proposed action would comply with Clean Water Act standards, however PBNP qualifies for a waiver under NR299.01(2)(c)of Wis. Admin. Code.
Wisconsin Historical Society	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)
Wisconsin Department of Administration	Federal Coastal Zone Management Act (16 USC 1451 et seq.)	Certification	Requires an applicant to provide certification to the federal agency issuing the license that license renewal would be consistent with the federally approved state coastal zone management program. Based on its review of the proposed activity, the State must concur with or object to the applicant's certification. (Appendix E)

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

10.0 REFERENCES

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

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Zeuske, C. Wisconsin Department of Revenue. 2001. Letter to S. McCallum, Governor of Wisconsin. Recommendations for utility tax law reformation. February 28.

APPENDIX A

NRC NEPA ISSUES FOR LICENSE RENEWAL OF NUCLEAR POWER PLANTS

Nuclear Management Company, LLC (NMC) has prepared this environmental report in accordance with the requirements of U.S. Nuclear Regulatory Commission (NRC) regulation 10 CFR 51.53. NRC included in the regulation a list of National Environmental Policy Act (NEPA) issues for license renewal of nuclear power plants. Table A-1 lists these 92 issues and identifies the section in which NMC addressed each issue in the environmental report. For expediency, NMC has assigned a number to each issue and uses the issue numbers throughout the environmental report.

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

	Issue	Category	Section of this Environmental Report
1.	Impacts of refurbishment on surface water quality	1	4.0
2.	Impacts of refurbishment on surface water use	1	4.0
3.	Altered current patterns at intake and discharge structures	1	4.0
4.	Altered salinity gradients	1	4.0
5.	Altered thermal stratification of lakes	1	4.0
6.	Temperature effects on sediment transport capacity	1	4.0
7.	Scouring caused by discharged cooling water	1	4.0
8.	Eutrophication	1	4.0
9.	Discharge of chlorine or other biocides	1	4.0
10.	Discharge of sanitary wastes and minor chemical spills	1	4.0
11.	Discharge of other metals in waste water	1	4.0
12.	Water use conflicts (plants with once-through cooling systems)	1	4.0
13.	Water use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow)	2	4.1
14.	Refurbishment impacts to aquatic resources	1	4.0
15.	Accumulation of contaminants in sediments or biota	1	4.0
16.	Entrainment of phytoplankton and zooplankton	1	4.0
17.	Cold shock	1	4.0
18.	Thermal plume barrier to migrating fish	1	4.0
19.	Distribution of aquatic organisms	1	4.0
20.	Premature emergence of aquatic insects	1	4.0
21.	Gas supersaturation (gas bubble disease)	1	4.0
22.	Low dissolved oxygen in the discharge	1	4.0
23.	Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	1	4.0
24.	Stimulation of nuisance organisms (e.g., shipworms)	1	4.0
25.	Entrainment of fish and shellfish in early life stages for plants with once-through and cooling pond heat dissipation systems	2	4.2
26.	Impingement of fish and shellfish for plants with once-through and cooling pond heat dissipation systems	2	4.3
27.	Heat shock for plants with once-through and cooling pond heat dissipation systems	2	4.4

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

	Issue	Category	Section of this Environmental Report
28.	Entrainment of fish and shellfish in early life stages for plants with cooling-tower-based heat dissipation systems	1	4.0
29.	Impingement of fish and shellfish for plants with cooling-tower-based heat dissipation systems	1	4.0
30.	Heat shock for plants with cooling-tower-based heat dissipation systems	1	4.0
31.	Impacts of refurbishment on groundwater use and quality	1	4.0
32.	Groundwater use conflicts (potable and service water; plants that use < 100 gpm)	1	4.0
33.	Groundwater use conflicts (potable, service water, and dewatering; plants that use > 100 gpm)	2	4.5
34.	Groundwater use conflicts (plants using cooling towers withdrawing makeup water from a small river)	2	4.6
35.	Groundwater use conflicts (Ranney wells)	2	4.7
36.	Groundwater quality degradation (Ranney wells)	1	4.0
37.	Groundwater quality degradation (saltwater intrusion)	1	4.0
38.	Groundwater quality degradation (cooling ponds in salt marshes)	1	4.0
39.	Groundwater quality degradation (cooling ponds at inland sites)	2	4.8
40.	Refurbishment impacts to terrestrial resources	2	4.9
41.	Cooling tower impacts on crops and ornamental vegetation	1	4.0
42.	Cooling tower impacts on native plants	1	4.0
43.	Bird collisions with cooling towers	1	4.0
44.	Cooling pond impacts on terrestrial resources	1	4.0
45.	Power line right-of-way management (cutting and herbicide application)	1	4.0
46.	Bird collisions with power lines	1	4.0
47.	Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	1	4.0
48.	Floodplains and wetlands on power line right-of-way	1	4.0
49.	Threatened or endangered species	2	4.10
50.	Air quality during refurbishment (non-attainment and maintenance areas)	2	4.11
51.	Air quality effects of transmission lines	1	4.0

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

	Issue	Category	Section of this Environmental Report
52.	Onsite land use	1	4.0
53.	Power line right-of-way land use impacts	1	4.0
54.	Radiation exposures to the public during refurbishment	1	4.0
55.	Occupational radiation exposures during refurbishment	1	4.0
56.	Microbiological organisms (occupational health)	1	4.0
57.	Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	2	4.12
58.	Noise	1	4.0
59.	Electromagnetic fields, acute effects (electric shock)	2	4.13
60.	Electromagnetic fields, chronic effects	NA[b]	4.0
61.	Radiation exposures to public (license renewal term)	1	4.0
62.	Occupational radiation exposures (license renewal term)	1	4.0
63.	Housing impacts	2	4.14
64.	Public services: public safety, social services, and tourism and recreation	1	4.0
65.	Public services: public utilities	2	4.15
66.	Public services: education (refurbishment)	2	4.16
67.	Public services: education (license renewal term)	1	4.0
68.	Offsite land use (refurbishment)	2	4.17.1
69.	Offsite land use (license renewal term)	2	4.17.2
70.	Public services: transportation	2	4.18
71.	Historic and archaeological resources	2	4.19
72.	Aesthetic impacts (refurbishment)	1	4.0
73.	Aesthetic impacts (license renewal term)	1	4.0
74.	Aesthetic impacts of transmission lines (license renewal term)	1	4.0
75.	Design basis accidents	1	4.0
76.	Severe accidents	2	4.20
77.	Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste)	1	4.0
78.	Offsite radiological impacts (collective effects)	1	4.0

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

	Issue	Category	Section of this Environmental Report
79.	Offsite radiological impacts (spent fuel and high-level waste disposal)	1	4.0
80.	Nonradiological impacts of the uranium fuel cycle	1	4.0
81.	Low-level waste storage and disposal	1	4.0
82.	Mixed waste storage and disposal	1	4.0
83.	Onsite spent fuel	1	4.0
84.	Nonradiological waste	1	4.0
85.	Transportation	1	4.0
86.	Radiation doses (decommissioning)	1	4.0
87.	Waste management (decommissioning)	1	4.0
88.	Air quality (decommissioning)	1	4.0
89.	Water quality (decommissioning)	1	4.0
90.	Ecological resources (decommissioning)	1	4.0
91.	Socioeconomic impacts (decommissioning)	1	4.0
92.	Environmental justice	NA[b]	2.6.2

a. 10 CFR 51, Subpart A, Appendix A, Table B-1. (Issue numbers added to facilitate discussion.)
b. Not applicable. Regulation does not categorize this issue.
NEPA = National Environmental Policy Act.
< = less than
> = greater than
gpm = gallons per minute

APPENDIX B

WPDES PERMIT

The Wisconsin Pollutant Discharge Elimination System (WPDES) permit for Wisconsin Electric Power Company's Point Beach Nuclear Plant is approximately 20 pages long. Therefore, only the cover page, providing the authority to discharge to Lake Michigan, is included in this Appendix.

WPDES Permit No. WI-0000957-6

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

PERMIT TO DISCHARGE UNDER THE
WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of Chapter 283, Wisconsin Statutes [formerly Chapter 147],

WISCONSIN ELECTRIC POWER COMPANY

is permitted to discharge from a facility located at

POINT BEACH NUCLEAR POWER PLANT
6610 NUCLEAR ROAD
TWO RIVERS, WISCONSIN 54241

to

LAKE MICHIGAN, an UNNAMED TRIBUTARY TO LAKE MICHIGAN, and the GROUNDWATERS of the LAKE MICHIGAN DRAINAGE BASIN

in accordance with the effluent limitations, monitoring requirements and other conditions set forth in this permit.

The permittee shall not discharge after the date of expiration. If the permittee wishes to continue to discharge after this expiration date an application shall be filed for reissuance of this permit, according to Chapter NR 200, Wis. Adm. Code, at least 180 days prior to the expiration date given below.

State of Wisconsin Department of Natural Resources
For the Secretary

By Al Shea

Al Shea, Bureau Director
Bureau of Watershed Management

4/12/99

Date of Signature

WISCONSIN
DEPT. OF NATURAL RESOURCES

EFFECTIVE DATE: Date of Signature

EXPIRATION DATE: March 31, 2004

APPENDIX C

SPECIAL-STATUS SPECIES CORRESPONDENCE

Letter

NMC
Committed to Nuclear Excellence

Point Beach Nuclear Plant
Operated by Nuclear Management Company, LLC

December 22, 2003

NPL 2003-0293
10 CFR 54

Ms. Janet Smith
Field Supervisor
Green Bay Ecological Services Office
U.S. Fish & Wildlife Service
1015 Challenger Court
Green Bay, WI 54311-8331

SUBJECT: License Renewal Application for Point Beach Nuclear Plant
Request for Information on Threatened or Endangered Species

Dear Ms. Smith:

Nuclear Management Company[1], LLC (NMC) is assessing the requirements for renewing the operating licenses for Point Beach Nuclear Plant Units 1 and 2 (PBNP). The results of this assessment will be contained in an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses. We are contacting you to obtain your feedback regarding the impact continued plant operation would have on threatened and endangered species. The NRC is the federal agency responsible for reviewing and approving nuclear plant License Renewal Applications. As part of that application the NRC recommends that each applicant make advanced contact with other state and federal agencies, including the U.S. Fish & Wildlife Service. Each agency assessment will be included in the records established as part of the License Renewal Application review by the NRC.

The current operating licenses for Units 1 and 2 expire in 2010 and 2013, respectively. The renewal term would be for an additional 20 years beyond the original license expiration date. As part of the license renewal process, the NRC requires license renewal applicants to "assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act" (10 CFR 51.53). The NRC will request an informal consultation with your office at a later date under Section 7 of the Endangered Species Act. By contacting you early in the assessment process, we hope to identify any issues that need to be addressed or any information your office may need to help expedite the NRC consultation.

1 NMC holds the operating license for PBNP, and is applying for a renewed PBNP operating license. Wisconsin Electric Power Company (WEPCO) doing business under the name We Energies owns the plant and retains exclusive rights to electricity generated at the plant.

6590 Nuclear Road • Two Rivers, Wisconsin 54241
Telephone: 920.755.2321

U.S. Fish and Wildlife Services
Page 2

The remainder of this letter describes the location of PBNP, its associated facilities, and our own assessment of the continued plant operation on threatened and endangered species.

NRC regulations require that the applicant provide an assessment of impacts to all resources that were affected by the original construction of the facility, including affects related to all associated facilities. Therefore the following description of the plant and related facilities includes corridors containing transmission lines that connect PBNP to the state's electrical grid. The American Transmission Company (ATC) is owner of these facilities and will continue to own, maintain and operate this electricity transmission equipment.

PBNP lies on the western shore of Lake Michigan in Manitowoc County, Wisconsin, approximately 30 miles southeast of Green Bay (see attached Figure 2-1). The PBNP site proper encompasses approximately 1,260 acres, most of which is agricultural land (leased to farmers) and scattered woodlots. Three 345-kV transmission lines were built in the 1960s to connect PBNP to the regional grid (see Figure 3-2). A fourth 345-kV transmission line connects the Kewaunee Nuclear Plant to the PBNP. These lines, owned and maintained by ATC, total approximately 73 miles.

Based on a review of historical documents and information on the Wisconsin Department of Natural Resources (WDNR) website (county records of "rare, threatened, and endangered species"), NMC believes that no federally-listed species occur on the PBNP site proper or within/along approximately 73 miles of associated transmission corridors. As noted above, NMC does not own or maintain the transmission lines that connect PBNP to the regional grid, and is not involved in vegetation management in the associated transmission corridors.

Two listed bird species, the bald eagle (*Haliaeetus leucocephalus*) and the piping plover (*Charadrius melodus*), have been recorded in Brown and Manitowoc Counties, however, and cannot be ruled out as occasional visitors to the PBNP site. Bald eagles are relatively common in western and central Wisconsin, particularly along the Mississippi and Wisconsin Rivers. They are uncommon in southeastern Wisconsin in the more populous counties that border Lake Michigan. Bald eagles are not believed to nest in the area. They are known to nest in the western part of Manitowoc County, however.

Piping plovers have historically nested in small numbers along the Lake Superior shoreline, but have not nested successfully along the Wisconsin shore of Lake Michigan in a half-century. Small numbers of migrants (1-4 birds) are seen each spring migrating along the western shore of Lake Michigan. Approximately 5 miles of Lake Michigan shoreline in the Point Beach State Forest (3 miles south of PBNP) was designated

U.S. Fish and Wildlife Services
Page 3

critical habitat for the Great Lakes population of piping plover in May 2001 (66 FR 22938) because the beach area "includes areas of suitable piping plover nesting habitat." One piping plover was observed in the Point Beach State Forest in the spring of 2001. No nesting has been documented in the area.

In addition to the bald eagle and piping plover, three federally listed plants may be found in Brown and Manitowoc Counties: the dune (or pitcher's) thistle (*Cirsium pitcheri*), the dwarf lake iris (*Iris lacustris*), and the prairie white-fringed orchid (*Plantanthera leucophaea*). There is no suitable habitat for any of these species on the PBNP property, and none are likely to be found inland along transmission corridors.

NMC is committed to the conservation of significant natural habitats and protected species, and expects that operation of the Plant through the license renewal period (an additional 20 years) would not adversely affect any listed species. NMC has no plans to alter current operations over the license renewal period. Maintenance activities necessary to support continued operation would be limited to previously disturbed areas. No expansion of existing facilities is planned, and no additional land disturbance is anticipated during the period of continued operation. As a consequence, we believe that operation of the plant, including maintenance of transmission lines, over the license renewal term would not adversely affect any threatened or endangered species.

This letter is to solicit your input into identification of any issues related to threatened and endangered species at Point Beach and associated facilities that you believe may need to be addressed. Once the License Renewal Application is filed with the NRC, you will be contacted by the NRC to assess any impact this license renewal would have on issues concerning the U.S. Fish and Wildlife Service and other agencies. A letter similar to this is being sent to Jennifer Bardeen at the WDNR, also regarding assessment of any impact of license renewal on threatened and endangered species.

Your response to requests for feedback regarding any effects license renewal may have on threatened and endangered species, is very important in this application process. To ensure that your written comments are included in our application filing with the NRC, we would appreciate your response to us by late January, 2004. If there are any concerns that need to be addressed regarding any listed species in the project area, please let us know as soon as possible. We will include a copy of this letter and your response, if available, as part of our License Renewal Application.

U.S. Fish and Wildlife Services
Page 4

Please contact Sue Schumacher of We Energies at 414 221-2189 or Roger Newton, NMC License Renewal Project Manager, at 920-755-6522 if you have any questions or require any additional information.

A. J. Cayia
Site Vice-President, Point Beach Nuclear Plant
Nuclear Management Company, LLC

Enclosures: Figures 2-1 and 3-2 from Environmental Report

cc: Sue Schumacher
Dave Weaver
Kris McKinney
Rita Hayen, ATC

U.S. Fish and Wildlife Services
Page 5

bcc:	A. J. Cayia	D. E. Cooper	K. M. Duescher (2)
	J. G. Schweitzer	R. D. Kuester	M. E. Holzmann
	L. A. Schofield (OSRC)	J. H. McCarthy	R. D. Scott
	J. W. Connolly	D. A. Weaver (P346)	E. J. Weinkam III
	File		

ENCLOSURE 1

**Figure 2.1
Point Beach Nuclear Plant
License Renewal Application
Environmental Report**

Page 1 of 2

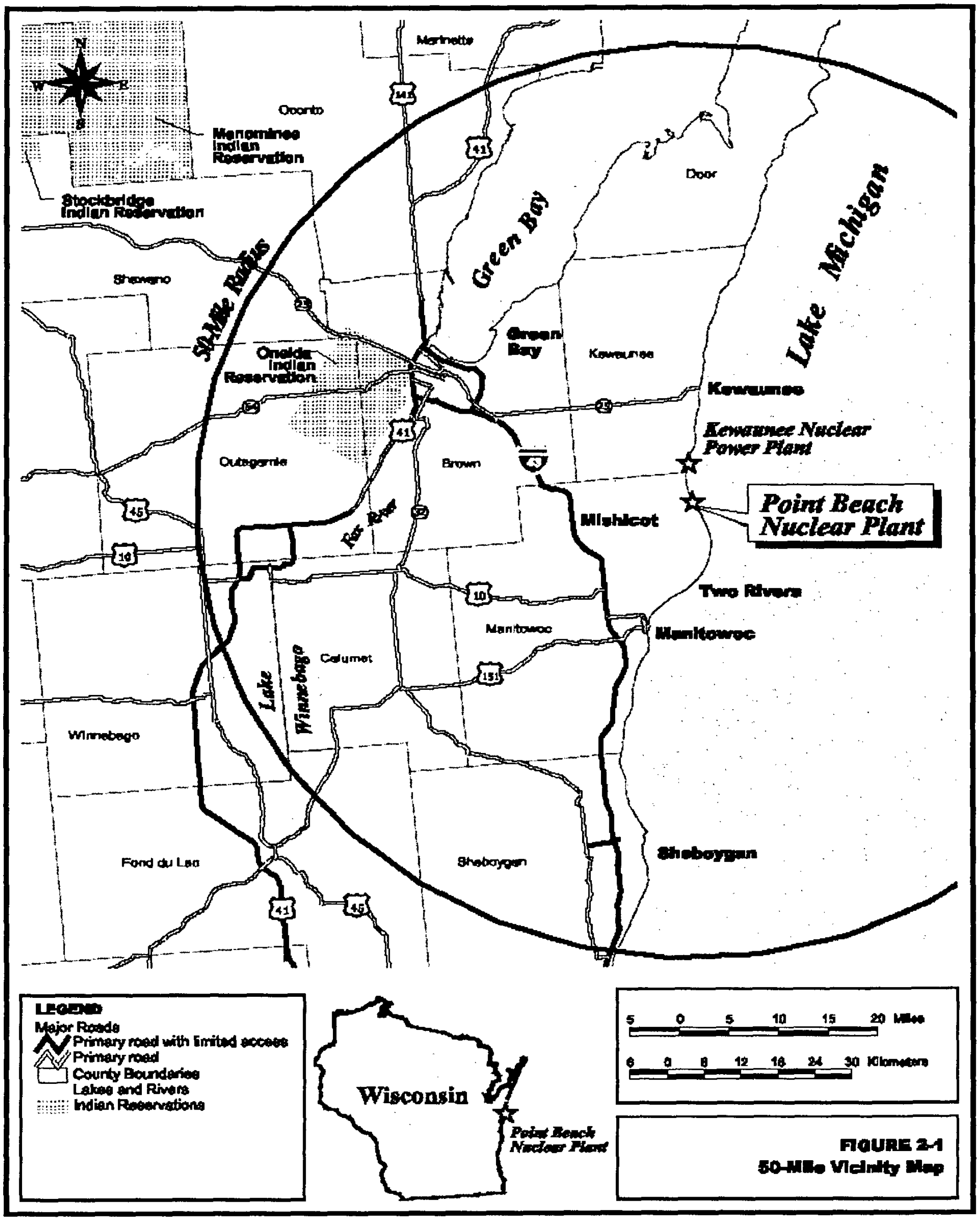

FIGURE 2-1
50-Mile Vicinity Map

ENCLOSURE 2

Figure 3-2
Point Beach Nuclear Plant
License Renewal Application
Environmental Report

Page 1 of 2

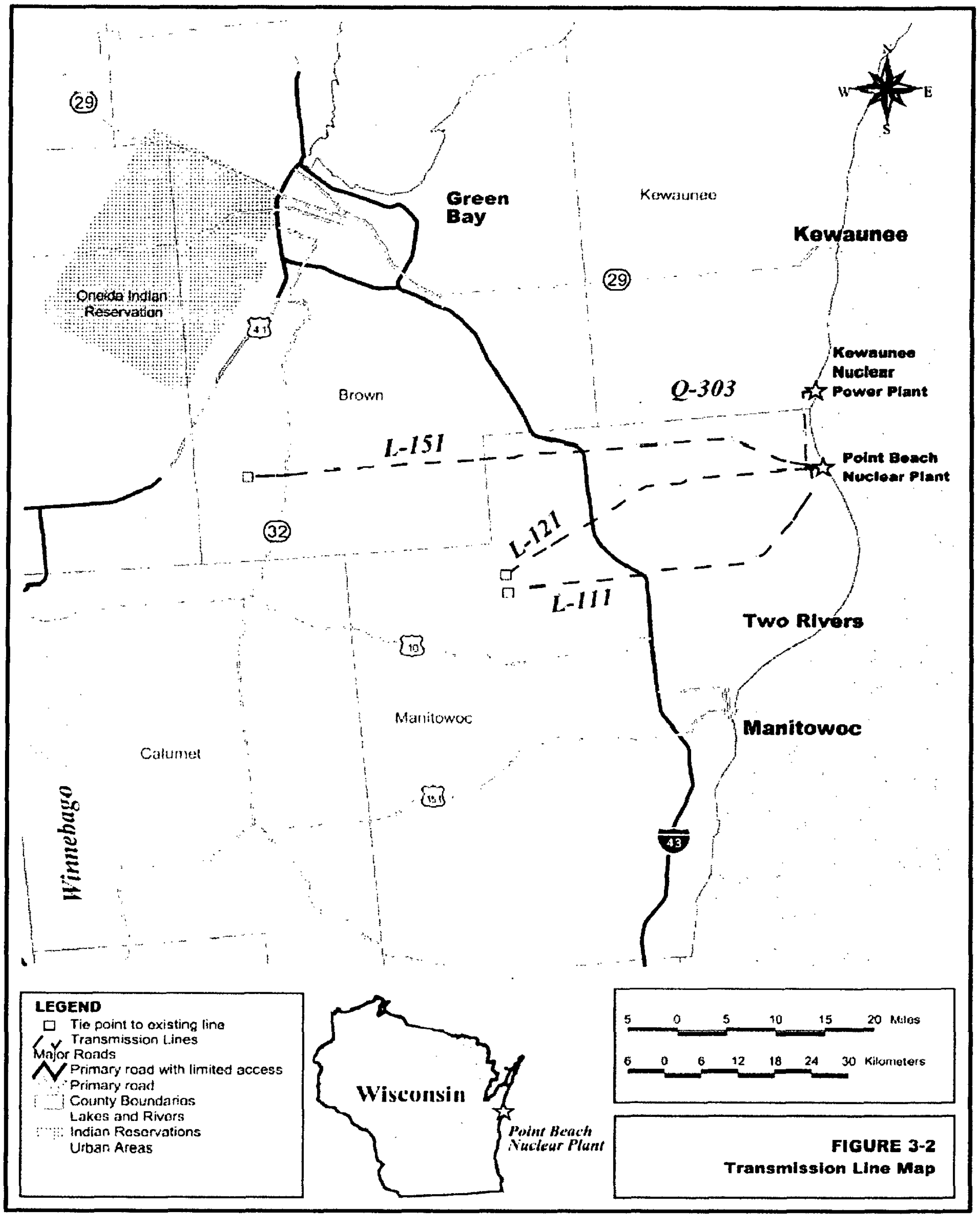

FIGURE 3-2
Transmission Line Map

Page 2 of 2

NMC
Committed to Nuclear Excellence

Point Beach Nuclear Plant
Operated by Nuclear Management Company, LLC

December 22, 2003

NPL 2003-0295
10 CFR 54

Ms. Jennifer Bardeen
Environmental Review Coordinator
Bureau of Endangered Resources
Wisconsin Dept. of Natural Resources
101 South Webster St., Box 7921
Madison, WI 53707-7921

SUBJECT: License Renewal Application for Point Beach Nuclear Plant Request for Agency Assessment of Impacts on Threatened or Endangered Species

Dear Ms. Bardeen:

Nuclear Management Company[1], LLC (NMC), is assessing the requirements for renewing the operating licenses for Point Beach Nuclear Plant Units 1 and 2 (PBNP). The results of our assessment will be contained in an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses. We are contacting you to obtain your feedback regarding the impact continued plant operation would have on threatened and endangered species. The NRC is the federal agency responsible for reviewing and approving nuclear plant License Renewal Applications. As part of that application, the NRC recommends that each applicant make advanced contact with other state and federal agencies, including the Wisconsin Department of Natural Resources (WDNR). The Bureau of Endangered Resources' assessment of environmental impact on threatened and endangered species will be included in the records established as part of the License Renewal Application review by the NRC.

The current operating licenses for Units 1 and 2 expire in 2010 and 2013, respectively. The renewal term would be for an additional 20 years beyond the original license expiration date. As part of the license renewal process, the NRC requires license renewal applicants to "assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act" (10 CFR 51.53). Once a License Renewal Application is received, the NRC will contact the WDNR to seek assistance in the identification of important species and habitats in the project area. By contacting you early in the assessment process, we hope to identify any

1 NMC holds the operating license for PBNP, and is applying for a renewed PBNP operating license. Wisconsin Electric Power Company (WEPCO) doing business under the name We Energies owns the plant and retains exclusive rights to electricity generated at the plant.

RECD JAN 05 2004

6590 Nuclear Road • Two Rivers, Wisconsin 54241
Telephone: 920.755.2321

Department of Natural Resources
Page 2

issues that need to be addressed or any information your office may need to help expedite the NRC consultation.

The remainder of this letter describes the location of PBNP, its associated facilities, and our own assessment of the continued plant operation on threatened and endangered species.

NRC regulations require that the applicant provide an assessment of impacts to all resources that were affected by the original construction of the facility, including affects related to all associated facilities. Therefore the following description of the plant and related facilities includes corridors containing overhead transmission lines that connect PBNP to the state's electrical grid. The American Transmission Company (ATC) is owner of these transmission facilities and will continue to own, maintain and operate this electricity transmission equipment.

PBNP lies on the western shore of Lake Michigan in Manitowoc County, Wisconsin, approximately 30 miles southeast of Green Bay (see attached Figure 2-1). The PBNP site proper encompasses approximately 1,260 acres, most of which is active agricultural land (leased to farmers) and scattered woodlots. Three 345-kV transmission lines were built in the 1960s to connect to the regional grid (see Figure 3-2). A fourth 345-kV transmission line connects the Kewaunee Nuclear Plant to the PBNP. These lines, owned and maintained by ATC, total approximately 73 miles.

NMC has reviewed historical WEPCO documents and information on the WDNR website (Natural Heritage Inventory Database), and has determined that five federally-listed species likely occur in Brown and Manitowoc Counties: the bald eagle *(Hallaeetus leucocephalus),* the piping plover *(Charadrius melodus)*, the dune or pitcher's thistle *(Cirsium pitcheri)*, the dwarf lake iris *(Iris lacustris)*, and the prairie white-fringed orchid *(Platanthera leucophaea)*. It should be emphasized, however, that none of these species has actually been observed on the PBNP site.

NMC's review of the Natural Heritage Inventory database suggests that two state-listed species could occur in the terrestrial or aquatic vicinity of the transmission lines that connect the plant to the regional grid (see Figure 3-2 for the routes of the transmission lines). They are the Greater redhorse (*Moxostoma valenciennesi*) and the Snow trillium (*Trillium nivale*).

Department of Natural Resources
Page 3

The following species could occur in or nearby transmission corridors associated with PBNP:

Transmission Line No.	**Species**
L-111	Greater redhorse (*Moxostoma valenciennesi*)
L-121	Snow trillium (*Trillium nivale*)
L-151	Snow trillium (*Trillium nivale*), Greater redhorse (*Moxostoma valenciennesi*)
Q-303	No known species

As noted above, WEPCO no longer owns or maintains the transmission lines that connect PBNP to the regional grid, and is not involved in vegetation management in these transmission corridors. Typical maintenance of a transmission line corridor includes cutting of tall woody vegetation (which could interfere with the transmission lines). Therefore, any potential impacts to these species would only occur as a result of ATC maintenance of these transmission lines. The lines are now an integral part of the regional transmission grid and independent of Point Beach operation.

NMC is committed to the conservation of significant natural habitats and protected species, and expects that operation of the Plant through the license renewal period (an additional 20 years) would not adversely affect any listed species. NMC has no plans to alter current operations over the license renewal period. Maintenance activities necessary to support continued operation would be limited to previously disturbed areas. No expansion of existing facilities is planned, and no additional land disturbance is anticipated during the period of continued operation. As a consequence, we believe that operation of the plant, including maintenance of transmission lines, over the license renewal term would not adversely affect any threatened or endangered species.

This letter is to solicit your input into identification of any issues related to threatened and endangered species at Point Beach and associated facilities that you believe may need to be addressed. Once the License Renewal Application is filed with the NRC, you will be contacted by the NRC to assess any impact this license renewal would have on threatened and endangered species. Ms. Janet Smith at the U.S. Fish and Wildlife Service will also receive a similar request regarding assessment of any impact on Federal threatened and endangered species.

Your response to requests for feedback regarding any effects license renewal may have on threatened and endangered species, is very important in this application process. To ensure that your written comments are included in our application filing with the NRC, we would appreciate your response to us by late January, 2004. If there are any concerns that need to be addressed regarding any listed species in the project area, please let us know as soon as possible. We will include a copy of this letter and, if available, your response as part of our License Renewal Application.

Department of Natural Resources
Page 4

Please contact Sue Schumacher of We Energies at 414-221-2189 or Roger Newton, NMC License Renewal Project Manager, at 920-755-6522 if you have any questions or require any additional information.

Sincerely,

A. J. Cayia
Site Vice-President, Point Beach Nuclear Plant
Nuclear Management Company, LLC

Enclosures: *Figures 2-1 and 3-2 from the LRA Environmental Report*

cc: Sue Schumacher
Dave Weaver
Kris McKinney
Rita Hayen, ATC

Department of Natural Resources
Page 5

bcc:	A. J. Cayia	J. W. Connolly	D. E. Cooper
	K. M. Duescher (2)	M. E. Holzmann	F. D. Kuester
	J. H. McCarthy	L. A. Schofield (OSRC)	J. G. Schweitzer
	R. D. Scott	D. A. Weaver (P346)	E. J. Weinkam III
	File		

ENCLOSURE 1

Figure 2.1
Point Beach Nuclear Plant
License Renewal Application
Environmental Report

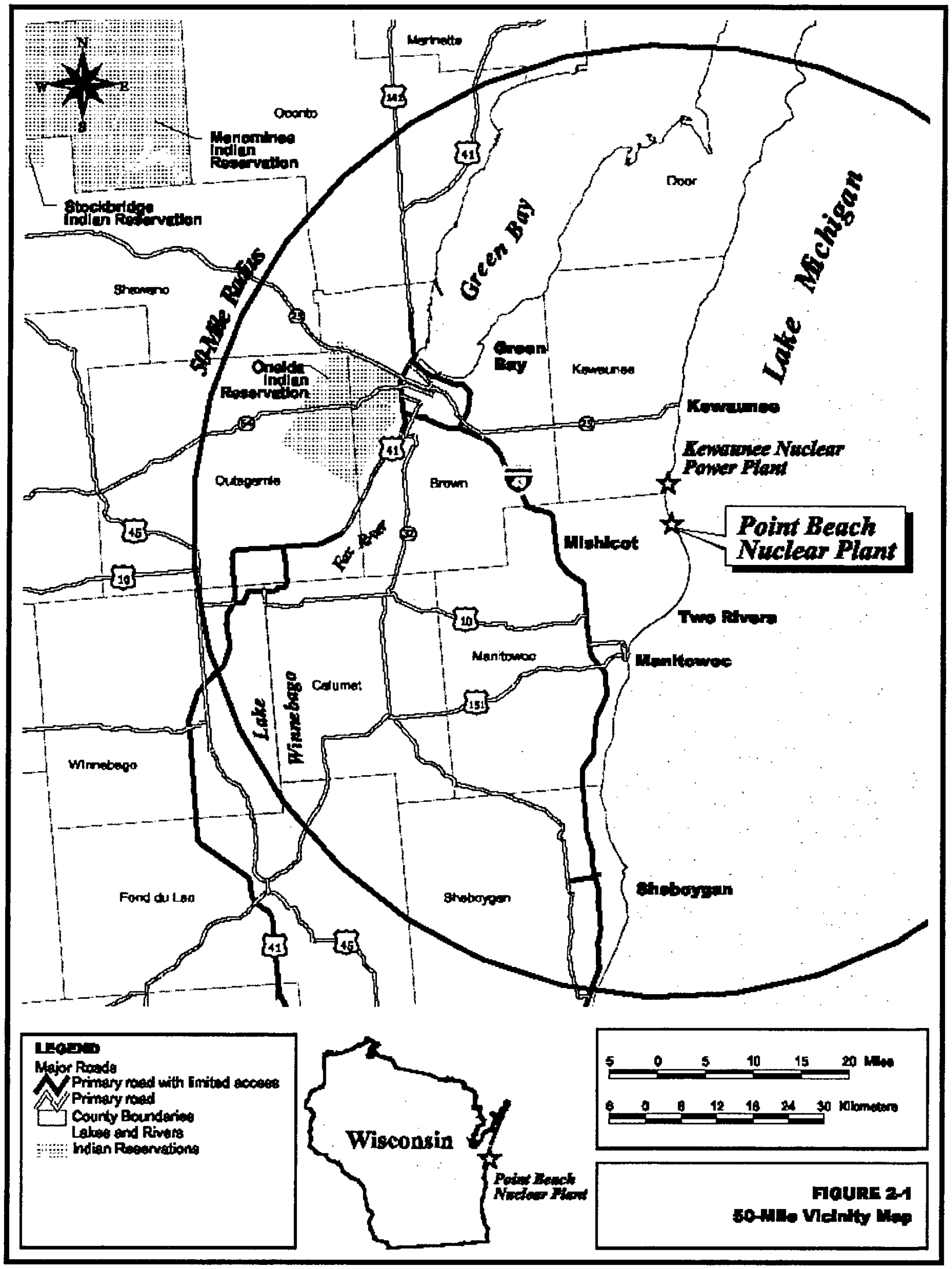

FIGURE 2-1
50-Mile Vicinity Map

Page 2 of 2

ENCLOSURE 2

Figure 3-2
Point Beach Nuclear Plant
License Renewal Application
Environmental Report

Page 1 of 2

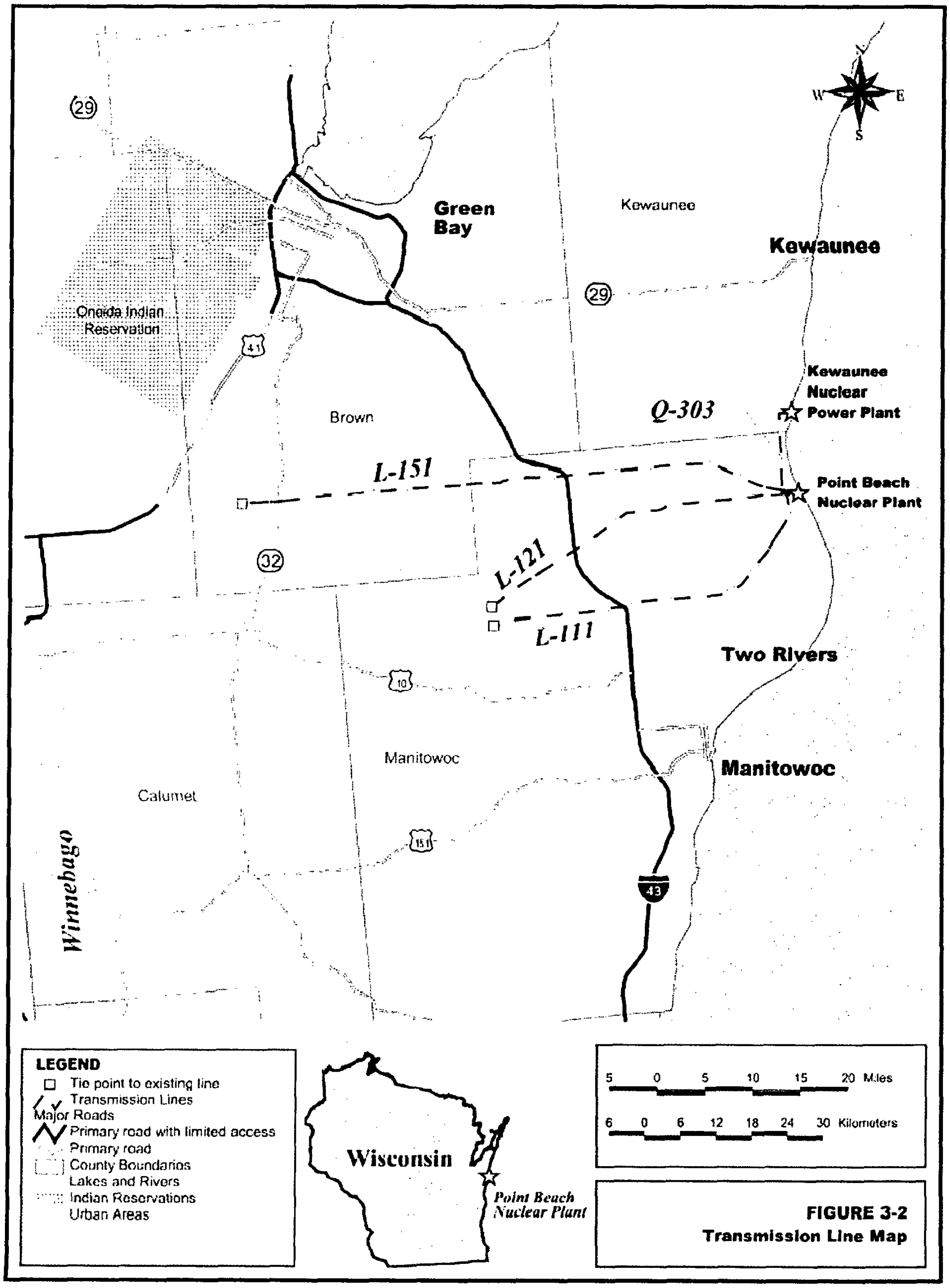

FIGURE 3-2
Transmission Line Map

Page 2 of 2

WISCONSIN DEPT. OF NATURAL RESOURCES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Jim Doyle, Governor
Scott Hassett, Secretary

101 S. Webster St.
Box 7921
Madison, Wisconsin 53707-7921
Telephone 608-266-2621
FAX 608-267-3579
TTY 608-267-6897

January 28, 2004

Mr. A.J. Cayia
Point Beach Nuclear Plant
6590 Nuclear Road
Two Rivers, WI 54241

SUBJECT: Endangered Resources Review (ERIR Log # 03 - 231)
License Renewal Application for Point Beach Nuclear Plant

Dear Mr. Cayia,

The Bureau of Endangered Resources has reviewed the project area described in your letter of December 22, 2003 for the proposed license renewal for the Point Beach Nuclear Plant.

Our Natural Heritage Inventory (NHI) data files contain no occurrence records of Endangered, Threatened, or Special Concern species, natural communities, or State Natural Areas that I believe would be impacted by the license renewal, nor for the actual project areas in T21N R24E Sec. 24 in Manitowoc County.

Although there are no records in the NHI database of endangered resources occurring at the project site, comprehensive endangered resource surveys have not been completed for the project area. As a result, our data files may be incomplete. However, given your description of the project site and the nature of the proposed project I do not believe that further surveys are warranted.

This letter is for informational purposes and only addresses endangered resource issues. This letter does not constitute Department of Natural Resources authorization of the proposed project and does not exempt the project from securing necessary permits and approvals from the Department.

Please contact me at (608) 266-8736 if you have any questions about this information.

Sincerely,

Jennifer Bardeen
Bureau of Endangered Resources

CC: Sue Schumacher, WE Energies
Al Stranz, NER – Green Bay

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APPENDIX D

STATE HISTORIC PRESERVATION OFFICER CORRESPONDENCE

<u>Letter</u>

NMC
Committed to Nuclear Excellence

Point Beach Nuclear Plant
Operated by Nuclear Management Company, LLC

December 22, 2003

NPL 2003-0294
10 CFR 54

Mr. Sherman Banker
State Historical Society of Wisconsin
816 State Street
Madison, Wisconsin 53706-1488

Subject: License Renewal Application for Point Beach Nuclear Plant
Request for Information on Historical/Archeological Resources

Dear Mr. Banker:

Nuclear Management Company[1], LLC (NMC), is assessing the requirements for renewing the operating licenses for Point Beach Nuclear Plant Units 1 and 2 (PBNP). The results of this assessment will be contained in an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses. We are contacting you to obtain your feedback regarding the impact continued plant operation would have on any historical or archeological resources. The NRC is the federal agency responsible for reviewing and approving nuclear plant License Renewal Applications. As part of that application, the NRC recommends that each applicant make advanced contact with other state and federal agencies, including the State Historical Society of Wisconsin. Each agency assessment will be included in the records established as part of the License Renewal Application review by the NRC.

The current operating licenses for Units 1 and 2 expire in 2010 and 2013, respectively. The renewal term would be for an additional 20 years beyond the original license expiration date. As part of the license renewal process, the NRC requires license renewal applicants to "assess whether any historical or archeological resources will be affected by the proposed project." The NRC may also request an informal consultation with your office at a later date under Section 106 of the National Historic Preservation Act of 1966, as amended (16 USC 470) and the Federal Advisory Council on Historic Preservation regulations (36 CFR 800). By contacting you early in the assessment process, we hope to identify any issues that need to be addressed or any additional information your office may need in order to help expedite the NRC consultation.

1 NMC holds the operating license for PBNP, and is applying for a renewed PBNP operating license. Wisconsin Electric Power Company (WEPCO) doing business under the name We Energies owns the plant and retains exclusive rights to electricity generated at the plant.

6590 Nuclear Road • Two Rivers, Wisconsin 54241
Telephone: 920.755.2321

RECD JAN 05 2004

State Historical Society
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The remainder of this letter describes the location of PBNP, its associated facilities, and our own assessment of the continued plant operation on historical or archeological resources.

PBNP is located on the western shore of Lake Michigan in Manitowoc County, Wisconsin, approximately 30 miles southeast of Green Bay and 15 miles north-northeast of Manitowoc (Figures 2-2 and 2-3). The PBNP site consists of approximately 1,260 acres owned by Wisconsin Electric Power Company (WEPCO). Structures and parking lots occupy about 70 acres. Approximately 1,050 acres are used for agriculture. The balance is a combination of natural woods, wetlands, and open areas. The site includes approximately 2 miles of continuous frontage on the western shore of Lake Michigan. Site structures include: two reactor containments and associated auxiliary, service, turbine, and office buildings; switchyard, pumphouse, cooling water intake and discharge structures; and spent fuel storage.

There are three 345-kilovolt (kV) transmission lines that were built to connect PBNP to the electric grid (Figure 3-2). A fourth 345-kV transmission line (Q-303) was constructed by Wisconsin Public Service Corporation to connect the Kewaunee Nuclear Power Plant (KNPP), which is located in Kewaunee County, to the PBNP. Line L-111 connects to the Granville Substation via a previously existing line and is 20 miles in length. Line L-121 connects to the Arcadian Substation via a previously existing line and is 18 miles in length. Line L-151 connects to the North Appleton Substation via a previously existing line and is 29.7 miles in length. Line Q-303 runs 5.6 miles in a northerly direction to the substation at KNPP. All transmission corridors are 220 feet in width.

PBNP was built on the eastern edge of a vast forested area that was buried by the Valderan glacier about 12,400 years ago. The buried forest is of scientific interest, but is not unique to the Plant site. The Two Creeks Buried Forest unit of the Ice Age National Scientific Reserve is located approximately 2 miles north of the PBNP property. The Reserve is part of the national park system, and provides public access to remnants of the buried forest.

As of 2001, 19 properties in Manitowoc County and 8 properties in Kewanee County have been listed in the National Register of Historic Places. Of these 27 properties, only one, the Rawley Point Light Station, falls within the 6-mile radius of PBNP. We will provide all of this information to the NRC to aid in their evaluation of the License Renewal Application.

A fisherman's shed located on PBNP property that is of indeterminate age, but most likely more than 50 years old, has not been submitted to the National Register of Historic Places for eligibility. However, a verbal agreement with the former landowner was reached, and the shed is being preserved in its present state.

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NMC is committed to the conservation of any historical or archeological resources, and expects that operation of the Plant through the license renewal period (an additional 20 years) would not adversely affect any listed resources. NMC has no plans to alter current operations over the license renewal period. Any maintenance activities necessary to support continued operation would be limited to previously disturbed areas. No expansion of existing facilities is planned, and no additional land disturbance is anticipated during the period of continued operation. As a consequence, we believe that operation of the plant, including maintenance of transmission lines, over the license renewal term would not adversely affect any historical or archeological resources.

This letter is to solicit your input into the identification of any issues related to historical or archeological resources at Point Beach and associated facilities that you believe may need to be addressed. Once the License Renewal Application is filed with the NRC, you will be contacted by the NRC to assess any impacts this license renewal would have on issues concerning the Wisconsin State Historical Society and other agencies.

Your response to requests for feedback regarding any effects license renewal may have on historical or archeological resources is very important in this application process. To ensure that your written comments are included in our application filing with the NRC, we would appreciate your response to us by late January 2004. If there are any concerns that need to be addressed regarding historical or archeological resources, please let us know as soon as possible. We will include a copy of this letter and, if available, your response as part of our License Renewal Application.

Please contact Sue Schumacher of We Energies at 414-221-2189 or Roger Newton, NMC License Renewal Project Manager, at 920-755-6522 if you have any questions or require any additional information.

Sincerely,

A. J. Cayia
Site Vice-President, Point Beach Nuclear Plant
Nuclear Management Company, LLC

Enclosures: Figures 2-2, 2-3, 3-2 from the LRA Environmental Report

State Historical Society
Page 4

cc: Sue Schumacher
Dave Weaver
Kris McKinney
Rita Hayen, ATC

State Historical Society
Page 5

bcc:	A. J. Cayia	D. E. Cooper	K. M. Duescher (2)
	J. G. Schweitzer	R. D. Kuester	M. E. Holzmann
	L. A. Schofield (OSRC)	J. H. McCarthy	R. D. Scott
	J. W. Connolly	D. A. Weaver (P346)	E. J. Weinkam III
	File		

ENCLOSURE 1

Figure 2-2

**Point Beach Nuclear Plant
License Renewal Application
Environmental Report**

Page 1 of 2

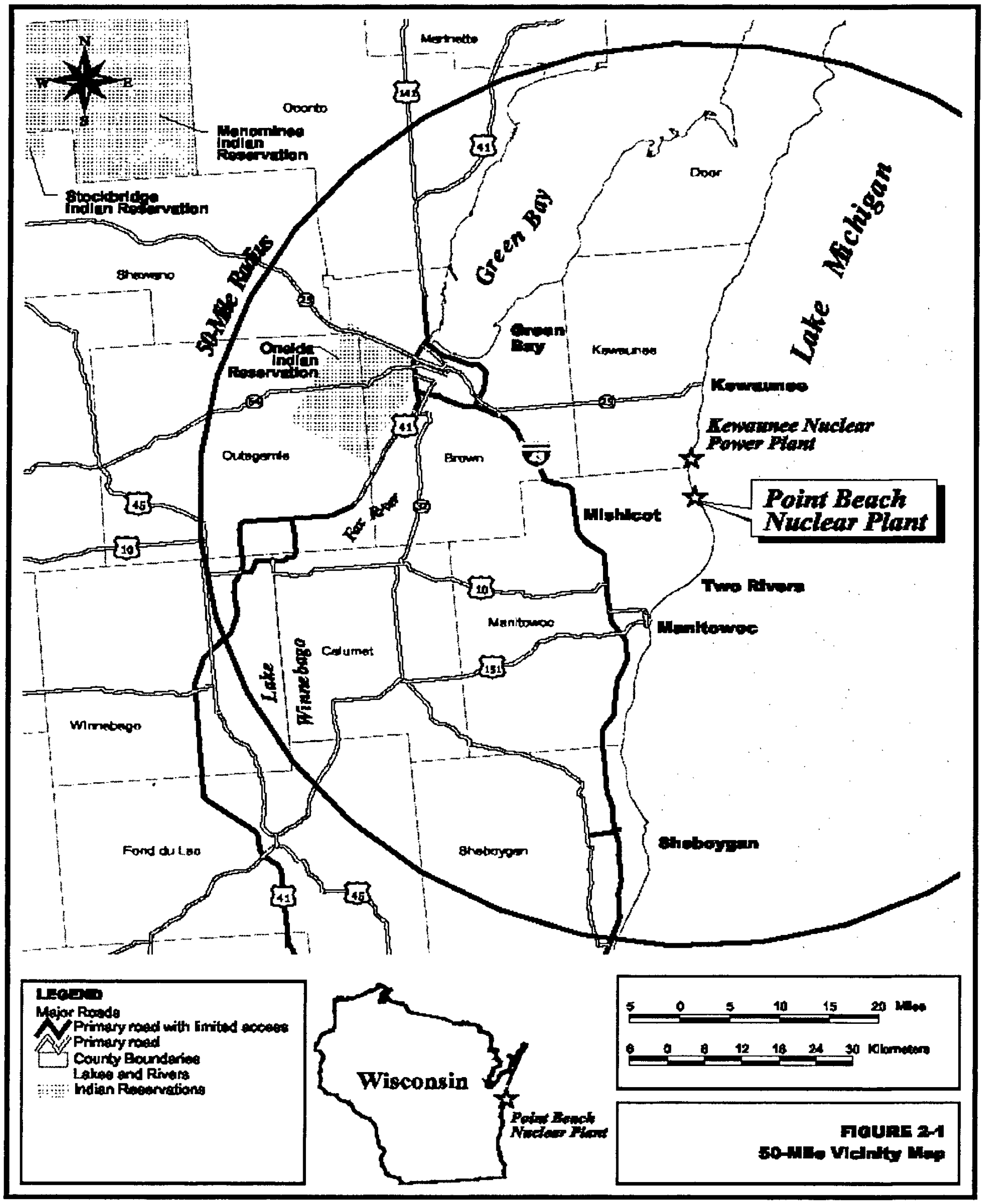

FIGURE 2-1
50-Mile Vicinity Map

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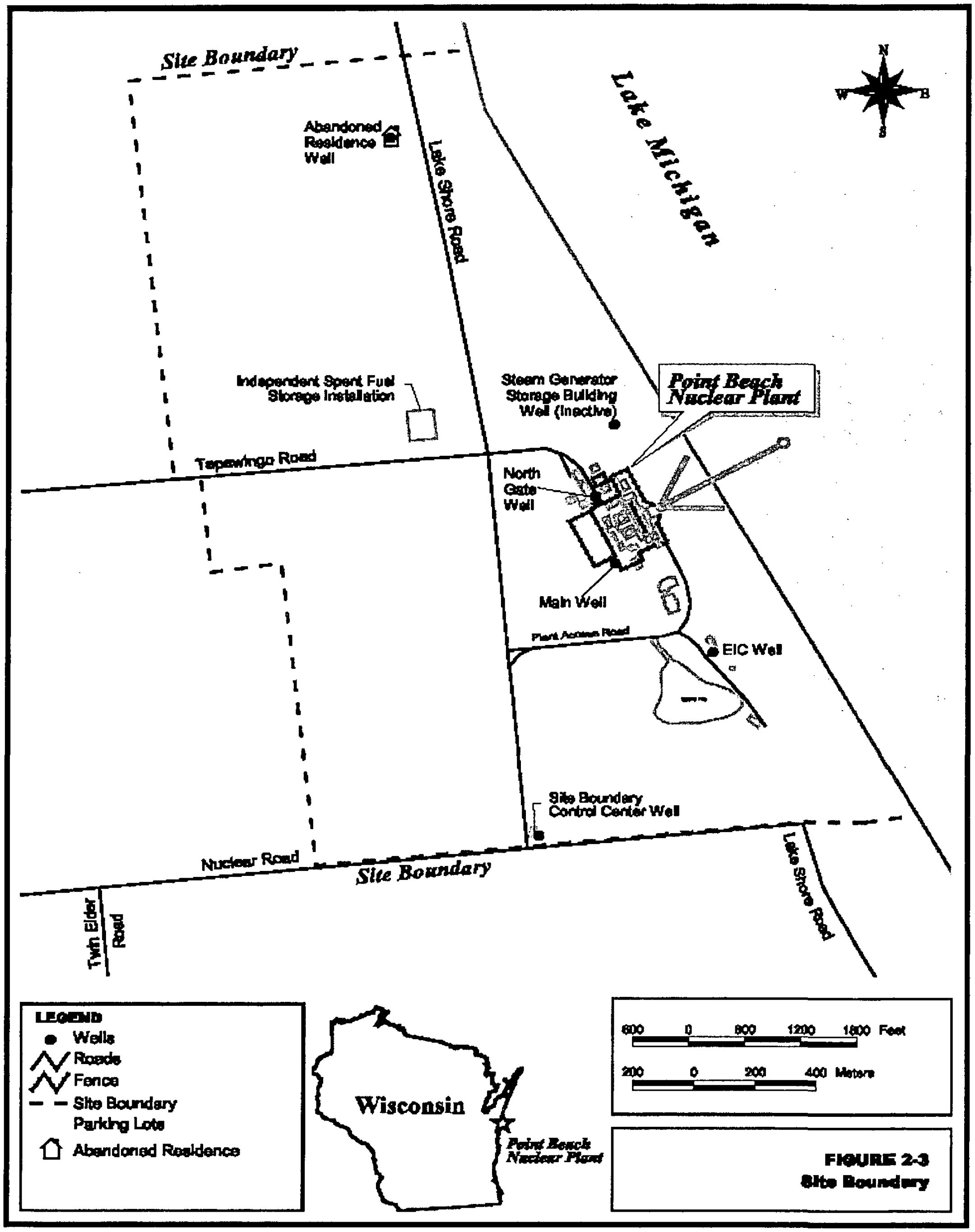
ENCLOSURE 2

Figure 2-3

Point Beach Nuclear Plant
License Renewal Application
Environmental Report

Page 1 of 2


Site Boundary
Abandoned Residence Well
Lake Shore Road
Lake Michigan
Independent Spent Fuel Storage Installation
Steam Generator Storage Building Well (Inactive)
Point Beach Nuclear Plant
Tapawingo Road
North Gate Well
Main Well
Plant Access Road
EIC Well
Site Boundary Control Center Well
Nuclear Road
Site Boundary
Twin Elder Road
Lake Shore Road
LEGEND
Wells
Roads
Fence
Site Boundary
Parking Lots
Abandoned Residence
Wisconsin
Point Beach Nuclear Plant
600 0 600 1200 1800 Feet
200 0 200 400 Meters
FIGURE 2-3
Site Boundary

Page 2 of 2

Enclosure 3

Figure 3-2

Point Beach Nuclear Plant
License Renewal Application
Environmental Report

Page 1 of 2

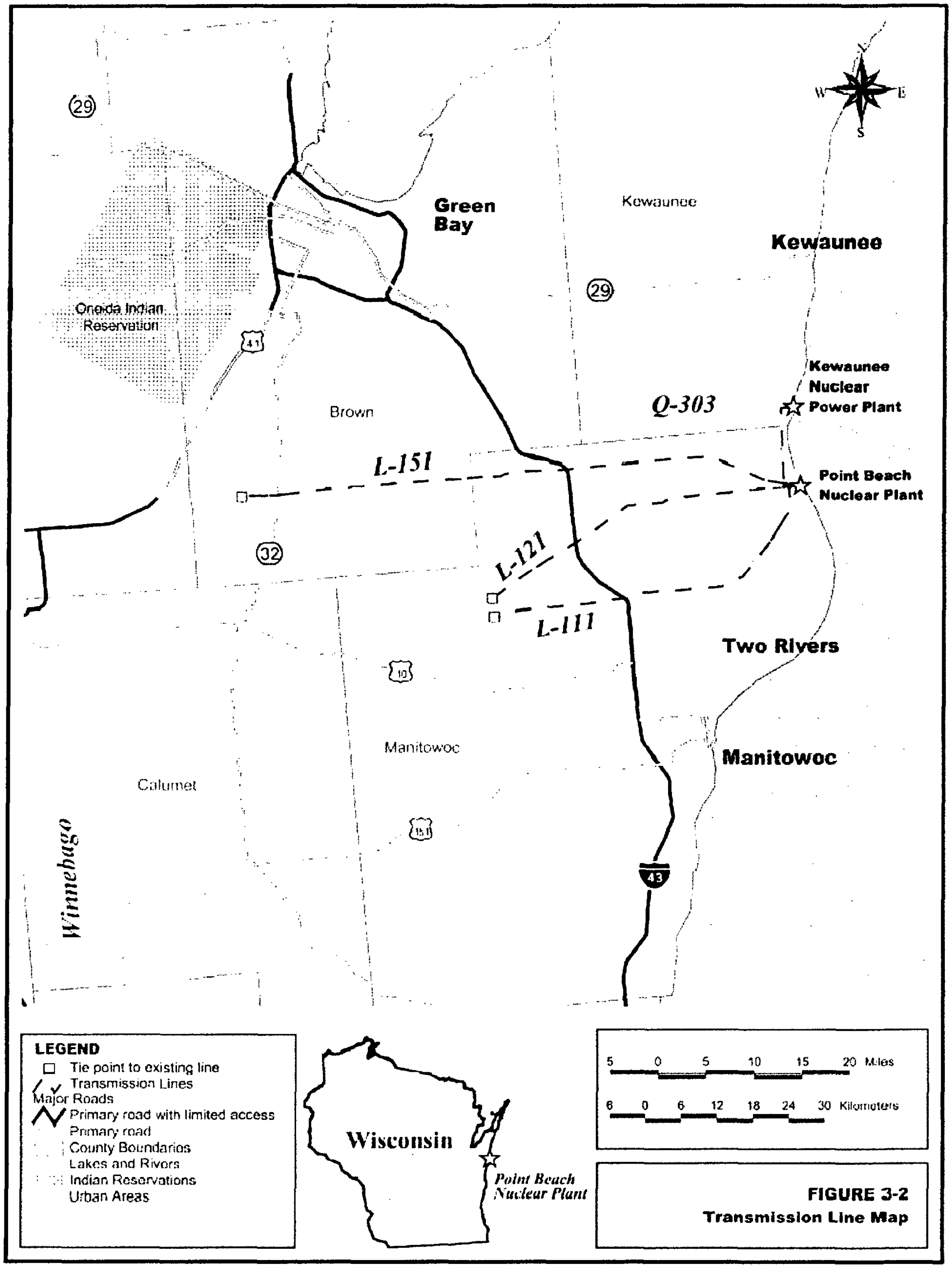


FIGURE 3-2
Transmission Line Map

APPENDIX E

COASTAL ZONE MANAGEMENT CONSISTENCY CERTIFICATION

Consistency Certification with
Wisconsin Coastal Management Program

Nuclear Management Company, LLC (NMC), has determined that Nuclear Regulatory Commission (NRC) renewal of the Point Beach Nuclear Plant (PBNP) licenses to operate complies with the policies of Wisconsin's approved Coastal Management Program and will be conducted in a manner consistent with such policies. NMC expects PBNP operations during the license renewal term to be a continuation of current operations as described below, with no changes that would affect Wisconsin's coastal zone.

Proposed Activity

NMC operates PBNP Units 1 and 2 in accordance with NRC Operating Licenses DPR-24 and DPR-27, respectively. The Unit 1 license will expire on October 5, 2010 and the Unit 2 license on March 8, 2013. NMC is assessing the requirements for the renewal of both licenses, which would enable 20 additional years of operation (i.e., until October 5, 2030 for Unit 1 and until March 8, 2033 for Unit 2).

PBNP is located on the western shore of Lake Michigan in Manitowoc County, Wisconsin, approximately 30 miles southeast of Green Bay and 15 miles north-northeast of the City of Manitowoc. The area within six miles of PBNP includes portions of Manitowoc and Kewaunee Counties and is largely rural. The nearest town is Two Creeks, approximately one-mile north-northwest of the site. Figures 2-1 and 2-2 show the 50-mile and 6-mile regions, respectively, around PBNP and Figure 3-2 shows the PBNP transmission line corridors. The PBNP site boundary encompasses approximately 1,260 acres. Structures and parking lots occupy about 70 acres, and approximately 1,050 acres are used for agriculture. The balance remains in a natural mixture of woodlands, wetlands, and open areas. This includes approximately two miles of continuous frontage on Lake Michigan. The plant's location, therefore, gives rise to the possibility of it affecting the Wisconsin coastal zone.

PBNP consists of two nuclear reactors and associated auxiliary, service, turbine, and office buildings. Each pressurized water reactor has a thermal rating of 1,540 megawatts. Commercial operation of Unit 1 began in December 1970, followed by the operation of Unit 2 in October 1972. Each reactor and its primary cooling system is housed in a containment building, together with the associated steam generators and circulating system. The plant design provides a common gallery containing the principal radwaste systems and the control room located between the two units. Both units use a once-through cooling system that draws water from and discharges to Lake Michigan. The cooling system removes waste heat from the condensers, as well as other plant equipment, and discharges through separate flumes for each unit. Additional site structures and facilities include transmission lines, spent fuel storage installation, diesel generator building, steam generator storage building, combustion turbine building, sewage treatment facility, Nuclear Engineering Services Building, Training Building, and the Point Beach Energy Information Center.

PBNP uses a once-through cooling system for both units that draws water from and discharges to Lake Michigan. Lake water is provided to the forebay through two 14-foot-diameter pipes buried beneath the lakebed extending 1,750 feet offshore to an intake structure. At peak capacity, water would be circulated at a maximum rate of 350,000 gallons per minute (gpm) through each condenser, then returned to the lake. NMC holds Wisconsin Pollutant Discharge Elimination System (WPDES) permits for this and other plant and stormwater discharges. In accordance with permit conditions, NMC monitors discharge characteristics and Wisconsin Electric Power Company (WEPCO) reports results to the Wisconsin Department of Natural Resources (WDNR).

NMC employs approximately 740 permanent and 231 contract employees at PBNP. Approximately 81 percent of the employees live in Manitowoc County; the remaining 19 percent live in other locations. During refueling outages, nuclear related site employment increases by approximately 300 workers for temporary (typically 30 to 40 days) duty. In compliance with NRC regulations, NMC has identified activities needed for PBNP to operate an additional 20 years. NMC conservatively assumes that renewal of the PBNP licenses would require the addition of no more than one or two permanent workers during the period of extended operations.

Environmental Impacts

The NRC has prepared a generic environmental impact statement (GEIS) on impacts that nuclear power plant operations can have on the environment (Generic Environmental Impact Statement for License Renewal of Nuclear Plants. NRC. May 1996), and it has codified its finding (10 CFR 51, Subpart A, Appendix B, Table B-1). The codification identifies 92 potential environmental issues, 69 of which NRC identifies as having small impacts and terms “Category 1” issues, regardless of plant or locations. NRC defines “small” as follows:

Small – For the issue, environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any attribute of the resource. For the purpose 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 as the term is used in this table. (10 CFR 51, Subpart A, Appendix B, Table B-1).

The NRC codification and the GEIS discuss the following types of Category 1 environmental issues:

- Surface water quality, hydrology, and use
- Aquatic Ecology
- Groundwater use and quality
- Terrestrial resources
- Air quality
- Land use
- Human health
- Postulated accidents
- Socioeconomics
- Uranium fuel cycle and waste management
- Decommissioning

In its decision-making for plant-specific license renewal applications, absent new and significant information to the contrary, NRC will rely on its codified findings, as amplified by supporting information in the GEIS, for assessment of environmental impact from Category 1 issues (10 CFR 51.95[c][4]). For plants such as PBNP that are located in the coastal zone, many of these issues involve impact to the coastal zone. NMC has adopted by references the NRC findings and GEIS analyses for all 49[3] applicable Category 1 issues.

3 The other 20 Category 1 issues apply to design or operational features that PBNP does not have (i.e., cooling ponds and cooling towers) or to an activity, refurbishment, that NMC will not undertake.

The NRC regulation identifies 21 issues as "Category 2," for which license renewal applicants must submit additional site-specific information.[4] Of these, 12 apply to PBNP[5] and, like Category 1 issues, could involve impact to the coastal zone. The applicable issues and NMC's impact conclusions are listed below:

- Aquatic ecology
  - Entrainment of fish and shellfish in early life stages – This issue addresses mortality of organisms small enough to pass through the plant's circulating cooling water system. WEPCO has conducted studies of this issue under direction of the WDNR and, in issuing the plant's discharge permit, the State of Wisconsin has approved the plant's intake structure as best available technology to minimize impact. NMC concludes that these impacts are small during current operations and has no plans that would change this conclusion for the license renewal term. However, the U.S. Environmental Protection Agency (USEPA) is expected to publish new rules in 2004 that will require a revisit of this issue. At a minimum, the rules will require an assessment of impacts and possibly an evaluation of retrofit intake technology for reducing impacts. These activities will be covered under the WPDES permitting process.
  - Heat shock – This issue addresses mortality of aquatic organisms caused by exposure to heated plant effluent. WEPCO has conducted studies of this issue under direction of WDNR and, in issuing the plant's discharge permit, the state of Wisconsin has determined that more stringent limits on the heated effluent are not necessary to protect the aquatic environment. Currently, the PBNP WPDES permit does not contain thermal effluent limitations. NMC concludes that these impacts are small during current operations and has no plans that would change this conclusion for the license renewal term. However, the WNDR is in the process of developing water quality-based thermal effluent rules. It is likely that the current discharge will need to be evaluated against these new rules. This evaluation will be covered under the WPDES permitting process.

4 10 CFR 51, Subpart A, Appendix B, Table B-1 also identifies 2 issues as "NA", for which NRC could not come to a conclusion regarding categorization. NMC believes that these issues, chronic effects of electromagnetic fields and environmental justice, do not affect the "coastal zone" as that phrase is defined by the Coastal Zone Management Act [16 USC 1453(1)].

5 The rest apply to design or operational features that PBNP does not have (i.e., cooling ponds and cooling towers) or to an activity, refurbishment, that NMC will not undertake.

- Groundwater use and quality
  - Groundwater use conflicts (Plants Using > 100 GPM of Groundwater) – This issue addresses effects that PBNP groundwater withdrawals could have on offsite groundwater users. NMC has calculated that the total capacity of three (3) domestic supply wells at PBNP is 105 gpm. However, the actual usage is much lower and averages 9,707 gallons per day or 6.7 gpm. Therefore, NMC concludes that impacts to the Silurian aquifer and nearby groundwater users are small.

- Threatened or endangered species – This issue addresses effects that PBNP operations could have on species that are listed under federal law as threatened or endangered. In analyzing this issue, NMC has also considered species that are listed under State of Wisconsin law. One state-listed species, the Greater redhorse (Moxostoma valenciennesi) could occur near the PBNP site five to six miles away in the East Twin River. WEPCO environmental studies and environmental protection programs have identified no adverse impacts to this species and NMC consultation with cognizant Federal and State agencies has identified no impacts of concern. NMC concludes that PBNP impacts to this species are small during current operations and has no plans that would change this conclusion for the license renewal term.

- Human health
  - Electromagnetic fields, acute effects (electric shock) – This issue addresses the potential for shock from induced currents, similar to static electricity effects, in the vicinity of transmission lines. Because this strictly human-health issue does not directly or indirectly affect natural resources of concern within the Coastal Zone Management Act definition of "coastal zone" (16 USC 1453[1]), NMC concludes that the issue is not subject to the certification requirement.
- Socioeconomics

  As a result of its studies on managing the effects of PBNP aging, NMC expects to perform license renewal activities without adding staff. NMC has assumed, for the purposes of socioeconomic impact analysis, adding nor more than one or two additional employees. NMC assumes that these employees would find housing in the same locales where current employees reside.

- Housing – This issue addresses impacts on local housing availability that could occur as a result of NMC adding license-renewal-term workers and the community gaining additional indirect jobs. NRC concluded, and NMC concurs, that impacts would be small for plants located in high population areas having no growth control measures. Using the NRC definitions and categorization methodology, PBNP is located in a high population area and locations where additional employees would probably live have no growth control measures. NMC concludes that impacts during the PBNP license renewal term would be small.
- Public services; public utilities – This issue addresses impacts that adding license renewal term workers could have on public water supply systems. NMC has analyzed public water supply availability in candidate locales and has found no system limitations that would suggest that additional PBNP workers would cause significant impacts. PBNP does not use water from a municipal system; therefore, PBNP operations do not affect local water supplies. NMC has concluded that impacts during the PBNP license renewal term would be small.
- Offsite land use – This issue addresses impacts that local government spending of plant property tax dollars can have on land use patterns. PBNP pays Gross Revenue Taxes in lieu of property taxes which becomes part of the State's general purpose revenue, which goes to fund the Shared Revenue Program. Land use patterns within Manitowoc County have not shown significant change since NMC began operations. Based on past practices, NMC concludes that impacts during the PBNP license renewal term would be small.
- Public services; transportation – This issue addresses impacts that adding license renewal term workers could have on local traffic patterns. NMC expects no more than one or two additional employees during license renewal period. Therefore, NMC concludes that license renewal impacts to transportation would be small.
- Historical and archaeological resources – This issue addresses impacts that license renewal activities could have on resources of historical or archaeological significance. There are several areas of historical interest on the PBNP site including prehistoric buried forest and an Indian burial ground. These sites have not been disturbed by the operation of PBNP. NMC has no plans for license renewal activities that would disturb these or any unknown resources. NMC consultation with the State Historic Preservation Officer has identified no issues of concern. NMC concludes that continued operation of PBNP would have no adverse impacts to historic resources in the Wisconsin coastal zone.

- Postulated accidents
    - Severe accidents – NRC determined that the license renewal impacts from severe accidents would be small, but determined that applicants should perform site-specific severe accident mitigation alternative analyses as part of the license renewal effort, if severe accident analyses had not been previously performed. NMC performed the analysis and identified no severe accident mitigation alternatives that would be cost beneficial.

Findings

1. NRC has found that the environmental impacts of Category 1 issues are small. NMC has adopted by reference NRC findings for Category 1 issues applicable to PBNP.

2. For Category 2 issues applicable to PBNP, NMC has determined that the environmental impacts are small.

3. To the best of NMC's knowledge, PBNP is in compliance with Wisconsin licensing and permitting requirements and is in compliance with its state-issued licenses and permits.

4. NMC's license renewal and continued operation of PBNP would be consistent with the enforceable provisions of the Wisconsin Coastal Management Program.

State Notification

By this certification that PBNP license renewal is consistent with Wisconsin's Coastal Management Program, the State of Wisconsin is notified that it has three months from receipt of this certification and accompanying information in which to concur or object with NMC's certification. However, pursuant to 15 CFR 930.63(b), if the State of Wisconsin has not issued a decision within three months following the commencement of State agency review, it shall notify the contacts listed below of the status of the matter and the basis for further delay. The State's concurrence, objection, or notification of review status shall be sent to:

A. J. Cayia
Site Vice President
Nuclear Management Company
6610 Nuclear Road
Two Rivers, WI 54241

With a copy to:

Roger Newton
License Renewal Project Manager
Nuclear Management Company
6610 Nuclear Road
Two Rivers, WI 54241

920-755-6522

roger.newton@nmcco.com

(To Be Determined), Project Manager
Environmental Section
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

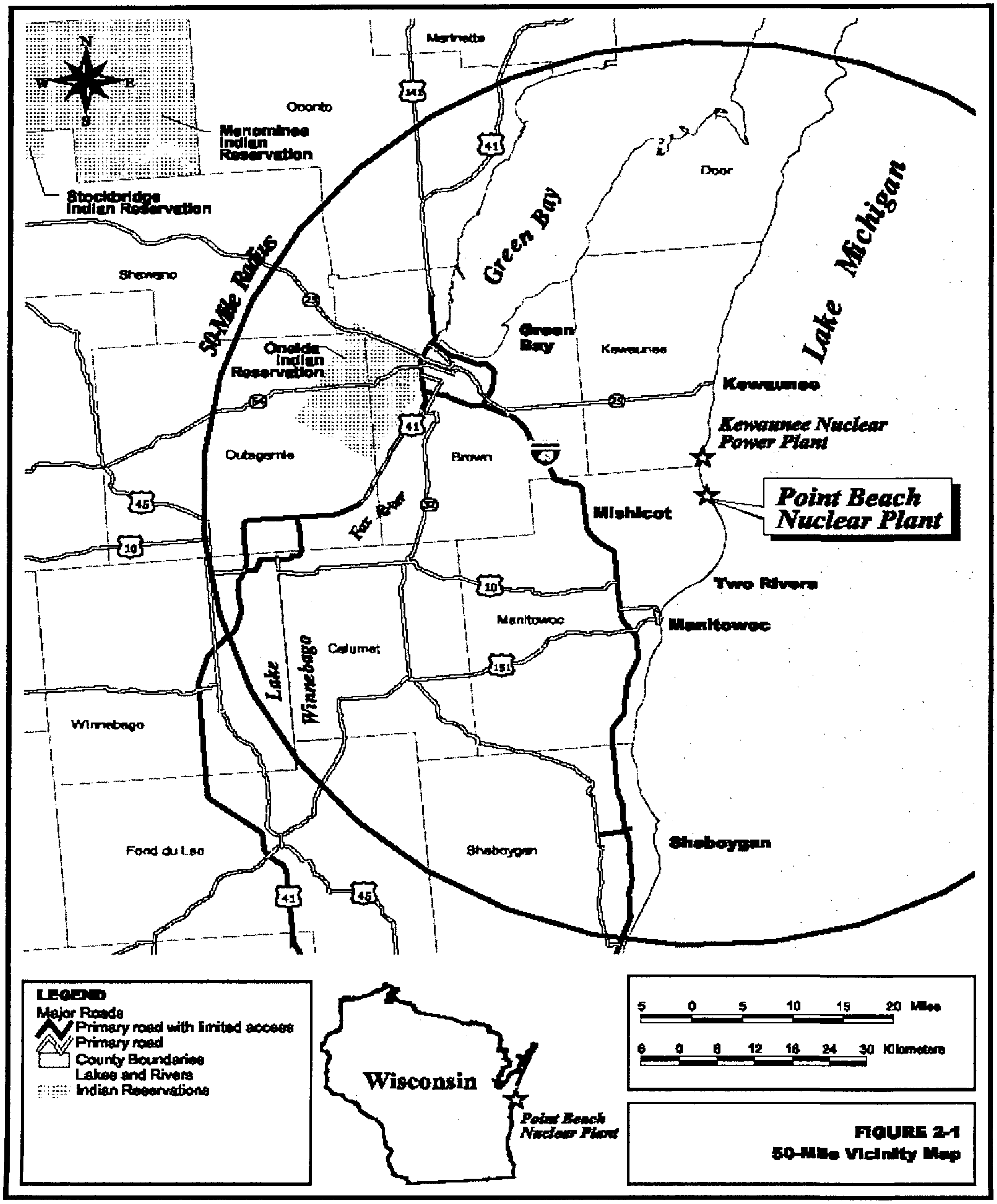
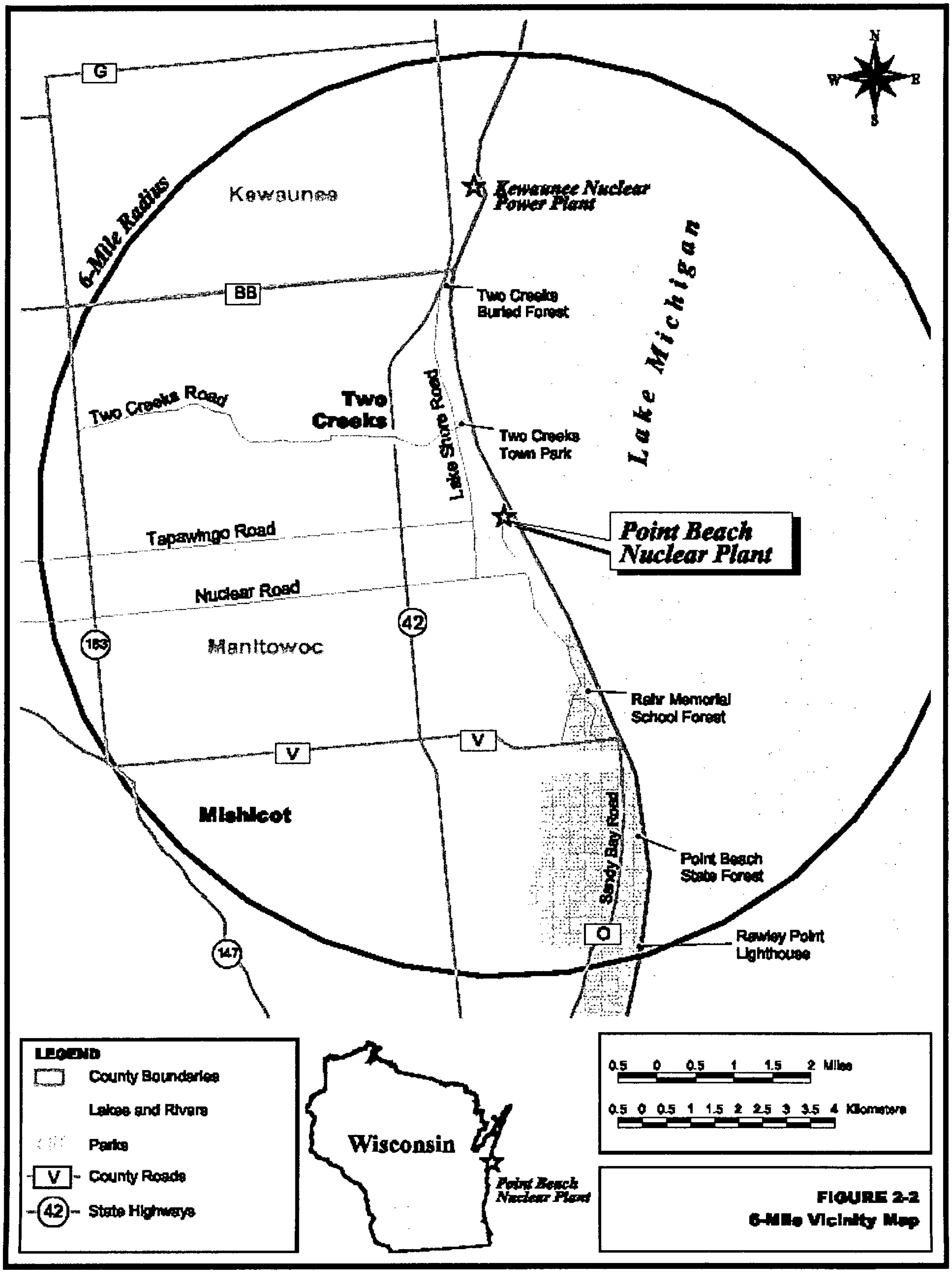


FIGURE 2-1
50-Mile Vicinity Map


6-Mile Radius
Kewaunee
Kewaunee Nuclear Power Plant
Lake Michigan
G
BB
Two Creeks Buried Forest
Two Creeks Road
Two Creeks
Lake Shore Road
Two Creeks Town Park
Tapawingo Road
Point Beach Nuclear Plant
Nuclear Road
42
163
Manitowoc
Rahr Memorial School Forest
V
V
Mishicot
Sandy Bay Road
Point Beach State Forest
O
147
Rawley Point Lighthouse
LEGEND
County Boundaries
Lakes and Rivers
Parks
V - County Roads
42 - State Highways
Wisconsin
Point Beach Nuclear Plant
0.5 0 0.5 1 1.5 2 Miles
0.5 0 0.5 1 1.5 2 2.5 3 3.5 4 Kilometers
FIGURE 2-2
6-Mile Vicinity Map

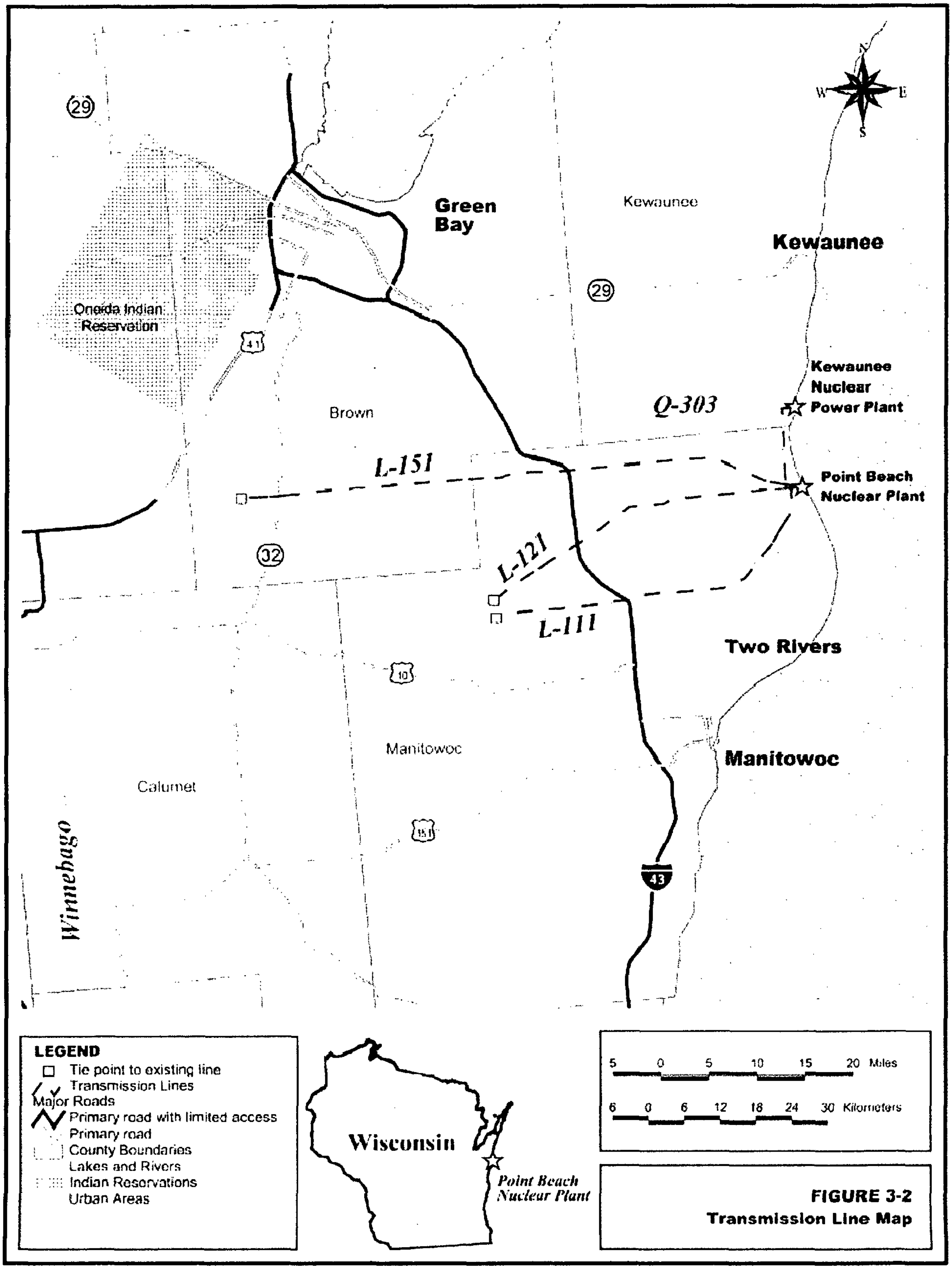


FIGURE 3-2
Transmission Line Map

APPENDIX F

SAMA ANALYSIS

Table of Contents

List of Tables

Acronyms Used in Appendix F

AB	Auxiliary Building
AC	Alternating Current
ADS	Automatic Depressurization System
AF(W)	Auxiliary Feed(water)
AFWST	Auxiliary Feedwater Storage Tank
AMSAC	ATWS Mitigating System Actuation Circuitry
ANO-1	Arkansas Nuclear One Unit 1
AOV	Air Operated Valve
ATWS	Anticipated Transient Without Scram
BOC	Bureau of the Census
BWR	Boiling Water Reactor
CCF	Common Cause Failure
CCNP	Calvert Cliffs Nuclear Plant
CCW	Component Cooling Water
CDF	Core Damage Frequency
CET	Containment Event Tree
COMSORS	Core Melt Source Reduction System
CR	Control Room
CRD	Control Rod Drive
CSR	Cable Spreading Room
CST	Condensate Storage Tank
CV	Control Valve
CVCS	Charging and Volume Control System
DC	Direct Current
DG	Diesel Generator
DHR	Decay Heat Removal
ECCS	Emergency Core Cooling System
EDG	Emergency Diesel Generator
EFIC	Emergency Feedwater Initiation and Control
EFW	Emergency Feedwater
EOP	Emergency Operating Procedure
EP	Emergency Plan
ERCW	Emergency Raw Cooling Water
FP	Fire Protection
FW	Feedwater
GDC	General Design Criterion
HCLPF	High Confidence of Low Probability of Failure
HP	High Pressure
HPCI	High Pressure Coolant Injection
HPCS	High Pressure Core Spray
HPI	High Pressure Injection

HPSI	High Pressure Safety Injection
HVAC	Heating, Ventilation and Air Conditioning
I&C	Instrumentation and Control
ICONE	International Conference on Nuclear Engineering
ICW	Intermediate Cooling Water
IPE	Individual Plant Examination
IPEEE	Individual Plant Examination for External Events
ISLOCA	Interfacing System LOCA
KV	Kilo-Volts
LO(S)P	Loss of (Offsite) Power
LOCA	Loss of Coolant Accident
LOSW	Loss of Service Water
LP	Low Pressure
LPCI	Low Pressure Coolant Injection
LPI	Low Pressure Injection
LPSI	Low Pressure Safety Injection
LWR	Light Water Reactor
MAB	Maximum Attainable Benefit
MACCS2	Melcor Accident Consequences Code System
MCC	Motor Control Center
MD	Motor Driven
MFW	Main Feed Water
MG	Motor Generator
MOV	Motor Operated Valve
MSIV	Main Steam Isolation Valve
NMC	Nuclear Management Company
NRC	Nuclear Regulatory Commission
PBNP	Point Beach Nuclear Plant
PORV	Power Operated Relief Valve
PRA	Probabilistic Risk Analysis
PSA	Probabilistic Safety Assessment
PWR	Pressurized Water Reactor
RAI	Request for Additional Information
RCIC	Reactor Core Isolation Cooling
RCP	Reactor Coolant Pump
RCS	Reactor Coolant System
RHR	Residual Heat Removal
RV	Relief Valve
RWST	Refueling Water Storage Tank
S/G	Steam Generator
SAC	Safety Assessment Consulting
SAMA	Severe Accident Mitigation Alternative
SAMDA	Severe Accident Mitigation Design Alternative

SAMG	Severe Accident Management Guideline
SBO	Station Blackout
SGTR	Steam Generator Tube Rupture
SI	Safety Injection
SKI	Swedish Nuclear Power Inspectorate
SLC	Standby Liquid Control
SRP	Standard Review Plan
SRV	Safety Relief Valve
SSE	Safe Shutdown Earthquake
SSF	Safe Shutdown Feature
SW	Service Water
TD	Turbine Driven
TDP	Turbine Driven Pump
TVA	Tennessee Valley Authority
U.S.I	Unresolved Safety Issue
V	Volts
WBN	Watts Bar Nuclear Plant

F.1 Melcor Accident Consequences Code System Modeling

F.1.1 Introduction

The following sections describe the assumptions made for and the results of modeling performed to assess the risks and consequences of severe accidents (U.S. Nuclear Regulatory Commission Class 9) at Point Beach Nuclear Plant (PBNP).

The severe accident consequence analysis was carried out with the Melcor Accident Consequence Code System (MACCS2) code (Reference F.1-1). MACCS2 simulates the impact of severe accidents at nuclear power plants on the surrounding environment. The principal phenomena considered in MACCS2 are atmospheric transport, mitigating actions based on dose projections, dose accumulation by a number of pathways including food and water ingestion, early and latent health effects, and economic costs.

F.1.2 Input

The input data required by MACCS2 are outlined below.

F.1.2.1 Core Inventory

The core inventory (Table F.1-1) is for a reference pressurized water reactor producing 3,412 megawatts-thermal (MWt); the PBNP PRA model is based on units producing a power level of 1518.5 MWt. Therefore, the values for PBNP are calculated by applying a linear scaling factor of 0.445 (Reference F.1-1) to the end-of-cycle values given in Table F.1-1.

In 2003, the PBNP units underwent a 1.4 percent uprate that raised each unit's rated power level to 1,540 MWt. Because NMC performed the SAMA analysis before completing the uprate, NMC accounted for the uprate in the SAMA analysis by performing a sensitivity analysis. Section F.2.5 presents the results of this sensitivity analysis.

F.1.2.2 Source Terms

The source term input data to MACCS2 were the severe accident source terms developed for the probabilistic risk assessment in the PBNP IPE (Reference F.1-4). This document defines the releases in terms of release modes and demonstrates the method of calculating releases. The only significant release modes are: early steam generator tube rupture (SGTR), late SGTR, loss of containment isolation and interfacing system LOCA (assumed to be the same as early SGTR). Table F.1-2 lists the input release fractions for each release species group.

The amounts (becquerels) of each radionuclide released to the atmosphere for each accident sequence or release category were calculated by multiplying the (adjusted) core inventory at the time of the hypothetical accident (Table F.1-1, noting that the Point Beach Inventory is assumed to be 0.445 of these values, based on the ratio of the thermal powers) by the release fractions (Table F.1-2) assigned to each of the nuclide groups.

The offsite consequences were summed for all the release modes weighted by the annual frequency to obtain the total annual accident risk, for the base case and for each of the SAMA concepts evaluated. (This summation calculation is performed outside of the MACCS2 code as part of the SAMA cost benefit analyses.)

F.1.2.3 Meteorological Data

The MACCS2 input uses a full year of consecutive hourly values of windspeed, wind direction, stability class, and precipitation. A complete site-specific data set was not available. The site weather file, (as used in MACCS2 for the year 2000) is therefore a composite of the best available data from the plant and two nearby sites:

PBNP:

The plant site is in east central Wisconsin on the west shore of Lake Michigan.

PBNP has plant met tower 10 m wind speed and direction, and (45 m – 10 m) delta temperature data available for October through December of year 2000 (Reference F.1-5).

Kewaunee Nuclear Plant:

This plant is on the lakeshore about 3.6 miles north of PBNP.

Met data in the form of wind direction, wind speed and sigma-theta are available from the Kewaunee plant for the period January through September of year 2000 (Reference F.1-5).

Sheboygan County Memorial Airport:

Approximately 39 miles south of PBNP and 6 miles inland from the west shore of Lake Michigan:

Hourly precipitation data for year 2000 were obtained from the National Climatic Data Center of the U.S. National Oceanic and Atmospheric Administration for Sheboygan County Memorial Airport (WBAN # 04841) (Reference F.1-6). Sheboygan was selected because of its relative closeness to the lakefront, as compared to the other possibility, the Green Bay Airport.

Pasquill stability classes were calculated from the Kewaunee data using the sigma-theta method (Reference F.1-22), and from the PBNP data using the NRC delta temperature -delta height tables (Reference F.1-23) (as no sigma-theta data were available from this site).

MACCS2 calculations examine a representative subset (typically about 150 sequences) of the 8,760 hourly observations contained in one year's data set. The representative subset is selected by sampling the weather sequences after sorting them into weather bins defined by windspeed, atmospheric stability, and rain conditions at various distances from the site.

F.1.2.4 Population Distribution

The predicted permanent resident population around the site for the year 2035 was distributed across a grid consisting of sixteen directional sectors, the first of which is centered on due north, the second on 22.5 degrees east of north, and so on. A summary of the population distribution is shown in Table F.1-3. Each directional sector is divided into 9 radial intervals extending out to 50 miles. The habitable land fraction for each grid element was calculated from land fraction data within a 50-mile radius of the plant.

The computer program SECPOP90 (Reference F.1-11) was used to process block-level 1990 census data, to prepare population estimates for the region surrounding the plant. The SECPOP90 census data file contains a record for the location (geometric centroid coordinates) and the population of each census block (6,660,337 records) in the continental U.S. If the centroid point meets the distance criteria, it is then processed to determine the exact grid element in which it lies, based on its radial distance and direction from the site. The population associated with that data point is included in the population of that grid section. This process produced the raw 1990 population estimate for each grid element. The transient populations in the emergency planning zone (exclusion boundary of 0.65 miles out to 10 miles) were included in those grid elements. Transient populations are estimated in the Site Emergency Plan on a yearly average. The area is a popular recreational destination and it was considered appropriate to include transients for dose calculation purposes even if it resulted in an overestimate of the economic costs for non-farm property in this area.

The fractional area of each county in each of the MACCS2 grid elements was estimated. The population estimates and projections described below were then produced on an element/county area-weighted basis.

The year 1990 segment population was used to estimate the year 2000 population using the ratio of Bureau of Census (BOC) county Census 2000 to Census 1990 populations (Reference F.1-13). Wisconsin county growth rate data were used to project year 2000 estimates to the year 2020, using the same fractional growth that Wisconsin estimated for each county of interest from year 2000 to year 2020 (Reference F.1-14). The BOC state population projections were used to project the year 2020 county data forward to the year 2025 by multiplying by the ratio of the Wisconsin state population projection for the year 2025 to the year 2020 (Reference F.1-15). Finally the BOC projection of the U.S. national population for the years 2035 and 2025 was then applied as a ratio uniformly to project the data to the year 2035 (Reference F.1-11).

The aggregate population for the fifty-mile radius region was 644,800 in 1990 and is projected to be 836,137 in year 2035 (+30 percent). The aggregate population for the 11 counties within about fifty miles of the plant was 896,047 in 1990. The projected year 2035 population is 1,148,757 (+28 percent). These year 2035 data are conservative (high) in that U.S.-wide projections are used for the period 2025 to 2035. Inspection of the available data suggests that Wisconsin growth rates in this period would be below the national average. The BOC U.S. population projections increase by 4 percent for each 5-year interval between the years 2030 to 2045. Therefore the 50-mile radius rosette population projections for the year 2030 would be uniformly 4 percent less than for the year 2035, and similarly the years 2040 and 2045 would be 4 percent and 8 percent higher, respectively.

F.1.2.5 Emergency Response

The NMC has developed a plan for the evacuation of the population within the plume exposure Emergency Planning Zone. This zone has an approximately 10-mile radius centered on the PBNP site, and divided into four parts in the plan. A site-specific evacuation study has been carried out by the NMC, and the evacuation modeling employed for the severe accident analysis was based primarily on this study.

The Point Beach Emergency Plan (Reference F.1-8) presents various emergency plan evacuation scenarios. The evacuation time estimates were prepared assuming a 90-degree sector to be evacuated and swinging this sector through 45 degrees steps to prepare estimates for each area covered in the 2-to-5 miles and 5-to-10 miles distances from the plant. The 0-to-2 mile zone was treated as one 180-degree sector. A notification time of 15 minutes was assumed. Estimates were prepared for normal and adverse weather (immediately following a heavy snowstorm). A limiting case is the 299 minutes it would take to evacuate the 5-to-10 mile range S to WSW sector in adverse weather. Most other sectors take about 100 minutes. (The 0-to-2 miles and 2-to-5 mile limiting sectors take about 110 minutes.) The limiting normal weather case is 157 minutes. An assumed 1,200 person transient population in the Point

Beach State Forest Campgrounds (5 to 10 miles in the SSE to SSW sector) would be evacuated in 150 minutes in normal weather. Under adverse weather conditions the analysis assumed 100 persons maximum at the State Forest so that in both cases the sector-wise time estimates bound the State Forest times.

The above data was modeled by assuming an average evacuation speed in the 2-10 miles radius of 5 hours = 1.6 mph, i.e. 0.715 meters per second, as the evacuation rate in adverse weather in various directions. This considers the population within 5 miles to be more significant in terms of potential exposure. Complete (100 percent) evacuation is assumed as a base case.

For this analysis it was conservatively assumed that people beyond 10 miles would continue their normal activities unless the following predicted radiation dose levels would be exceeded. At locations for which a 50 rem whole body effective dose equivalent in 1 week was predicted, it was assumed that relocation would take place after half a day. If a 25 rem whole body dose equivalent in 1 week was predicted, relocation was assumed to take place after 1 day.

No sensitivity analysis was performed where it was assumed that 100 percent of the people within the Emergency Planning Zone would evacuate. This was deemed appropriate because the very low population within 5 miles of the plant and the low population in the 5-to-10 miles radius indicate that very little benefit would accrue. The plant FSAR noted that the seasonal population variation is small. There are 25 cottages within 5 miles of the site. Additionally at the Point Beach State Forest, there are 127 individual campsites and 2 group campsites (located 3 to 7 miles from the plant site). Exposure and accident mitigation costs are governed mainly by the long-term effects over the whole 50 mile zone, and so the net changes would be small. For the same reasons, no significant dependencies on evacuation speed, warning time, and release delay times would be expected. Other recent SAMA analyses have shown that year-to-year weather variations for various locations in the East do not lead to very significant sensitivities in the results.

The long-term phase is assumed to begin after 1 week and extend for 5 years. Long-term relocation is assumed to be triggered by a 4 rem whole body effective dose equivalent. Long-term protective measures were assumed to be based on generic protective action guideline levels for actions such as decontamination, temporary relocation, contaminated crops and milk condemnation, and farmland production prohibition.

F.1.2.6 Economic Data

Land use statistics including farmland values, farm product values, dairy production, and growing season information were provided on a countywide basis within 50 miles.

Much of the data was prepared by the computer program SECPOP90 (Reference F.1-11). It contains a database extracted from BOC PL 94-171 (block level census) CD-ROMS, the 1992 Census of Agriculture CD ROM Series 1B, the 1994 U.S. Census County and City Data Book CD-ROM, the 1993 and 1994 Statistical Abstract of the United States, and other minor sources. The reference (Reference F.1-11) contains details on how the database was created and checked. For the preparation of data for PBNP, the county data file was updated to circa 1999 for the eleven counties within 50 miles of the plant (a small section of Marinette County just at 50 miles in the N sector was ignored). This means the SITE file contained updated values for each economic region. The SECPOP90 regional economic values were updated to 1999 using the Consumer Price Index (Reference F.1-12) and other data from the State of Wisconsin (Reference F.1-14), the Bureau of the Census (References F.1-13,-15,-16, and -21), the Department of Commerce (References F.1-18,-19,-20) and the Department of Agriculture (Reference F.1-17).

Economic consequences were estimated by summing the following costs:

- Costs of evacuation,
- Costs for temporary relocation (food, lodging, lost income),
- Costs of decontaminating land and buildings,
- Lost return-on-investments from properties that are temporarily interdicted to allow contamination to be decreased by decay of nuclides,
- Costs of repairing temporarily interdicted property,
- Value of crops destroyed or not grown because they were contaminated by direct deposition or would be contaminated by root uptake, and
- Value of farmland and of individual, public, and nonfarm commercial property that is condemned.

Costs associated with damage to the reactor, the purchase of replacement power, medical care, life-shortening, and litigation are not calculated by MACCS2.

F.1.3 Results

Based on the preceding input data, MACCS2 was used to estimate the following:

- The downwind transport, dispersion, and deposition of the radioactive materials released to the atmosphere from the failed reactor containment
- The short- and long-term radiation doses received by exposed populations via direct (cloudshine, plume inhalation, groundshine, and resuspension inhalation) and indirect (ingestion) pathways
- The mitigation of those doses by protective actions (evacuation, sheltering, and post-accident relocation of people; disposal of milk, meat, and crops; and decontamination, temporary interdiction, or condemnation of land and buildings)
- The early fatalities and injuries expected to occur within 1 year of the accident (early health effects) and the delayed (latent) cancer fatalities and injuries expected to occur over the lifetime of the exposed individuals
- The offsite costs of short-term emergency response actions (evacuation, sheltering, and relocation), of crop and milk disposal, and of the decontamination, temporary interdiction, or condemnation of land and buildings

The consequences calculated with the MACCS2 model in terms of the population dose and offsite economic costs are shown in Table F.1-4. Using representative frequencies of accident occurrence and a value of $2,000 per person-Rem, the expected total offsite annual risk from the plant is on the order of a few thousand dollars per year.

F.2 Evaluation of Candidate SAMAs

This section describes the generation of the initial list of potential SAMAs for PBNP, screening methods and the analysis of the remaining SAMAs.

F.2.1 SAMA List Compilation

The NMC generated a list of candidate SAMAs by reviewing industry documents and considering plant-specific enhancements not considered in published industry documents. Industry documents reviewed include the following:

- The Point Beach IPE submittal (Reference F.2-1)
- The Watts Bar Nuclear Plant Unit 1 PRA/IPE submittal (Reference F.2-2)
- The Limerick SAMDA cost estimate report (Reference F.2-3)
- NUREG-1437 description of Limerick SAMDA (Reference F.2-4)
- NUREG-1437 description of Comanche Peak SAMDA (Reference F.2-5)
- Watts Bar SAMDA submittal (Reference F.2-6)
- TVA response to NRC's RAI on the Watts Bar SAMDA submittal (Reference F.2-7)
- Westinghouse AP600 SAMDA (Reference F.2-8)
- Safety Assessment Consulting (SAC) presentation by Wolfgang Werner at the NUREG 1560 conference (Reference F.2-9)
- NRC IPE Workshop - NUREG 1560 NRC Presentation (Reference F.2-10)
- NUREG 0498, supplement 1, section 7 (Reference F.2-11)
- NUREG/CR-5567, PWR Dry Containment Issue Characterization (Reference F.2-12)
- NUREG-1560, Volume 2, NRC Perspectives on the IPE Program (Reference F.2-13)
- NUREG/CR-5630, PWR Dry Containment Parametric Studies (Reference F.2-14)
- NUREG/CR-5575, Quantitative Analysis of Potential Performance Improvements for the Dry PWR Containment (Reference F.2-15)
- CE System 80+ Submittal (Reference F.2-16)
- NUREG 1462, NRC Review of ABB/CE System 80+ Submittal (Reference F.2-17)

- An ICONE paper by C. W. Forsberg, et. al, on a core melt source reduction system (Reference F.2-18)

In addition to the industry sources, plant-specific sources were also reviewed. The PBNP IPE and IPEEE were examined to determine whether any additional plant-specific improvements were identified, however, there were none. The Point Beach plant staff provided several plant-specific items that were included in the evaluation. Finally, the top 100 cutsets of the level 1 PSA update and the basic events having the greatest potential for risk reduction were examined to determine whether additional SAMAs could be identified from these sources.

Use of Importance Measures

Risk reduction worth (RRW) of the basic events in the baseline model was used to identify those basic events that could have a significant potential for reducing risk. The approach taken was to determine the RRW that would correspond to a $30,000 benefit, if all the benefit were associated with a single containment event tree (CET) end state. Each CET end state result was examined and the lowest RRW from all the endstates, corresponding to a $30,000 benefit was selected to determine the list of important basic events to consider as SAMA candidates.

Use of the Top 100 Cutsets

After identifying the important basic events from the RRW approach described above, the top 100 cutsets were examined to determine whether they were addressed. Nearly all the top 100 cutsets were directly addressed by the important basic events. Those that were not addressed directly were examined separately and found to be either already addressed by existing SAMA cases or small contributors to CDF. The top 100 cutsets constitute 67 percent of the internal events CDF.

Since the IPEEE was based on a screening analysis approach, no cutsets were available for a similar type of assessment. It is believed, however, that some of the improvements evaluated would reduce the risk contribution from external events. No new improvement is assumed to be beneficial beyond current Appendix R or other regulations governing external events. Shutdown related improvements are not addressed explicitly. However, SAMAs that affect structures, systems, and components that may enhance mitigative functions during both at-power and shutdown conditions are addressed.

F.2.2 Overview of Point Beach PSA

Summary of PRA Level 1 Results: The Point Beach Level 1 PRA Revision 3.02 calculated a core damage frequency (CDF) for internal events (excluding internal flooding) of 3.6E-5/year for each PBNP unit. Among the contributors to the PBNP CDF, no single initiator clearly dominates. However, the largest contributor, with a 25 percent contribution, is SGTR. The SGTR core damage sequences are largely dominated by human error events.

Internal Flooding: The Point Beach internal flooding CDF (1.08E-5/year) is dominated by two flooding sources: (1) rupture of a service water header in the auxiliary building and (2) rupture of a circulating water expansion joint or fire water main in the water intake facility pump house.

Summary of External Events Results: Seismic events contribute a core damage frequency of 1.3E-05/year and internal fires a core damage frequency of 1.2E-05/year to the Point Beach risk profile. Other external events were found to add a probabilistically insignificant risk to the plant.

PRA Model Description: A detailed Level 1 PRA of PBNP was performed in accordance with the methodology described in NUREG/CR-2300, "PRA Procedures Guide" (Reference F.2-20). The Point Beach PRA models were developed using small event trees (primarily systemic) and large fault trees. The model represents accident and transient initiating events starting from power operation and continuing for a 24-hour mission time. The PBNP design modeled in the PRA and used in the IPE (Reference F.2-1) was based on a design freeze date of September 5, 1990. Therefore, the quantification results presented in the IPE report reflect the September 1990 design and operation of PBNP. The IPE was submitted to the NRC on June 30, 1993. This submittal and supporting documentation was reviewed by internal PRA and systems and operations experts and by independent industry PRA specialists. A Staff Evaluation Report (SER) on the Point Beach IPE was issued by the NRC on January 26, 1995. The Level 2 results are calculated based upon the containment event tree used in the IPE submittal.

Several design modifications have been installed since the IPE PRA model was developed. A 1993 update to the PRA model incorporated installation of an additional safety-related station battery, a non-safety-related battery, and alternate shutdown switchgear with associated 13.8 KV system upgrades, and upgrades of the Gas Turbine Generator and the MSIVs to improve reliability. The installation of two additional emergency diesel generators and a plant specific data update were incorporated into a 1996 revision of the model.

The most recent update of the PBNP PRA model was largely completed by the summer of 2001. Updates included initiating event frequencies, event trees, failure data, and system models for the four most risk significant systems: auxiliary feedwater, service water, ECCS (safety injection and residual heat removal), and electric power. A partial update to human reliability analysis was also performed. Finally, the event tree / fault tree logic was converted to an all fault tree top logic. This enables a direct upload of the model to the risk monitoring software Safety Monitor. As a result, future model updates can be more easily incorporated into Safety Monitor to keep it current with plant changes. The Point Beach PRA model update process is controlled by plant administrative procedures.

In the fall of 2001, an issue involving the mini-recirculation flow valves for the Auxiliary Feedwater pumps was discovered as a result of final reviews of the updated system model for the PRA. These valves are air operated and designed to fail closed on a loss of instrument air to ensure sufficient flow is delivered forward to the steam generators. For certain scenarios where a loss of instrument air is involved, forward flow of the steam generators may be shut off in accordance with operating procedures to control steam generator level or primary system cooldown. This could result in the pumps overheating and failing due to a lack of recirculation flow. To eliminate this concern, modifications to provide a backup air supply to these valves and procedure improvements have been implemented. These changes were incorporated into Point Beach PRA model Revision 3.02. This version of the model was used for the SAMA analysis.

The internal flooding analysis and seismic PRA have not been updated since the original IPE submittal. The fire analysis has been updated once since the IPEEE submittal. This update was done in 1998 and consisted of developing new conditional core damage probabilities using the 1996 version of the internal events model.

In March 2002 a Level 3 analysis was completed. The Level 3 severe accident consequence analysis was carried out with the MELCOR Accident Consequence Code System (MACCS2) code. MACCS2 simulates the impact of severe accidents at nuclear power plants on the surrounding environment. The principal phenomena considered in MACCS are atmospheric transport, mitigative actions based on dose projections, dose accumulation by a number of pathways including food and water ingestion, early and latent health effects, and economic costs (Reference F.2-22).

<u>WOG Peer Review</u>: Revision 3.00 of the PRA model was reviewed in June 2001 by a Westinghouse Owners Group PRA Peer Review Team. The team consisted of a team leader from Westinghouse, two contract PRA reviewers, and three reviewers from PRA groups at other Westinghouse power plants. In general, the review team concluded

that the PBNP PRA could be used effectively to support applications involving risk significance determinations supported by deterministic analyses once the items noted in the report are addressed. A major observation was that the thermal hydraulic bases for system and human action success were largely from either conservative design basis analyses or analyses that were not specific to Point Beach. These thermal hydraulic bases date from the original PRA done for the IPE. Other observations discussed shortcomings with the basis and documentation of the common cause failure analysis, a general lack of miscalibration errors in the model, the need to complete the human reliability analysis update, and the need to document the quantification and complete documentation of the remainder of the model. Some of these items (primarily documentation issues) have already been addressed since the Peer Review team completed their work. The thermal hydraulic analysis items will take considerable work to resolve, and these are scheduled for 2003. While addressing the Peer Review Team's observations will take time to resolve completely, they are largely concerned with providing a well documented basis for the model and are not expected to result in model changes that will significantly affect the overall results or conclusions of the SAMA evaluations.

F.2.3 Qualitative Screening of SAMAs

The initial list of potential SAMAs are presented in Table F.2-1. Table F.2-1 also presents a qualitative screening of the initial list. Items were eliminated from further evaluation based on one of the following criteria:

- The SAMA is not applicable at PBNP, either because the enhancement is only for boiling water reactors, the Westinghouse AP600 design or PWR ice condenser containments, or it is a plant specific enhancement that does not apply at PBNP (Criterion A – Not applicable); or
- The SAMA has already been implemented at PBNP (or the PBNP design meets the intent of the SAMA) (Criterion B – Implemented or intent met).

Based on preliminary screening, 137 improvements were eliminated, leaving 65 subject to the final screening process (Criterion N – Not initially screened). These 65 improvements are listed in Table F.2-2.

The final screening process involved identifying and eliminating those items whose cost exceed their benefit. Table F.2-2 provides a description of the evaluation of each and provides the basis for their elimination or describes their final resolution.

F.2.4 Analysis of Potential SAMAs

The approach selected for this portion of the analysis (potential SAMAs to reduce core damage frequency) is to calculate the value of the averted risk to the public for each alternative. It relies on the NRC's handbook (Reference F.2-23) to convert public health risk (person-rem) into dollars to estimate the cost of the public health consequences. The requirement established in this handbook is to use $2,000 per person-rem to convert public health consequences to dollars (not indexed to inflation). Therefore, the value (or safety improvement) of implementing an alternative is expressed in terms of averted cost to the public (public benefit). It should be noted that the maximum attainable benefit (MAB) for any improvement is, hypothetically, the elimination of all plant risk. The expected cost of some SAMAs exceed this benefit and can be eliminated on this basis in the cost-benefit analysis.

The evaluation process described in Reference F.2-23 calculates the value of averted risk on an annual basis. Therefore, a method of "discounting" is used to calculate the "present value" or "present worth of averted risk" based on a specified period of time. For this analysis, a discount factor of 7 percent as described in the NRC Regulatory Analysis Technical Evaluation Handbook was used to determine the present worth of averted risk over the 20 year license renewal period for PBNP.

The PSA results used in this analysis are calculated using internal event results only. To account for the potential impact of external events on the results of these SAMA evaluations, because PBNP does not currently have an external events PSA model, it was assumed that the benefits of each SAMA would be increased for purposes of comparing with its cost by an amount equal to the ratio of the sum of internal CDF and external CDF to the internal CDF.

F.2.5 Sensitivity Analyses

Discount Rate

NUREG/BR-0184 recommends using a 7 percent real (i.e., inflation-adjusted) discount rate for value-impact analysis and notes that a 3 percent discount rate should be used for sensitivity analysis to indicate the sensitivity of the results to the choice of discount rate. This reduced discount rate takes into account the additional uncertainties (i.e., interest rate fluctuations) in predicting costs for activities that would take place several years in the future. Analyses presented in Section 4.20.4 used the 7 percent discount rate in calculating benefits of all the unscreened SAMAs. The NMC also performed a sensitivity analysis by substituting the lower discount rate and recalculating the benefit of the candidate SAMAs.

Each sensitivity performed produced an additional benefit result for each of the SAMAs analyzed in the cost-benefit analysis. In addition to the discount rate sensitivity discussed above, a calculation of the benefits was performed assuming a discount rate that is realistic for the NMC (8.95 percent).

The benefits calculated for each of these sensitivities are presented in Table F.2-3.

Reactor Power Level

NMC performed the SAMA analysis before implementing the 1.4 percent reactor uprate NMC undertook for each unit in 2003. The uprate raised the power level from 1,518.5 MWt to 1,540 MWt for each reactor and raised the net electrical output to 518 megawatts-electric (MWe) per unit. The SAMA analysis used the original power level of 1518.5 MWt. NMC is also considering an additional 8.7 percent uprate, which would raise the power level to 1,678 MWt for each reactor and the net electrical output to 564 MWe per unit.

A reactor power uprate can affect a SAMA analysis three ways. First, plant modifications performed to achieve an uprate can necessitate changing the PRA model to reflect configuration or operational changes. The PBNP 1.4 percent uprate included installation of a flow monitoring device and the 8.7 percent uprate would involve modifications to the secondary and electrical systems. NMC performed a review of the Level 1` PRA to determine whether changes were necessary as a result of implementing a 1.4 percent uprate and concluded that none were needed. NMC used the sensitivity analysis described below to account for potential effects of plant changes.

Second, the power level is used to calculate the core inventory for input to the Level 3 modeling. Because other PBNP Level 3 input is output from the Level 2 modeling and the Level 2 model is based on the 1,518.5 MWt-power level, NMC used that value in calculating the core inventory and used the sensitivity analysis described below to account for potential effects of increased power levels.

Third, the power level influences the net electrical rating of the plant which, in turn, is input for calculating the cost of replacement power. It has been the experience of industry that of all averted costs, the onsite economic costs of replacement power and cleanup most strongly determine whether a SAMA would be cost beneficial. In order to avoid skewing the analysis against potential SAMAs, the SAMA analysis assumes the net electrical output value that NMC expects to achieve from the planned uprate to be 564 MWe (see Section 4.20.2, *Replacement Power Costs*).

In order to evaluate the effect that uprate modifications and power level increases could have on the SAMA analysis conclusions, NMC performed a sensitivity analysis by increasing the Level 3 offsite results (dose and economic impacts) by first 10 percent and then by 100 percent and re-calculating the benefits for each SAMA candidate using each increased value. Neither increase resulted in a significant change in the SAMA benefits and neither impact the original conclusion that no candidate SAMAs are cost beneficial. This lack of model sensitivity to these level changes is attributable to the overwhelming effect that onsite cleanup costs and replacement power costs have on the cost/benefit analysis.

After reviewing the PBNP SAMA analysis and performing an analysis of the sensitivity of analytical results to variations in Level 3 output, NMC concludes that the analysis, augmented by this sensitivity analysis, bounds the effects that the 2003 uprate had, and a planned 8.7 percent uprate could have, on cost/benefit analysis of PBNP SAMAs.

Table F.1-1. MACCS2 Reference PWR Core Inventory (PBNP Inventory is 44.5 percent of each Nuclide).

Nuclide	Core inventory (becquerels)		Nuclide	Core inventory (becquerels	
	MACCS2 Reference	Calculated for PBNP		MACCS2 Reference	Calculated for PBNP
Cobalt-58	3.223E+16	1.434E+16	Tellurium-131M	4.680E+17	2.083E+17
Cobalt-60	2.465E+16	1.097E+16	Tellurium-132	4.658E+18	2.073E+18
Krypton-85	2.475E+16	1.101E+16	Iodine-131	3.206E+18	1.427E+18
Krypton-85M	1.159E+18	5.158E+17	Iodine-132	4.725E+18	2.103E+18
Krypton-87	2.118E+18	9.425E+17	Iodine-133	6.779E+18	3.017E+18
Krypton-88	2.864E+18	1.274E+18	Iodine-134	7.440E+18	3.311E+18
Rubidium-86	1.888E+15	8.402E+14	Iodine-135	6.392E+18	2.844E+18
Strontium-89	3.590E+18	1.598E+18	Xenon-133	6.782E+18	3.018E+18
Strontium-90	1.938E+17	8.624E+16	Xenon-135	1.273E+18	5.665E+17
Strontium-91	4.616E+18	2.054E+18	Cesium-134	4.324E+17	1.924E+17
Strontium-92	4.803E+18	2.137E+18	Cesium-136	1.316E+17	5.856E+16
Yttrium-90	2.079E+17	9.252E+16	Cesium-137	2.417E+17	1.076E+17
Yttrium-91	4.374E+18	1.946E+18	Barium-139	6.282E+18	2.795E+18
Yttrium-92	4.821E+18	2.145E+18	Barium-140	6.216E+18	2.766E+18
Yttrium-93	5.454E+18	2.427E+18	Lanthanum-140	6.352E+18	2.827E+18
Zirconium-95	5.526E+18	2.459E+18	Lanthanum-141	5.826E+18	2.593E+18
Zirconium-97	5.759E+18	2.563E+18	Lanthanum-142	5.616E+18	2.499E+18
Niobium-95	5.224E+18	2.325E+18	Cerium-141	5.651E+18	2.515E+18
Molybdium-99	6.098E+18	2.714E+18	Cerium-143	5.494E+18	2.445E+18
Technetium-99M	5.263E+18	2.342E+18	Cerium-144	3.405E+18	1.515E+18
Ruthenium-103	4.542E+18	2.021E+18	Praseodymium-143	5.395E+18	2.401E+18
Ruthenium-105	2.954E+18	1.315E+18	Neodymium-147	2.412E+18	1.073E+18
Ruthenium-106	1.032E+18	4.592E+17	Neptunium-239	6.464E+19	2.876E+19
Rhodium-105	2.046E+18	9.105E+17	Plutonium-238	3.664E+15	1.630E+15
Antimony-127	2.787E+17	1.240E+17	Plutonium-239	8.263E+14	3.677E+14
Antimony-129	9.872E+17	4.393E+17	Plutonium-240	1.042E+15	4.637E+14
Tellurium-127	2.692E+17	1.198E+17	Plutonium-241	1.755E+17	7.810E+16
Tellurium-127M	3.564E+16	1.586E+16	Americium-241	1.159E+14	5.158E+13
Tellurium-129	9.267E+17	4.124E+17	Curium-242	4.436E+16	1.974E+16
Tellurium-129M	2.443E+17	1.087E+17	Curium-244	2.596E+15	1.155E+15

Table F.1-2. PBNP Release Fraction by Nuclide Group.

	Early SGTR and ISLOCA	Late SGTR	Unisolated Containment	No Cont. Failure or Bypass
Release Fraction by Specie				
NOBL;IN	5.4E-01	5.9E-01	6.7E-01	1.4E-02
CSI	3.2E-02	1.8E-02	9.7E-03	1.2E-04
TEO2	0.	0.	0.0E+00	0.0E+00
SRO	5.0E-06	1.E-06	7.2E-06	2.9E-06
MOO2 (RU)	3.6E-05	3.3E-06	5.5E-05	3.3E-05
CSOH	2.6E-02	1.6E-02	9.7E-03	1.5E-04
BAO	2.9E-05	4.8E-06	6.0E-05	8.6E-06
LA2O3	5.8E-08	1.0E-08	8.7E-08	4.7E-06
CEO2	5.9E-08	1.0E-08	3.6E-07	9.0E-06
SB (TE)	1.1E-03	3.1E-04	1.2E-03	3.9E-04
TE2	3.1E-08	2.3E-09	3.4E-05	7.8E-04
Times, sec				
Alarm	8,748	72,360	9,036	9,056
Release	11,700	83,160	10,898	13,820
Duration	2,556	4,320	18,000	36,000
Energy, W	1.5E+6	1.0E+6	1.0E+6	1.E+5

Table F.1-3. PBNP Regional Population Distribution.

Sector	Radial Ring Outside Distance, Miles								
	1	2	5	10	15	20	30	40	50
N	0	0	0	239	3917	732	7848	11957	3018
NNE	0	0	0	0	0	0	272	3821	2478
NE	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0	0	0
S	0	35	303	214	0	0	0	0	0
SSW	0	33	65	15229	16091	14589	3559	71074	34780
SW	0	41	102	1540	7568	5687	5948	16248	11051
WSW	0	2	159	1957	2054	2315	7961	12083	5831
W	0	43	66	795	1581	1233	5213	45999	200274
WNW	0	0	142	584	1061	4103	81443	90568	13563
NW	0	0	156	545	935	1941	46507	37367	11512
NNW	0	0	79	460	1216	2124	6044	880	8932

Table F.1-4. Summary of Offsite Consequence Results for Each Release Mode.

Release Category	Offsite Effects/Accident	
	Person-SV	Dollars
Late SGTR	1.39E+03	1.21E+08
Early SGTR	1.88E+03	1.87E+08
Isolation Failure	1.13E+03	5.94E+07
Other CM	3.86E+01	1.59E+05

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis.

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
1	Stage backup fans in Switchgear rooms.	Provides alternate ventilation in the event of a loss of switchgear ventilation.	(13)	B	PB IPE indicates that AC power is not dependent on ventilation. The capability and the procedures exist to provide temporary cooling.
2	Provide redundant train of ventilation to 480V board room.	Would improve reliability of 480V HVAC. At Watts Bar, only one train of HVAC cools the 480V board room that contains the unit vital inverters, and recovery actions are heavily relied on. Watts Bar IPE said their corrective action program is dealing with this.	(2), (13)	A	PB IPE indicates that AC power is not dependent on ventilation.
3	Add a switchgear room high temp alarm.	Improve diagnosis of a loss of switchgear HVAC.	(13)	A	PB IPE indicates that AC power is not dependent on ventilation.
4	Install tornado protection on gas turbine generator.	If the unit has a gas turbine, the tornado-induced SBO frequency would be reduced.	(16), (17)	N	Evaluation case LOSP2 determined the impact of eliminating tornado induced LOSP. The benefit was determined to be $181,189. Modifications to implement this SAMA are expected to cost considerably more than the benefit.
5	Provide an additional diesel generator.	Would increase on-site emergency AC power reliability and availability (decrease SBO) The ANO-1 IPE reported that ANO committed to install an AAC power source capable of supplying the LOOP loads of any one of the four safety buses. This source would be available within 10 minutes after determination of SBO conditions.	(5), (6), (10), (13) (16), (17)	B	PB has a gas turbine generator installed. Two EDGs were also added.
6	Develop procedures to repair or change out failed 4KV breakers.	Offers a recovery path from a failure of breakers that perform transfer of 4.16KV non-emergency buses from unit station service transformers to system station service transformers, leading to loss of emergency AC power (i.e., in conjunction with failures of the diesel generators).	(13)	B	There is currently a process in place for this
7	Install gas turbine generators.	Improve on-site AC power reliability.	(13)	B	PB has a gas turbine generator installed.
8	Provide a connection to alternate offsite power source.	Increase offsite power redundancy.	(13)	A	There are 4 offsite power lines already. The cost of adding another line is expected to exceed MAB.
9	Implement underground offsite power lines.	Could improve offsite power reliability, particularly during severe weather.	(13)	A	There are 4 offsite power lines already. The cost of adding another line is expected to exceed MAB.
10	Train operations crew for response to inadvertent actuation signals.	Improves chances of a successful response to the loss of two 120VAC buses, which causes inadvertent signals.	(13)	A	Point Beach does not have high head injection so no special response is needed.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
11	Proceduralize alignment of spare diesel to shutdown board after LOP and failure of the diesel normally supplying it.	Reduced SBO frequency.	(2)	B	Use of gas turbine and the two additional EDGs already proceduralized.
12	Improved bus cross tie ability.	Improved AC power reliability.	(10), (13)	B	Bus cross tie capability exists both between units and between busses on the same unit.
13	Create AC power cross tie capability across units at a multi-unit site.	Improved AC power reliability.	(11), (12), (13)	B	Bus cross tie capability exists both between units and between busses on the same unit.
14	Create a cross-unit tie for diesel fuel oil.	For multi-unit sites, adds diesel fuel oil redundancy.	(13)	B	Diesels are shared between units. Fuel supply is from common 60,000 gal. Tanks.
15	Emphasize steps in recovery of offsite power after a SBO.	Reduced human error probability of offsite power recovery.	(13)	B	Done during the normal course of operator training and requalification (each 2 years).
16	Procedures for replenishing diesel fuel oil.	Allow long term diesel operation.	(13)	B	Plant has 7 day supply on site and procedures for replenishing fuel supply
17	Create a river water backup for diesel cooling.	Provides redundant source of diesel cooling.	(13)	B	Diesel generators G03 and G04 are air cooled with radiators and do not depend on external cooling water.
18	Use firewater as a backup for diesel cooling.	Redundancy in diesel support systems.	(13)	B	Diesel generators G03 and G04 are air cooled with radiators and do not depend on external cooling water. G01 can be cooled by firewater.
19	Replace anchor bolts on diesel generator oil cooler.	Millstone found a high seismic SBO risk due to failure of the diesel oil cooler anchor bolts. For plants with a similar problem, this would reduce seismic risk.	(13)	A	Point Beach seismic anchorage issues addressed b y item 81.
20	Separate non-vital buses from vital buses.	Some non-vital loads mixed with vital loads on load centers causing load shedding difficulties.	(20)	B	Non-vital loads fed from the emergency switchgear are automatically load shed on an undervoltage signal.
21	Additional emergency AC sources	Two new DGs were installed with new 4160VAC safeguards switchgear and new emergency fuel oil systems. Independent of SW cooling.	PB IPEEE (21), PB IPE (1)	B	Two additional diesel generators have been installed.
22	Provide a motor operated AFW pump.	Currently AFW pumps are both turbine driven.	(20)	B	PB has one Turbine driven AFW pump for each unit and two motor driven AFW pumps that are shared between the units.
23	AFW Pump Control Upgrade	Control system for the AFW pumps being changed such that a fire in the non-vital switchgear room will not disable AFW pump auto-start capability.	PB IPEEE (21)	A	Further evaluation has determined that the electric AFW pumps are lost due to a fire in this room.
24	Manual alignment of alternate AFW sources.	EOPs were to be revised to include more detailed steps for manually aligning alternate AFW sources.	PB IPE (1)	B	Procedure changes implemented.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
25	Fire Water connection to CSTs	A modification was to be made to add a quick-connecting mechanism to all for rapidly connecting fire water hoses to the CSTs.	PB IPE (1)	B	Modification installed
26	Replace old air compressors with more reliable ones.	Improve reliability and increase availability of instrument air compressors.	(13)	B	Replaced already; maintenance practices revised to enhance reliability.
27	Modify EOPs for ability to align diesel power to more air compressors.	For plants which do not have diesel power to all normal and backup air compressors, this change allows increased reliability of instrument air after a LOP.	(13)	B	Once SI signal is reset, equipment restoration is directed by procedures. This includes restoration of air compressors.
28	Create cross-connect ability for standby liquid control (SLC) trains.	Improved reliability for boron injection during ATWS.	(13)	A	BWR item
29	Create an alternate boron injection capability (backup to SLC).	Improved reliability for boron injection during ATWS.	(13)	A	BWR item
30	Remove or allow override of LPCI injection during ATWS.	On failure of HPCI and condensate, the Susquehanna units direct reactor depressurization followed by 5 minutes of automatic LPCI injection. Would allow control of LPCI immediately.	(13)	A	BWR item
31	Create a boron injection system to back up the mechanical control rods.	Provides a redundant means to shut down the reactor.	(16), (17)	B	Capability for emergency boration exists.
32	Install MG set trip breakers in control room.	Provides trip breakers for the motor generator sets in the control room. Currently, at Watts Bar, an ATWS would require an immediate action outside the control room to trip the MG sets. Would reduce ATWS CDF.	(11)	N	Evaluation case NOATWS determined the benefit of eliminating all ATWS events. The benefit was determined to be $28,982.
33	Add capability to remove power from the bus powering the control rods.	Decrease time to insert control rods if the reactor trip breakers fail (during a loss of feedwater ATWS which has rapid pressure excursion).	(13)	B	Capability to remove power already exists.
34	Provide an additional I&C system (e.g., AMSAC).	Improve I&C redundancy and reduce ATWS frequency.	(16), (17)	B	AMSAC already installed.
35	Install relief valves in the component cooling water system .	Would relieve pressure buildup from an RCP thermal barrier tube rupture, preventing an ISLOCA.	(13)	B	If a leak from a barrier takes place, the CCW system HP piping which will be automatically isolated from LP piping to prevent ISLOCA. Additionally, relief valves (2500PSI) are installed on the thermal barrier piping.
36	Cap downstream piping of normally closed CCW drain and vent valves.	Reduces the frequency of loss of CCW initiating event, a large portion of which was derived from catastrophic failure of one of the many single isolation valves.	(13)	B	Vents and drains are capped.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
37	Enhance Loss of CCW (or LOSW) procedure to facilitate stopping RCPs.	Reduces potential for RCP seal damage due to pump bearing failure.	(2), (10), (13)	B	Diverse cooling exists.
38	Enhance Loss of CCW procedure to present desirability of cooling down RCS prior to seal LOCA.	Potential reduction in the probability of RCP seal failure.	(2)	B	Diverse cooling exists.
39	Additional training on the Loss of CCW.	Potential improvement in success rate of operator actions after a loss of CCW.	(2)	B	Diverse cooling exists.
40	Provide hardware connections to allow another ERCW (SW) to cool charging pump seals.	Reduce effect of loss of CCW by providing a means to maintain the charging pump seal injection after a loss of CCW. Note, in Watts Bar, this capability was already there for one charging pump at one unit, and the potential enhancement identified was to make it possible for all the charging pumps.	(2), (6), (11), (13)	A	The charging pumps at Point Beach do not have a dependence on external cooling.
41	On loss of ERCW, proceduralize shedding CCW loads to extend the CCW heatup time.	Increase time before the loss of CCW (and RCP seal failure) in the loss of ERCW sequences.	(2)	B	Diverse cooling exists.
42	Eliminate RCP thermal barrier dependence on CCW, such that loss of CCW does not result directly in core damage.	Would prevent loss of RCP seal integrity after a loss of CCW. Watts Bar IPE stated they could do this with ERCW connection to charging pump seals.	(2), (13)	B	Diverse cooling exists.
43	Replace ECCS pump motors with air cooled motors.	Remove dependency on CCW.	(10), (13)	B	ECCS pump motors are air-cooled.
44	Add a third CCW pump.	Reduce chance of loss of CCW leading to RCP seal LOCA.	(13)	B	Diverse cooling exists.
45	Procedural guidance for use of cross-tied CCW or SW pumps.	Can reduce the frequency of the loss of either of these.	(13)	N	Pumps cannot be cross-tied. Heat Exchangers C & D can be cross-tied and procedural guidance exists. Evaluation case RCPLOCA determined the benefit of eliminating all small LOCA events, including RCP seal LOCA. The benefit was determined to be $13,025. The Expert Panel agreed that a cross-tie procedure could be developed, even though the benefit is low.
46	Make CCW trains separate.	Current cross-tie capability creates a potential common mode failure mechanism for both trains (and both stations).	(20)	A	The CCW system is not laid out in trains so as to be able to separate them.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
47	Provide self-cooled ECCS seals.	ECCS pump seals are CCW cooled.	(20)	N	Charging pumps do not require cooling. Evaluation case CCWECCS determined the benefit of eliminating the cooling requirement for the ECCS pump seals. The benefit was determined to be $0.
48	Provide a centrifugal charging pump.	Currently charging pumps are positive displacement pumps.	(20)	N	Evaluation case CHCCF determined the effect of eliminating the common cause failure of the charging pumps. The benefit was determined to be $341.
49	Install an independent method of suppression pool cooling .	Would decrease frequency of loss of containment heat removal.	(3), (4)	A	BWR item
50	Install a containment vent large enough to remove ATWS decay heat.	Assuming injection is available, would provide alternative decay heat removal in an ATWS.	(3), (4)	N	Evaluation case NOATWS determined the benefit of eliminating all ATWS events. The benefit was determined to be $28,982.
51	Secondary containment filtered ventilation.	For plants with a secondary containment, would filter fission products released from the primary containment.	(8)	A	BWR item
52	Add redundant and diverse limit switch to each containment isolation valve.	Enhanced isolation valve position indication, which would reduce frequency of containment isolation failure and ISLOCAs.	(16), (17)	N	Evaluation case ISOL determined the benefit of eliminating all isolation failures. The benefit was determined to be $302.
53	Self-actuating containment isolation valves .	For plants that don't have this, it would reduce the frequency of isolation failure.	(8)	N	Evaluation case ISOL determined the benefit of eliminating all isolation failures. The benefit was determined to be $302.
54	Provide containment isolation design per GDC and SRP.	Enhance containment isolation capability.	(20)	N	Evaluation case ISOL determined the benefit of eliminating all isolation failures. The benefit was determined to be $302.
55	Add Penetration valve leakage control system.	Enhance capability to detect/control leakage from penetrations valves.	(20)	N	Evaluation case ISOL determined the benefit of eliminating all isolation failures. The benefit was determined to be $302.
56	Change failure position of condenser makeup valve.	If the condenser makeup valve fails open on loss of air or power, this can result in CST flow diversion to condenser. Allows greater inventory for the AFW pumps.	(13)	A	Condenser make-up/letdown valves fail closed on loss of power and air.
57	Delay containment spray actuation after large LOCA.	When ice remains in the ice condenser at such plants, containment sprays have little impact on containment performance, yet rapidly drain down the RWST. This improvement would lengthen time of RWST availability.	(2), (6)	A	Applicable to ice condenser containments only

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
58	Install containment spray throttle valves.	Can extend the time over which water remains in the RWST, when full containment spray flow is not needed.	(11), (12), (13)	B	The current procedures already have the operators reduce flow to manage inventory
59	Use firewater spray pump for containment spray.	Redundant containment spray method without high cost.	(7), (9), (10), (12)	A	Point Beach does not credit containment spray in any risk analyses. Due to the containment design, the containment spray system does not prevent release in any scenarios
60	Install a passive containment spray system.	Containment spray benefits at a very high reliability, and without support systems.	(8)	A	Point Beach does not credit containment spray in any risk analyses. Due to the containment design, the containment spray system does not prevent release in any scenarios
61	Change CRD flow control valve failure position.	Change failure position to the 'fail-safest' position.	(13)	A	BWR item
62	Provide additional DC battery capability.	Would ensure longer battery capability during a SBO, reducing frequency of long term SBO sequences.	(5), (6), (13), (16), (17)	N	Evaluation case NOSBO determined the benefit of eliminating all station blackout events. The benefit was determined to be $15,094.
63	Use fuel cells instead of lead-acid batteries.	Extend DC power availability in a SBO.	(16), (17)	N	Evaluation case LOSP3 determined the benefit of eliminating all loss of offsite power events. The benefit was determined to be $181,189.
64	Alternate battery charging capability.	Improved DC power reliability. Either cross tie of AC buses, or a portable diesel-driven battery charger.	(10), (11), (12), (13)	B	AC power cross-ties fulfill this need.
65	Increase/improve DC bus load shedding.	Improved battery life in station blackout.	(10), (11), (12), (13)	B	PBNP procedures reference actions to take if DC bus voltages drop below 105v, however these actions do not include shedding DC loads. Operators are directed to shift to the swing battery if a low voltage condition exists. The non-1E batteries and chargers were installed specifically to reduce the loads on the station batteries.
66	Replace batteries.	Improved reliability.	(10)	N	Evaluation case LOSP3 determined the benefit of eliminating all loss of offsite power events. The benefit was determined to be $181,189.
67	Provide modification for flooding of the drywell head.	Would help mitigate accidents that result in leakage through the drywell head seal.	(4), (9)	A	BWR item

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
68	Creating other options for reactor cavity flooding (Part a).	(a)Use water from dead-ended volumes, the condensed blowdown of the RCS, or secondary system by drilling pathways in the reactor vessel support structure to allow drainage from the steam generator compartments, refueling canal, sumps, etc., to the reactor cavity. Also (for ice condensers), allow drainage of water from melted ice into the reactor cavity.	(7), (9), (13)	B	Implemented in SAMG documents per owner's group guidance
69	Provide a dedicated existing drywell spray system.	Identical to the previous concept, except that one of the existing spray loops would be used instead of developing a new spray system.	(3), (4) [similar PWR containment spray option in (5), (6), (11)]	A	BWR item
70	Develop an enhanced drywell spray system.	Would provide a redundant source of water to the containment to control containment pressure, when used in conjunction with containment heat removal.	(3), (4), (16), (17)	A	BWR item
71	Install a filtered containment vent to remove decay heat.	Assuming injection is available (non-ATWS sequences), would provide alternate decay heat removal with the released fission products being scrubbed.	(3), (4) (similar options in (5), (6), (8), (11), (12), (16), (17)	N	TVA estimate $20M; expected to well exceed MAB The costs associated with the plant modifications required to implement this alternative are greater than the benefit.
72	Install an unfiltered hardened containment vent.	Provides an alternate decay heat removal method (non-ATWS), which is not filtered.	(3), (4), (9), (14)	N	TVA estimate $20M; expected to well exceed MAB The costs associated with the plant modifications required to implement this alternative are greater than the benefit.
73	Create a reactor cavity flooding system.	Would enhance debris coolability, reduce core concrete interaction and provide fission product scrubbing.	(5), (6), (9), (11), (12), (13), (15), (16), (17)	B	Point Beach already has this capability.
74	Provide a reactor vessel exterior cooling system.	Potential to cool a molten core before it causes vessel failure, if the lower head can be submerged in water.	(16), (17)	B	Point Beach already has this capability.
75	Creating other options for reactor cavity flooding (Part b).	(b)Flood cavity via systems such as diesel driven fire pumps.	(7), (9), (13)	B	Implemented in SAMG documents per owner's group guidance
76	Develop a severe weather conditions procedure.	For plants that do not already have one, reduces the likelihood of external events CDF.	(13)	B	Procedure exists and is felt to be adequate.
77	Tornado damage to RWST and penetration rooms.	Penetration rooms are tornado protected. Tornado category F2 and higher can generate heavy enough missiles that could impact and damage the RWST.	(19)	N	Per the tornado study in PSA Section 9, These areas OK to winds of 350 mph. Frequency of exceedance for these wind speeds is 7.33E-8.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
78	Tornado causes failure of power and upper surge tanks.	Consider protection for tanks or switchgear in Turbine Building. Surge tanks are suction for emergency feedwater pumps.	(19)	N	Per the tornado study in PSA Section 9, These areas OK to winds of 350 mph. Frequency of exceedance for these wind speeds is 7.33E-8.
79	CR/CSR Fire procedure upgrades	Abnormal Operating Procedure AOP-10A revised to add verification of additional valves closed for Cont Isolation.	PB IPEEE (21)	B	Procedure has been revised.
80	CR smoke detectors	CR smoke detectors located below grated ceiling could affect ability to detect fire early.	PB IPEEE (21)	B	Modification scheduled for implementation in 2002 per discussions with PRA staff.
81	Seismic equipment anchorages	Commitment to fix anchorages found in USI A-46/IPEEE walkdowns by Feb 1998.	PB IPEEE (21)	B	RWST anchorage scheduled for completion by 9/15/2001 and completed
82	Relay Chatter Issue	Westinghouse Model ITH relays exist in the 4160V switchgear (SI pump and 4160/480V transformer supply breakers). Being resolved as part of USI-A-46 program.	PB IPEEE (21)	B	G-01 and G-02 relays scheduled for completion in 2002. This will complete implementation.
83	Reverse Door Frames in Control Building Tunnel	Certain equipment access doors in the control building access tunnel were to be reversed so that only the latch would be holding the doors against flooding from the service water header in the AFW pump room.	PB IPE (1)	B	Modification completed.
84	Internal flooding improvements at Fort Calhoun.	Prevention or mitigation of 1)A rupture in the RCP seal cooler of the CCW system, 2)An ISLOCA in a shutdown cooling line, 3)An AFW flood involving the need to possibly remove a watertight door. For a plant where any of these apply, would reduce flooding risk.	(13)	A	These items not indicated by PB internal flooding analysis.
85	Modify swing direction of doors separating turbine building basement from areas containing safeguards equipment.	For a plant where internal flooding from turbine building to safeguards areas is a concern, this modification can prevent flood propagation.	(13)	B	This concern was already considered in the flooding analysis.
86	Improve inspection of rubber expansion joints on main condenser.	For a plant where internal flooding due to failure of circulating water expansion joint is a concern, this can help reduce the frequency.	(13)	B	This concern was already considered in the flooding analysis.
87	Internal flood prevention and mitigation enhancements.	1)Use of submersible MOV operators. 2)Back flow prevention in drain lines.	(13)	A	These items not indicated by PB internal flooding analysis.
88	Create ability for emergency connections of existing or alternate water sources to feedwater/condensate.	Would be a backup water supply for the feedwater/condensate systems.	(12)	B	Service Water can be used as a backup suction source for the AFW pumps. Firewater can be used to refill the CST.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
89	Digital feedwater upgrade.	Reduces chance of loss of MFW following a plant trip.	(13)	N	Evaluation case NOT2A determined the benefit of eliminating all transients with loss of power conversion system. The benefit was determined to be $52,259.
90	Create ability to switch fan power supply to DC in SBO.	(was created for a BWR RCIC room, Fitzpatrick; possible for turbine AFW if has its own fan) Allow continued operation in SBO.	(13)	A	IPE indicates that AFW ventilation is not required to support system operation.
91	Enhance air return fans (ice condenser containment).	Provide an independent power supply for the air return fans, reducing containment failure in SBO sequences.	(6), (11)	A	Applicable to Ice Condenser plant only.
92	Procedures for temporary HVAC.	Provides for improved credit to be taken for loss of HVAC sequences.	(11), (13)	B	See Item #1. Procedures for temporary cooling already are in place.
93	Provide Auxiliary Building Vent/Seal structure.	Enhance ventilation in AB.	(20)	N	Evaluation case ISLOCA determined the benefit of eliminating all ISLOCA events. The benefit was determined to be $13,628.
94	Procure a portable diesel pump for isolation condenser makeup.	Backup to the city water supply and diesel fire water pump in providing isolation condenser makeup.	(13)	A	Applicable only to isolation condenser plants
95	Locate RHR inside of containment.	Would prevent ISLOCA out the RHR pathway.	(8)	A	For an existing plant, relocating the RHR inside the containment is not feasible, as it would require an entirely new RHR system. Therefore this SAMA is not considered further.
96	Install additional instrumentation for ISLOCA sequences.	Pressure or leak monitoring instruments installed between the first two pressure isolation valves on low-pressure injection lines, RHR suction lines, and high pressure injection lines would decrease ISLOCA frequency.	(5), (6), (11), (13)	N	Evaluation case ISLOCA determined the benefit of eliminating all ISLOCA events. The benefit was determined to be $13,628.
97	Increase frequency of valve leak testing.	Decrease ISLOCA frequency.	(12)	N	Evaluation case ISLOCA determined the benefit of eliminating all ISLOCA events. The benefit was determined to be $13,628.
98	Improvement of operator training on ISLOCA coping.	Decrease ISLOCA effects.	(12), (13)	N	Evaluation case ISLOCA determined the benefit of eliminating all ISLOCA events. The benefit was determined to be $13,628.
99	Provide leak testing of valves in ISLOCA paths.	At Kewaunee, four MOVs isolating RHR from the RCS were not leak tested. Would help reduce ISLOCA frequency.	(13)	B	Already exists
100	Revise EOPs to improve ISLOCA identification.	Salem had a scenario in which an RHR ISLOCA could direct initial leakage back to the PRT, giving indication that the LOCA was inside containment. Procedure enhancement would ensure LOCA outside containment would be observed.	(13)	N	Evaluation case ISLOCA determined the benefit of eliminating all ISLOCA events. The benefit was determined to be $13,628.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
101	Ensure all ISLOCA releases are scrubbed.	Would scrub ISLOCA releases. One suggestion was to plug drains in the break area so the break point would cover with water.	(14), (15)	N	Evaluation case ISLOCA determined the benefit of eliminating all ISLOCA events. The benefit was determined to be $13,628.
102	Secondary side guard pipes up to the MSIVs.	Would prevent secondary side depressurization should a steam line break occur upstream of the MSIVs. Would also guard against or prevent consequential multiple SGTR following a main steam line break event.	(16), (17)	N	Evaluation case NOSLB determined the benefit of eliminating all steam line break events. The benefit was determined to be $170,789.
103	Digital large break LOCA protection.	Upgrade plant instrumentation and logic to improve the capability to identify symptoms/precursors of a large break LOCA (a leak before break).	(17)	N	Evaluation case NOA determined the benefit of eliminating all large break LOCA events. The benefit was determined to be $4,782.
104	Procedure & operator training enhancements in support system failure sequences, with emphasis on anticipating problems and coping.	Potential improvement in success rate of operator actions after support system failures.	(2), (13)	B	This item is redundant with the individual consideration of important human action contributors.
105	Defeat 100 percent load rejection capability. INTERPRET AS "PROVIDE 100 percent…"	Eliminates the possibility of a stuck open PORV after a LOP, since PORV opening wouldn't be needed.	(13)	A	Point Beach does not require automatic or manual operation of the PORV following a loss of offsite power.
106	Enhance training for important operator actions.	Key operator actions are: U3OPS2HPR (0.0078) ZZXCROSST (0.0501) XMANBYPASS (0.016) U3OPMLPR (0.03) X3OPKMRODI (0.1) U0RABFAN (0.01) U3OPALHR (0.12) AHFL0N2BKU (0.003) UISOPMP (0.0003) U3T3CD4-3 (0.003)	(20)	B	Operator training program includes input from the PRA.
107	Provide a core debris control system.	(intended for ice-condenser plants): Would prevent the direct core debris attack of the primary containment steel shell by erecting a barrier between the seal table and containment shell.	(6), (11)	A	Applicable to ice condenser plants only.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
108	Improved SGTR coping abilities.	Improved instrumentation to detect SGTR, or additional systems to scrub fission product releases.	(7), (9), (10), (13), (14), (16), (17)	N	Evaluation case NOSGTR determined the impact of eliminating all steam generator tube rupture events. The benefit was determined to be $641,592. SGTR2 reduced the probability of tube failure by a factor of 10. The benefit was determined to be $565,059. Early detection capability: No readily available data to support reduction in frequency of rupture given early detection. The probability of leak-before-break is not known. Vent scrubbing: This would be extremely expensive and would exceed the benefit.
109	Create/enhance hydrogen ignitors with independent power supply.	Use either a new, independent power supply, a non-safety grade portable generator, existing station batteries, or existing AC/DC independent power supplies such as the security system diesel. Would reduce hydrogen detonation at lower cost.	(3), (5), (6), (7), (9), (12), (13), (14), (15), (16), (17)	A	Point Beach does not have hydrogen recombiners ; but does own a portable recombiner jointly with another plant which can be obtained in a short time if needed. Hydrogen concentration or pockets are not likely based on IPE insights.
110	Create a giant concrete crucible with heat removal potential under the basemat to contain molten debris.	A molten core escaping from the vessel would be contained within the crucible. The water cooling mechanism would cool the molten core, preventing a meltthrough.	(3), (4), (16), (17)	A	For an existing plant, design and installation of this SAMA is not considered feasible. The costs associated with the plant modifications required to implement this alternative are greater than the benefit. S80 estimate $108M; expected to well exceed MAB.
111	Create a water cooled rubble bed on the pedestal.	This rubble bed would contain a molten core dropping onto the pedestal, and would allow the debris to be cooled.	(3), (4), (8), (16), (17)	A	BWR Item

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
112	Create a core melt source reduction system (COMSORS).	Place enough glass underneath the reactor vessel such that a molten core falling on the glass would melt and combine with the material. Subsequent spreading and heat removal from the vitrified compound would be facilitated, and concrete attack would not occur (such benefits are theorized in the reference).	(18)	A	For an existing plant, design and installation of this SAMA is not considered feasible. The costs associated with the plant modifications required to implement this alternative are greater than the benefit. S80 estimate $108M; expected to well exceed MAB.
113	Provide containment inerting capability.	Would prevent combustion of hydrogen and carbon monoxide gases.	(6), (9), (11), (14)	A	Point Beach does not have hydrogen recombiners ; but does own a portable recombiner jointly with another plant which can be obtained in a short time if needed. Hydrogen concentration or pockets are not likely based on IPE insights.
114	Create a passive hydrogen ignition system.	Reduce hydrogen detonation potential without requiring electric power.	(7), (11), (16), (17)	A	Point Beach does not have hydrogen recombiners ; but does own a portable recombiner jointly with another plant which can be obtained in a short time if needed. Hydrogen concentration or pockets are not likely based on IPE insights.
115	Enhance fire protection system and/or standby gas treatment system hardware and procedures.	Improve fission product scrubbing in severe accidents.	(4)	A	BWR Item.
116	Direct steam generator flooding after a SGTR, prior to core damage.	Would provide for improved scrubbing of SGTR releases.	(14), (15)	B	Procedures currently in place direct this appropriately.
117	Add charcoal filters on Aux Bldg exhaust.	Enhance fission product removal after ISLOCA.	(20)	B	Filtration system already exists. It auto starts.
118	Install improved RCP seals.	RCP seal O-rings constructed of improved materials would reduce chances of RCP seal LOCA.	(11), (13)	B	Improved seals installed.
119	Create an independent RCP seal injection system, with dedicated diesel.	Would add redundancy to RCP seal cooling alternatives, reducing CDF from loss of CCW, SW or SBO.	(6), (11), (13)	N	Evaluation case RCPLOCA determined the benefit of eliminating all small LOCA events, including RCP seal LOCA. The benefit was determined to be $13,025.
120	Create an independent RCP seal injection system, without dedicated diesel.	Would add redundancy to RCP seal cooling alternatives, reducing CDF from loss of CCW, SW or SBO.	(11)	B	Redundant seal cooling alternative currently exists.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
121	Use existing hydro test pump for RCP seal injection.	Independent seal injection source, without cost of a new system.	(7)	A	No such hydro pump with sufficient capacity
122	Change procedures to isolate RCP seal letdown flow on loss of CCW, and guidance on loss of injection during seal LOCA.	Reduce CDF from loss of seal cooling.	(13)	B	Procedures already in place.
123	Create the ability to manually align ECCS recirculation.	Provides a backup should automatic or remote operation fail.	(12)	B	ECCS Recirculation alignment is only manual.
124	Improve ability to cool RHR heat exchangers.	Reduced chance of loss of DHR by 1) Performing procedure and hardware modification to allow manual alignment of fire protection system to the CCW system, or 2) Installing a CCW header cross-tie.	(12), (13)	B	See Item #45.
125	Emphasize timely recirc swapover in operator training.	Reduce human error probability of recirculation failure.	(13)	B	Recirc alignment is remote manual operation only, and for which operators are trained.
126	Create automatic swapover to recirculation on RWST depletion.	Would remove human error contribution from recirculation failure.	(5), (6), (11)	N	Evaluation case SWAP determined the benefit of no failures of swap to recirculation to be $534,897. Evaluation case SWAP2 evaluated the benefit of an assumed automatic system to be $531,385. The human action basic events evaluated are HEP-HHR-EOP13-23 and HEP-RHR-EOP13-23. These actions are also dominant contributors to the benefit of the SGTR coping SAMA (#108).
127	Improve RHR sump reliability.	Common mode failure of RHR due to debris in sump.	(20)	N	Evaluation case SUMP determined the benefit of no sump clogging to be $1065.
128	ECCS switchover to recirc (manual)	EOP revisions to PBNP EOP 1.3 and 1.4 were committed to reduce the HEP for switchover	PB IPE (1)	B	EOPs revised per WOG guidance.
129	Procedure to cross tie HPCS diesel.	(BWR 5/6).	(10)	A	BWR item
130	Upgrade CVCS to mitigate small LOCAs.	For a plant like the AP600 where CVCS can't mitigate small LOCA, an upgrade would decrease CDF from small LOCA.	(8)	N	Evaluation case RCPLOCA determined the benefit of eliminating all small LOCA events, including RCP seal LOCA. The benefit was determined to be $13,025.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
131	Install an active high pressure SI system.	For a plant like the AP600, where an active high-pressure injection system does not exist, would add redundancy in high pressure injection.	(8)	A	Active injection already exists.
132	Change "in-containment" RWST suction from 4 check valves to 2 check and 2 air-operated valves.	Remove common mode failure of all four injection paths.	(8)	A	SAMA refers to AP600 design with RWST inside containment. At PB, RWSTs are outside containment. Suction line to HHSI/LHSI pumps contains 2 locked open MOVs and and a locked open manual valve in series. Since valves not required to change state, no CCF applied.
133	Replace two of the four safety injection pumps with diesel pumps.	Intended for System 80+, which has four trains of SI. This would reduce common cause failure probability.	(16), (17)	A	Intended for System 80+.
134	Align LPCI or core spray to CST on loss of suppression pool cooling.	Low pressure ECCS can be maintained in loss of suppression pool cooling scenarios.	(10), (13)	A	BWR item. Would involve injection of non-borated water.
135	Raise HPCI/RCIC backpressure trip setpoints.	Ensures HPCI/RCIC availability when high suppression pool temperatures exist.	(13)	A	BWR item
136	Provide capability for diesel driven, low pressure vessel makeup.	Extra water source in sequences in which the reactor is depressurized and all other injection is unavailable (e.g., firewater).	(4), (5), (13)	A	Unborated water for safety injection implies applicability to BWR, not PWR
137	Provide an additional high pressure injection pump with independent diesel.	Reduce frequency of core melt from small LOCA sequences, and from SBO sequences.	(6), (16), (17)	N	Evaluation case SIGOOD determined the effect of having perfectly reliable safety injection pumps. The benefit was determined to be $4,146.
138	Install independent AC high pressure injection system.	Would allow make up and feed and bleed capabilities during a SBO.	(11)	N	Evaluation case SIGOOD determined the effect of having perfectly reliable safety injection pumps. The benefit was determined to be $4,146.
139	Increase charging pump lube oil capacity.	Would lengthen time before charging pump failure due to lube oil overheating in loss of CCW sequences.	(2)	A	The charging pumps have no external cooling requirements
140	Prevent charging pump flow diversion from the relief valves.	If relief valve opening causes a flow diversion large enough to prevent RCP seal injection, then modification can reduce frequency of loss of RCP seal cooling.	(13)	N	Evaluation case RCPLOCA determined the benefit of eliminating all small LOCA events, including RCP seal LOCA. The benefit was determined to be $13,025.
141	Procedures to stagger HPSI pump use after a loss of SW.	Allow high pressure injection to be extended after a loss of SW.	(13)	A	The SI pumps and charging pumps do not require external cooling during the injection phase. Seal coolers are only needed during recirculation mode of SI.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
142	Use firewater pumps as a backup seal injection and high-pressure makeup.	Reduce RCP seal LOCA frequency and SBO core damage frequency.	(13)	N	Evaluation case RCPLOCA determined the benefit of eliminating all small LOCA events, including RCP seal LOCA. The benefit was determined to be $13,025. Fire pumps do not have sufficient discharge head. Modification to provide high enough discharge head expected to exceed MAB.
143	Implement an RWST makeup procedure.	Decrease core damage frequency from ISLOCA scenarios, some smaller break LOCA scenarios, and SGTR.	(12), (13)	B	Implemented in SAMG guidance documents
144	Stop low-pressure injection pumps earlier in medium or large LOCAs.	Would give more time to perform recirculation swapover.	(13)	B	EOPs revised per WOG guidance.
145	Man SSF continuously to align Coolant Makeup system for RCP seal cooling.	At Turkey Point a dedicated operator for seals or for the highest value operator action could be considered.	(19)	A	This event/action is not a high value action at Point Beach.
146	Improve the reliability of the ADS.	Reduce frequency high pressure core damage sequences.	(4)	A	BWR item
147	Disallow automatic vessel depressurization in non-ATWS scenarios.	Improve operator control of plant.	(13)	A	BWR issue.
148	Install nitrogen bottles as backup gas supply for SRVs.	Extend operation of Safety Relief Valves during SBO and loss of air events (BWRs).	(13)	N	Evaluation case IAPORV determined the impact of removing the air supply dependency to the PORVs. The benefit was determined to be $0.
149	Install a redundant spray system to depressurize the primary system during a SGTR.	Enhanced depressurization ability during SGTR.	(16), (17)	N	Evaluation case HEP2 evaluated the impact of eliminating all human errors related to depressurization, thus ensuring that the depressurization is successful. The benefit was determined to be $305,841.
150	Create/enhance reactor coolant system depressurization ability.	Either with a new depressurization system, or with existing PORVs, head vents and secondary side valve, RCS depressurization would allow low pressure ECCS injection. Even if core damage occurs, low RCS pressure alleviates some concerns about high-pressure melt ejection.	(5), (6), (9), (11), (12), (13), (14), (15), (16), (17)	N	Evaluation case HEP2 evaluated the impact of eliminating all human errors related to depressurization, thus ensuring that the depressurization is successful. The benefit was determined to be $305,841.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
151	Make procedural changes only for the RCS depressurization option.	Reduce RCS pressure without cost of a new system.	(7), (9), (13)	N	Evaluation case HEP2 evaluated the impact of eliminating all human errors related to depressurization, thus ensuring that the depressurization is successful. The benefit was determined to be $305,841.
152	Proceduralize use of pressurizer vent valves during SGTR sequences.	CCNPP procedures direct the use of pressurizer sprays to reduce RCS pressure after a SGTR. Use of the vent valves provides a backup method.	(13)	B	Already covered in EOP.
153	A system of relief valves that prevents any equipment damage from a pressure spike during an ATWS.	Would improve equipment availability after an ATWS.	(16), (17)	N	Evaluation case NOATWS determined the benefit of eliminating all ATWS events. The benefit was determined to be $28,982.
154	Adding other SGTR coping features.	(a)A highly reliable (closed loop) steam generator shell-side heat removal system that relies on natural circulation and stored water sources, (b) a system which returns the discharge from the steam generator relief valve back to the primary containment, (c)an increased pressure capability on the steam generator shell side with corresponding increase in the safety valve setpoints.	(7), (8), (17)	N	Evaluation case NOSGTR determined the impact of eliminating all steam generator tube rupture events. The benefit was determined to be $641,592. SGTR2 reduced the probability of tube failure by a factor of 10. The benefit was determined to be $565,059.
155	Increase secondary side pressure capacity such that a SGTR would not cause the relief valves to lift.	SGTR sequences would not have a direct release pathway.	(8), (17)	N	Evaluation case NOSGTR determined the impact of eliminating all steam generator tube rupture events. The benefit was determined to be $641,592. SGTR2 reduced the probability of tube failure by a factor of 10. The benefit was determined to be $565,059.
156	Replace steam generators with new design.	Lower frequency of SGTR.	(13)	B	New style generators are already installed at Point Beach.
157	A maintenance practice that inspects 100 percent of the tubes in a steam generator.	Reduce chances of tube rupture.	(16), (17)	N	Evaluation case NOSGTR determined the impact of eliminating all steam generator tube rupture events. The benefit was determined to be $641,592. SGTR2 reduced the probability of tube failure by a factor of 10. The benefit was determined to be $565,059.
158	Create passive secondary side coolers.	Provide a passive heat removal loop with a condenser and heat sink. Would reduce CDF from the loss of feedwater.	(17)	N	For an existing plant, design and installation of this SAMA is not considered feasible, as it would involve major changes in plant structures.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
159	Provide capability for remote operation of secondary side PORVs in SBO.	Manual operation of these valves is required in a SBO scenario. High area temperatures may be encountered in this case (no ventilation to main steam areas), and remote operation could improve success probability.	(2)	B	Valves have handwheel for local operation if needed. Use of manual handwheels is proceduralized. This would more appropriately be done by adding reach rods.
160	Revise EOPs to direct that a faulted steam generator be isolated.	For those plants whose EOPs don't already direct this, would reduce consequences of SGTR.	(13)	B	Already included in EOP
161	Install manual isolation valves around AFW turbine driven steam admission valves.	Reduces the dual turbine driven pump maintenance unavailability.	(13)	A	Not a dual turbine configuration.
162	Install accumulators for turbine driven AFW pump flow control valves.	Provide control air accumulators for the turbine driven AFW flow control valves, the motor driven AFW pressure control valves, and SG PORVs. This would eliminate the need for local manual action to align nitrogen bottles for control air during a LOP.	(11)	A	The TDAFW valves are DC MOVs. The MDAFW valves have installed nitrogen backup already in place. PBNP does not have SG PORVs backup in use. Accumulators are present but are valved out due to Appendix R concerns. Evaluation case ADVAIR was run to determine the benefit of a perfect air supply to the SG ADVs. The result was $2,389.
163	Use firewater as a backup for steam generator inventory.	Would create a backup to main and auxiliary feedwater for steam generator water supply	(13)	B	Firewater already used as a backup source to replenish CST.
164	Add a motor train of AFW to the steam trains.	For PWRs that do not have any motor trains of AFW, this can increase reliability in non-SBO sequences.	(13)	B	PB already has turbine and motor driven AFW.
165	Perform surveillances on manual valves used for backup AFW pump suction.	Improves success probability for providing alternate water supply to AFW pumps.	(13	N	SW valves are cycled. Firewater valves are not cycled. Case FPVLV was performed to evaluate the benefit of improving the reliability of the firewater valves. This analysis set their failure rates to 0, implying perfect reliability. The result was a benefit of $0.
166	Install a new CST (AFWST).	Either replace old tank with a larger one, or install a backup tank.	(13), (16), (17)	N	Currently have 2 CSTs shared by Unit 1 and 2. Also backup AFW suction to SW and emergency CST makeup from firewater. This SAMA would not be cost beneficial because the cost would exceed the MAB.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
167	Cooling of steam driven AFW pump in a SBO.	1)Use firewater to cool pump, or 2)Make the pump self-cooled. Would improve success chances in a SBO.	(13)	B	The ability to cool TD AFW pump with firewater already exists. Pump can run for 1 hour with no cooling. Firewater has diesel driven pump that will operate in SBO.
168	Proceduralize local manual operation of AFW when control power is lost.	Lengthen AFW availability in SBO. Also provides a success path should AFW control power be lost in non-SBO sequences.	(13)	B	Procedures already in place.
169	Provide portable generators to be hooked in to the turbine driven AFW, after battery depletion.	Extend AFW availability in a SBO (assuming the turbine-driven AFW requires DC power).	(16), (17)	N	Evaluation case AFWDC determined the benefit of removing the dependency of AFW on DC power to be $98,406.
170	Install an independent diesel for the condensate storage tank makeup pumps.	Would allow continued inventory in CST during a SBO.	(13)	B	Diesel driven fire pump can be used for CST makeup.
171	Increase containment design pressure.	Reduce chance of containment overpressure.	(8)	A	This SAMA was identified in the Westinghouse AP600 design submittal. Because of the extensive reconstruction of the containment building that would be considered for an existing plant, this SAMA was not considered further.
172	Increase the depth of the concrete basemat, or use an alternative concrete material to ensure melt through does not occur.	Prevent basemat melt through.	(16), (17)	A	Applicable to new design, not to existing containments.
173	Create another building, maintained at a vacuum to be connected to containment.	In an accident, connecting the new building to containment would depressurize containment and reduce any fission product release.	(17)	A	For an existing plant, design and installation of this SAMA is not considered feasible. Industry cost estimate >$10M; expected to well exceed MAB
174	Add ribbing to the containment shell.	Would reduce the chance of buckling of containment under reverse pressure loading.	(17)	A	This SAMA was identified in the CE System 80+ design submittal. Because of the extensive reconstruction of the containment building that would be considered for an existing plant, this SAMA was not considered further.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
175	Increase seismic capacity of the plant to a HCLPF of twice the SSE.	Reduced seismic CDF.	(17)	A	This SAMA was considered in the CE System 80+ original design submittal and is clearly not applicable to an existing plant. Therefore it is not considered further.
176	Replace reactor vessel with stronger vessel.	Reduce core damage contribution due to vessel failure.	(19)	N	For an existing plant, design and installation of this SAMA is expected to greatly exceed total MAB.
177	Provide additional SW pump.	Providing another pump would decrease core damage frequency due to a loss of SW.	(5)	N	Evaluation case SWPUMP determined the impact of perfectly reliable service water pumps. The benefit was determined to be $6,647.
178	Make ICW trains separate.	Current cross-tie capability creates a potential common mode failure mechanism for both trains (and both stations).	(20)	B	SW is a common system for each unit. Isolation valves exist to isolate either unit should a break occur. CCW is a cross-tied system with normally closed isolation valves.
179	Enhance screen wash.	Potential for loss of ICW due to clogging of seawater screens.	(20)	A	Clogging of screens causes a loss of condenser vacuum and trip of the circulating water pumps. Once the circulating water pumps are shut down, there is sufficient screen bypass flow to provide water for the service water pumps.
180	Provide automatic repowering of the battery chargers following a loss of offsite power event.	The battery chargers must be manually aligned to AC power following a loss of power. This modification would eliminate the requirement for manual action.	PB Updated PSA Model Results	N	Evaluation case DC1 determined the benefit of always successful reloading of the battery chargers to be $120,419.
181	Provide procedural improvements and training to improve operator performance for the task of feed and bleed cooling without SI.	Reduce operator errors and their contribution to total plant risk.	PB Updated PSA Model Results	N	Evaluation case HEP13 determined the benefit of a factor of 3 reduction in the human error rate to perform this task to be $102,492.
182	Improvements in the performance of the turbine driven AFW pumps	Provide more reliable AFW pumps.	PB Updated PSA Model Results	B	Evaluation case AFWT1 determined the benefit of perfectly reliable AFW pumps to be $140,116. This pump is important. It is under the MR and efforts are being taken to improve its reliability. It is not economically feasible to replace it or to add a redundant pump.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
183	Provide a modification or procedure change that would reduce tube leakage in the waste gas heat exchanger.	Tube leakage in the waste gas heat exchanger is the highest probability cause for loss of component cooling water initiating events.	PB Updated PSA Model Results	A	Evaluation case WGHX determined the benefit of eliminating tube leaks in the waste gas heat exchanger to be $59,044. This SAMA has been eliminated because more detailed evaluation of this physical event has revealed that it will not occur.
184	Provide procedural improvements and training to improve operator performance for the task of manually controlling AFW following loss of instrument air.	Reduce operator errors and their contribution to total plant risk.	PB Updated PSA Model Results	N	Evaluation case HEP33 determined the benefit of a factor of 3 reduction in the human error rate to perform this task to be $23,075.
185	Provide procedural improvements and training to improve operator performance for the task of providing an alternate source of water for AFW following low CST level.	Reduce operator errors and their contribution to total plant risk.	PB Updated PSA Model Results	N	Evaluation case HEP43 determined the benefit of a factor of 3 reduction in the human error rate to perform this task to be $178,337.
186	Provide procedural improvements and training to improve operator performance for the task of manually starting the gas turbine generator.	Reduce operator errors and their contribution to total plant risk.	PB Updated PSA Model Results	N	Evaluation case HEP53 determined the benefit of a factor of 3 reduction in the human error rate to perform this task to be $22,463.
187	Provide procedural improvements and training to improve operator performance for the task of opening valve CV-112B (RWST - charging)	Reduce operator errors and their contribution to total plant risk.	PB Updated PSA Model Results	N	Evaluation case HEP63 determined the benefit of a factor of 3 reduction in the human error rate to perform this task to be $82,939.
188	Provide procedural improvements and training to improve operator performance for the task of diagnosing steam generator tube rupture	Reduce operator errors and their contribution to total plant risk.	PB Updated PSA Model Results	N	Evaluation case HEP73 determined the benefit of a factor of 3 reduction in the human error rate to perform this task to be $36,885.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
189	Provide procedural improvements and training to improve operator performance for the task of feed and bleed cooling with SI.	Reduce operator errors and their contribution to total plant risk.	PB Updated PSA Model Results	N	Evaluation case HEP83 determined the benefit of a factor of 3 reduction in the human error rate to perform this task to be $25,495.
190	Provide procedural improvements and training to improve operator performance for the task of isolating a service water header rupture.	Reduce operator errors and their contribution to total plant risk.	PB Updated PSA Model Results	N	Evaluation case HEP9 determined the benefit of a factor of 10 reduction in the human error rate to perform this task to be $19,244.
191	Provide procedural improvements and training to improve operator performance for the task of opening the instrument air valves to containment.	Reduce operator errors and their contribution to total plant risk. This item and #193 are an action/recovery pair.	PB Updated PSA Model Results	N	Evaluation case HEPA3 determined the benefit of a factor of 3 reduction in the human error rate to perform this task to be $23,101.
192	Provide procedural improvements and training to improve operator performance for the task of opening reopening air system valves 3047 or 3048.	Reduce operator errors and their contribution to total plant risk. This item and #192 are an action/recovery pair.	PB Updated PSA Model Results	N	Evaluation case HEPB3 determined the benefit of a factor of 3 reduction in the human error rate to perform this task to be $22,471.
193	Provide procedural improvements and training to improve operator performance for the task of opening valve SW-2880 following an SI signal.	Reduce operator errors and their contribution to total plant risk.	PB Updated PSA Model Results	N	Evaluation case HEPC determined the benefit of a factor of 10 reduction in the human error rate to perform this task to be $24,645.
194	Reduce likelihood of MOV CV-112B failing to open CV—MOV-CC-011B	Reduce risk through improving the reliability of the motor operated CV-112B	PB Updated PSA Model Results	B	Evaluation case CV112B determined the benefit of assuming perfect behavior for this MOV. The benefit determined for this ideal case was found to be $66,184.
195	Improve running reliability of Motor Driven AFW Pumps. AF—MDP-FR---38A, AF—MDP-FR---38B	Reduce risk through improving the reliability fo the motor driven AFW pumps	PB Updated PSA Model Results	N	Evaluation case AFWT2 determined the benefit of assuming perfect behavior for the AFW MDPs. The benefit determined for this ideal case was found to be $159,656.

Table F.2-1. Initial List of Candidate Improvements for the PBNP SAMAs Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Reference	Screening Criterion	Evaluation
196	Reduce likelihood of RHR A and B full flow test lines being left open (pre-initiator) RH—VLV-RE-0706A, RH—VLV-RE-0706B	Reduce risk through improving the reliability of isolating the full flow test lines.	PB Updated PSA Model Results	N	Evaluation case RH706AB determined the benefit of assuming a factor of three reduction in the actions to isolate these lines. The benefit determined for this case was found to be $49,889.
197	Reduce likelihood of Check valve in recirc line from AFW pumps to CSTs failing to open AF—CKV-CC---117	Reduce risk through improving the reliability of check valve in AFW recirc line to CSTs	PB Updated PSA Model Results	N	Evaluation case AF117 determined the benefit of assuming perfect behavior for this CKV. The benefit determined for this ideal case was found to be $18,335.
198	Reduce likelihood of CCW pump B being in Test & Maintenance. CC—MDP-TM-0011B	Reduce risk by keeping the CCW pump on line as much as possible.	PB Updated PSA Model Results	B	Evaluation Case CCPBTM determined the benefit of a reduction in TM unavailability of a factor of 10 to be $47,638.
199	Reduce likelihood of failure of Bus 1B03. 480-BS—LP—1B03	Reduce risk by improving the reliability of power supplied to the components powered from Bus 1B03	PB Updated PSA Model Results	N	Evaluation Case BS1B03 determined the benefit of having a perfectly reliable Bus 1B03 to be $49,413
200	Reduce likelihood of FP pump A being in Test & Maintenance. FP—MDP-TM-0035A	Reduce risk by keeping the FP pump on line as much as possible.	PB Updated PSA Model Results	B	Evaluation Case FPPATM determined the benefit of a reduction in TM unavailability of a factor of 10 to be $43,954.
201	Reduce the likelihood of FP pump B failing to run. FP—DDP-FR-0035B.	Reduce risk by improving the reliability of the diesel driven fire pump.	PB Updated PSA Model Results	B	Evaluation Case FPUMP determined the benefit of a perfectly reliably diesel driven fire pump to be $41,611. Case FPMP2 determined the benefit to a reduction in the failure rate of a factor of 10 to be $37,716.
202	Reduce likelihood of AF pumps A and B being in Test & Maintenance. AF—MDP-TM---38A, AF—MDP-TM---38B	Reduce risk by keeping the AF pumps on line as much as possible.	PB Updated PSA Model Results	B	Evaluation Case AFPTM determined the benefit of a reduction in TM unavailability of a factor of 10 to be $70,970.

Note 1: The benefit of this SAMA was not specifically evaluated because the cost would exceed the MAB.
Note 2: The benefit of this SAMA was not specifically evaluated because of the extremely small Initiating Event Frequency

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis.

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
4	Install tornado protection on gas turbine generator.	If the unit has a gas turbine, the tornado-induced SBO frequency would be reduced.	14	1	$181.2k	>$1000k (EP)	This SAMA is not cost beneficial.	Implementation costs expected to far exceed benefit.
32	Install MG set trip breakers in control room.	Provides trip breakers for the motor generator sets in the control room. Currently, at Watts Bar, an ATWS would require an immediate action outside the control room to trip the MG sets. Would reduce ATWS CDF.	2	0	$29k	>$100k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification is expected to greatly exceed the benefit.
45	Procedural guidance for use of cross-tied CCW or SW pumps.	Can reduce the frequency of the loss of either of these.	1	0	$13k	>$30k (EP)	This SAMA is not cost beneficial.	The cost of this modification exceeds the benefit. No further evaluation required.
47	Provide self-cooled ECCS seals.	ECCS pump seals are CCW cooled.	0	0	$0	No benefit, so cost greatly exceeds benefit. (EP)	This SAMA is not cost beneficial.	The cost of this modification will greatly exceed the benefit.
48	Provide a centrifugal charging pump.	Currently charging pumps are positive displacement pumps.	0	0	$0.3k	>$500k (EP)	This SAMA is not cost beneficial.	The cost of this modification is expected to greatly exceed the benefit.
50	Install a containment vent large enough to remove ATWS decay heat.	Assuming injection is available, would provide alternative decay heat removal in an ATWS.	2	0	$29k	>$5000k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification is expected to greatly exceed the benefit.

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
52	Add redundant and diverse limit switch to each containment isolation valve.	Enhanced isolation valve position indication, which would reduce frequency of containment isolation failure and ISLOCAs.	0	0	$0.3k	>$50k per valve (EP)	This SAMA is not cost beneficial.	The cost associated with this modification will greatly exceed the benefit.
53	Self-actuating containment isolation valves .	For plants that don't have this, it would reduce the frequency of isolation failure.	0	0	$0.3k	>$100k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification will greatly exceed the benefit.
54	Provide containment isolation design per GDC and SRP.	Enhance containment isolation capability.	0	0	$0.3k	>$100k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification will greatly exceed the benefit.
55	Add Penetration valve leakage control system.	Enhance capability to detect/control leakage from penetrations valves.	0	0	$0.3k	>$100k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification will greatly exceed the benefit.
62	Provide additional DC battery capability.	Would ensure longer battery capability during a SBO, reducing frequency of long term SBO sequences.	1	0	$15.1k	>$150k (EP)	This SAMA is not cost beneficial.	The cost associated with implementing this modification will greatly exceed the benefit.
63	Use fuel cells instead of lead-acid batteries.	Extend DC power availability in a SBO.	14	1	$181.2k	>$1000k (EP)	This SAMA is not cost beneficial.	The cost associated with implementing this modification will greatly exceed the benefit.
66	Replace batteries.	Improved reliability.	14	1	$181.2k	>$500k (EP)	This SAMA is not cost beneficial.	The costs associated with implementing this modification will greatly exceed the benefit.

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
71	Install a filtered containment vent to remove decay heat.	Assuming injection is available (non-ATWS sequences), would provide alternate decay heat removal with the released fission products being scrubbed.	See Note 1	See Note 1	See Note 1	>$20000k (EP) This is >>MAB.	This SAMA is not cost beneficial.	TVA estimate $20M; expected to well exceed MAB The costs associated with the plant modifications required to implement this alternative are greater than the benefit. Screened out due to expected high cost.
72	Install an unfiltered hardened containment vent.	Provides an alternate decay heat removal method (non-ATWS), which is not filtered.	See Note 1	See Note 1	See Note 1	>$5000k (EP) This is >>MAB.	This SAMA is not cost beneficial.	TVA estimate $20M; expected to well exceed MAB The costs associated with the plant modifications required to implement this alternative are greater than the benefit. Screened out due to expected high cost.
77	Tornado damage to RWST and penetration rooms.	Penetration rooms are tornado protected. Tornado category F2 and higher can generate heavy enough missiles that could impact and damage the RWST.	See Note 2	See Note 2	See Note 2	>$1000k (EP)	This SAMA is not cost beneficial.	Cost to implement will exceed benefit.
78	Tornado causes failure of power and upper surge tanks.	Consider protection for tanks or switchgear in Turbine Building. Surge tanks are suction for emergency feedwater pumps.	See Note 2	See Note 2	See Note 2	>$1000k (EP)	This SAMA is not cost beneficial.	Cost to implement will exceed benefit.
89	Digital feedwater upgrade.	Reduces chance of loss of MFW following a plant trip.	4	0	$52.3k	>$250k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification is expected to exceed the benefit.

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
93	Provide Auxiliary Building Vent/Seal structure.	Enhance ventilation in AB.	0	0	$13.6k	>$200k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification is expected to greatly exceed the benefit.
96	Install additional instrumentation for ISLOCA sequences.	Pressure or leak monitoring instruments installed between the first two pressure isolation valves on low-pressure injection lines, RHR suction lines, and high pressure injection lines would decrease ISLOCA frequency.	0	0	$13.6k	>$50k per line. (EP)	This SAMA is not cost beneficial.	The cost associated with this modification is expected to greatly exceed the benefit.
97	Increase frequency of valve leak testing.	Decrease ISLOCA frequency.	0	0	$13.6k	>$100k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification is expected to greatly exceed the benefit.
98	Improvement of operator training on ISLOCA coping.	Decrease ISLOCA effects.	0	0	$13.6k	>$50k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification is expected to greatly exceed the benefit.

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
100	Revise EOPs to improve ISLOCA identification.	Salem had a scenario in which an RHR ISLOCA could direct initial leakage back to the PRT, giving indication that the LOCA was inside containment. Procedure enhancement would ensure LOCA outside containment would be observed.	0	0	$13.6k	>$30k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification is expected to greatly exceed the benefit.
101	Ensure all ISLOCA releases are scrubbed.	Would scrub ISLOCA releases. One suggestion was to plug drains in the break area so the break point would cover with water.	0	0	$13.6k	>$100k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification is expected to greatly exceed the benefit.
102	Secondary side guard pipes up to the MSIVs.	Would prevent secondary side depressurization should a steam line break occur upstream of the MSIVs. Would also guard against or prevent consequential multiple SGTR following a main steam line break event.	13	1	$170.80	>$1000k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification is expected to greatly exceed the benefit.

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
103	Digital large break LOCA protection.	Upgrade plant instrumentation and logic to improve the capability to identify symptoms/precursors of a large break LOCA (a leak before break).	0	0	$4.8k	>$100k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification is expected to greatly exceed the benefit.
108	Improved SGTR coping abilities.	Improved instrumentation to detect SGTR, or additional systems to scrub fission product releases.	29	79	$565k	Not Determined (EP)	No cost-effective hardware changes identified.	This item has been evaluated at Point Beach. The contribution to potential economic risk is significant but it is driven by human actions that are very important..
119	Create an independent RCP seal injection system, with dedicated diesel.	Would add redundancy to RCP seal cooling alternatives, reducing CDF from loss of CCW, SW or SBO.	1	0	$13k	>$1000k (EP)	This SAMA is not cost beneficial.	The costs associated with the proposed modification are expected to greatly exceed the benefit.
126	Create automatic swapover to recirculation on RWST depletion.	Would remove human error contribution from recirculation failure.	30	48	$531.4k	>$1000k per unit (EP) Cost estimate at PTN was $450K.	This SAMA is not cost beneficial.	This item has been evaluated at Point Beach. These human actions are also considered as other SAMA items. The human actions involved impact other SAMAs. It is recognized that they are very important actions.
127	Improve RHR sump reliability.	Common mode failure of RHR due to debris in sump.	0	0	$1.1k	>$100k (EP)	This SAMA is not cost beneficial.	The costs associated with this modification will greatly exceed the benefit.
130	Upgrade CVCS to mitigate small LOCAs.	For a plant like the AP600 where CVCS can't mitigate small LOCA, an upgrade would decrease CDF from small LOCA.	1	0	$13k	>$1000k (EP)	This SAMA is not cost beneficial.	The costs associated with the proposed modification are expected to greatly exceed the benefit.

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
137	Provide an additional high pressure injection pump with independent diesel.	Reduce frequency of core melt from small LOCA sequences, and from SBO sequences.	0	0	$4.1k	>$1000k (EP)	This SAMA is not cost beneficial.	The costs associated with the proposed modification are expected to greatly exceed the benefit.
138	Install independent AC high pressure injection system.	Would allow make up and feed and bleed capabilities during a SBO.	0	0	$4.1k	>$1000k (EP)	This SAMA is not cost beneficial.	The costs associated with the proposed modification are expected to greatly exceed the benefit.
140	Prevent charging pump flow diversion from the relief valves.	If relief valve opening causes a flow diversion large enough to prevent RCP seal injection, then modification can reduce frequency of loss of RCP seal cooling.	1	0	$13k	>$50k (EP)	This SAMA is not cost beneficial.	This situation can occur at Point Beach and the operators are trained to cope with it. The costs associated with the proposed modification are expected to greatly exceed the benefit.
142	Use firewater pumps as a backup seal injection and high-pressure makeup.	Reduce RCP seal LOCA frequency and SBO core damage frequency.	1	0	$13k	>$1000k (EP)	This SAMA is not cost beneficial.	Fire pumps do not have sufficient discharge head. Modification to provide high enough discharge head expected to exceed MAB.
148	Install nitrogen bottles as backup gas supply for SRVs.	Extend operation of Safety Relief Valves during SBO and loss of air events (BWRs).	0	0	$0	>$100k (EP)	This SAMA is not cost beneficial.	Point Beach currently has accumulators installed. The accumulators are isolated due to an Appendix R issue relative to a fire in the control room that would cause an open signal to be generated to the PORVs . This will result in the equivalent of a stuck open PORV. The modification in this case would be to eliminate the Appendix R concern. The costs of this modification will greatly exceed the benefit.

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
149	Install a redundant spray system to depressurize the primary system during a SGTR.	Enhanced depressurization ability during SGTR.	17	52	$305.8k	>$1000k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification is expected to greatly exceed the benefit.
150	Create/enhance reactor coolant system depressurization ability.	Either with a new depressurization system, or with existing PORVs, head vents and secondary side valve, RCS depressurization would allow low pressure ECCS injection. Even if core damage occurs, low RCS pressure alleviates some concerns about high-pressure melt ejection.	17	52	$305.8k	>$1000k (EP)	This SAMA is not cost beneficial.	SAME AS ITEM #149.
151	Make procedural changes only for the RCS depressurization option.	Reduce RCS pressure without cost of a new system.	17	52	$305.8k	Not Determined (EP)	Use of procedure step mark offs implemented.	HEPs were evaluated and there does not appear to be a large opportunity for improvement for any of them by making procedural enhancements. Some credit can now be taken for use of placekeeping aids, but the largest part of these HEPs is from the execution portion, not cognitive.

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
153	A system of relief valves that prevents any equipment damage from a pressure spike during an ATWS.	Would improve equipment availability after an ATWS.	2	0	$29k	>$1000k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification is expected to greatly exceed the benefit.
154	Adding other SGTR coping features.	(a)A highly reliable (closed loop) steam generator shell-side heat removal system that relies on natural circulation and stored water sources, (b) a system which returns the discharge from the steam generator relief valve back to the primary containment, (c)an increased pressure capability on the steam generator shell side with corresponding increase in the safety valve setpoints.	29	79	$565.0k	>$10000k (EP)	This SAMA is not cost beneficial.	The cost associated with this modification is expected to greatly exceed the benefit.

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
155	Increase secondary side pressure capacity such that a SGTR would not cause the relief valves to lift.	SGTR sequences would not have a direct release pathway.	29	79	$565.0k	>$100000k (EP)	This SAMA is not cost beneficial.	This would require replacement of the current generators. The cost associated with this modification is expected to greatly exceed the benefit.
157	A maintenance practice that inspects 100 percent of the tubes in a steam generator.	Reduce chances of tube rupture.	29	79	$565.0k	>$500k per outage (EP)	This SAMA is not cost beneficial.	This would add to the duration of current outages. The costs associated with this ongoing inspection program will greatly exceed the benefit.
158	Create passive secondary side coolers.	Provide a passive heat removal loop with a condenser and heat sink. Would reduce CDF from the loss of feedwater.	See Note 1	See Note 1	See Note 1	>>MAB (EP)	This SAMA is not cost beneficial.	For an existing plant, design and installation of this SAMA is not considered feasible, as it would involve major changes in plant structures.
165	Perform surveillances on manual valves used for backup AFW pump suction.	Improves success probability for providing alternate water supply to AFW pumps.	0	0	$0	>$10k	This SAMA is not cost beneficial.	The cost of this modification exceeds the benefit. No further evaluation required.
166	Install a new CST (AFWST).	Either replace old tank with a larger one, or install a backup tank.	See Note 1	See Note 1	See Note 1	>$1000k (EP)	This SAMA is not cost beneficial.	Currently have 2 CSTs shared by Unit 1 and 2. Also backup AFW suction to SW and emergency CST makeup from firewater.

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
169	Provide portable generators to be hooked in to the turbine driven AFW, after battery depletion.	Extend AFW availability in a SBO (assuming the turbine-driven AFW requires DC power).	8	0	$98.4k	>$200k (EP)	This SAMA is not cost beneficial.	The cost of this modification exceeds the benefit. No further evaluation required.
176	Replace reactor vessel with stronger vessel.	Reduce core damage contribution due to vessel failure.	See Note 1	See Note 1	See Note 1	>>MAB (EP)	This SAMA is not cost beneficial.	For an existing plant, design and installation of this SAMA is expected to greatly exceed total MAB.
177	Provide additional SW pump.	Providing another pump would decrease core damage frequency due to a loss of SW.	0	0	$6.6k	>$5000k (EP)	This SAMA is not cost beneficial.	The costs associated with this modification will greatly exceed the benefit.
180	Provide automatic repowering of the battery chargers following a loss of offsite power event.	The battery chargers must be manually aligned to AC power following a loss of power. This modification would eliminate the requirement for manual action.	9	1	$120.4k	>$200k (EP)	This SAMA is not cost beneficial.	This would require the development and installation of “smart” DG controllers that would sense the DG load and determine whether the chargers could be loaded or not.
181	Provide procedural improvements and training to improve operator performance for the task of feed and bleed cooling without SI.	Reduce operator errors and their contribution to total plant risk.	8	0	$102.5k	Not Determined (EP)	Use of procedure step mark offs implemented.	Procedures are currently considered adequate. Use of Procedure step mark offs implemented.

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
184	Provide procedural improvements and training to improve operator performance for the task of manually controlling AFW following loss of instrument air.	Reduce operator errors and their contribution to total plant risk.	2	0	$23.1k	~$30k	Use of procedure step mark offs implemented.	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented.
185	Provide procedural improvements and training to improve operator performance for the task of providing an alternate source of water for AFW following low CST level.	Reduce operator errors and their contribution to total plant risk.	13	7	$178.3k	~$30k	Use of procedure step mark offs implemented.	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented.
186	Provide procedural improvements and training to improve operator performance for the task of manually starting the gas turbine generator.	Reduce operator errors and their contribution to total plant risk.	2	0	$22.5k	~$30K	Use of procedure step mark offs implemented.	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented.

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
187	Provide procedural improvements and training to improve operator performance for the task of opening valve CV-112B (RWST - charging)	Reduce operator errors and their contribution to total plant risk.	7	0	$82.9k	~$30K	Use of procedure step mark offs implemented.	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented. This human action is a recovery action to open CV0112B manually if it fails to open automatically on low VCT level. Further training is not expected to have much benefit.
188	Provide procedural improvements and training to improve operator performance for the task of diagnosing steam generator tube rupture	Reduce operator errors and their contribution to total plant risk.	2	7	$36.9k	~$30k	Use of procedure step mark offs implemented.	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented.
189	Provide procedural improvements and training to improve operator performance for the task of feed and bleed cooling with SI.	Reduce operator errors and their contribution to total plant risk.	2	0	$25.5k	~$30k	Use of procedure step mark offs implemented.	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented.

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
190	Provide procedural improvements and training to improve operator performance for the task of isolating a service water header rupture.	Reduce operator errors and their contribution to total plant risk.	2	0	$19.2k	Not Determined (EP)	Use of procedure step mark offs implemented.	Procedures are currently considered adequate. Use of procedure step mark offs implemented.
191	Provide procedural improvements and training to improve operator performance for the task of opening the instrument air valves to containment.	Reduce operator errors and their contribution to total plant risk. This item and #193 are an action/recovery pair.	1	5	$23.1k	~$30k	Use of procedure step mark offs implemented.	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented.
192	Provide procedural improvements and training to improve operator performance for the task of opening reopening air system valves 3047 or 3048.	Reduce operator errors and their contribution to total plant risk. This item and #192 are an action/recovery pair.	1	4	$22.5k	~$30k	Use of procedure step mark offs implemented.	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented.

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
193	Provide procedural improvements and training to improve operator performance for the task of opening valve SW-2880 following an SI signal.	Reduce operator errors and their contribution to total plant risk.	2	7	$26.5k	~$30k	Use of procedure step mark offs implemented.	Procedures are currently considered adequate. Use of procedure step mark offs implemented.
195	Improve running reliability of Motor Driven AFW Pumps. AF—MDP-FR---38 A, AF—MDP-FR---38 B	Reduce risk through improving the reliability fo the motor driven AFW pumps	12	7	$159.7k	>$1000K (EP)	This SAMA is not Cost Beneficial	Since these pumps are under strict observation normally and performance enhancements are routinely sought, it is expected that design modification would be necessary to significantly improve the reliability. Design modifications would greatly exceed the benefit.
196	Reduce likelihood of RHR A and B full flow test lines being left open (pre-initiator) RH—VLV-RE-0706 A, RH—VLV-RE-0706 B	Reduce risk through improving the reliability of isolating the full flow test lines.	4	4	$49.9k	Not Determined (EP)	No cost-effective hardware changes identified.	The probability for this pre-initiator human error used in PRA model Revision 3.02 was a screening value of 1E-03. Because there are actually two series valves in these lines that are both independently verified and locked closed, both would need to be left open for a flow diversion to occur. A more correct value of the HEP was calculated to be 6.4E-06. This corrected value eliminates any need for further evaluation.

Table F.2-2. Summary of PBNP SAMAs Considered in Cost-Benefit Analysis. (Continued)

Point Beach SAMA Number	Potential Improvement	Discussion	Percent Reduction in CDF (Bounding)	Percent Reduction in Offsite Person-Rem (Bounding)	Total Benefit (Bounding	Estimated Cost	Conclusion	Basis for Conclusion
197	Reduce likelihood of Check valve in recirc line from AFW pumps to CSTs failing to open AF—CKV-CC---117	Reduce risk through improving the reliability of check valve in AFW recirc line to CSTs	1	1	$18.3k	>>$22k	Check valve internals have been removed.	Since valves are under strict observation normally and performance enhancements are routinely sought, it is expected that design modification would be necessary to significantly improve the reliability. Check valve internals have been removed.
199	Reduce likelihood of failure of Bus 1B03. 480-BS—LP—1B03	Reduce risk by improving the reliability of power supplied to the components powered from Bus 1B03	4	0	$49.4k	>$300k	This SAMA is not cost beneficial	Any hardware modification to improve the physical reliability of this bus will cost more than the benefit.

Note 1: The benefit of this SAMA was not specifically evaluated because the cost would exceed the MAB.
Note 2: The benefit of this SAMA was not specifically evaluated because of the extremely small Initiating Event Frequency.

Table F.2-3. Sensitivity Analysis Results.

Point Beach SAMA Number	Potential Improvement	Total Benefit (Bounding	Estimated Cost	Conclusion	Benefit (3% Discount Rate Sensitivity) (Bounding	Benefit (8.95% Discount Rate Sensitivity) (Bounding)	Basis for Conclusion
4	Install tornado protection on gas turbine generator.	$181.2k	>$1000k (EP)	This SAMA is not cost beneficial.	$318kk	$136k	Implementation costs expected to far exceed benefit.
32	Install MG set trip breakers in control room.	$29k	>$100k (EP)	This SAMA is not cost beneficial.	$51k	$22k	The cost associated with this modification is expected to greatly exceed the benefit.
45	Procedural guidance for use of cross-tied CCW or SW pumps.	$13k	>$30k (EP)	This SAMA is not cost beneficial.	$23k	$10k	The cost of this modification exceeds the benefit. No further evaluation required.
47	Provide self-cooled ECCS seals.	$0	No benefit, so cost greatly exceeds benefit. (EP)	This SAMA is not cost beneficial.	$0	$0	The cost of this modification will greatly exceed the benefit.
48	Provide a centrifugal charging pump.	$0.3k	>$500k (EP)	This SAMA is not cost beneficial.	$0.6k	$0.3k	The cost of this modification is expected to greatly exceed the benefit.
50	Install a containment vent large enough to remove ATWS decay heat.	$29k	>$5000k (EP)	This SAMA is not cost beneficial.	$51k	$22k	The cost associated with this modification is expected to greatly exceed the benefit.
52	Add redundant and diverse limit switch to each containment isolation valve.	$0.3k	>$50k per valve (EP)	This SAMA is not cost beneficial.	$0.5k	$0.2k	The cost associated with this modification will greatly exceed the benefit.
53	Self-actuating containment isolation valves .	$0.3k	>$100k (EP)	This SAMA is not cost beneficial.	$0.5k	$0.2k	The cost associated with this modification will greatly exceed the benefit.
54	Provide containment isolation design per GDC and SRP.	$0.3k	>$100k (EP)	This SAMA is not cost beneficial.	$0.5k	$0.2k	The cost associated with this modification will greatly exceed the benefit.
55	Add Penetration valve leakage control system.	$0.3k	>$100k (EP)	This SAMA is not cost beneficial.	$0.5k	$0.2k	The cost associated with this modification will greatly exceed the benefit.
62	Provide additional DC battery capability.	$15.1k	>$150k (EP)	This SAMA is not cost beneficial.	$27k	$11k	The cost associated with implementing this modification will greatly exceed the benefit.
63	Use fuel cells instead of lead-acid batteries.	$181.2k	>$1000k (EP)	This SAMA is not cost beneficial.	$318k	$136k	The cost associated with implementing this modification will greatly exceed the benefit.

Table F.2-3. Sensitivity Analysis Results. (Continued)

Point Beach SAMA Number	Potential Improvement	Total Benefit (Bounding	Estimated Cost	Conclusion	Benefit (3% Discount Rate Sensitivity) (Bounding	Benefit (8.95% Discount Rate Sensitivity) (Bounding)	Basis for Conclusion
66	Replace batteries.	$181.2k	>$500k (EP)	This SAMA is not cost beneficial.	$318k	$136k	The costs associated with implementing this modification will greatly exceed the benefit.
71	Install a filtered containment vent to remove decay heat.	See Note 1	>$20000k (EP) This is >>MAB.	This SAMA is not cost beneficial.	See Note 1	See Note 1	TVA estimate $20M; expected to well exceed MAB The costs associated with the plant modifications required to implement this alternative are greater than the benefit. Screened out due to expected high cost.
72	Install an unfiltered hardened containment vent.	See Note 1	>$5000k (EP) This is >>MAB.	This SAMA is not cost beneficial.	See Note 1	See Note 1	TVA estimate $20M; expected to well exceed MAB The costs associated with the plant modifications required to implement this alternative are greater than the benefit. Screened out due to expected high cost.
77	Tornado damage to RWST and penetration rooms.	See Note 2	>$1000k (EP)	This SAMA is not cost beneficial.	See Note 2	See Note 2	Cost to implement will exceed benefit.
78	Tornado causes failure of power and upper surge tanks.	See Note 2	>$1000k (EP)	This SAMA is not cost beneficial.	See Note 2	See Note 2	Cost to implement will exceed benefit.
89	Digital feedwater upgrade.	$52.3k	>$250k (EP)	This SAMA is not cost beneficial.	$92k	$39k	The cost associated with this modification is expected to exceed the benefit.
93	Provide Auxiliary Building Vent/Seal structure.	$13.6k	>$200k (EP)	This SAMA is not cost beneficial.	$20k	$11k	The cost associated with this modification is expected to greatly exceed the benefit.
96	Install additional instrumentation for ISLOCA sequences.	$13.6k	>$50k per line. (EP)	This SAMA is not cost beneficial.	$20k	$11k	The cost associated with this modification is expected to greatly exceed the benefit.
97	Increase frequency of valve leak testing.	$13.6k	>$100k (EP)	This SAMA is not cost beneficial.	$20k	$11k	The cost associated with this modification is expected to greatly exceed the benefit.
98	Improvement of operator training on ISLOCA coping.	$13.6k	>$50k (EP)	This SAMA is not cost beneficial.	$20k	$11k	The cost associated with this modification is expected to greatly exceed the benefit.

Table F.2-3. Sensitivity Analysis Results. (Continued)

Point Beach SAMA Number	Potential Improvement	Total Benefit (Bounding	Estimated Cost	Conclusion	Benefit (3% Discount Rate Sensitivity) (Bounding	Benefit (8.95% Discount Rate Sensitivity) (Bounding)	Basis for Conclusion
100	Revise EOPs to improve ISLOCA identification.	$13.6k	>$30k (EP)	This SAMA is not cost beneficial.	$20k	$11k	The cost associated with this modification is expected to greatly exceed the benefit.
101	Ensure all ISLOCA releases are scrubbed.	$13.6k	>$100k (EP)	This SAMA is not cost beneficial.	$20k	$11k	The cost associated with this modification is expected to greatly exceed the benefit.
102	Secondary side guard pipes up to the MSIVs.	$170.8k	>$1000k (EP)	This SAMA is not cost beneficial.	$300k	$128k	The cost associated with this modification is expected to greatly exceed the benefit.
103	Digital large break LOCA protection.	$4.8k	>$100k (EP)	This SAMA is not cost beneficial.	$8k	$4k	The cost associated with this modification is expected to greatly exceed the benefit.
108	Improved SGTR coping abilities.	$565k	Not Determined (EP)	No cost-effective hardware changes identified.	$1074k	$499k	This item has been evaluated at Point Beach. The contribution to potential economic risk is significant but it is driven by human actions that are very important. See SAMA 188 for a discussion of the human error reduction measures implemented.
119	Create an independent RCP seal injection system, with dedicated diesel.	$13k	>$1000k (EP)	This SAMA is not cost beneficial.	$23k	$10k	The costs associated with the proposed modification are expected to greatly exceed the benefit.
126	Create automatic swapover to recirculation on RWST depletion.	$531.4k	>$1000k per unit (EP) Cost estimate at PTN was $450K.	This SAMA is not cost beneficial.	$905k	$409k	This item has been evaluated at Point Beach. These human actions are also considered as other SAMA items. The human actions involved impact other SAMAs. It is recognized that they are very important actions.
127	Improve RHR sump reliability.	$1.1k	>$100k (EP)	This SAMA is not cost beneficial.	$2k	$0.8k	The costs associated with this modification will greatly exceed the benefit.
130	Upgrade CVCS to mitigate small LOCAs.	$13k	>$1000k (EP)	This SAMA is not cost beneficial.	$23k	$10k	The costs associated with the proposed modification are expected to greatly exceed the benefit.

Table F.2-3. Sensitivity Analysis Results. (Continued)

Point Beach SAMA Number	Potential Improvement	Total Benefit (Bounding	Estimated Cost	Conclusion	Benefit (3% Discount Rate Sensitivity) (Bounding	Benefit (8.95% Discount Rate Sensitivity) (Bounding)	Basis for Conclusion
137	Provide an additional high pressure injection pump with independent diesel.	$4.1k	>$1000k (EP)	This SAMA is not cost beneficial.	$7k	$3k	The costs associated with the proposed modification are expected to greatly exceed the benefit.
138	Install independent AC high pressure injection system.	$4.1k	>$1000k (EP)	This SAMA is not cost beneficial.	$7k	$3k	The costs associated with the proposed modification are expected to greatly exceed the benefit.
140	Prevent charging pump flow diversion from the relief valves.	$13k	>$50k (EP)	This SAMA is not cost beneficial.	$23k	$10k	This situation can occur at Point Beach and the operators are trained to cope with it. The costs associated with the proposed modification are expected to greatly exceed the benefit.
142	Use firewater pumps as a backup seal injection and high-pressure makeup.	$13k	>$1000k (EP)	This SAMA is not cost beneficial.	$23k	$10k	Fire pumps do not have sufficient discharge head. Modification to provide high enough discharge head expected to exceed MAB.
148	Install nitrogen bottles as backup gas supply for SRVs.	$0	>$100k (EP)	This SAMA is not cost beneficial.	$0	$0	Point Beach currently has accumulators installed. The accumulators are isolated due to an Appendix R issue relative to a fire in the control room that would cause an open signal to be generated to the PORVs . This will result in the equivalent of a stuck open PORV. The modification in this case would be to eliminate the Appendix R concern. The costs of this modification will greatly exceed the benefit.
149	Install a redundant spray system to depressurize the primary system during a SGTR.	$305.8k	>$1000k (EP)	This SAMA is not cost beneficial.	$509k	$239k	The cost associated with this modification is expected to greatly exceed the benefit.
150	Create/enhance reactor coolant system depressurization ability.	$305.8k	>$1000k (EP)	This SAMA is not cost beneficial.	$509k	$239k	SAME AS ITEM #149.

Table F.2-3. Sensitivity Analysis Results. (Continued)

Point Beach SAMA Number	Potential Improvement	Total Benefit (Bounding	Estimated Cost	Conclusion	Benefit (3% Discount Rate Sensitivity) (Bounding	Benefit (8.95% Discount Rate Sensitivity) (Bounding)	Basis for Conclusion
151	Make procedural changes only for the RCS depressurization option.	$305.8k	Not Determined (EP)	Use of procedure step mark offs implemented.	$509k	$239k	HEPs were evaluated and there does not appear to be a large opportunity for improvement for any of them by making procedural enhancements. Some credit can now be taken for use of placekeeping aids, but the largest part of these HEPs is from the execution portion, not cognitive.
153	A system of relief valves that prevents any equipment damage from a pressure spike during an ATWS.	$29k	>$1000k (EP)	This SAMA is not cost beneficial.	$51k	$22k	The cost associated with this modification is expected to greatly exceed the benefit.
154	Adding other SGTR coping features.	$565.0k	>$10000k (EP)	This SAMA is not cost beneficial.	$1074k	$499k	The cost associated with this modification is expected to greatly exceed the benefit.
155	Increase secondary side pressure capacity such that a SGTR would not cause the relief valves to lift.	$565.0k	>$100000k (EP)	This SAMA is not cost beneficial.	$1074k	$499k	This would require replacement of the current generators. The cost associated with this modification is expected to greatly exceed the benefit.
157	A maintenance practice that inspects 100 percent of the tubes in a steam generator.	$565.0k	>$500k per outage (EP)	This SAMA is not cost beneficial.	$1074k	$499k	This would add to the duration of current outages. The costs associated with this ongoing inspection program will greatly exceed the benefit.
158	Create passive secondary side coolers.	See Note 1	>>MAB (EP)	This SAMA is not cost beneficial.	See Note 1	See Note 1	For an existing plant, design and installation of this SAMA is not considered feasible, as it would involve major changes in plant structures.
165	Perform surveillances on manual valves used for backup AFW pump suction.	$0	>$10k	This SAMA is not cost beneficial.	$0	$0	The cost of this modification exceeds the benefit. No further evaluation required.
166	Install a new CST (AFWST).	See Note 1	>$1000k (EP)	This SAMA is not cost beneficial.	See Note 1	See Note 1	Currently have 2 CSTs shared by Unit 1 and 2. Also backup AFW suction to SW and emergency CST makeup from firewater.

Table F.2-3. Sensitivity Analysis Results. (Continued)

Point Beach SAMA Number	Potential Improvement	Total Benefit (Bounding	Estimated Cost	Conclusion	Benefit (3% Discount Rate Sensitivity) (Bounding	Benefit (8.95% Discount Rate Sensitivity) (Bounding)	Basis for Conclusion
169	Provide portable generators to be hooked in to the turbine driven AFW, after battery depletion.	$98.4k	>$200k (EP)	This SAMA is not cost beneficial.	$173k	$74k	The cost of this modification exceeds the benefit. No further evaluation required.
176	Replace reactor vessel with stronger vessel.	See Note 1	>>MAB (EP)	This SAMA is not cost beneficial.	See Note 1	See Note 1	For an existing plant, design and installation of this SAMA is expected to greatly exceed total MAB.
177	Provide additional SW pump.	$6.6k	>$5000k (EP)	This SAMA is not cost beneficial.	$11k	$5k	The costs associated with this modification will greatly exceed the benefit.
180	Provide automatic repowering of the battery chargers following a loss of offsite power event.	$120.4k	>$200k (EP)	This SAMA is not cost beneficial.	$212k	$91k	This would require the development and installation of “smart” DG controllers that would sense the DG load and determine whether the chargers could be loaded or not.
181	Provide procedural improvements and training to improve operator performance for the task of feed and bleed cooling without SI.	$102.5k	Not Determined (EP)	Use of procedure step mark offs implemented.	$180k	$77k	Procedures are currently considered adequate. Use of Procedure step mark offs implemented.
184	Provide procedural improvements and training to improve operator performance for the task of manually controlling AFW following loss of instrument air.	$23.1k	~$30k	Use of procedure step mark offs implemented.	$41k	$17k	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented.

Table F.2-3. Sensitivity Analysis Results. (Continued)

Point Beach SAMA Number	Potential Improvement	Total Benefit (Bounding	Estimated Cost	Conclusion	Benefit (3% Discount Rate Sensitivity) (Bounding	Benefit (8.95% Discount Rate Sensitivity) (Bounding)	Basis for Conclusion
185	Provide procedural improvements and training to improve operator performance for the task of providing an alternate source of water for AFW following low CST level.	$178.3k	~$30k	Use of procedure step mark offs implemented.	$311k	$135k	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented.
186	Provide procedural improvements and training to improve operator performance for the task of manually starting the gas turbine generator.	$22.5k	~$30K	Use of procedure step mark offs implemented.	$40k	$17k	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented.
187	Provide procedural improvements and training to improve operator performance for the task of opening valve CV-112B (RWST - charging)	$82.9k	~$30K	Use of procedure step mark offs implemented.	$146k	$62k	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented. This human action is a recovery action to open CV0112B manually if it fails to open automatically on low VCT level. Further training is not expected to have much benefit.

Table F.2-3. Sensitivity Analysis Results. (Continued)

Point Beach SAMA Number	Potential Improvement	Total Benefit (Bounding	Estimated Cost	Conclusion	Benefit (3% Discount Rate Sensitivity) (Bounding	Benefit (8.95% Discount Rate Sensitivity) (Bounding)	Basis for Conclusion
188	Provide procedural improvements and training to improve operator performance for the task of diagnosing steam generator tube rupture	$36.9k	~$30k	Use of procedure step mark offs implemented.	$61k	$29k	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented.
189	Provide procedural improvements and training to improve operator performance for the task of feed and bleed cooling with SI.	$25.5k	~$30k	Use of procedure step mark offs implemented.	$45k	$19k	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented.
190	Provide procedural improvements and training to improve operator performance for the task of isolating a service water header rupture.	$19.2k	Not Determined (EP)	Use of procedure step mark offs implemented.	$34k	$14k	Procedures are currently considered adequate. Use of procedure step mark offs implemented.
191	Provide procedural improvements and training to improve operator performance for the task of opening the instrument air valves to containment.	$23.1k	~$30k	Use of procedure step mark offs implemented.	$38k	$18k	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented.

Table F.2-3. Sensitivity Analysis Results. (Continued)

Point Beach SAMA Number	Potential Improvement	Total Benefit (Bounding	Estimated Cost	Conclusion	Benefit (3% Discount Rate Sensitivity) (Bounding	Benefit (8.95% Discount Rate Sensitivity) (Bounding)	Basis for Conclusion
192	Provide procedural improvements and training to improve operator performance for the task of opening reopening air system valves 3047 or 3048.	$22.5k	~$30k	Use of procedure step mark offs implemented.	$37k	$18k	Implementation of a procedure step mark off for the procedure represented by this human action could reduce the HEP by a factor of 3, using the current HRA process. Procedures are otherwise currently considered adequate. Use of procedure step mark offs implemented.
193	Provide procedural improvements and training to improve operator performance for the task of opening valve SW-2880 following an SI signal.	$26.5k	~$30k	Use of procedure step mark offs implemented.	$44k	$21k	Procedures are currently considered adequate. Use of procedure step mark offs implemented.
195	Improve running reliability of Motor Driven AFW Pumps. AF—MDP-FR---38A, AF—MDP-FR---38B	$159.7k	>$1000K (EP)	This SAMA is not Cost Beneficial	$278k	$121k	Since these pumps are under strict observation normally and performance enhancements are routinely sought, it is expected that design modification would be necessary to significantly improve the reliability. Design modifications would greatly exceed the benefit.
196	Reduce likelihood of RHR A and B full flow test lines being left open (pre-initiator) RH—VLV-RE-0706A, RH—VLV-RE-0706B	$49.9k	Not Determined (EP)	No cost-effective hardware changes identified.	$86k	$38k	The probability for this pre-initiator human error used in PRA model Revision 3.02 was a screening value of 1E-03. Because there are actually two series valves in these lines that are both independently verified and locked closed, both would need to be left open for a flow diversion to occur. A more correct value of the HEP was calculated to be 6.4E 06. This corrected value eliminates any need for further evaluation.

Table F.2-3. Sensitivity Analysis Results. (Continued)

Point Beach SAMA Number	Potential Improvement	Total Benefit (Bounding	Estimated Cost	Conclusion	Benefit (3% Discount Rate Sensitivity) (Bounding	Benefit (8.95% Discount Rate Sensitivity) (Bounding)	Basis for Conclusion
197	Reduce likelihood of Check valve in recirc line from AFW pumps to CSTs failing to open AF—CKV-CC---117	$18.3k	>>$22k	Check valve internals have been removed.	$32k	$14k	Since valves are under strict observation normally and performance enhancements are routinely sought, it is expected that design modification would be necessary to significantly improve the reliability. Check valve internals have been removed.
199	Reduce likelihood of failure of Bus 1B03. 480-BS—LP—1B03	$49.4k	>$300k	This SAMA is not cost beneficial	$87k	$37k	Any hardware modification to improve the physical reliability of this bus will cost more than the benefit.

Note 1: The benefit of this SAMA was not specifically evaluated because the cost would exceed the MAB.
Note 2: The benefit of this SAMA was not specifically evaluated because of the extremely small Initiating Event Frequency

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