# 3.0 PROPOSED ACTION

**NRC**

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

Nuclear Management Company (NMC) proposes that the U.S. Nuclear Regulatory Commission (NRC) renew the operating licenses for Prairie Island Nuclear Generating Plant (PINGP) Units 1 and 2 for the maximum period currently allowable under the Atomic Energy Act and NRC's regulations (10 CFR 54.31). This action would provide the option to operate PINGP up to 20 years beyond the current operating license terms expiring on August 9, 2013 (Unit 1) and October 29, 2014 (Unit 2). Renewal would thereby enable the State of Minnesota, Xcel Energy and its subsidiary companies, and other participants in the wholesale power market to rely on PINGP to meet future electric power needs through the period of extended operation of these generating units.

In the following sections of Chapter 3, NMC presents a description of the PINGP site and activities relevant to assessments presented in Chapter 4 of this Environmental Report (ER). Section 3.1 provides a general description of plant design and operating features. Sections 3.2 through 3.4 describe potential changes to support the renewed PINGP Unit 1 and PINGP Unit 2 operating licenses.

## 3.1 GENERAL PLANT INFORMATION

General information about the design and operational features of PINGP from an environmental impact standpoint is available in several documents. Among the most comprehensive sources are the Final Environmental Statement (FES) prepared by the NRC's predecessor agency, the U.S. Atomic Energy Commission (AEC) and the Updated Safety Analysis Report (USAR). In 1973, the AEC issued an FES that analyzed impacts of constructing and operating a two-unit plant with a cooling tower-based heat dissipation system (AEC 1973). In compliance with NRC regulations, NMC routinely updates the USAR to reflect current plant design and operating features (NRC 1996).

The major structures, housed facilities, and nearby areas are shown in Figure 3.1-1. Major site buildings include the following:

- Unit 1 and Unit 2 containment buildings that house the nuclear steam supply systems including the reactors, steam generators, reactor coolant pumps, and related equipment;

- The auxiliary building that houses major components of the primary component cooling water system, boric acid storage tanks and pumps, and other safety-related equipment;

- The turbine building, where the turbine generators, main condensers, turbine plant heat exchangers, and related equipment are housed;

- Other structures and facilities of interest within the site boundary include the PINGP substation, intake and plant screenhouses, intake and discharge canals, Independent Spent Fuel Storage Installation (ISFSI), four mechanical draft cooling towers, and emergency diesel generators.

### 3.1.1 REACTOR AND CONTAINMENT SYSTEMS

PINGP is a two-unit plant utilizing pressurized water reactors. The plant was originally constructed with two pressurized light-water reactor nuclear steam supply systems and turbine generators designed and manufactured by Westinghouse Electric Company (Scientech 2005). Initial fuel loading was completed in 1973 for Unit 1 and 1974 for Unit 2. Following a period of testing, full commercial operation began December 16, 1973 for Unit 1 under Facility Operating License Number DPR-42, and December 21, 1974 for Unit 2 under Facility Operating License Number DPR-60 (NMC 2007, p. 1.1-1).

The containment for each unit consists of two systems. The primary containment is a cylindrical steel pressure vessel with a hemispherical dome and ellipsoidal bottom designed to withstand a loss-of-coolant accident. The secondary containment is a cylindrical shield building constructed of reinforced concrete which serves as radiation shielding for normal operation and for the loss-of-coolant condition. The shield building also acts as a secondary containment structure for control of containment leakage

(NMC 2007). The shield buildings are cylindrical (205 feet high by 120 feet in diameter), each capped with a hemispheric dome (AEC 1973, p. III-1).

PINGP has a design rating of 1650 megawatts-thermal (MWt) per reactor, which corresponds to a gross electrical output of 575 megawatts-electrical (MWe). Each reactor is capable of an ultimate thermal power output of 1721.4 MWt, and all steam and power conversion equipment, including the turbine generator, has the capability to generate a maximum calculated gross unit output of 592 MWe. All plant safety systems, including containment and engineered safeguards, were designed and originally evaluated for operation at the maximum power level of 1721.4 MWt (NMC 2007, p. 1.1-2). Unit 1's original Westinghouse steam generators were replaced with Framatome-ANP designed generators in 2004 (AREVA 2006).

### 3.1.2 NUCLEAR FUEL

PINGP is licensed for low-enriched uranium-dioxide fuel with enrichments to a nominal 5.0 percent by weight uranium-235 and an average fuel burn-up for the peak rod that does not exceed 62,000 megawatt days per metric ton uranium (MWd/MTU). The uranium-dioxide fuel is in the form of high-density ceramic pellets. Fuel rods used in the reactors consist of Zircaloy with fuel pellets stacked inside and sealed with welded end plugs. The fuel rods are fabricated into assemblies designed for loading into the reactor core. The PINGP reactor cores contain 29 control rod assemblies and 121 fuel assemblies. Refueling of the reactors is performed every 20 months with approximately 40 percent of the fuel being replaced during each refueling outage.

PINGP has two spent fuel pools, a larger one to store spent fuel and a smaller one intended primarily to handle a spent fuel shipping cask. New racks were installed in 1981, and resulted in the current pool storage capacity of 1,386 assemblies (MEQB 1991, Appendix D).

The NRC has licensed an Independent Spent Fuel Storage Installation (ISFSI) at PINGP, allowing up to 48 casks. Prior to 2003, State law limited the authorized use to 17 casks, but new State law enacted in 2003 now allows use of up to the 48 casks permitted by the NRC. Currently, there are 24 casks installed in the ISFSI (Minnesota Legislative Reference Library 2006).

### 3.1.3 COOLING AND AUXILIARY WATER SYSTEMS

#### 3.1.3.1 Water Use Overview

Water for condenser cooling is withdrawn from the Mississippi River. Water used for service water cooling, screen wash, irrigation, and domestic water supply is groundwater withdrawn from on-site wells. Station surface water and groundwater withdrawals are governed by water appropriation limits set by the Minnesota Department of Natural Resources (MN DNR). Under Water Appropriations Permit Number 690171, PINGP may withdraw a maximum of 1,200 gallons per minute (gpm) of groundwater from two on-site wells for the domestic water system. A third well

provides domestic and irrigation water for the Training Center. Water Appropriations Permit Number 690172 limits withdrawal of surface water from the Mississippi River for condenser cooling to 630,000 gpm.

The FES related to the Prairie Island Nuclear Generating Plant (AEC 1973) describes the original configuration of the plant's cooling water systems, which were extensively modified in the early 1980s. As designed and initially operated, the plant withdrew cooling water from the Mississippi River (Sturgeon Lake) via a 750-foot-long intake canal that extended from the river shoreline to the screen house, where a trash rack removed large debris and four (3/8-inch mesh) traveling screens (per unit) removed fish and smaller debris. A skimmer wall (barrier) at the mouth of the intake canal prevented large floating objects from entering the intake canal. The plant's heated discharge flowed into a discharge basin, from which it was (depending on plant operating mode) either pumped to the cooling towers or discharged to the river via an 800-foot-long canal. The plant could be operated in any one of three modes: open cycle (once-through flow, with no cooling towers in operation), helper cycle (once-through flow with cooling towers in operation), and closed-cycle (recirculation of up to 95 percent of the cooling water flow).

The plant's cooling system was heavily modified in the early 1980s to reduce impacts of plant operation on aquatic communities (Stone & Webster 1983). A new intake screenhouse with improved traveling screens was constructed across the mouth of intake canal. A fish return line was installed to convey organisms washed from the traveling screens back to the Mississippi River. A new, half-mile-long discharge canal with a north-south orientation was created by building a 2,350-foot-long dike that paralleled the river shoreline. A new discharge structure was built at the southern terminus of the canal, and connected to the river's edge by four underground discharge pipes. The new submerged jet discharge was intended to promote rapid mixing of the heated effluent, keep fish out of the discharge canal, and prevent recycling of warm discharge water (Stone & Webster 1983). The intake and discharge modifications were completed in 1983.

### 3.1.3.2 Circulating Water System

As previously discussed, PINGP withdraws water from the Mississippi River for its circulating water (condenser cooling) system. Key components of the circulating water system and closely related cooling tower system are the intake screenhouse, plant screenhouse, circulating water pumps, condensers, discharge structure, mechanical draft cooling towers, discharge canal, and discharge structure, shown in Figure 3.1-1.

The PINGP cooling water intake system is designed to minimize impacts to fish populations. Aquatic organisms on the traveling screens and in the attached buckets are lifted to the level of the fish sprays and washed off into a fish collection trough within four minutes. Removal of the fish and organisms is accomplished on the upward travel side with a low pressure [10 pounds per square inch (psi)] inside spray when fine mesh screen is used and with a low pressure (20 psi) outside spray when coarse mesh screen is used. Debris is removed by a backside interior high pressure (50 psi for fine

mesh and 100 psi for coarse mesh) spray system. In spring and summer (April 1 – August 31), traveling screens are equipped with fine mesh (0.5 millimeter) panels (Xcel Energy 2006a). For the remainder of the year, conventional screens with coarse mesh (3/8 inch) panels are employed. Traveling screens can be operated over a range of speeds, depending on panel mesh size and debris loading. The pump supplying the 50 psi fine mesh spray is run at a higher speed to provide a 125 psi spray to supplement the 100 psi coarse mesh spray during periods of high trash loading. The separate fish and debris troughs combine to form a common trough. The fish and debris are then returned to the river through a buried pipe. The pipe discharges at a point approximately 1,500 feet south of the intake screenhouse. Transferring the fish downriver, outside of the influence of the cooling water intake, serves to prevent re-impingement of weakened or disoriented fish. The pipe is designed for velocities between 3 and 5 feet per second with higher velocities encountered for short durations. All internal surfaces of the pipe are smooth to preclude abrasion damage. The pipe discharges below the mean water elevation at a depth which ensures submergence below any ice cover.

River water flows into the intake screenhouse through eight (18.5 foot by 11.2 foot) intake bays, each equipped with a trash rack, a 10-foot-wide traveling screen, and high/low pressure wash systems (Xcel Energy 2006a). Bypass gates permit a continuous flow in the event that traveling screens become clogged with debris (Stone & Webster 1983). After moving through the traveling screens, circulating water flows down the intake canal to the plant screenhouse, where the circulating water pumps are housed. Four circulating water pumps (two per nuclear unit) supply water to the condensers for cooling. Each pump has a design capacity of 147,000 gpm, meaning the circulating water flow is approximately 294,000 gpm per unit (NMC 2007, pg. 11.5-1) and the total circulating water flow is approximately 588,000 gpm. Smaller volumes of water are also withdrawn for its cooling water (i.e., service water) system, which supplies cooling water to a variety of feedwater pumps, air compressors, and small heat exchangers in the plant.

### 3.1.3.3 Circulating Water System Operating Modes

After passing through the condensers, cooling water is piped to a discharge basin from which it may be (a) pumped to the cooling towers (closed-cycle or helper cycle) or (b) allowed to flow to the discharge canal (open cycle) via the distribution basin. If it is pumped to the cooling towers, the cooling tower outfall may be routed back to the intake canal (closed cycle) or flow to the discharge canal (helper cycle). The distribution basin receives circulating water flow from the discharge basin during open-cycle operation and from the cooling tower return canal during closed-cycle operation. During transition periods (from closed cycle to open cycle), the distribution basin receives flow from both sources.

The cooling tower system is comprised of four towers, fans, water distribution headers and basins. Each tower has one cooling tower pump and is made up of 12 cells grouped together (a bank).

The cooling tower pumps intake water from the discharge basin and discharge into individual distribution pipes to the top of the cooling towers. The pumps are vertical, dry pit pumps mounted so that the casing will be flooded with the water in the discharge basin at normal level. The pump motors are mounted on, and supported by, the pump. The intakes to the pumps are submerged to prevent the intake of air from any cause. Spray nozzles at the top of the cooling towers break-up the water stream into small streams which drop by gravity through a maze of "fill" to a basin at the base of the towers. Fans draw air up through the streams of water and the heat of the water is carried into the atmosphere by the airstream. From the cold water basin at the bottom of the towers, the water flows through the cooling tower return canal to the distribution basin (NMC 2007). The towers are designed to accommodate the full circulating water flow of the plant and are capable of removing up to 96 percent of the waste heat generated by plant operation (AEC 1973).

Operation of PINGP's circulating water system is governed by spring and fall "trigger points." The spring trigger point is defined as the point in time that the daily average ambient river temperature increases to 43 degrees Fahrenheit (F) or above for five consecutive days, or April 1, whichever occurs first. The fall trigger point is the point at which the daily average upstream ambient river temperature falls below 43 degrees F for five consecutive days. From the spring trigger point through the fall trigger point, PINGP is required to operate the cooling towers as necessary to meet the following requirements: (1) the temperature of the receiving water immediately below Lock and Dam No. 3 can not be raised by more than 5 degrees F above ambient, (2) the cooling water discharge can not exceed a daily average temperature of 86 degrees F, and (3) if the daily average ambient river temperature reaches 78 degrees F for two consecutive days, all cooling towers shall be operated to the maximum extent practicable (NPDES Permit No. MN0004006).

From the fall trigger point through March 31, the temperature of the receiving water immediately below Lock and Dam No. 3 can not be raised above 43 degrees F for an extended period of time. If the receiving water temperature exceeds this 43-degree F limit for two consecutive days, NMC must notify the Commissioner and the MN DNR. The Commission may require NMC to operate the cooling towers or take alternative action to meet the 43-degree F criterion (NPDES Permit No. MN0004006).

PINGP is equipped with a deicing system to prevent the formation of ice on trash racks, traveling screens, and bypass gates (Stone and Webster 1983). Warm water is pumped from the discharge canal to the intake screenhouse via a 30-inch-diameter pipe buried below the frostline. The warm water is discharged at the bottom of the approach canal, directly in front of the intake screenhouse.

#### 3.1.3.4 Biofouling and Scale Control

PINGP uses a cleaning system to mechanically remove biofouling micro-organisms from circulating water piping. The PINGP NPDES permit provides for periodic chlorine/bromine use in the circulating water system to treat for pathogenic amoeba (see Section 4.12) and zebra mussels (NPDES Permit No. MN0004006). The cooling

water system (service water system), however, is treated with oxidizing biocides (chlorine and bromine) to prevent the growth of biofouling micro-organisms. The current PINGP NPDES permit limits the release of total residual bromine and total residual chlorine at Outfall SD 001 (combined circulating water and cooling water discharge) to 0.001 and 0.04 milligrams per liter (mg/L), respectively, during continuous application and 0.05 and 0.2 mg/L, respectively, during intermittent application (NPDES Permit No. MN0004006).

#### 3.1.3.5 Domestic Water Supply and Sanitary Wastewater Treatment

NMC operates three groundwater wells to meet the domestic water needs of PINGP. Two main wells, each equipped with 300-gpm pumps, supply the majority of the domestic water and are permitted to withdraw a total of 50 million gallons per year. The actual usage for these wells averaged approximately 60 gpm for the years 2000 through 2005. A third well provides domestic and irrigation water for the Training Center. This well is equipped with an 80-gpm pump and is permitted to withdraw 4.7 million gallons per year (NSP 2006). Actual use for the years 2000 through 2005 averaged 4 gpm (TtNUS 2006).

The plant's sanitary wastes are directed to seven septic systems, which are pumped on varying schedules. The systems are designated as the Plant Septic (consisting of three tanks), the Warehouse 1 Holding Tank, the Guardhouse Septic, the Office Complex, the Fabrication Shop, the New Administration Building, the Environmental Lab, and the Prairie Island Training Center (Xcel Energy Undated).

### 3.1.4 RADIOACTIVE WASTE TREATMENT SYSTEMS

#### 3.1.4.1 Liquid Radioactive Waste Systems

Radioactive liquids entering the Waste Disposal System are collected in intermediate holding tanks for determination of subsequent treatment. If liquids are to be released, they are first sampled and analyzed to determine the quantity of radioactivity and if it meet acceptable release criteria. The liquid wastes are then processed as required for reuse or released under controlled conditions and in accordance with applicable limits of 10 CFR 20 and the design objectives of Appendix I to 10 CFR 50 (NMC 2007).

The bulk of the radioactive liquid drained from the Reactor Coolant System is processed by the Chemical and Volume Control System recycle train, and retained inside the plant. This minimizes liquid input to the Waste Disposal System which processes relatively small quantities of generally low activity level wastes. The processed water from the waste disposal system, from which the majority of the radioactive material has been removed, may be reused or released through a monitored line to the discharge canal downstream of the cooling towers (NMC 2007).

### 3.1.4.2 Gaseous Radioactive Waste Systems

The gaseous radwaste system is designed to process and control the release of gaseous radioactive effluents to the site environs so that the offsite radiation dose rate does not exceed the limits specified in 10CFR20 and the design objectives of Appendix 1 to 10CFR50 are met. Waste gases are processed by one of two interconnected equipment trains. The low level loop provides sufficient storage capacity for cover gases from the nitrogen blanketing system to minimize the need to vent gases which accumulate as a result of shutdown operations. Discharges of fission gases from the system are limited to maintenance vents, unavoidable equipment leaks, and infrequent gas decay tank releases to dispose of gases accumulated by inflows from shutdown operations and miscellaneous vents. Controls are provided to regulate the rate of release from these tanks through the monitored plant vent. The high level loop was designed to accumulate, concentrate, and contain fission gases at high activity concentrations from continuous purging of the volume control tanks gas space. It would provide continuous removal of fission gases from the letdown coolant to maintain the coolant fission gas concentrations at a low residual level. This loop can perform these functions and/or be used for reserve holdup capacity of low level loop gas (NMC 2007, Section 9.3).

### 3.1.4.3 Solid Radioactive Waste Systems

The solid radiological waste system is designed to package, store, and provide shielded storage facilities for solid wastes and to allow temporary storage prior to shipment from the plant for off-site processing or disposal. The system is designed to meet the requirements of 10 CFR 20, 10 CFR 71, and 49 CFR 170-189.

Solid wastes consist mainly of dry active waste (DAW) such as contaminated paper, plastic, wood, metals, and spent resin. DAW may be compacted for disposal or storage or may be sent off-site for further processing, such as sorting or incineration. The by-product of such off-site processing (incinerator ash for example) may be returned to the plant site for storage if no disposal site is available.

Contaminated metals may be compacted on-site for storage or disposal. Contaminated metals may also be sent off-site for processing such as decontamination or metal melting.

Spent resin originates in any of several system ion exchangers. Spent resin is flushed to a resin shipping liner for disposal or off-site processing. Alternatively, resin may be placed in on-site storage if a disposal site is not available. NMC plans to continue managing its low-level radioactive waste in compliance with all applicable regulations established by state and federal agencies.

Solid wastes received at disposal sites must meet the requirements of 10 CFR 61 relating to waste form and classification as well as disposal site-specific regulations (NMC 2007, Section 9.4).

### 3.1.5 NON-RADIOACTIVE WASTE MANAGEMENT

As outlined in Xcel Energy Environmental Policy, PINGP is committed to conducting its business in an environmentally responsible manner (Xcel Energy 2006b). One element of this policy is ensuring that wastes generated by business activities/operations are managed in compliance with applicable regulations and in a manner protective of the environment and human health. It also includes, where appropriate, minimizing the creation of waste, especially hazardous waste.

Xcel Energy's Waste Management Guidance Manual (Xcel Energy 2006c) assists PINGP employees in the identification of regulated wastes. It includes directions for selecting waste collection containers, storage and labeling requirements, and transport and disposal procedures. Training, emergency planning, and record keeping requirements associated with waste management are also described. Additional topics on waste regulations, employee responsibilities, and handling a regulatory inspection are included.

Proper management of regulated waste falls under three federal agencies: the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), and the Department of Transportation (DOT). Congress began the process of waste regulation with the passage of the Resource Conservation and Recovery Act of 1976 (RCRA). This act authorized the EPA to write regulations providing for a comprehensive management system for hazardous wastes. It also imposed 'cradle to grave' responsibility on the generator of a hazardous waste, meaning Xcel Energy never loses liability for its waste. As a result, Xcel Energy does not select waste disposal vendors on cost alone, but also evaluates and selects transportation and disposal companies that demonstrate competence in managing hazardous wastes. RCRA authorizes states to develop their own waste regulations. The State of Minnesota has authorization to manage their hazardous waste management programs and have developed additional regulations making them more restrictive than federal requirements (MN Rules Chapter 7045).

OSHA is involved in waste management through the Hazard Communication (HAZCOM) Standard, requiring that employers inform and train workers in proper handling of hazardous substances. Under the Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard, OSHA established training requirements for workers that respond to releases of hazardous substances.

The DOT considers hazardous wastes a subset of hazardous materials, which means many regulated wastes are subject to DOT requirements during shipment. DOT regulations contain packaging specifications, container marking and labeling requirements, emergency reporting requirements, release response requirements, and a complex tracking system using shipping papers and manifests. DOT also requires training for employees with responsibility for the shipment of hazardous materials.

Non-radioactive waste is produced from plant maintenance, cleaning, and operational processes. The majority of the waste generated consists of non-hazardous waste oil,

oil-filled equipment used in operations and maintenance, and oily debris. Universal waste defined by Minnesota Pollution Control Agency (MPCA) includes lighting ballasts, polychlorinated biphenyl (PCB) small capacitors, mercury containing devices and batteries, antifreeze, circuit boards, electronics, photographic negatives, cathode ray tubes (CRTs), alkaline batteries, and non-TCLP fluorescent and HID lamps, common to any industrial facility, comprise a majority of the remaining waste volumes generated. Hazardous waste routinely makes up a small percentage of the total waste generated and consists of spent and off-specification (e.g. shelf-life expired) chemicals, laboratory chemical wastes, Freon-contaminated oil, and occasional project-specific wastes.

As outlined in the company environmental policy, Xcel Energy is committed to considering pollution prevention in business planning and decision-making processes. Pollution prevention reduces wastes, which in turn reduces regulatory burdens, reduces liability, and saves money. It also helps conserve valuable resources and protects human health and the environment. Pollution prevention is achieved by utilizing the Waste Management Hierarchy for reducing waste generation. This hierarchy prioritizes waste reduction though source reduction, reuse/recycle, and treatment and disposal, respectively (Xcel Energy 2006c).

## 3.1.6 TRANSMISSION FACILITIES

### 3.1.6.1 History/Background

When PINGP was built, its generating and transmission facilities were owned and operated by Northern States Power, a regulated utility with headquarters in Minneapolis, Minnesota. In May 2000, Northern States Power transferred its authorization to operate PINGP to NMC, a contract/operations firm that currently oversees the operation of two nuclear plants in Minnesota. Northern States Power continued to operate and maintain the PINGP transmission lines when the responsibility for managing the PINGP generating facilities was transferred to NMC. Therefore the discussion that follows on the planning, construction, and modification of PINGP transmission facilities in the 1970s and 1980s applies to Northern States Power, whereas the discussion of current maintenance and vegetation management practices applies to Xcel Energy.

Before PINGP was built, a 345-kilovolt (kV) line was installed between the Red Rock substation in St. Paul and the Adams substation in Mower County, 74 miles south of Prairie Island (NSP 1971, p. II-25). This line was designed to pass near the proposed PINGP site and link to the new plant once built, thereby providing connections between the plant and St. Paul (Red Rock) and between the plant and southeastern Minnesota (Adams). When PINGP was built, the Red Rock – Adams line was divided, and the two new “halves” connected to PINGP by means of a 2.5-mile-long corridor that runs to the plant substation.

The FES noted that two new 345-kV lines were required to connect the plant to the regional electric transmission system (AEC 1973, p. III-1). One new line was built from PINGP Unit 1 to the Blue Lake substation in Scott County; another was built from PINGP Unit 2 to the Red Rock substation in south St. Paul. The new line from Unit 1 to

the Blue Lake substation required construction of a new corridor to the Inver Grove substation, in Dakota County; the remaining segment, between Inver Grove and the Blue Lake substation, was routed along an existing corridor. The entire length of the new line from Unit 2 to the Red Rock substation was routed along an existing corridor. In total, Northern States Power built 78 miles of new line to deliver power to the transmission system (AEC 1973). Because NSP was able to take advantage of existing transmission corridors, it was only necessary to acquire 33 miles of new right-of-way.

NRC defines the transmission corridors of concern for license renewal as those constructed for the specific purpose of connecting the plant to the transmission system [10 CFR 51.53(c)(3)(ii)(H)]. NRC further elaborates in the GEIS and guidance that the corridors of concern are those that were "constructed between the plant switchyard to its connection with the existing transmission system." Supplement 1 to Reg. Guide 4.2 (NRC 2000) recommends that applicants "specifically identify those transmission lines that were identified in the construction permit review as being constructed to connect the plant to the transmission system." AEC's 1968 construction permit review for PINGP predated the 1970 enactment of the National Environmental Policy Act. The FES related to the Prairie Island Nuclear Generating Plant (AEC 1973) was concerned with impacts of "…the continuation of construction permits…and the issuance of operating licenses…for the startup and operation of the PINGP" and considered impacts of both construction and operation of the plant. Two 345-kV transmission lines, PINGP - Blue Lake and PINGP - Red Rock 2, were considered in the 1973 FES and will therefore be considered for transmission-related impacts in Chapter 4. The two 2.5-mile-long transmission line connections built to connect PINGP to the Red Rock 1 and Adams lines will also be analyzed. In addition, the 161-kV line owned by Great River Energy that runs from PINGP to Spring Creek is included in the scope of this analysis.

### 3.1.6.2 Current System Configuration

The output of PINGP is delivered to the substation just north of the generating facilities with 345-kV and 161-kV switchyards (NMC 2007, Section 8.2). Five transmission lines leave the switchyards via three transmission corridors:

- One corridor, running west, contains the 2.5-mile-long transmission line connection to Red Rock 1 and Blue Lake 345-kV lines.

- A second corridor, running west, contains the Red Rock 2 and the 2.5-mile-long transmission line connection to Adams 345-kV lines.

- A third corridor, running south, contains the Spring Creek 161-kV line.

These five transmission lines connect PINGP to the regional transmission system (NMC 2007, Section 8.2.1). The current transmission system is summarized in Table 3.1-1. Figure 3.1-1 shows the layout of the transmission lines leaving the PINGP substation. Figure 3.1-2 presents the routes of the five in-scope transmission lines.

Northern States Power and Great River Energy designed and constructed the PINGP transmission lines in accordance with industry guidance that was current when the lines were built. Ongoing surveillance and maintenance of PINGP-related transmission facilities ensure continued conformance to design standards. Section 4.10 examines the conformance of the lines with the National Electrical Safety Code requirements on line clearance to limit shock from induced currents (IEEE 1997).

Xcel Energy uses a variety of methods to ensure that transmission corridors are kept free of brush and fast-growing trees that could interfere with transmission facilities (e.g., towers, conductors, sub-stations). Because transmission corridors cross areas with different kinds of terrain and vegetation, Xcel Energy employs an Integrated Vegetation Management (IVM) approach that includes both mechanical and chemical control methods. IVM involves the judicious use of a range of vegetation management treatments including tree removal, pruning, mowing, and chemical (herbicide) application (Xcel Energy 2005). Great River Energy also uses an IVM program to enhance wildlife along power line rights-of-way. This effort includes the use of low-volume biodegradable herbicides to remove unwanted woody species, while leaving behind the grasses, wildflowers, and low-growing trees preferred by butterflies, songbirds, wild turkey, and deer (Great River Energy 2006).

The goal of Xcel Energy's IVM program is to develop site-specific, environmentally-sensitive, and cost-effective solutions to vegetation management near transmission and distribution facilities. The primary objective is to keep transmission facilities clear of tall-growing trees and brush that could grow too close to conductors and interfere with electricity transmission. This is accomplished with routine vegetation management on each transmission circuit that is conducted on an established maintenance cycle.

Xcel Energy has adopted the "Wire zone/Border zone" concept to allow for different types and heights of vegetation in transmission corridors (Xcel Energy 2005). The goal is to manage vegetation in rights-of-way so as to establish a "wire zone" directly underneath towers and conductors with low-growing forbs and grasses and a "border zone" (from outside edge of wire zone to edge of right-of-way) with slow-growing shrubs and trees that do not grow high enough to interfere with transmission structures. Areas outside the border zone are periodically inspected for tall "danger trees" (dead, dying, or diseased trees that could fall and interfere with transmission lines). These trees are removed expeditiously, outside of the normal maintenance cycle.

Xcel Energy has adopted guidelines that govern the use of herbicides in its transmission corridors (Xcel Energy 2005). Contractors engaged in vegetation management must submit plans/proposals to Xcel Energy's Vegetation Management representative detailing any planned use of herbicides. Product labels and Material Safety Data Sheets must be supplied to the Vegetation Management representative along with the treatment plan. In addition to this oversight of site-specific vegetation management plans, Xcel Energy's Vegetation Management Guidelines (provided to all contractors engaged in vegetation management) prohibit the use of herbicides outside of right-of-way boundaries and instruct contractors to discontinue the use of herbicides

immediately if a property owner objects to their use, pending the resolution of any issues.

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

### 3.1.6.3 Avian Mortality Resulting from Collisions with Transmission Lines

NRC (1996) noted in the GEIS that "No relatively high collision mortality is known to occur along transmission lines associated with nuclear power plants in the United States other than the Prairie Island plant in Minnesota." The statement refers to a 5-year study in which bird carcasses were collected along two transmission corridors originating at PINGP (Goddard 1977; 1978; 1979). The corridors were searched from the substation just north of the PINGP generating facilities to the transmission towers nearest the Vermillion River (Goddard 1977), a distance of about 1.5 miles. A total of 453 bird carcasses representing 53 species were found during the 5-year period. About 64 percent of the carcasses were found along the 2,500-foot east-west portion of the corridors slightly northwest of the PINGP substation (Figure 3.1-1). This section of the corridors is perpendicular to the bird migration corridor along the Mississippi River. Other avian collision studies have also found that transmission lines at right angles to avian flight paths are associated with greater collisions (Goddard 1979).

As a result of the criminal prosecution of the Moon Lake Electric Association, Inc., a Utah-based electric power company, for electrocution of protected birds, the U.S. Fish and Wildlife Service (FWS) and several power companies began to discuss a method for addressing the avian electrocution problem (USDOJ 2002). A Memorandum of Understanding (MOU) between the FWS and Xcel Energy, the first of its type completed in the U.S., has been in effect since 2002 (NSPCM & FWS 2002). The MOU was created to establish procedures and policies dealing with migratory birds that may be present on NSP property, and outlined the development of an Avian Protection Plan. Xcel Energy submits semi-annual reports to the FWS summarizing activities covered under the MOU. The Avian Protection Plan for PINGP and associated transmission lines is in development.

Very few bird carcasses have been observed at PINGP or along PINGP-associated transmission lines since 1978, but systematic searches or formal avian collision studies have not been conducted. Therefore, the current extent of collision-related mortality and a comparison of avian mortality at PINGP to other nuclear plants have not been evaluated. However, the GEIS noted that the mortality at PINGP may not be unique, and may simply reflect the fact that surveys were performed. NRC (1996) further states that "the issue is whether collision mortality is large enough to cause long-term reductions in bird populations." Based on a literature search, NRC (1996) concluded that avian collisions with transmission lines did not significantly reduce species populations, and bird collisions with transmission lines associated with license renewal would not cause long-term reduction in bird populations, and thus, collision mortality is of small significance.

### 3.1.7 MAINTENANCE, OPERATION, AND INSPECTION

NMC implements programs to maintain, inspect, test, and monitor the performance of plant equipment. These programs are designed to meet several requirements:

- 10 CFR 50, Appendix B (Quality Assurance), Appendix R (Fire Protection), and Appendices G and H, Reactor Vessel Materials;
- 10 CFR 50.55a, American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section XI, In-service Inspection and Testing Requirements;
- 10 CFR 50.65, the maintenance rule, and
- Maintain water chemistry in accordance with Electric Power Research Institute (EPRI) guidelines.

Additional programs include those implemented to meet Technical Specification surveillance requirements, those implemented in response to NRC generic communications, and various periodic maintenance, testing, and inspection procedures necessary to manage the effects of aging on structures and components. Certain program activities are performed during the operation of the units, while others are performed during scheduled refueling outages. Current maintenance, operation, and inspection activities will continue and be expanded to include programs for managing the effects of aging.

## 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 environmental report must contain analyses of …refurbishment activities, if any, associated with license renewal…" 10 CFR 51.53(c)(3)(ii)**

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

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 1996). NRC requirements for the renewal of operating licenses for nuclear power plants include the preparation of an integrated plant assessment (IPA) (10 CFR 54.21). The IPA must identify and list systems, structures, and components subject to an aging management review. Items that are subject to aging and might require refurbishment include, for example, 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 1996) 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 (NRC 1996) 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. Examples of refurbishment activities include pressurized water reactor steam generator replacement and boiling water reactor recirculation piping replacement when these activities are carried out to ensure safe operations for 20 additional years. The GEIS assumes that refurbishment activities would take place within the 10 years prior to current license expiration and would culminate in a major outage immediately prior to the extended (license renewal) term. Because the situation at PINGP is consistent with this example, NMC is analyzing Unit 2 steam generator replacement in this environmental report as a refurbishment activity, pursuant to 10 CFR 51.53(c)(3)(ii).

The new steam generators would be manufactured at AREVA's Chalon Saint-Marcel plant. Delivery of the steam generators would take place in May 2013 with installation following in September 2013 (AREVA 2006). The refurbishment outage is expected to last approximately 80 days. Like the 2004 Unit 1 steam generator replacement, the steam generators would arrive by barge after journeying from France and traveling up the Mississippi River. A temporary construction area is planned to be located approximately 100 yards northwest of the turbine building. Several temporary buildings would be built, including a facility for preparing the steam generators, office space for construction contractors, and a decontamination building. Warehouse(s) would also be built on site and would remain after the steam generator replacement outage. Any construction would occur within the existing plant boundaries. There would be no clearing of previously-undisturbed areas. No road improvements would be required because the steam generators would arrive via barge and be offloaded to a self-propelled nuclear transporter capable of traveling on existing site roads without damage. NMC estimates that 750 workers would be required to perform the steam generator replacement and standard outage maintenance and refueling.

## 3.3 PROGRAMS AND ACTIVITIES FOR MANAGING THE EFFECTS OF AGING

**NRC**

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

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

The IPA required by 10 CFR 54.21 identifies the programs and inspections for managing aging effects at PINGP. These programs are described in the Prairie Island Nuclear Generating Plant License Renewal Application, Appendix B, Aging Management Programs. Other than implementation of programs and inspections identified in the IPA, NMC has no plans to modify administrative controls that are associated with license renewal.

## 3.4 EMPLOYMENT

### 3.4.1 CURRENT WORKFORCE

NMC employs approximately 685 permanent and long-term contract employees at PINGP, a two-unit facility. Approximately 83 percent of the employees live in Goodhue and Dakota Counties, Minnesota, and Pierce County, Wisconsin. Table 3.4-1 presents the number of employees that reside in each of these counties. The remaining employees are distributed across 21 counties in Minnesota and Wisconsin, with numbers ranging from 1 to 47 employees per county. A few employees live outside of these two states.

PINGP is on a 20-month refueling cycle. During refueling outages, site employment increases above the permanent work force by as many as 925 workers for temporary duty (based on 2003 to 2006 normal refueling outage workforces at PINGP). This number of outage workers generally falls within the range (200 to 900 workers per reactor unit) reported in the GEIS for additional maintenance workers (NRC 1996).

### 3.4.2 REFURBISHMENT INCREMENT

Performing the refurbishment activities described in Section 3.2 would necessitate increasing the PINGP 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.

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

NMC analysis, including the 10 CFR 54 aging management assessments, has identified one refurbishment activity for PINGP; the steam generators for Unit 2 will be replaced (tentatively scheduled for 2013). The NMC estimate assumes a schedule similar to the Unit 1 steam generator replacement project. The estimated size of the workforce for this project is assumed to be similar to that of the workforce for the Unit 1 steam

generator replacement, 750 workers. Therefore, NMC has determined that the GEIS work force size and scheduling assumptions amply bound the PINGP refurbishment work force sizes and scheduling.

Adding 750 full-time employees to the plant work force, on a similar schedule as Unit 1 steam generator replacement, would have the indirect effect of creating additional jobs because of the multiplier effect. In the multiplier effect, each dollar spent on goods and services by a worker becomes income to the recipient who saves some but re-spends the rest. In turn, this re-spending becomes income to someone else, who in turn saves part and re-spends the rest. The number of times the final increase in consumption exceeds the initial dollar spent is called the "multiplier." There are economic models that incorporate buying and selling linkages among regional industries and are used to estimate the impact of employee expenditures in a region of interest. However, due to the temporary nature of this project, the size of the surrounding population (2,733,326 residents within a 50-mile radius), and the fact that most indirect jobs would be service related, NMC assumes that the majority of indirect workers would already be residing within the 50-mile radius and a multiplier would not be needed.

### 3.4.3 LICENSE RENEWAL INCREMENT

Performing the license renewal activities described in Section 3.3 would necessitate increasing the PINGP 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. The analysis of license renewal employment increment focuses on programs and activities for managing the effects of aging.

The GEIS (NRC 1996) assumes that NRC would renew a nuclear power plant license for a 20-year period, 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 surveillance, monitoring, inspections, testing, trending, and recordkeeping (SMITTR) activities at the time of issuance of the new license and would conduct license renewal SMITTR activities throughout the remaining 30-year life of the plant, sometimes during full-power operation, but mostly during normal refueling and the 5- and 10-year in-service inspection and refueling outages (NRC 1996).

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

The GEIS estimates that the most additional personnel needed to perform license renewal SMITTR activities would typically be 60 persons during the 3-month duration of a 10-year in-service inspection and refueling outage. Having established this upper

value for what would be a single event in 20 years, the GEIS uses this number as the expected number of additional permanent workers needed per unit attributable to license renewal. GEIS Section C.3.1.2 uses this approach in order to "...provide a realistic upper bound to potential population-driven impacts…."

In reality, NMC expects to add no more than two additional permanent workers to perform all license renewal SMITTR activities. However, in an effort to be conservative, NMC is analyzing impacts for a maximum of 60 additional permanent workers. Therefore, NMC assumes that PINGP would require 60 additional permanent workers to perform all license renewal SMITTR activities and that all 60 employees would migrate into the 50-mile radius.

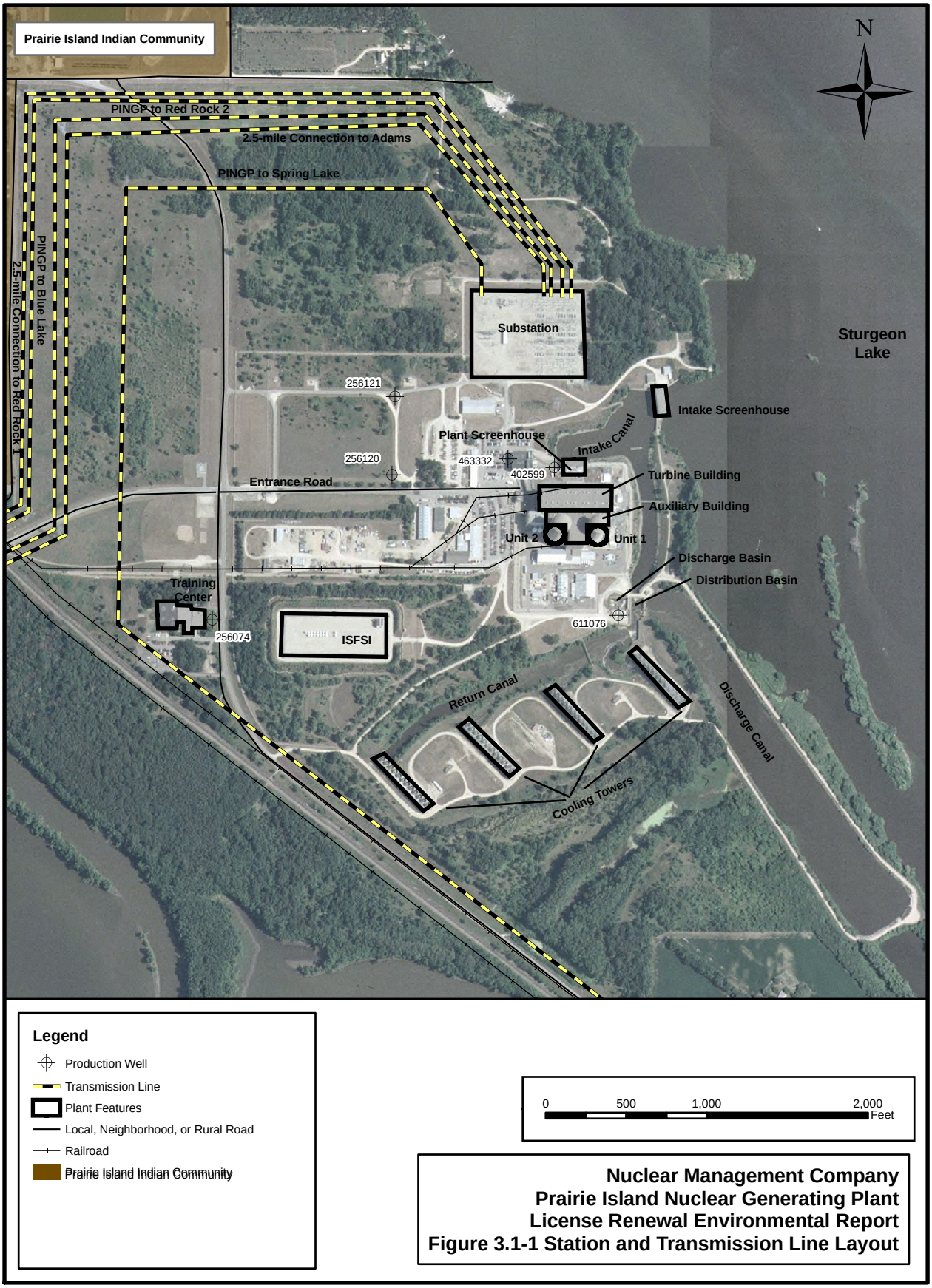
Adding employees to the plant work force for the period of extended operation would have the indirect effect of creating additional jobs. However, considering the size of the 50-mile radius population (2,733,326) and the fact that most indirect jobs would be service-related, NMC assumes that the majority of indirect workers would already be residing within the 50-mile radius.

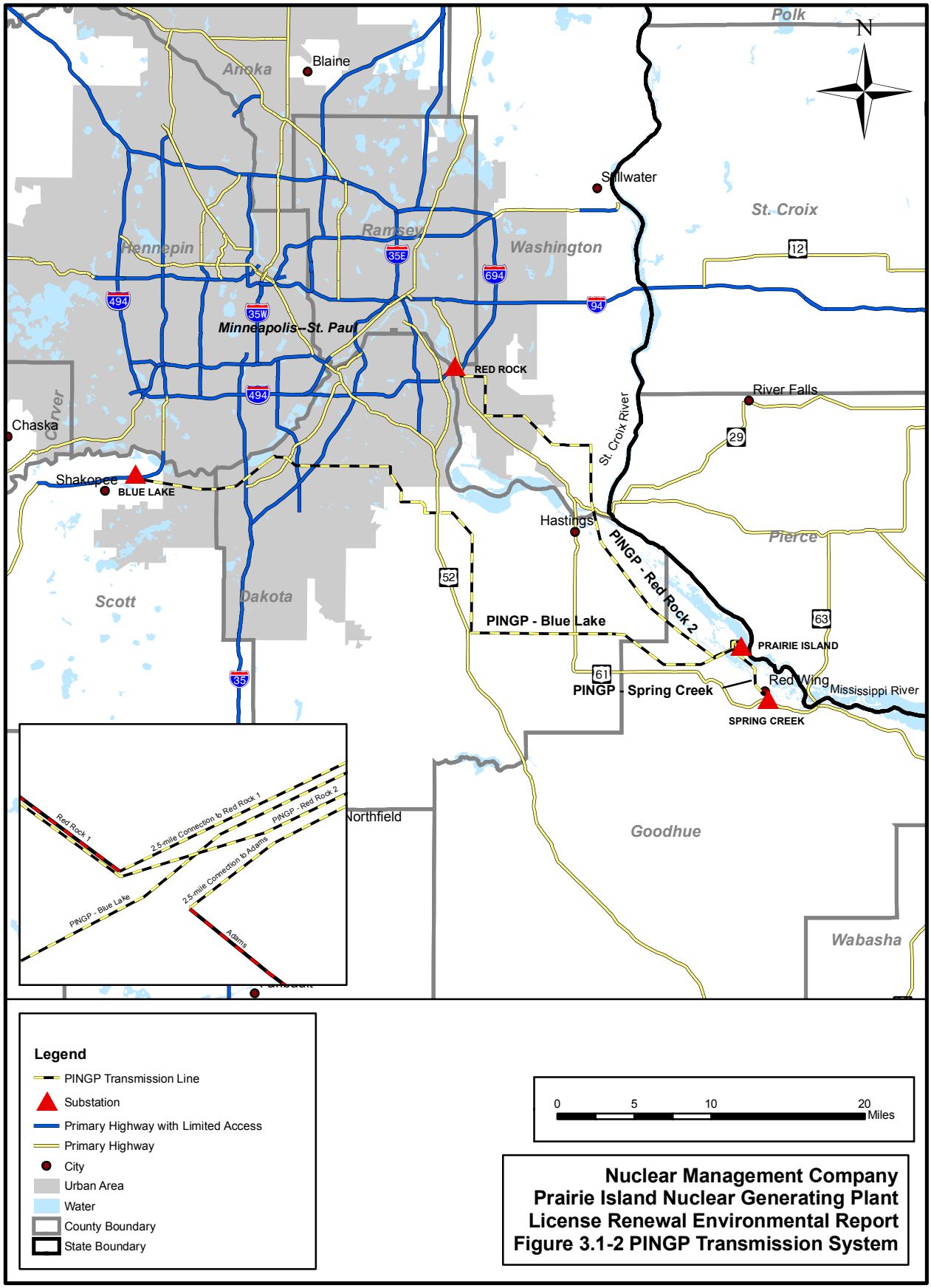
# TABLE 3.1-1
# TRANSMISSION LINES FROM PINGP SUBSTATION

| |
|---|
| **2.5-mile-long transmission line connection to Red Rock 1 (345-kV; Xcel Energy Line #0986)** |
| When the PINGP generating facilities were completed in 1973, the Red Rock – Adams line described in the 1971 Environmental Report Operating License Stage (OLER) (NSP 1971) was "split" to create two new 345-kV circuits, one running north from the plant to Red Rock and one running south from the plant to Adams. The 2.5-mile-long transmission line connection runs from PINGP to the Red Rock 1 line. It shares a 250-foot-wide corridor with the PINGP-Red Rock 2 line, PINGP-Blue Lake line, and the 2.5-mile-long transmission line connection to the Adams line. |
| **PINGP to Red Rock 2 (345-kV; Xcel Energy Line #0987)** |
| The Red Rock 2 line, described in the 1973 FES, connects PINGP to the Red Rock substation in St. Paul. It is approximately 32 miles long, and shares a corridor with three other lines for approximately 2.5 miles, then with the Red Rock 1 line for the remainder of its length. |
| **PINGP to Blue Lake (345-kV; Xcel Energy Line #0976)** |
| The Blue Lake Line, described in the 1973 FES, connects PINGP to the Blue Lake substation in Scott County. It is approximately 50 miles long, and is associated with a 150-foot-wide corridor. |
| **2.5-mile transmission line Connection to Adams (345-kV; Xcel Energy Line #0979)** |
| When the PINGP generating facilities were completed in 1973, the Red Rock – Adams line described in the 1971 OLER was "split" to create two new 345 kV circuits, one running north from the plant to Red Rock and one running south from the plant to Adams in Mower County. A 345-kV 2.5-mile-long transmission line connection to the Adams line was constructed from PINGP. This 2.5-mile-long transmission line connection shares a 250-foot wide corridor with the other 345-kV lines. |
| **PINGP to Spring Creek (161-kV; Great River Energy Line #5302)** |
| This 161-kV circuit, owned by Great River Energy, supplies power to the Red Wing, Minnesota area. It moves west from the PINGP switchyard, then turns to the southeast, extending to the Spring Creek substation, near Red Wing. The Spring Creek line is approximately 5 miles long, and runs through a 100-foot-wide corridor. |

## TABLE 3.4-1
## PINGP EMPLOYEES BY COUNTY

| County | Number of Employees (Permanent and Contract) | Percentage of Total Employees |
|---|---|---|
| Goodhue County, Minnesota | 329 | 48.0 |
| Dakota County, Minnesota | 139 | 20.3 |
| Pierce County, Wisconsin | 99 | 14.5 |
| Other | 118 | 17.2 |
| Total | 685 | 100.0 |


Prairie Island Indian Community
N
PINGP to Red Rock 2
2.5-mile Connection to Adams
PINGP to Spring Lake
PINGP to Blue Lake
2.5-mile Connection to Red Rock 1
Substation
Sturgeon Lake
256121
Intake Screenhouse
Plant Screenhouse
Intake Canal
256120
463332
402599
Entrance Road
Turbine Building
Auxiliary Building
Unit 2
Unit 1
Discharge Basin
Distribution Basin
Training Center
256074
ISFSI
611076
Return Canal
Discharge Canal
Cooling Towers
Legend
Production Well
Transmission Line
Plant Features
Local, Neighborhood, or Rural Road
Railroad
Prairie Island Indian Community
0
500
1,000
2,000
Feet
Nuclear Management Company
Prairie Island Nuclear Generating Plant
License Renewal Environmental Report
Figure 3.1-1 Station and Transmission Line Layout


Polk
N
Anoka
Blaine
Stillwater
St. Croix
Ramsey
Hennepin
Washington
35E
694
494
94
12
35W
Minneapolis–St. Paul
RED ROCK
River Falls
Carver
Chaska
St. Croix River
29
Shakopee
BLUE LAKE
Hastings
Pierce
PINGP - Red Rock 2
52
Scott
Dakota
PINGP - Blue Lake
63
PRAIRIE ISLAND
61
PINGP - Spring Creek
Red Wing
Mississippi River
SPRING CREEK
35
Northfield
Goodhue
Wabasha
Red Rock 1
2.5-mile Connection to Red Rock 1
PINGP - Red Rock 2
2.5-mile Connection to Adams
PINGP - Blue Lake
Adams
Legend
PINGP Transmission Line
Substation
Primary Highway with Limited Access
Primary Highway
City
Urban Area
Water
County Boundary
State Boundary
0
5
10
20
Miles
Nuclear Management Company
Prairie Island Nuclear Generating Plant
License Renewal Environmental Report
Figure 3.1-2 PINGP Transmission System

## 3.5 REFERENCES

Note to reader: This list of references identifies web pages and associated URLs where reference data was obtained. Some of these web pages may no longer be available or their URL addresses may have changed. NMC has maintained hard copies of the information and data obtained from the referenced web pages.

AEC (United States Atomic Energy Commission). 1973. *Final Environmental Statement related to the Prairie Island Nuclear Generating Plant*. Directorate of Licensing, Washington, DC. May.

AREVA. 2006. *Press release – AREVA Wins Contract for Two Replacement Steam Generators at Prairie Island Nuclear Generating Plant*. Available at http://www.areva-np.com/scripts/press/publigen/content/templates/show.asp?P=795&L=US. October 3.

Goddard, S.V. 1977. "Number and Composition of Birds Killed by Striking Transmission Lines from the Prairie Island Nuclear Generating Plant." *NSP 1976 Annual Report for the Prairie Island Nuclear Generating Plant.* Volume 2.

Goddard, S.V. 1978. "Number and Composition of Birds Killed by Striking Transmission Lines from the Prairie Island Nuclear Generating Plant." *Environmental Monitoring Program, 1977 Annual Report, Special Ecological Studies*. Prairie Island Nuclear Generating Plant.

Goddard, S.V. 1979. "Number and Composition of Birds Killed by Striking Transmission Lines from the Prairie Island Nuclear Generating Plant." *Environmental Monitoring and Ecological Studies Program, 1978 Annual Report, Volume 2*. Prairie Island Nuclear Generating Plant.

Great River Energy. 2006. *Stewardship and Other Initiatives*. Available at http://www.greatriverenergy.com/environment/stewardship.html.

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

MEQB (Minnesota Environmental Quality Board). 1991. *Final Environmental Impact Statement, Prairie Island Independent Spent Fuel Storage Installation*. April 12.

Minnesota Legislative Reference Library. 2006. *Resources on Minnesota Issues, Nuclear Waste Storage in Minnesota*. Available online at http://www.leg.state.mn.us/lrl/issues/prairieisland.asp. October.

NMC (Nuclear Management Company, LLC). 2007. *Prairie Island Nuclear Generating Plant Updated Safety Analysis Report, Revision 29*. May 4.

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

NRC (U.S. Nuclear Regulatory Commission). 2000. *Supplement 1 to NRC Regulatory Guide 4.2, Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses*. Office of Regulatory Research. Washington D.C. September.

NSPCM & FWS (Northern States Power Company-Minnesota and U.S. Fish and Wildlife Service). 2002. *Memorandum of Understanding*. April 19.

NSP (Northern States Power). 1971. *Environmental Report Operating License Stage, Prairie Island Nuclear Generating Plant Units 1 and 2*. May 12.

NSP (Northern States Power). 2006. *2005 DNR Annual Report of Water Use*. February 15.

Scientech. 2005. *Commercial Nuclear Power Plants, Edition No. 23*. July.

Stone & Webster (Stone & Webster Engineering Corporation). 1983. *Modify Circulating Water Intake and Discharge: System Description and Design Criteria*. Prepared for Northern States Power by Stone & Webster Engineering Corporation. Denver. April 1.

TtNUS (Tetra Tech NUS). 2006. *Calculation Package Water Use 2000 through 2005*. Prepared by Gary Gunter. August.

USDOJ (U.S. Department of Justice). 2002. *Historic Agreement between United States and Xcel Energy to Save Raptors from Electrocution in 12 States*. Available at http://www.usdoj.gov/opa/pr/2002/April/02_enrd_240.htm. April 19.

Xcel Energy. 2005. *Vegetation Management Guidelines*.

Xcel Energy. 2006a. *Proposal for Information Collection*. Prepared by Xcel Energy Environmental Services. July.

Xcel Energy. 2006b. *Environmental (Uniform Policy)*. January 23, 2006.

Xcel Energy. 2006c. *Waste Management Program Procedure/Waste Management Guidance Manual*. Prepared by Xcel Energy Environmental Services. February.

Xcel Energy. Undated. *Prairie Island Nuclear Plant Septic System Overview*.

# 4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS

**NRC**

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

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

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

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

## 4.1 BACKGROUND

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

- the environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic;

- a single significance level (i.e., small, moderate, or large) has been assigned to the impacts that would occur at any plant, regardless of which plant is being evaluated (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent-fuel disposal); and

- mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely to be not sufficiently beneficial to warrant implementation.

If the NRC analysis concluded that one or more of the Category 1 criteria could not be met, NRC designated the issue as Category 2. NRC requires plant-specific analyses for Category 2 issues (NRC 2000).

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

As discussed later in Chapter 5, NMC is not aware of any new and significant information that would make NRC findings regarding Category 1 issues inapplicable to PINGP. An applicant may reference the generic findings or GEIS analyses for Category 1 issues. Attachment A of this report lists the 92 issues and identifies the environmental report section that addresses each issue.

### 4.1.1 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 analyses for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant's environmental report for license renewal…." 61 FR 109, June 15, 1996**

NMC has determined that seven of the 69 Category 1 issues do not apply to PINGP because they are specific to design or operational features that are not found at the facility. Attachment A, Table A-1 lists the 69 Category 1 issues, indicates whether or not each issue is applicable to PINGP, and if inapplicable provides the basis for this determination. Attachment A, Table A-1 also includes references to supporting analyses in the GEIS where appropriate.

NMC has not identified any new and significant information that would make the NRC findings, with respect to Category 1 issues, inapplicable to PINGP. Therefore, NMC adopts by reference the NRC findings for these Category 1 issues.

### 4.1.2 CATEGORY 2 LICENSE RENEWAL ISSUES

**NRC**

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

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

NRC designated 21 issues as Category 2. Sections 4.2 through 4.17 address the Category 2 issues, beginning with a statement of the issue. As is the case with Category 1 issues, two Category 2 issues apply to operational features that PINGP

does not have. If the issue does not apply to PINGP, the section explains the basis for inapplicability.

For the 19 Category 2 issues that NMC has determined to be applicable to PINGP, the appropriate sections contain the required analyses. These analyses include conclusions regarding the significance of the impacts relative to the renewal of the operating licenses for PINGP and, if applicable, discuss potential mitigation 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 important attributes of the resource.

In accordance with National Environmental Policy Act (NEPA) 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).

### 4.1.3 "NA" LICENSE RENEWAL ISSUES

NRC determined that its categorization and impact-finding definitions did not apply to Issues 60 and 92; however, NMC included these issues in Table A-1. NRC noted that applicants currently do not need to submit information on Issue 60, chronic effects from electromagnetic fields (10 CFR 51). For Issue 92, environmental justice, NRC does not require information from applicants, but noted that it will be addressed in individual license renewal reviews (10 CFR 51). NMC has included environmental justice demographic information in Section 2.5.3.

## 4.2 SURFACE WATER AND GROUNDWATER USE CONFLICTS

NRC categorized surface water and groundwater use conflicts in the GEIS as Category 2 issues for plants located on a small river because the significance of impacts of cooling tower makeup water withdrawals on aquatic biota (Issue 13) and alluvial aquifers (Issue 34) could not be determined without site-specific information. Consultations with regulatory agencies by NRC indicated that surface water use conflicts represented by Issue 13 were a concern at two closed-cycle plants (Limerick and Palo Verde) and could present a future problem at other plants. In particular, NRC indicates in the GEIS that some plants equipped with cooling towers and located on small rivers are susceptible to droughts or competing water uses (NRC 1996, Section 4.3.2.1). Additionally, the consumptive water loss resulting from operation of these plants may represent a substantial proportion of the river flow, with consequent potential for adverse impact on aquatic and riparian ecological communities (e.g., by reducing available aquatic habitat or dewatering riparian zone wetlands through lowered water levels). Similarly, these flow reductions could result in indirect groundwater use conflicts by reducing availability of groundwater in associated alluvial aquifers (NRC 1996, Section 4.8.1.3).

As discussed in Section 3.1.3, PINGP uses a system that can be operated in any one of three modes: open cycle (once-through flow, with no cooling towers in operation), helper cycle (once-through flow with cooling towers in operation), and closed-cycle (recirculation of up to 95 percent of the cooling water flow). Cooling water lost to cooling tower evaporation and blowdown is replaced by make-up water pumped from the Mississippi River. The site's blowdown is returned to the river via an NPDES-permitted outfall on the discharge canal. The system includes an arrangement of intake, recycle, and discharge canals that can be operated to re-use circulating water during times of the year, primarily winter and spring months. A separate line is also provided to supply condenser outlet water to the front of the new intake screenhouse for de-icing purposes during winter months.

Based on data from water years 1928 to 2005, the annual mean flow of the Mississippi River at the closest U.S. Geological Survey upstream gaging station (Prescott) is 18,380 cubic feet per second (cfs) ($5.8 \times 10^{11}$ cubic feet per year) (USGS 2006), which means that the Mississippi River meets the NRC definition of a small river at PINGP.

## 4.2.1 IMPACT ON MISSISSIPPI RIVER FLOWS AND WATER LEVELS

**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 $3.15\times10^{12}$ $ft^3$ / year ($9\times10^{10}$ $m^3$/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**

Flow in the reach of the Mississippi adjacent to PINGP is controlled in part by the Army Corps of Engineers Lock and Dam 3, which creates a pool that extends upstream to Lock and Dam 2, and also influences stream levels in the St. Croix River. During the initial rise in pool level, Sturgeon Lake was created by the flooding of low lying areas in the floodplain adjacent to the Mississippi River. The lock and dam was created by the Army Corps of Engineers as part of a flood control and navigation project (AEC 1973, pp. II-32 to II- 42). At PINGP, the surface water withdrawal from the Mississippi River (Sturgeon Lake) occurred at an average rate of approximately 381,031 gallons per minute (gpm) (849 cfs) (TtNUS 2006) for the period from 2000 through 2005 (Table 4.2-1). PINGP's water withdrawal from the Mississippi River represents approximately 4.6 percent of the average river flow (18,380 cfs) and 11 percent of the lowest annual mean (7,656 cfs in 1977) at Prescott since completion of Lock and Dam 3 in 1938. The rate of consumptive use at PINGP is 39 cfs. This value is the difference between PINGP's surface water withdrawal and the average annual blowdown rate discharged under the site's NPDES permit back to the river or the amount of water consumed by PINGP. The 39 cfs represents approximately 5 percent of PINGP's average river withdrawal during the 2000 to 2005 period. This rate of consumptive use represents approximately 0.2 percent of the Mississippi River's annual average flow and approximately 0.5 percent of the lowest annual mean at Prescott (TtNUS 2006). The storage capacity curve for this section of the river shows that the consumption of 39 cfs (Table 4.2-1, 849 cfs – 810 cfs = 39 cfs) translates into a maximum local water elevation decrease of approximately 0.1 inch. Under normal circumstances, consumptive use of water at PINGP (evaporative losses from cooling towers) represent a small reduction in Mississippi River flow and an imperceptible (0.1 inch) reduction in stream level. A reduction in flow (or stream level) of this magnitude would have only SMALL impacts on instream and riparian ecological communities.

## 4.2.2 INDIRECT IMPACTS FROM SURFACE WATER USE

**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 $3.15\times10^{12}$ $ft^3$ / year ($9\times10^{10}$ $m^3$/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)**

**"…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**

The alluvial aquifer in the vicinity of the PINGP site was described in Section 2.2.2 of this ER. This aquifer consists of the unconsolidated sediments and alluvial material isolated within the Mississippi River channel.

The rate of consumptive use of water at PINGP is small compared to average monthly discharges at Lock and Dam 3, which ranged from 10,425 (January) to 39,562 cfs (May) in the 1995 to 2006 period (Table 2.2-3). A consumptive loss of 39 cfs relates to 0.1 percent and 0.4 percent of the highest monthly and lowest monthly average flow at Lock and Dam 3. The average consumptive use relates to a decrease in pool level at Pool 3 of 0.1 inch. The loss of cooling water through evaporation has no significant effect on Mississippi River flows, pool level, or on the adjacent alluvial aquifer. In addition, most groundwater in the vicinity of PINGP is withdrawn from the deeper confined aquifer, not from the alluvium along the Mississippi River. Therefore, NMC concludes that impacts of withdrawing water from the river on the alluvial aquifer would be SMALL and that mitigation measures would not be warranted.

### 4.2.3 GROUNDWATER USE CONFLICTS (PLANTS USING >100 GPM OF GROUNDWATER)

**NRC**

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

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

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

Based on information presented in Section 2.2, PINGP used an annual average of approximately 92 gpm of groundwater from 2000 through 2005. However, during 2005, PINGP pumped 118 gpm of groundwater.

In order to determine potential offsite impacts to wells, the 118 gpm well yield from 2005 was used to calculate drawdown as though it had been pumped from a single onsite well. Well 256121 (Installation 122) (Figure 3.1-1) was used, due to its close proximity to the PINGP property boundary (approximately 1,800 feet) and its proximity to the closest off-site residence (approximately 2,100 feet). The well is also one of the site's primary production wells. Data used to input to an analytical in-well drawdown model for an unconfined aquifer was taken from PINGP's Updated Safety Analysis Report (NMC 2007, Appendix E) as indicated in Section 2.2. The calculated drawdown for Well 256121 represents a small portion of the saturated thickness of the unconfined aquifer. This allowed a confined aquifer scenario to be used to simulate site conditions. The equations used in the calculations assume that the aquifer is homogeneous, isotopic, with negligible recharge and gradient, and that boundary impacts do not occur. Assuming minimal recharge made the scenario very conservative. It was also assumed that the pumping rate used in the modeling (118 gpm) was consistent from the initial startup period. Based on the conservative results of the modeling, pumping at a rate of 118 gpm in Well 256121 would create a stabilized drawdown of 0.4 foot at a distance of 2,100 feet from the pumping well during the first 10 years of plant operations. Based on the modeling performed, there would be no additional drawdown that would occur over the period of the current operating license (40 year period) or during the license renewal period (additional 20 years) (TtNUS 2006). Based on the predicted conservative drawdown (0.4 foot) that would occur during the life of the current operating permit and the fact that no additional drawdown would occur during the license renewal period,

NMC concludes that the impacts to the aquifer system over the license renewal period would be SMALL and mitigation, such as drilling wells deeper, would be unwarranted.

### 4.2.4 GROUNDWATER USE CONFLICTS (PLANTS USING RANNEY WELLS)

**NRC**

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

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

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

The issue of groundwater use conflicts does not apply to PINGP because the plant does not use Ranney wells.

## 4.2.5 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 tends to concentrate constituents (ions, dissolved solids, minerals, contaminants) in water. In turn, seepage into the water table aquifer could degrade groundwater quality.

The issue of groundwater degradation does not apply to PINGP because the plant does not use cooling ponds.

### 4.2.6 CONCLUSIONS

In view of these considerations, NMC concludes that consumptive losses of water from the Mississippi River would not significantly reduce river flow or affect surface water elevation, and would have no significant impact on the associated alluvial aquifer (Issue 34) or aquatic or riparian ecological communities (Issue 13) described in Section 2.3 of this ER. Hence, there would be no substantial impacts to mitigate. Also, the limited projected drawdown associated with the PINGP site's groundwater use would not create significant potential impacts on nearby groundwater users (Issue 33). Because the definition of "SMALL" includes impacts that are not detectable, the appropriate characterization of the impacts from consumptive surface water and groundwater use is SMALL, and further mitigation would be unwarranted.

## 4.3 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 can not 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 from entrainment a Category 2 issue, because it could not assign a single significance level to the issue. The impacts of entrainment are small at many plants, but they may be moderate or large at others. Also, ongoing restoration efforts may increase the number of fish susceptible to intake effects during the license renewal period (NRC 1996, 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.

PINGP was designed to allow open-cycle, closed-cycle, or helper-cycle operation, but was originally intended to operate as a closed-cycle plant "to the maximum extent practicable" (AEC 1973, p. iv). Discussions and negotiations with resource and regulatory agencies produced agreement on a conceptual cooling system design that was subsequently installed and permitted in the early 1980s. This design, which addressed both operational constraints and environmental concerns, included a new screenhouse (with fine-mesh screening and continuous low-pressure wash capabilities during critical periods of the year) and new discharge configuration. Section 3.1.3 discusses these modifications in more detail.

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

Northern States Power (NSP) submitted its original 316(b) demonstration to the Minnesota Pollution Control Agency (MPCA) in late 1976. The 316(b) demonstration concluded that "Fish entrainment losses represent such low percentages of ambient (local) populations that no short or long term effects are expected to be detectable."

(NUS Corporation 1976, page 9, Summary). After reviewing the 316(b) Demonstration and several annual environmental (monitoring) reports, MPCA issued a Public Notice on November 27, 1980 relating to issuance of draft National Pollutant Discharge Elimination System (NPDES) permit number MN0004006 to PINGP. The Public Notice made clear that issuance of the permit was contingent upon construction of new cooling water intake and discharge structures "to mitigate present impacts and minimize future impacts of the aquatic biota."

The NPDES permit issued to PINGP by the MPCA in January 1981 noted that it would be necessary for NSP to build an "alternate" (new or modified) cooling water intake structure "…designed to minimize the mortality of entrained and impinged fish." The NPDES permit stipulated certain essential features and design criteria for the alternate cooling water intake structure, as follows:

"The alternate structure shall include and employ the use of fine mesh screens and a low pressure wash, fish buckets and fish return system, and shall be constructed to eliminate the access of fish to the recirculating cooling water canal…minimum design criteria shall include a screen face velocity of 0.5 feet per second at a discharge rate of 800 cubic feet per second using 0.5 millimeter mesh screens."

Source: PINGP NPDES Permit No. MN 0004006, issued Jan. 19, 1981

In addition to these required hardware changes, the NPDES permit issued to PINGP in 1981 also imposed limits on plant flow/withdrawal of cooling water over the April 1 – June 30 period that were to go into effect once the new cooling water intake structure was completed:

- April 1 - 30 150 cubic feet per second (97 MGD)
- May 1 - 31 300 cfs (194 MGD)
- June 1 - 15 400 cfs (259 MGD)
- June 16 - 30 800 cfs (517.5 MGD)

The 1981 PINGP NPDES permit also mandated operation with fine mesh screens over the period April 16 – August 31. Finally, the 1981 permit required a (condenser) cooling water intake study to evaluate the effectiveness of the new cooling water intake system in reducing entrainment and impingement. Aside from determining survival rates of impinged fish, the study was intended to determine the optimum fine mesh screen size (one that would promote survival of impinged larval and juvenile fish and not create extreme clogging problems) and examine how often fine-mesh traveling screens would have to be rotated to operate as designed.

These design changes along with flow/withdrawal restrictions in spring and early summer were intended to reduce both entrainment and impingement mortality. The fine mesh screens and withdrawal limits were intended to reduce entrainment of early life

stages of fish. The lower through-screen velocities were intended to reduce impingement. The fish return system was intended to minimize mortality of larval fish, juvenile fish, and adult fish impinged on the fine-mesh screens (and larger fish impinged on coarse-mesh screens). NSP completed the MPCA-mandated modifications of the Cooling Water Intake System (CWIS) in 1983.

The flow/withdrawal restrictions in the current NPDES permit mirror those imposed in 1981, except for the month of April. Based on discussions with state agencies and studies conducted in the 1980s that showed low impingement rates and high impingement survival in April, NSP asked MPCA to apply the withdrawal restrictions on April 15 rather than April 1 and to raise the April withdrawal limit to 300 cfs (Bodensteiner 1991). The NPDES permit issued to PINGP in December 1991 incorporated this recommendation, but tied higher April withdrawals to river flows. The 1994 permit limited cooling water flow/withdrawals over the April 15-30 period to 300 cfs when river flow was 15,000 cfs or higher and 150 cfs when the river flow was lower than 15,000 cfs. When the NPDES permit was renewed in May 2000, the withdrawal limits were expressed in millions of gallons per day rather than cubic feet per second, which helped provide consistency with existing plant operations and protocols, as a maximum instantaneous value was not stipulated.

The current PINGP NPDES permit, like the 1981 permit, contains specific requirements related to intake screen operation. The plant is allowed to operate with 3/8-inch mesh screens over the period September 1 – March 31, but must employ fine mesh (0.5 mm) screens over the April 1 – August 31 period to “minimize mortality of fish and other organisms” (NPDES Permit No. MN0004006, Chapter 5, Section 4.1).

Thus the current PINGP NPDES permit (Attachment B), which was issued June 30, 2006 and expires August 31, 2010, reflects major modifications in design and operation of the CWIS made in the early 1980s to minimize entrainment and impingement mortality and constitutes the current CWA Section 316(b) determination for PINGP and reflects the cumulative results of about 30 years of study at the site. For this reason, NMC concludes that impacts of entrainment of fish and shellfish at PINGP are SMALL and warrant no mitigation beyond that already in place and required by the current NPDES permit.

The U.S. Environmental Protection Agency (EPA) issued new regulations in 2004 regarding design and operation of CWIS at large existing power-generating facilities, like PINGP, designed to withdraw 50 million gallons a day or more of cooling water (69 FR 131, pp. 41576-41653). These regulations, implementing Section 316(b) of the Clean Water Act, were intended to ensure that the “location, design, construction, and capacity of cooling water intake structures reflect the best technology available to protect aquatic organisms from being killed or injured by impingement…or entrainment…” (EPA 2004). Prior to 2004, state NPDES permitting authorities relied on draft Section 316(b) regulations issued, but never promulgated, in 1976 or made decisions on a “case-by-case, site-specific basis” (69 FR 131, p. 41584).

The NPDES permit issued to PINGP in June 2006 contained a list of required 316(b)-related submittals, all due October 28, 2006. To facilitate its 316(b) planning, Xcel Energy prepared the required Proposal for Information Collection well in advance of the October 28 deadline, and submitted it to the MPCA in July 2006 (Xcel Energy 2006a). Xcel Energy submitted a comprehensive demonstration study (CDS) on October 27, 2006 in accordance with 40 CFR 125.95 that characterized entrainment and impingement mortality, described the operation of the CWIS, and asserted that the technologies and operational measures in place at PINGP satisfy the applicable requirements (performance standards) at 40 CFR 125.94. Xcel Energy selected Compliance Alternative (2) of 40 CFR 125.94(a) to meet the impingement and entrainment reduction requirements for PINGP (Xcel Energy 2006b). Alternative (2) requires that applicants demonstrate that existing design and construction technologies, operational measures, and/or restoration measures meet the impingement and entrainment performance standards.

The CDS submitted in October 2006 indicated that entrainment performance standards were satisfied by installation and use of 0.5 mm (fine) mesh screens at the intake screenhouse over the April-August period. Fine-mesh screens collect drifting eggs and larvae of most, if not all, fish species that spawn in the vicinity of PINGP, preventing their entrainment. As discussed in the CDS, studies of entrainment at PINGP before fine-mesh screens were installed and studies of “backwash” samples after fine-mesh screens were installed provided additional evidence for the effectiveness of the fine-mesh screens in reducing impacts of entrainment (Xcel Energy 2006b).

In January 2007, the U.S. Court of Appeals for the Second Circuit remanded the EPA’s 2004 rule. On July 9, 2007, EPA published a notice in the Federal Register (72 FR 130) formally suspending the Phase II regulation.

Based on informal communications between Xcel Energy and MPCA, the agency completed a preliminary review of the 316(b) submittal before the Phase II regulation was suspended and determined that PINGP’s CWIS design and operation represented Best Technology Available. MPCA has indicated, informally, that it has no plans to review the submittal further, pending further rulemaking. However, the MPCA may re-open and modify the permit at any time if they see a need.

Attachment B contains relevant portions of the current NPDES permit. Based on the existing 316(b) demonstration and determination, as supported by the results of the recent studies, NMC concluded that any environmental impact from entrainment of fish and shellfish in early life stages at PINGP is SMALL and does not require further mitigation.

## 4.4 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 can not 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. The impacts of impingement are small at many plants, but they may be moderate or large at others (NRC 1996, Section 4.2.2.1.3). Information needing to be ascertained includes: (1) type of cooling system (whether once-through or cooling pond), and (2) status of CWA Section 316(b) determination or equivalent state documentation.

PINGP was designed to allow open-cycle, closed-cycle, or helper-cycle operation, but was originally intended to operate as a closed-cycle plant "to the maximum extent practicable" (AEC 1973, p. iv). Discussions and negotiations with resource and regulatory agencies produced agreement on a conceptual cooling system design that was subsequently installed and permitted in the early 1980s. This design, which addressed both operational constraints and environmental concerns, included a new screenhouse (with fine-mesh screening and continuous low-pressure wash capabilities during critical periods of the year) and new discharge configuration. Section 3.1.3 discusses these modifications in more detail.

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). Impingement of fish and shellfish on traveling screens at cooling water intake structures is a potential adverse environmental impact that can be minimized by the best available technology.

As noted in Section 4.2, Northern States Power submitted its original 316(b) demonstration to the MPCA in late 1976. With regard to impingement, the 316(b) demonstration concluded that "…numbers of young fish impinged per year appear to represent only a small percentage increase in the mortality resulting from natural causes and fishing" (NUS Corporation 1976, page 9 of Summary). As regards important sport fish, the report asserts that "…numbers of young white bass, walleye, and sauger impinged are approximately 0.2 percent of their adult populations in the region and represent an even smaller percentage loss of recruitment into the sport fishery." After reviewing the 316(b) Demonstration and several annual environmental

(monitoring) reports, MPCA issued a Public Notice on November 27, 1980 relating to issuance of draft NPDES permit number MN0004006 to PINGP. The Public Notice made clear that issuance of the permit was contingent upon construction of new cooling water intake and discharge structures "...to mitigate present impacts and minimize future impacts of the aquatic biota."

As discussed in Section 4.2, the NPDES permit issued to PINGP by the MPCA in 1981 required NSP to modify its cooling water intake structure to reduce the mortality of entrained and impinged fish. The MPCA directed NSP to retrofit its CWIS with fine-mesh screens, a continuous low-pressure wash system, fish buckets/trays, and a fish return system. The 1981 NPDES permit also imposed limits on plant flow/withdrawal of cooling water over the April 1 – June 30 period that were to go into effect once the new cooling water intake structure was completed and mandated operation with fine mesh screens over the period April 16 – August 31.

These design changes and spring/early summer flow/withdrawal restrictions were intended to reduce both entrainment and impingement mortality. The fine mesh screens and withdrawal limits were intended to reduce entrainment of early life stages of fish. The lower through-screen velocities were intended to reduce both entrainment and impingement. The fish return system was intended to minimize mortality of larval fish, juvenile fish, and adult fish impinged on the fine-mesh screens (and larger fish impinged on coarse-mesh screens). NSP completed the MPCA-mandated modifications of the CWIS in 1983.

The flow/withdrawal restrictions in the current NPDES permit mirror those imposed in 1981, except for the month of April. Based on studies conducted in the 1980s that showed low impingement rates and high impingement survival in April, NSP asked MPCA to apply the withdrawal restrictions on April 15 rather than April 1 and to raise the April withdrawal limit to 300 cfs (Bodensteiner 1991). The NPDES permit issued to PINGP in December 1991 incorporated this recommendation, but tied higher April withdrawals to river flows. Permits since 1991 have limited cooling water flow/withdrawals over the April 15-30 period to 300 cfs when river flow is 15,000 cfs or higher and 150 cfs when the river flow is lower than 15,000 cfs. The current permit was changed to MGD.

The current PINGP NPDES permit, like the 1981 permit, contains specific requirements related to intake screen operation. The plant is allowed to operate with 3/8-inch mesh screens over the period September 1 – March 31, but must employ fine mesh (0.5 mm) screens over the April 1 – August 31 period to "minimize mortality of fish and other organisms" (NPDES Permit No. MN0004006, Chapter 6, Section 4.2).

Thus the current PINGP NPDES permit (Attachment B), which was issued June 30, 2006 and expires August 31, 2010, reflects major modifications in design and operation of the CWIS made in the early 1980s to minimize entrainment and impingement mortality and constitutes the current CWA Section 316(b) determination for PINGP. For this reason, NMC concludes that impacts of impingement of fish and shellfish at the

PINGP CWIS are SMALL and warrant no mitigation beyond that already in place and required by the current NPDES permit.

As discussed in Section 4.2, Xcel Energy has compiled information to demonstrate compliance with EPA's Final Regulations for Cooling Water Intake Structures at Phase II Existing Facilities. Xcel Energy has selected Compliance Alternative (2) of 40 CFR 125.94(a) to meet the impingement and entrainment reduction requirements for PINGP. Alternative (2) requires that applicants demonstrate that existing design and construction technologies, operational measures, and/or restoration measures meet the impingement and entrainment performance standards. Xcel Energy submitted a comprehensive demonstration study (CDS) in accordance with 40 CFR 125.95 that characterized impingement mortality and entrainment, described the operation of the CWIS, and asserted that the technologies and operational measures in place at PINGP satisfy the applicable requirements (performance standards) at 40 CFR 125.94.

With regard to impingement, the CDS noted that 71.5 percent of juvenile and adult fish impinged on fine mesh screens at PINGP survive. When the survival rate was adjusted for sampling-induced mortality, the survival rate increased to more than 80 percent. Operational measures (reduced rates of cooling water withdrawal in April, May, and June) were also assumed to substantially reduce impingement mortality during the period of highest larval densities. The CDS concluded that "based on survival studies, sampling induced mortality studies, and operational measures, PINGP meets the impingement standards set forth by the 316(b) rule."

In January 2007, the U.S. Court of Appeals for the Second Circuit remanded the EPA's 2004 rule. On July 9, 2007, EPA published a notice in the Federal Register (72 FR 130) formally suspending the Phase II regulation.

Based on informal communications between Xcel Energy and MPCA, the agency completed a preliminary review of the 316(b) submittal before the Phase II regulation was suspended and determined that PINGP's CWIS design and operation represented Best Technology Available. MPCA has indicated, informally, that it has no plans to review the submittal further, pending further rulemaking.

Attachment B contains relevant portions of the current NPDES permit. Based on the existing 316(b) demonstration and determination as supported by the results of the recent studies, NMC concludes any environmental impact from impingement of fish and shellfish at PINGP is SMALL and does not require further mitigation.

## 4.5 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 from heat shock a Category 2 issue, because of continuing concerns about thermal discharge effects and the possible need to modify thermal discharges in the future in response to changing environmental conditions (NRC 1996). Information to be ascertained includes: (1) type of cooling system (whether once-through or cooling pond), and (2) evidence of a CWA Section 316(a) variance or equivalent state documentation.

As described in Section 3.1.3, PINGP was designed to operate as a closed-cycle or open-cycle plant, depending on environmental conditions (river flow and water temperature) and certain operational constraints. The plant withdraws condenser cooling water from the Mississippi River and discharges to the same waterbody approximately 0.5 mile downstream of the plant intake, to prevent recirculation of heated water.

Section 316(a) of the Clean Water Act provides for alternate thermal effluent limitations when operators of facilities can demonstrate that state thermal standards are more stringent than necessary to assure "protection and propagation of a balanced indigenous population of fish and shellfish." These alternate thermal effluent limits represent a "variance" from established state water quality standards.

NSP submitted its original 316(a) demonstration to MPCA in August 1978 (HDR 1978). The 316(a) demonstration concluded that "the thermal discharge resulting from past operation of PINGP has not caused appreciable harm to any aquatic organisms, and the protection and propagation of a balanced, indigenous biota has been maintained. In the future, the discharge plume is predicted to cause neither appreciable harm nor adverse levels of impact to aquatic biota" (HDR 1978, page VII-3). However, the 316(a) demonstration acknowledged that thermal modeling had shown the plant would not be able to meet proposed NPDES thermal limits under certain extreme circumstances and would be forced to seek a variance to the proposed thermal limits "to meet the thermal criteria without derating the plant" (HDR 1978, page I-6).

After reviewing the 316(a) Demonstration and several annual environmental (monitoring) reports, MPCA issued a Public Notice on November 27, 1980 relating to

issuance of draft NPDES permit number MN0004006 to PINGP. The Public Notice made clear that issuance of the permit was contingent upon construction of new cooling water intake and discharge structures "to mitigate present impacts and minimize future impacts of the aquatic biota."

The NPDES permit issued to PINGP by the MPCA in 1981 noted that it would be necessary for NSP to build a "new discharge structure downstream from Barney's Point to reduce the potential for cold shock." The 1981 permit contained interim thermal limitations for operation prior to completion of the new discharge structure, and final limitations, which were to take effect on the day the discharge structure became operational. The 1981 NPDES permit included requirements to:

- Operate all cooling towers to the maximum practical extent from April 1 through November 30 so that the temperature of receiving waters immediately below Lock and Dam 3 is raised no more than 5°F above "natural" (ambient upstream) and in no case exceeds a daily average temperature of 86°F.

- Not raise the mixed river temperature immediately below Lock and Dam 3 above 43°F for an extended period of time after the fall trigger point (average upstream ambient river temperature at or below 43°F for five consecutive days). Should temperature equal or exceed 43°F immediately below Lock and Dam 3 for two consecutive days, NSP must notify the Director of MPCA and Minnesota Department of Natural Resources.

- Minimize to the extent practical abrupt temperature changes in the discharge to reduce the potential for cold shock in receiving water.

- Monitor mixed river temperature immediately below Lock and Dam 3 continuously.

The new discharge structure, completed in 1983, was designed specifically to be protective of local fish populations. Its design incorporated features intended to promote mixing of the heated effluent with receiving water and eliminate recirculation to the intake area. The terminus (sluice gates) of the new discharge canal was 2,150 feet downstream of the original discharge canal and used underground pipes to convey heated effluent from the discharge structure to the Mississippi River. The new discharge canal is closed off from the Mississippi River by a dike, whereas the original discharge canal was open to the Mississippi River. Heated effluent moves through the discharge pipes to the river at a velocity of 8 to 10 feet per second, which ensures rapid mixing and prevents fish from entering the pipes and moving into the discharge canal. The new configuration was also intended to prevent recirculation of heated water back to the intake area, removing a possible attractant to fish and increasing system efficiency (Stone & Webster 1983).

Permits issued to NSP prior to 1991 required PINGP to operate all cooling towers to the maximum practical extent from April 1 through October 31 so as not to raise the temperature of the receiving waters immediately below Lock and Dam 3 by more than

5°F above ambient. They also established a year-round limit of 86°F (daily average) on the temperature of the receiving waters. Based on results of fish studies conducted by NSP and submitted to MPCA, the permit issued in 1991 relaxed this requirement, requiring only that cooling towers be operated (the word "all" was removed) so as to meet the 5°F and 86°F limits. To ensure that cooling towers were operated during extremely warm periods, MPCA retained the requirement that all cooling towers would be operated in the event that ambient river temperatures reached 78°F for two consecutive days.

Thermal limitations in the current NPDES permit, issued in June 2006, are similar to those in the 1991 and 1995 permits. Thermal limits in the current permit are keyed to temperatures in the Mississippi River up- and downstream of the plant and are referred to in the permit as spring and fall "trigger points." From April 1 through the fall "trigger point" (when daily average upstream river temperature falls below 43°F for five consecutive days) PINGP is required to operate cooling towers in such a way that:

- Water temperature below Lock and Dam 3 (Outfall SW 001) is not raised more than 5 degrees above ambient (upstream) temperature, and

- Water temperature below Lock and Dam 3 (Outfall SW 001) does not exceed a daily average of 86°F

Also, if ambient (upstream) temperatures reach or exceed 78°F for two days, PINGP is required to operate cooling towers "to the maximum extent practicable" (NPDES Permit No. MN0004006, Chapter 6, Section 2.3), meaning two cooling towers per operating unit.

From the date of the fall trigger point (see above) through March 31, PINGP is not allowed to raise the temperature of the water below Lock and Dam 3 (Outfall SW 001) above 43°F "for an extended period of time" (NPDES Permit No. MN0004006, Chapter 6, Section 2.4). Should the temperature exceed 43°F for two consecutive days, PINGP is required to notify both the Minnesota Pollution Control Agency and the Minnesota Department of Natural Resources, and, having done so, may be required to operate cooling towers until such time as the 43°F criteria is met. From April 1 or once the spring trigger point (>43°F for five consecutive days) is reached, plant thermal limits default to those of Section 2.3, above (maximum discharge temperature of 86°F, maximum delta-T of 5°F).

The current NPDES permit therefore reflects fishery study data and subsequent major modifications to the discharge structure in the early 1980s and subsequent NPDES-related changes in plant operations designed to reduce thermal impacts to aquatic populations, specifically the potential for fish kills in the discharge canal due to sudden temperature changes. Based on the 316(a) variance and supporting documentation, and consistent with the thermal effluent limitations in the current NPDES permit, NMC concludes that heat shock impacts are SMALL and no further mitigation is necessary.

## 4.6 IMPACTS OF REFURBISHMENT ON TERRESTRIAL RESOURCES

**NRC**

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

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

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

NRC made impacts to terrestrial resources from refurbishment a Category 2 issue, because the significance of ecological impacts cannot be determined without considering site- and project-specific details (NRC 1996, Section 3.6). Aspects of the site and project to be ascertained are: (1) the nature of refurbishment activities, (2) the identification of important ecological resources, and (3) the extent of impacts to plant and animal habitats.

The only license-renewal related construction activities anticipated are those associated with the replacement of the Unit 2 steam generators in 2013, as discussed in Section 3.2. These one-time activities would occur in a developed area that is devoid of natural habitats. Foraging birds such as pigeons and European starlings, which are especially common in developed areas of PINGP, could be temporarily displaced by noise, machinery, and personnel associated with refurbishment activities, but such disturbances would be temporary and minor.

Peregrine falcons (state-listed as threatened), have nested on the Unit 1 containment dome at PINGP annually since 1997. More than 30 peregrine falcons have fledged from this nest since 1997. The peregrine falcon nesting season at PINGP extends roughly from March through July. Peregrine falcons vary greatly in responsiveness to human activities, depending on individual characteristics and environmental circumstances. Breeding pairs in remote locations are especially sensitive to human disturbance, while those in areas frequently visited by humans or urban areas become habituated to close human activities. Many cities in North America have recently had peregrine falcons nesting on ledges of tall buildings and under bridges in densely populated urban areas (UM 2002, White et al. 2002). Refurbishment activities during the nesting season could startle nesting peregrine falcons at PINGP, but these birds have presumably become habituated to activities at PINGP, including movement of personnel and machinery and loud noise. In addition, the nest is not near the ground but is instead high atop the containment dome, which serves to mitigate potential disturbances that might occur if the nest were lower. Furthermore, Xcel Energy plans to

conduct the Unit 2 steam generator replacement outside the March through July falcon breeding period. Thus, the steam generator replacement project will not impact falcon breeding activities. In summary, NMC concludes that impacts to terrestrial resources from refurbishment activities would be SMALL and do not warrant mitigation.

## 4.7 THREATENED AND ENDANGERED SPECIES

**NRC**

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

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

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

Section 2.3.1 of this Environmental Report describes the aquatic communities of Pool 3 of the Mississippi River, including Sturgeon Lake. Section 2.3.2 describes important terrestrial habitats at PINGP and along the associated transmission corridors. Section 2.3.3 discusses threatened or endangered species that occur or may occur in the vicinity of PINGP and along associated transmission corridors.

In May 2007, NMC submitted a request to Minnesota DNR's Natural Heritage and Nongame Research Program seeking information on special-status plant and animal species in the vicinity of PINGP and associated transmission corridors. Minnesota DNR subsequently sent NMC information on occurrences of special-status species within a mile of the PINGP boundary and within a mile of PINGP transmission corridors (MN DNR 2007a, b). For the purposes of its environmental review, Minnesota DNR considered species in Township 113N, Range 15W, Sections 4 and 5 to be within one mile of the plant boundary. One federally listed species (Higgins Eye pearlymussel) and six state-listed species [peregrine falcon, Blanding's turtle, paddlefish, mucket (mussel), washboard (mussel), and butterfly (mussel)] were identified as occurring within one mile of PINGP and are the focus of the discussion of potential operational impacts that follows.

### *Higgins Eye pearlymussel*

Mussel surveys conducted by the Corps of Engineers in 1986, 1999, 2000, and 2003 did not reveal any Higgins' eye pearlymussels in the area around Lock and Dam 3 (USACE 2006). However, this species has been cultured (reared in cages) and recently re-introduced into lower Pool 4 and both upper and lower Pool 3 (Sturgeon Lake) of the Mississippi River (USACE 2004; USACE 2006). The Sturgeon Lake relocation site, where 195 sub-adult *Lampsilis higginsii* were placed in 2003 and 1,400 more sub-adults

were placed in 2005 (Mussel Coordination Team 2005), is approximately 0.5 mile up-river of the PINGP Intake Screenhouse.

The life cycle of *L. higginsii* is complicated, with sessile adults releasing planktonic larvae (known as glochidia) that are parasitic, attaching to the gills of fish (FWS 2004a). Glochidia develop on the gills of host fish for several weeks and drop off as juveniles, ultimately settling on suitable substrate and (if successful) growing into adults. In the genus *Lampsilis*, the mantle of the female grows into a ribbon-like appendage that resembles a minnow and is believed to have evolved to attract fish hosts (FWS 2004a). Females are known to expel glochidia in the presence of these fish, increasing the likelihood that they will attach to fish gills and survive (FWS undated). Sauger, walleye, yellow perch, largemouth bass, smallmouth bass, and freshwater drum all serve as hosts for Higgins eye glochidia (FWS 2004b). When glochidia are released into the water column in the absence of fish, survival is greatly reduced.

State (MN DNR) and federal (FWS and USACE) agency partners determined that the area 0.5 mile north of the PINGP intake was suitable area for the relocation of *L. higginsii*, notwithstanding the fact that it was a short distance upstream of the plant's intake. Sub-adult *higginsii* planted upstream of the PINGP intake screenhouse in 2003 reached adulthood (sexual maturity) in 2005 (FWS 2006a) and are assumed to be releasing glochidia into Sturgeon Lake. It is conceivable that some larval *higginsii* will be carried downstream into the power plant's intake screenhouse. It should be noted, however, that mortality rate of early life stages of mussels is very high under the best of circumstances, and glochidia that do not attach to fish hosts soon after being released have a very low probability of survival.

### *Peregrine falcon*

A pair of peregrine falcons has nested in a nest box on the Unit 1 containment dome annually since 1997, and over 30 falcons have fledged from the nest since then. As discussed in Section 4.6, peregrine falcons vary greatly in responsiveness to human activities, depending on individual characteristics and environmental circumstances. The falcons nesting on the Unit 1 containment dome have apparently become habituated to activities at PINGP, including movement of personnel and machinery and loud noise. For the reasons discussed in Section 4.6, refurbishment activities would have no impacts on this species. Similarly, continued operation of PINGP is unlikely to affect peregrine falcons.

### *Blanding's turtle*

Blanding's turtles *(Emydoidea blandingii)*, state listed as threatened, might occur on or near the PINGP site, particularly in sloughs, lakes, and marshes. A single Blanding's turtle was observed in 1989 crossing County Road 18 near the site (MN DNR 2007a). In Minnesota, Blanding's turtles are primarily marsh and pond inhabitants. Calm, shallow water bodies with mud bottoms and abundant aquatic vegetation (cattails, water lilies, etc.) are preferred, and extensive marshes bordering rivers provide excellent

habitat. Small temporary wetlands (those that dry up in the late summer or fall) are frequently used in spring and summer. Nesting in Minnesota typically occurs during June. Nests are dug by females in open sandy uplands, and 6-15 eggs are laid. Nesting can occur as much as a mile from wetlands. After a development period of approximately two months, hatchlings leave the nest from mid-August through early-October. In late autumn (typically November), Blanding's turtles bury themselves in the substrate of deeper wetlands to overwinter (MN DNR 2007c).

As discussed in Section 2.3.1.2, the Minnesota side of Pool 3 is associated with a broad floodplain that encompasses a variety of lentic and wetland habitats including small ponds, shallow lakes, shallow marshes, and deep-water marshes. Many of these areas could provide habitat for Blanding's turtles. The site proper provides very little potential habitat. Given that more-optimal habitat for the species is available all along the western shore of Pool 3 and that Xcel Energy biologists have never observed Blanding's turtles on the plant property, continued operation of PINGP is not expected to affect this species.

### *Paddlefish*

Northern States Power and Xcel Energy have conducted fish studies in the Mississippi River (Sturgeon Lake) since the 1970s to assess impacts of PINGP operation. With the exception of state-listed paddlefish, (see Section 2.3.3), no state- or federally-listed fish species has been collected or observed in more than 30 years of monitoring. Paddlefish in the Dakotas, Minnesota, and Wisconsin spawn in the spring over clean gravel or cobble in rivers with strong currents (high or rising flow is critical). Sturgeon Lake, a backwater of the Mississippi River, does not provide spawning habitat for the paddlefish, and as a result eggs and young of the species are not likely to be affected by PINGP operation.

### *State-listed mussels*

Three state-listed mussel species, all classified as threatened by Minnesota DNR, are known to occur in the Mississippi River and its backwaters in the vicinity of PINGP: mucket, washboard, and butterfly (Table 2.3-1; MN DNR 2007a). Several more species (e.g., ebonyshell and yellow sandshell) may also be present, but only dead specimens and shells have been collected in recent years (MN DNR 2007a).

Although the MN DNR report provided information on known occurrences, it did not provide detailed information on the abundance (or relative abundance) of these species in the Pool 3/Sturgeon Lake area. Based on the fact that all three are state listed, they are presumed to be uncommon to rare. As is the case with *Lampsilis higginsii*, these Unionid species have planktonic, parasitic larvae that attach to the gills or fins of host fish (FWS 2006b). The planktonic larvae of all three species could be entrained at the PINGP intake screenhouse. As suggested previously, freshwater mussel larvae experience high rates of mortality under the best of circumstances and are not likely to survive unless they attach to host fish soon after being released.

Plant operations are not expected to change significantly over the license renewal term and are not expected to jeopardize any threatened or endangered species. Similarly, the continued operations of PINGP transmission lines and the vegetation management practices along these lines (which would continue irrespective of license renewal) are not believed to jeopardize any threatened or endangered species. No critical habitats have been identified on the site or transmission corridors.

As discussed in Section 4.6, refurbishment activities at PINGP during the license renewal term are not expected to adversely impact important habitats and special-status species, and no further analysis of refurbishment-related impacts is applicable.

NMC has initiated contacts with the Minnesota Department of Natural Resources and the U.S. Fish and Wildlife Service requesting information on any listed species or critical habitats that might occur on the PINGP site or along the associated transmission corridors, with particular emphasis on species that might be adversely affected by continued operation over the license renewal period. Contact letters are provided in Attachment C.

Renewal of the PINGP license is not expected to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of any critical habitat. Because current operational practices will not be affected by license renewal, NMC concludes that impacts to threatened or endangered species from license renewal would be SMALL and do not warrant mitigation.

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

**NRC**

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

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

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

Activities associated with refurbishment at PINGP are discussed in Section 3.2. Several temporary buildings would be built, including a facility for preparing the steam generators, office space for construction contractors, and a decontamination building. Warehouse(s) would also be built on site and would remain after the steam generator replacement outage. NMC anticipates that there would be ample parking space for the refurbishment workforce. Any construction would occur within the existing plant boundaries. There would be no clearing of previously-undisturbed areas. No road improvements would be required because the steam generators would arrive via barge and be offloaded to a self-propelled nuclear transporter capable of traveling on existing site roads without damage. Because any construction areas would be limited to the PINGP site, the construction period would last approximately 80 days, and best management practices would be used, fugitive dust resulting from construction activities would be minimal.

Construction equipment would generate exhaust emissions as would the vehicles of refurbishment and refueling personnel. Temporary and localized increases in atmospheric concentrations of NOx, CO, VOCs, and particulate matter would result. NRC determined that vehicle emissions from refurbishment activities occurring in geographical areas of poor or marginal air quality could be cause for concern, based on a refurbishment and refueling workforce of 2,300 and duration of 9 months. As described in Section 3.2, replacement of the Unit 2 steam generators is expected to last approximately 80 days and require 750 workers.

NMC assumes that the entire refurbishment workforce would come from outside the 50-mile radius and reside throughout the 50-mile radius.

As discussed in Section 2.10, the EPA has established National Ambient Air Quality Standards (NAAQS) for six common pollutants and has designated all areas of the United States as having air quality better than (attainment) or worse than (non-attainment) the NAAQS. PINGP is located in Goodhue County, Minnesota, which is part of the Southeast Minnesota-La Crosse (Wisconsin) Interstate Air Quality Control Region (AQCR) (40 CFR 81.66). The AQCR is in attainment for all criteria pollutants, as are all counties in Minnesota (40 CFR 81.324).

The closest maintenance area to PINGP is Dakota County for lead, sulfur dioxide, and carbon monoxide. Refurbishment activities would not result in any lead emissions, and therefore would not have the potential to endanger the Dakota County lead attainment status. Olmsted County (also part of the Southeast Minnesota-La Crosse AQCR), directly south of Goodhue County is a maintenance area for sulfur dioxide and PM10. Other maintenance areas in the vicinity include multiple counties in the Minneapolis-St. Paul Intrastate AQCR (for carbon monoxide and sulfur dioxide) and Ramsey County (Minneapolis-St. Paul Intrastate AQCR) for $PM_{10}$ (40 CFR 81.324).

As noted in Section 3.3 of the GEIS (NRC, 1996), a conformity analysis is required for each pollutant where the total of direct and indirect emissions caused by a proposed federal action would exceed established threshold emission levels in a non-attainment or maintenance area. Federal conformity rules are defined in 40 CFR Parts 51 and 93.

As discussed in Section 3.2, the refurbishment outage would take place in fall 2013. All construction activities would take place in Goodhue County. Construction worker commuter traffic would travel from areas within the 50-mile radius and converge on Goodhue County. Assuming each of the 750 workers would travel an average of 50 miles daily commuting to and from PINGP; this would result in an additional 37,500 vehicle miles within the region. In 2005, the average number of vehicle miles traveled within Goodhue County was 1,766,701 per day (Mn/DOT 2006). Its close proximity to large job concentrations in the Twin Cities and Rochester has led to steady growth in population which is expected to continue (Goodhue County Transportation Plan Steering Committee 2004). The additional number of vehicle miles that would be traveled in the region per day (37,500) during refurbishment represents 2.1 percent of the total miles traveled daily in Goodhue County alone. Because the construction workforce would travel from all over the 50-mile region, the amount of pollutants emitted from commuter traffic would be SMALL compared with total vehicular emissions in the region. The increase in the amount of vehicle travel, and consequently, vehicle emissions in Goodhue County would also be insignificant. Because Goodhue County is in attainment for all criteria pollutants; construction and vehicular emissions would not significantly deteriorate air quality in the area and a conformity analysis is not required.

NRC's screening analysis in the GEIS determined that emissions from 2,300 vehicles may exceed the thresholds for carbon monoxide, oxides of nitrogen, and volatile organic compounds in nonattainment and maintenance areas, and that the amount of road dust generated by the vehicles traveling to and from work would exceed the threshold for PM10 in serious nonattainment areas. Dakota, Olmsted, and Ramsey counties are not

serious nonattainment areas, and the number of workers (750) required for PINGP refurbishment is estimated to be less than one third the number assumed in the GEIS. The refurbishment duration is also much shorter than the time frame assumed in the GEIS.

The disturbed area for the new facilities and laydown areas is expected to be less than 10 acres. During site excavation and grading, some particulate matter in the form of fugitive dust would be released into the atmosphere, but fugitive dust consists primarily of large particles that settle quickly and thus have minimal adverse public health effects. Because construction would probably occur within an existing plant yard, much less site preparation would be necessary than for a previously undisturbed site. Because of the (1) small size of the disturbed area, (2) relatively short construction period, (3) availability of paved roadways at existing facilities, and (4) use of the best management practices (such as seeding and wetting), fugitive dust resulting from these construction activities should be minimal. Air quality impacts from refurbishment activities are expected to be SMALL and would not warrant mitigation.

## 4.9 IMPACT ON PUBLIC HEALTH OF MICROBIOLOGICAL ORGANISMS

**NRC**

**"If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river having an annual average flowrate of less than $3.15\times10^{12}$ $ft^3$/year ($9\times10^{10}$ $m^3$/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**

NRC designated impacts to public health from thermophilic organisms a Category 2 issue, requiring plant-specific analysis, because the magnitude of the potential public health impacts associated with thermal enhancement of such organisms, particularly *Naegleria fowleri*, could not be determined generically. NRC noted in the GEIS that impacts of nuclear power plant cooling towers and thermal discharges are considered to be of small significance if they do not enhance the presence of microorganisms that are detrimental to water quality and public health (NRC 1996, Section 4.3.6). Information to be ascertained includes: (1) thermal conditions for the enhancement of *Naegleria fowleri*; (2) thermal characteristics of the Mississippi River; (3) thermal discharge temperature; and (4) impacts to public health.

NRC requires [10 CFR 51.53(c) (ii)(G)] an assessment of the potential impact of thermophillic organisms in receiving waters on public health if a nuclear power plant uses cooling ponds, cooling lakes, or cooling canals or discharges to a river with an average annual flow rate less than $3.15 \times 10^{12}$ cubic feet per year. Because the Mississippi River has an average flow rate of $5.8 \times 10^{11}$ cubic feet per year at U.S. Geological Survey Prescott gauging station upstream of PINGP (USGS 2006), the Mississippi River would be considered a small river at PINGP under NRC's definition. It is also relevant because the Mississippi River in the vicinity of PINGP is used by the public for recreation, including swimming, boating, and fishing (AEC 1973).

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

During the early 1980s, PINGP identified the presence of the parasitic amoeba *Naeglaria* at high population densities within the plant's circulating water system. In cooperation with the Minnesota Pollution Control Agency and Minnesota Department of Natural Resources, PINGP conducted chlorination and subsequent dechlorination of the circulating water system in August 1980, September 1981, and August 1983 (NSP 1981a, NSP 1981b, and NSP 1983). The chlorination processes were successful in controlling and reducing the populations of the organisms, however the dechlorination

process does impact the fish populations in the Mississippi River. Although the Minnesota Department of Health did not consider the presence of the organism to be a public health threat, it was recognized as an occupational health hazard and plant personnel were instructed to wear protective equipment when in contact with the circulating water system components (NRC 1980). PINGP continues to periodically treat the circulating water system to control microbiological organisms and zebra mussels in accordance with the NPDES permit requirements (MPCA 2006).

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

Heat dissipation at PINGP can be achieved by three separate modes. Closed-cycle or helper-cycle modes dissipate heat by utilizing four mechanical draft cooling towers. The open-cycle mode pipes condenser/circulating water and cooling water to the Mississippi River via the discharge basin to the discharge canal (see Section 3.1.3 for detailed description of the condenser cooling systems). To determine the ambient river water temperature, assess the plant's thermal input, and assure compliance with NPDES thermal discharge requirements, river water is monitored by PINGP at multiple locations. Temperatures are monitored at the discharge canal, the plant intake structure, main river channel (upstream), Sturgeon Lake (upstream), and immediately downstream of Lock and Dam 3 (MPCA 2006). The highest temperatures at the station upstream of the plant intake structure were as follows:

| 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|
| 81.0˚F | 86.0˚F | 82.1˚F | 79.8˚F | 78.4˚F | 82.7˚F |
| (July 9) | (August 8), | (July 8) | (August 22) | (July 22) | (July 16) |

ESWQD 2000, 2001, 2002, 2003, 2004, 2005

The highest temperature measured over the same period downstream of the plant at the Lock and Dam 3 monitoring station, was 86.4˚F in 2001 (August 9). The highest daily maximum temperature measured at the plant's discharge canal from January 2003 through December 2004 was 99˚F, recorded on July 28, 2003. The entire length of the discharge canal and adjoining portions of the Mississippi River are within the plant's exclusion zone, however, and there is no public access to these areas.

Water at these temperatures could, in theory, allow limited survival of thermophilic microorganisms, but are well below the optimal temperature range for growth and reproduction of thermophilic microorganisms. The probability of the presence of

thermophilic microorganisms due to plant operations is low. Given the thermal characteristics at the PINGP discharge and the fact that NMC periodically chlorinates the circulating water system, NMC does not expect PINGP operations to stimulate growth or reproduction of thermophilic organisms. Under certain circumstances, these organisms might be present in limited numbers in the station's discharge, but would not be expected in concentrations high enough to pose a threat to recreational users of the Mississippi River.

NMC wrote the Minnesota Department of Health on January 25, 2008, requesting information on any studies that may have been conducted on thermophilic microorganisms in the Mississippi River and any concerns the agency may have relative to these organisms. A copy of the letter is included in Attachment E of this environmental report. NMC is not aware of reported cases of illness caused by *Naegleria* or *Legionella* at, in the vicinity, or downstream of the plant. Therefore, NMC concludes that the impact of thermophilic organisms is SMALL and does not warrant mitigation.

## 4.10 ELECTROMAGNETIC FIELD – ACUTE EFFECTS

**NRC**

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

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

NRC made impacts of electric shock from transmission lines a Category 2 issue because, without a review of each plant's transmission line conformance with the National Electrical Safety Code (NESC) criteria (IEEE 1997), NRC could not determine the significance of the electric shock potential. This section provides an analysis of the PINGP transmission lines in conforming with the NESC standard. NRC does not define the phrase "transmission line" in its regulations at 10 CFR 51.53(c)(3)(ii)(H), but does indicate in the GEIS that transmission lines use voltages of about 115/138 kilovolts (kV) and higher (NRC 1996, Section 4.5.1). As indicated in the regulation above, the transmission lines of concern to license renewal are those constructed to connect the plant switchyard to the existing transmission system and reviewed as part of the construction permit for the plant (NRC 1996, Section 4.5; NRC 2000, Section 4.13).

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

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

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

As described in Section 3.1.3, there are four 345-kilovolt (kV) lines and one 161-kV line which distribute power from PINGP to the electric grid. The following portions of lines connecting PINGP to the grid were considered in the analysis:

- Line No. 0976 – PINGP to Blue Lake (345 kV)
- Line No. 0979 – Short connection to the pre-existing Adams line (345 kV)
- Line No. 0986 – Short connection to the pre-existing Red Rock 1 line (345 kV)
- Line No. 0987 – PINGP to Red Rock 2 (345 kV)
- Line No. 5302 – PINGP to Spring Creek (161 kV)

The analysis of these transmission lines began by identifying all road crossings and selecting the lowest clearance locations for analysis. These limiting cases represent locations along the line where the potential for current-induced shock would be greatest. Once the limiting cases were identified, the electric field strength was calculated for the transmission line at that location, and the induced current calculated at the point of the highest electric field strength. Had the induced current of the limiting cases exceeded the NESC limit, additional analyses would have been performed to identify all locations with the potential to exceed the limit.

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

The analytical results for each line are summarized in Table 4.10-1. The analysis determined that the maximum values for the five transmission lines are in compliance

[1] Part 2, Rules 232C1c and 232D3c.

[2] The NESC and the GEIS use the phrase “steady-state current,” whereas 10 CFR 51.53(c)(3)(ii)(H) uses the phrase “induced current.” The phrases mean the same here.

with the NESC and below the NESC limit of 5 milliamperes (TtNUS 2007). As shown in the table, the highest induced current was calculated to be 4.43 milliamperes for Line No. 0976 – PINGP to Blue Lake.

Xcel Energy, which owns and operates the PINGP 345-kV transmission lines, and Great River Energy, which owns and operates the 161-kV line to Spring Creek, conduct surveillance and maintenance inspections on a regular basis to assure that design ground clearances will not change. These procedures include routine ground inspections and aerial patrols by aircraft. The corridors are checked for encroachments, broken conductors, broken or leaning structures, and signs of burnt trees, any of which would be evidence of clearance problems. Ground inspections include examination for clearance at questionable locations, integrity of structures, and surveillance for dead or diseased trees that might fall on the transmission line. Problems noted during inspections are brought to the attention of the appropriate organizations for corrective action.

As a result of this analysis performed in accordance with the requirements of 10 CFR 51, NMC concludes that electric shock is of SMALL significance for the PINGP transmission lines because the magnitude of the induced currents does not exceed the NESC standard. Mitigation measures are not warranted because there is adequate clearance between energized conductors and the ground. These conclusions will remain valid into the future, provided there are no changes in line use, voltage, and maintenance practices or changes in land use under the line.

## 4.11 HOUSING

### 4.11.1 HOUSING – REFURBISHMENT

**NRC**

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

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

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

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

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

The maximum impact to area housing was assessed using the following assumptions: (1) all direct jobs would be filled by in-migrating residents; (2) the majority of indirect jobs would be filled by residents within the 50-mile radius because most jobs would be service-related, and (3) each new direct job created would represent one housing unit. As described in Section 3.4.2, NMC assumes that 750 refurbishment employees would be required for the steam generator replacement project. NMC's estimate of 750 refurbishment employees could generate the demand for 750 housing units.

As described in Section 2.5, PINGP is located in a high population area. As noted in Section 2.9, Land Use Planning, the three counties surrounding the plant are not subject to growth control measures that limit housing development. The 2000 population of the 50-mile radius was 2,733,326 and the state had an average of 2.52 persons per household (USCB 2000), suggesting the existence of approximately 1.1 million housing units. Hotels and motels in the vicinity, especially within the Minneapolis-St. Paul-St. Cloud, MN-WI Combined Statistical Area (CSA), also provide temporary housing opportunities.

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

## 4.11.2 HOUSING – LICENSE RENEWAL TERM

**NRC**

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

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

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

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

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

As described in Section 2.5, PINGP is located in a high population area. As noted in Section 2.9, Land Use, the area of interest is not subject to growth control measures that limit housing development.

The maximum impact to area housing was assessed using the following assumptions: (1) all direct jobs would be filled by in-migrating residents; (2) the majority of indirect jobs would be filled by residents within the 50-mile radius because most jobs would be service-related, (3) the residential distribution of new residents would be similar to current operations worker distribution; and (4) each new direct job created would represent one housing unit. As described in Section 3.4 and 6.3, NMC's conservative estimate of 60 license renewal employees could generate the demand for 60 housing units; however, NMC expects to require no more than two additional employees for the License Renewal term.

In an area which has a population within a 50-mile radius of approximately 2,733,326 and a state average of 2.52 persons per household (USCB 2000), suggesting the existence of approximately 1.1 million housing units, it is reasonable to conclude that this demand would not create a discernible change in housing availability, rental rates or housing values, or spur housing construction or conversion. NMC concludes that

impacts to housing availability resulting from station-related population growth would be SMALL and would not warrant mitigation.

## 4.12 PUBLIC UTILITIES: PUBLIC WATER SUPPLY AVAILABILITY

### 4.12.1 PUBLIC WATER SUPPLY – REFURBISHMENT

**NRC**

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

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

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

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

NRC's analysis of impacts to the public water supply system considered both plant demand and plant-related population growth demands on local water resources. As Section 3.4 indicates, NMC analyzed a 750-person increase in PINGP employment attributable to refurbishment. Section 2.8.1 describes the public water supply systems in the area, their permitted capacities, and current demands. The following discussion focuses on impacts of refurbishment on local public utilities based on the assumption that PINGP would add up to 750 employees for a period of 80 days during refurbishment activities.

#### Plant Demand

As stated in Section 2.2.4, there are six groundwater wells located on PINGP property. Three of the wells supply the domestic water for on-site facilities. Two of these wells (256120 and 256121) are used for air conditioning water, domestic water, primary and secondary makeup water. These two wells are permitted for a total permitted withdrawal of 600 gpm and a yearly maximum of 50 million gallons per year (NSP 1988). The third well (256074) supplies domestic and irrigation water and is permitted for 80 gpm and a yearly maximum of 4.7 million gallons per year (NSP 1995). Another site well (463332) currently does not require a permit (NSP 1993), but had a prior maximum pumping rate of 90 gpm. During 2005, the well pumped at a rate of approximately 1 gpm (Section 2.2.5). Well 611076 provides water for pump bearing cooling and is permitted to pump at a maximum rate of 40 gpm not to exceed an annual

maximum of 15 million gallons per year (Xcel Energy 2004). Well 402599, which supplies the screenhouse with water, is permitted to pump at a maximum rate of 50 gpm not to exceed 20 million gallons per year. The total permitted pumping rate for these wells is 770 gpm not to exceed 354 million gallons per year. From 2000 to 2005, groundwater production from the 5 permitted wells and one well not requiring a permit in operation at the site averaged 91 gpm with an annual high for the period of 117 gpm in 2005 (Section 2.2.5, Table 2.2-4).

PINGP replaced the steam generators and refueled for Unit 1 during the period between September 11 and November 23, 2004. The groundwater production rate during 2004 was 104 gpm (TtNUS 2006). The average groundwater use rate (91 gpm) at PINGP during the period of 2000 through 2005 was well below the MN DNR's permitted total pumping rates (770 gpm) for PINGP. PINGP does not use water from a municipal system and NMC expects groundwater demands during refurbishment for Unit 2 to be consistent with those experienced during the refurbishment/refueling operations performed for Unit 1. Therefore, NMC does not expect PINGP refurbishment to have an effect on local public water supplies.

**Plant-related Population Growth**

The maximum impact to area public water supplies was calculated using the following assumptions: (1) all direct jobs would be filled by in-migrating residents; (2) the majority of indirect jobs would be filled by residents within the 50-mile radius because most jobs would be service-related, (3) the refurbishment work force would reside in the 50-mile radius; and (4) refurbishment-related workers would not bring families due to the temporary nature of the refurbishment projects. These assumptions are conservative, because experience from the Unit 1 steam generator replacement project in 2004 suggests that a large number of the workforce would already reside within the 50-mile area, which would place little additional demand on the public water supply.

The impact to the local water supply systems from plant-related population growth can be determined by calculating the amount of water that would be required by these individuals. The average American uses about 90 gallons per day for personal use (EPA 2003). As described in Section 3.4, PINGP estimates an additional 750 employees (refurbishment and outage) attributable to refurbishment. The plant-related population increase could require an additional 0.07 million gallons per day (750 employees multiplied by 90 gallons per day) or approximately 47 gpm within the 50-mile radius. NMC concludes that impacts resulting from plant-related population growth to public water supplies would be SMALL, requiring no additional capacity and not warranting mitigation.

## 4.12.2 PUBLIC WATER SUPPLY – LICENSE RENEWAL TERM

**NRC**

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

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

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

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

NRC's analysis of impacts to the public water supply system considered both plant demand and plant-related population growth demands on local water resources. As Section 3.4 indicates, NMC analyzed a hypothetical 60-person increase in PINGP employment attributable to license renewal. Section 2.8.1 describes the public water supply systems in the area, their permitted capacities, and current demands. The following discussion focuses on impacts of continued operations on local public utilities, and the assumption that (1) PINGP would add up to 60 additional employees during the period of extended operation for license renewal activities, (2) the new employees would follow current employee residence trends where the majority (83 percent) of employees reside in Goodhue, Dakota, and Pierce Counties (Section 3.4).

### Plant Demand

As discussed in Section 4.12.1, there are six groundwater wells located on PINGP property. From 2000 to 2005, groundwater production from the six wells in operation at the site averaged 92 gallons per minute (gpm) with an annual high for the period of 118 gpm (Section 2.2.5). An additional 60 employees would increase water use at the plant by a maximum of 5,400 gallons per day (3.75 gpm) [60 employees multiplied by 90 gallons per day]; however, NMC expects to hire no more than two additional employees in the License Renewal Term. PINGP does not use water from a municipal system and the plant groundwater use impacts during the license renewal period would be considered SMALL; therefore, NMC does not expect PINGP operations to have an effect on local water supplies.

### Plant-related Population Growth

The impact to the local water supply systems from plant-related population growth can be determined by calculating the amount of water that would be required by these individuals. The average American uses about 90 gallons per day for personal use (EPA 2003). As described in Section 3.4.3, PINGP very conservatively assumes for the purposes of this analysis that an additional 60 employees, which could result in a population increase of 151 in the area (60 jobs multiplied by 2.52, which is the average number of persons per household in Minnesota). Using this consumption rate, the plant-related population increase could require an approximate additional 13,590 gallons per day (5 million gallons per year) (151 people multiplied by 90 gallons per day) in an area where the current excess public water supply capacity is approximately 528.4 million gallons per day from the municipal waterworks in Goodhue, Dakota, and Pierce Counties. Of the municipal water suppliers in Goodhue, Dakota, and Pierce Counties, there are no suppliers for which demand currently exceeds supply. If it is assumed that this increase in population would be consistent with current employee trends (83 percent reside in Goodhue, Dakota, and Pierce Counties), the increase in water demand would not create shortages in capacity of the water supply systems in these communities. NMC concludes that impacts resulting from plant-related population growth to public water supplies would be SMALL, requiring no additional capacity and not warranting mitigation.

## 4.13 EDUCATION IMPACTS FROM REFURBISHMENT

**NRC**

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

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

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

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

As stated in Section 3.4, NMC estimates that a maximum of 750 refurbishment workers would be required for a period similar to Unit 1 steam generator replacement. The 2004 Unit 1 steam generator replacement experience suggests that the refurbishment workforce would not relocate families to the plant site region for a project of this duration. Therefore, NMC estimates that few to no children would be relocated to the region and that impacts would be SMALL and mitigation would not be warranted.

## 4.14 OFFSITE LAND USE

### 4.14.1 OFFSITE LAND USE - REFURBISHMENT

**NRC**

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

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

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

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

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

As stated in Section 2.5, Demography, PINGP is located in a high population area. Within the 50-mile radius, the 2000 population was 2,733,326 and the population density was 349 persons per square mile. Within the 20-mile radius, the population was 107,131 and the population density was 85 persons per square mile. Two urban areas had a population of more than 100,000, with Minneapolis at 382,618 and St. Paul at 287,151. As stated in Section 2.9, Goodhue, Dakota, and Pierce counties, the counties closest to site and that contain the majority of the operations workforce, have established patterns of residential and commercial development.

PINGP is located in a high population area. NMC cannot predict exactly where the refurbishment workforce would reside; therefore, NMC assumes that the workers would live throughout the 50-mile radius. Even if one conservatively assumes that the entire 750 person refurbishment workforce migrates into the 50-mile area around the plant, such an increase would represent less than a 0.03 percent increase in the population of

the 50-mile region. Goodhue, Dakota, and Pierce counties have established patterns of residential and commercial development, the 20- and 50-mile radial population densities are greater than 60 persons per square mile, and there is more than one urban area with a population of 100,000 or more within 50 miles. Therefore, NMC concludes that impacts to off-site land use resulting from refurbishment would be SMALL and would not warrant mitigation.

## 4.14.2 OFFSITE LAND USE - LICENSE RENEWAL TERM

**NRC**

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

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

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

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

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

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

### Population-Related Impacts

Based on the GEIS case-study analysis, NRC concluded that all new population-driven land-use changes during the license renewal term at all nuclear plants would be small. Population growth caused by license renewal would represent a much smaller percentage of the local area's total population than the percent change represented by operations-related growth (NRC 1996, Section 4.7.4). NMC agrees with the NRC conclusion that population-driven land use impacts would be SMALL. Mitigation would not be warranted.

### Tax-Revenue-Related Impacts

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

*Tax Payment Significance*

NRC has determined that the significance of tax payments as a source of local government revenue would be large if the payments are greater than 20 percent of revenue, moderate if the payments are between 10 and 20 percent of revenue, and small if the payments are less than 10 percent of revenue (NRC 1996).

*Land Use Significance*

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

> SMALL - very little new development and minimal changes to area's land-use pattern.
>
> MODERATE - considerable new development and some changes to land-use pattern.
>
> LARGE - large-scale new development and major changes in land-use pattern.

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

*PINGP Tax Impacts*

Table 2.7-1 provides a comparison of the 2001 through 2006 tax payments made by PINGP to Goodhue County, the City of Red Wing, and School District 256 and the tax revenues for each of these taxing bodies. Using NRC's criteria, PINGP's property tax payments were of large to moderate significance to Goodhue County, large significance to the City of Red Wing, and large significance to School District 256.

**PINGP Land Use Impacts**

As stated in Sections 2.5.1 and 2.9, the three counties in the socioeconomic region of influence (ROI) have experienced growth over the last several decades. Goodhue County's rate of growth has trailed that of the State of Minnesota, but Dakota County has outpaced both. Dakota County's growth is attributed to its proximity to the Minneapolis-St. Paul metropolitan area, as its northern third rapidly becomes another of the cities' suburbs. Goodhue County's increase in population over the last several decades has been largely attributed to the increase in population along the major transportation corridors, US Highways 61 and 52. US Highway 52 connects the Minneapolis-St. Paul metropolitan area with the Rochester metropolitan area and, as the Minneapolis-St. Paul area continues to expand and commuting distances increase,

more growth is expected in this region. The population growth rate in Pierce County slightly outpaced that of the State of Wisconsin. Land use planning in Pierce County has recently been initiated, with the collection of data to build a comprehensive land use planning document. Local planning officials are predicting continued population growth in the county and feel the need to begin guiding future development.

Goodhue County is the only county receiving PINGP's property tax payments. Although Goodhue County has experienced some growth over the last several decades, the majority of its land use is still in agriculture, forest, or grassland (94 percent). Local planners cite the two major transportation corridors connecting the County to the Minneapolis-St. Paul and Rochester metropolitan areas as the impetus for this growth. As these metropolitan areas continue grow, continued suburbanization of adjacent rural areas is expected.

Goodhue County uses a comprehensive land use plan and zoning and subdivision ordinances to guide development. The ordinances promote the public health, safety, and general welfare of residents; protect agricultural land from urban sprawl; and provide a basis for the orderly development. The ordinances require building permits, conditional use permits, plat development, zoning district controls, and variance requests. The County has no formal growth control measures, however.

### Conclusion

Although PINGP's property taxes are of moderate to large significance to Goodhue County, and large significance to the City of Red Wing and School District 256, land use changes in the County have been minimal; less than 5 percent of the County has been developed. Population growth has been attributed to the larger influence of the surrounding metropolitan areas and advancements in the transportation network. The County has a pre-established pattern of development with a land use plan, subdivision regulations, and zoning ordinances to guide future development and has been able to provide the infrastructure needed to accommodate this growth. The nuclear plant's presence is not expected to directly attract support industries and commercial development or to encourage or deter residential development. Because population growth related to the license renewal of PINGP is expected to be SMALL and there would be no new tax impacts to Goodhue County land use, the renewal of PINGP's license would have a continued SMALL but beneficial impact on land use in Goodhue County. Therefore, mitigation would not be warranted.

## 4.15 TRANSPORTATION

### 4.15.1 TRANSPORTATION – REFURBISHMENT

**NRC**

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

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

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

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

The following discussion focuses on impacts of refurbishment on transportation, and the assumption that PINGP would add up to 750 additional employees for a period of 80 days during refurbishment on Unit 2. In the GEIS, NRC used the Transportation Research Board's level of service (LOS) definitions to assess significance levels of transportation impacts. LOS is a qualitative measure describing operational conditions within a traffic stream and their perception by motorists (NRC 1996). NMC was unable to employ the same definitions to analyze transportation impacts due to the lack of calculated LOS data for the roads/highways in the vicinity of the site.

The maximum impact to area transportation was analyzed using the following assumptions: (1) all direct jobs would be filled by in-migrating residents; (2) the majority of indirect jobs would be filled by residents within the 50-mile radius because most jobs would be service-related, (3) the refurbishment workforce would reside throughout the 50-mile radius, and (4) each new direct job created would represent one additional vehicle on area roadways.

The greatest concentration of refurbishment-related workforce traffic would be found in the vicinity of the intersection of County Road 18 and Sturgeon Lake Road. Goodhue County has not determined LOS values for the roads in the county. However, road/highway capacity data (vehicles per day) and the average annual daily traffic (AADT) data are outlined in Table 2.8-2 for the road sections in the vicinity of the site

that would be used by the temporary employees performing refurbishment. Traffic count data for County Road 18 north of the intersection with Sturgeon Lake Road indicates an AADT value of 6,200. Just south of the intersection the AADT value is 7,400. The AADT value for Sturgeon Lake Road is 11,500.

As discussed in Section 2.8.1, PINGP has only one entrance (the plant access road). However, employees from parking areas north of the plant access road exit the site via Wakonade Drive to Sturgeon Lake Road. Traffic at the intersections of the plant access road and Sturgeon Lake Road, Wakonade Drive and Sturgeon Lake Road, and Sturgeon Lake Road and County Road 18 is controlled by stop signs. During the refurbishment projects, construction and outage workers would use the same entrance road and exit roads as current employees. County Road 18 and Sturgeon Lake Road are also access routes to the Prairie Island Indian Community's gaming casino, Treasure Island Resort and Casino, located just off Sturgeon Lake Road.

Based on the 2004 Unit 1 SGR project, an estimated 750 workers would be involved in refurbishment work. The addition of 750 workers on County Road 18 and Sturgeon Lake Road would create a change in traffic flow during shift changes due to the added volume of vehicles. The refurbishment employees could increase the volume of traffic on Sturgeon Lake Road by approximately 7 percent. The experience from the 2004 SGR suggests that a large number of the workers would already reside within the 50-mile radius. Because no hard data were available on the relative percentages of workers traveling from north and south, a bounding analysis that evaluated the impact of 750 vehicles on both road segments was performed. Assuming that the entire refurbishment workforce would approach PINGP from the north on County Road 18 would create an increase in the volume of traffic on that road segment by 12 percent. Conversely, assuming all refurbishment workforce traffic would approach PINGP from the south on County Road 18 would increase the volume of traffic on that portion of the road segment by 10 percent. The road capacities for County Road 18 and Sturgeon Lake Road are more than adequate to deal with the added volume of traffic. Given these employment projections and the average number of vehicles per day currently using the roads in the vicinity of the PINGP, NMC concludes that impacts to the overall transportation system would be SMALL. However, due to the increased volume of traffic and the lack of timed traffic signals along Sturgeon Lake Road, there could be problems with traffic flow during PINGP shift changes. Due to the temporary nature of the refurbishment period, these increased traffic flow periods could be mitigated by staggering the refurbishment work schedule and by using local police officials to direct traffic during the PINGP shift changes if necessary.

## 4.15.2 TRANSPORTATION –LICENSE RENEWAL TERM

**NRC**

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

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

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

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

As described in Sections 3.4 and 6.3, NMC conservatively assumes an additional 60 employees would be necessary due to license renewal activities. The greatest concentration of workforce traffic during the license renewal period would be found in the vicinity of the intersection of County Road 18 and Sturgeon Lake Road. As discussed in Section 2.8.2, Goodhue County has not determined LOS values for the roads in the county. However, road/highway capacity data (vehicles per day) and the AADT data are outlined in Table 2.8-2 for the road sections in the vicinity of the site that would be used by the employees during the license renewal period. Traffic count data for County Road 18 north of the intersection with Sturgeon Lake Road indicates an AADT value of 6,200. Just south of the intersection the AADT value is 7,400. The AADT value for Sturgeon Lake Road is 11,500 compared with a vehicle capacity of 20,000. Based on the addition of 60 employees to the current operations work force during the license renewal period, the traffic data would remain well within the designed road capacities for roads used by employees in the vicinity of the site.

Therefore, NMC expects license-renewal impacts to transportation to be SMALL and believes no mitigation would be necessary.

## 4.16 HISTORIC AND ARCHAEOLOGICAL RESOURCES

### 4.16.1 HISTORIC AND ARCHAEOLOGICAL RESOURCES – REFURBISHMENT

**NRC**

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

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

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

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

As discussed in Section 2.10, the AEC consulted with the State Archaeologist in the course of reviewing the NSP application for a construction permit for PINGP. The AEC did so because previous archaeological surveys in the Mississippi River valley near Red Wing demonstrated that a large number of prehistoric sites were present, and that undisturbed portions of Prairie Island, in particular, contained "many undisturbed burial mounds and a large village habitation occupied by late prehistoric (Mississippian) peoples" (AEC 1973, p. II-28). The State Archaeologist subsequently uncovered parts of this village on the Prairie Island site. This village, later named the Bartron Site, was added to the National Register of Historic Places in 1970 (NPS 2006).

NMC has developed a corporate procedure ("Excavation and Trenching Controls," number FP-IH-EXC-01) that protects cultural resources at all NMC-managed plant sites and has instituted those procedures at Prairie Island. The procedure requires a review of any planned excavation (greater than 6 inches deep) to ensure the protection of archaeological and historical resources. The Site Environmental Coordinator is responsible for determining if proposed land-disturbing activity will occur in the vicinity of a culturally-significant site, and if so, consulting with the SHPO to mitigate potential impacts. The Site Environmental Coordinator is also responsible for evaluating any cultural artifacts inadvertently discovered during construction to determine if the material

discovered has potential archaeological or historic significance and thus should be reported to the SHPO. In any case, the discovery of cultural artifacts at NMC-managed nuclear plants requires employees to stop work until the Site Environmental Coordinator has evaluated the situation. Work can resume only after the situation had been addressed, disposition of any material or artifacts has been documented, and the Site Environmental Coordinator agrees that culturally-significant material is not at risk. These controls ensure that known archaeological/historical sites are avoided and newly-discovered archaeological/historical sites are protected.

Based on the Unit 1 SGR project, replacement of Unit 2 steam generators has little potential for disturbing, uncovering, or harming cultural artifacts. Steam generators will be barged up the Mississippi River to the PINGP site and transported to the containment building by a large, all-terrain vehicle (transporter). The transporter will move along an existing dirt service road that extends from the barge landing, 500 feet east of the Environmental Lab, to the Owner-Controlled Area security fence. The area through which the service road moves was heavily altered during construction of the original units and is surrounded by buildings and transmission towers and other infrastructure. Most natural vegetation in the area has been removed, and replaced with turf grasses, which are mowed during the growing season. Because the area was cleared and graded for construction of the original units and because moving the steam generators to the containment building will require no land disturbance, Unit 2 SGR will likely have no impact on the area's archaeological or historic resources.

Several temporary buildings would be built, including a facility for preparing the steam generators, office space for construction contractors, and a decontamination building. Warehouse(s) would also be built on site and would remain after the steam generator replacement outage. Any construction would occur within the existing plant boundaries. Several temporary buildings are planned for preparing the steam generators, office space for construction contractors, and a decontamination building. Warehouse(s) will also be built on site and would remain after the steam generator replacement outage. There would be no clearing of previously-undisturbed areas. No road improvements would be required because the steam generators would arrive via barge and be offloaded to a self-propelled nuclear transporter capable of traveling on existing site roads without damage. Additional construction personnel and additional traffic on area roadways and associated with the steam generator replacement project are not expected to impact archaeological or historical sites in the area. Therefore, NMC concludes that refurbishment activities would not impact cultural resources and no mitigation measures would be warranted beyond those prescribed in NMC's "Excavation and Trenching Controls" procedure.

NMC has written the Minnesota Historical Society, State Historic Preservation Office, to determine if the agency has any concerns regarding impacts to cultural resources from refurbishment (or license renewal) activities. This letter is included in Attachment D.

## 4.16.2 HISTORIC AND ARCHAEOLOGICAL RESOURCES – LICENSE RENEWAL TERM

**NRC**

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

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

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

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

NMC is not aware of any historic or archaeological resources that have been affected to date by PINGP operations, including operation and maintenance of transmission lines. NMC is aware, however, that the site vicinity and the surrounding environs have significant potential for containing cultural resources. Additionally, NMC is aware of cultural resources that have already been found within plant boundaries. Because NMC is aware of the potential for the discovery of cultural resources during land-disturbing activities at its facilities and along its transmission line corridors, it has developed a corporate procedure ("Excavation and Trenching Controls," number FP-IH-EXC-01) that protects cultural resources at all NMC-managed plant sites and has instituted those procedures at Prairie Island. Because NMC has no plans to construct new license renewal related facilities at PINGP during the license renewal term and because the policies and procedures established in the "Excavation and Trenching Controls" procedure should protect any resources that have been previously identified or inadvertently discovered, NMC concludes that operation of generation and transmission facilities over the license renewal term would not impact cultural resources; hence, no mitigation measures would be warranted beyond those prescribed in NMC's "Excavation and Trenching Controls" procedure.

## 4.17 SEVERE ACCIDENT MITIGATION ALTERNATIVES

**NRC**

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

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

This section provides a brief synopsis of the methodology and results for the PINGP SAMA analysis. Attachment F provides a detailed description of the severe accident mitigation alternatives (SAMA) analysis.

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

Historically, NRC has not included in its environmental impact statements or environmental assessments any analysis of alternative ways to mitigate the environmental impacts of severe accidents. A 1989 court decision ruled that, in the absence of an NRC finding that severe accidents are remote and speculative, severe accident mitigation alternatives (SAMAs) should be considered in the NEPA analysis [Limerick Ecology Action v. NRC, 869 F.d 719 (3rd Cir. 1989)]. For most plants, including PINGP, license renewal is the first licensing action that would necessitate consideration of SAMAs.

NRC concluded in its license renewal rulemaking that the unmitigated environmental impacts from severe accidents met its Category 1 criteria. However, NRC made consideration of mitigation alternatives a Category 2 issue because not all plants had completed ongoing regulatory programs related to mitigation (e.g., individual plant examinations and severe accident management). Since these programs have identified plant programmatic and procedural improvements (and, in a few cases, minor modifications) as cost effective in reducing severe accident and risk consequences, the NRC thought it premature to draw a generic conclusion as to whether severe accident mitigation would be required for license renewal.

Site-specific information to be presented in the license renewal environmental report includes: (1) potential SAMA candidates; (2) benefits, costs, and net value of implementing potential SAMA candidates; and (3) sensitivity of analysis to changes in key underlying assumptions. This section of the environmental report is a synopsis of key site-specific SAMA information. Additional details, as called out in the following sections, are provided in Attachment F.

### 4.17.1 METHODOLOGY OVERVIEW

NMC maintains a probabilistic risk assessment (PRA) model to use in evaluating the most significant risks of radiological release. The PINGP PRA model has two aspects. Level 1 determines core damage frequencies based on system analysis 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. To support the SAMA analysis, NMC developed a Level 3 PRA model to characterize the hypothetical impacts from severe accidents on the surrounding environment and members of the public. The results of these models provide the primary input to the cost-benefit analysis.

The methodology used to perform the PINGP SAMA cost-benefit analysis was based on the handbook used by NRC to analyze benefits and costs of its regulatory activities (NUREG/BR-0184), subject to PINGP-specific considerations. The metrics used to represent plant risk include core damage frequency (CDF), dose risk, and economic cost risk. The following summarizes the approach NMC used in the SAMA analysis in Attachment F.

PINGP PRA Model – Use the PINGP Internal and External Events PRA models to characterize plant risk (Section F.2).

Level 3 PRA Analysis – Use PINGP Level 1 and 2 Internal Events PRA output and site-specific meteorology, demographic, land use, and emergency response data as input in performing a Level 3 PRA using the MELCOR Accident Consequences Code System Version 2 (MACCS2) (Section F.3).

Baseline Risk Monetization – Use NRC regulatory analysis techniques to calculate the monetary value of the unmitigated PINGP severe accident risk. Assuming that all plant risk is eliminated, this value represents the maximum averted cost-risk (MACR) (Section F.4).

Phase I SAMA Analysis – Identify potential SAMA candidates based on the PINGP PRA, coupled with documentation from the industry and NRC. Screen out Phase I SAMA candidates that meet any of the following criteria (Section F.5):

(1) Candidates not applicable to the PINGP design;

(2) Candidates with no significant benefit in pressurized water reactors such as PINGP;

(3) Candidates that have already been implemented at PINGP;

(4) Candidates with benefits that have been achieved using other means;

(5) Candidates whose estimated implementation costs exceed the maximum averted cost-risk (Section F.5).

Phase II SAMA Analysis – Screen Phase II SAMA candidates using PRA insights. Calculate the risk reduction attributable to each remaining SAMA candidate, and perform a detailed cost-benefit analysis to identify the potential net benefit (Section F.6).

Uncertainty Analysis – Evaluate how changes in certain assumptions used in the SAMA analysis might affect the results (Section F.7).

Conclusions – Summarize results and identify SAMA candidates that should be considered for implementation (Section F.8).

### 4.17.2 BASELINE RISK MONETIZATION

The purpose of establishing baseline cost risk is to provide a basis for determining the cost-risk reductions (benefits) that would be attributable to the implementation of potential SAMA(s). In accordance with NUREG/BR-0184, the present dollar value for severe accident risk is characterized as the sum of the offsite exposure cost risk, offsite economic cost risk, on-site exposure cost risk, on-site cleanup and decontamination cost and replacement power cost. The total baseline cost risk for PINGP is approximately $557,000 for Unit 1 and $ 1,490,000 for Unit 2 (based on on-line internal events contributions). The higher baseline risk for Unit 2 is attributable primarily to the higher CDF and LERF resulting from the fact that Unit 2 has not yet replaced its steam generators. The Unit 2 steam generator replacement project planned for 2013, prior to the period of extended operation, would reduce the Unit 2 baseline risk, bringing it more in line with that of Unit 1. The methodology for calculating each of the 5 factors is presented in Attachment F, Section F.4. As described in Section F.4.6, NMC modified this value by applying a factor of two to account for external events contributions. Assuming all risk is eliminated, this modified value ($1,114,000 Unit 1 and $2,980,000 for Unit 2) represents the maximum averted cost-risk, and is used in the Phase I screening process.

### 4.17.3 SAMA IDENTIFICATION AND SCREENING

NMC utilized industry, NRC, and PINGP-specific information to create a list of 25 SAMA candidates for consideration. NMC analyzed this list and screened out those SAMAs already implemented at PINGP, those not applicable to PINGP design, or those achieving results already attained at PINGP by other means. NMC prepared preliminary cost estimates for the remaining SAMAs and used the baseline risk value to screen out

SAMAs that would clearly not be cost-beneficial. Nine candidate SAMAs remained for further consideration.

For each SAMA candidate, NMC calculated the risk reduction that would be attributable to implementing the modification and re-quantified the risk value. The difference between the baseline risk value (MACR) and the SAMA-reduced risk value is the averted risk or the benefit of implementing the SAMA.

### 4.17.4 COST-BENEFIT RESULTS

The benefits of revising the operational strategies in place at PINGP and/or implementing hardware modifications can be evaluated without the insight from a risk-based analysis. Use of the PRA in conjunction with cost-benefit analysis methodologies has, however, provided an enhanced understanding of the effects of the proposed changes relative to the cost of implementation and projected dose and economic impact.

The following SAMAs were determined to be cost beneficial for both Unit 1 and 2:

SAMA 9: Perform best-estimate room heatup calculations for the safeguard cooling water pump rooms to determine to what extent natural or forced circulation (for example, installing portable fans, opening doors, etc.) can adequately remove heat following a loss of the safeguard ventilation system serving those rooms. The analysis of this area that is currently available was performed using more conservative assumptions.

SAMA 22: Perform analysis of the actual capability of the pressurizer PORV backup air accumulators to support RCS bleed and feed cooling when the normal supply of instrument air to the PORVs is unavailable.

Note that the cost-benefit analyses performed for these SAMAs assume that the requested analyses successfully demonstrate the equipment capability in each case without implementation of additional procedural or plant modifications. If plant modifications were found to be required to achieve significant risk reduction, then re-evaluation of the cost-benefit for those modifications would be necessary. The results of the SAMA 9 and SAMA 22 analyses presented in Attachment F suggest that significant hardware modifications to address these issues may not be cost-beneficial.

Sensitivity cases were conducted to assess the impacts on the results if a 7 percent discount rate were used and if the 95th percentile results were used for CDF. The base case calculation used a 3 percent discount rate and a mean CDF value. The results of the sensitivity analysis were such that only one new SAMA, which was already shown for the base case to be cost-beneficial for Unit 2, proved cost-beneficial at the 95th percentile for Unit 1.

NMC notes that this analysis should not necessarily be considered dispositive because other engineering reviews are necessary to determine the ultimate implementation. NMC continues to consider implementation of SAMAs 9 and 22 identified in this analysis through PINGP's corrective action program.

## TABLE 4.2-1
## PINGP SURFACE WATER WITHDRAWALS FROM THE MISSISSIPPI RIVER AT STURGEON LAKE

| Year | Annual River Water Withdrawal (gallons) | Average Annual Blowdown Discharge (cfs) |
|---|---|---|
| **2000** | 211,164,000,000 | 851 |
| **2001** | 205,615,000,000 | 850 |
| **2002** | 200,408,000,000 | 807 |
| **2003** | 192,790,000,000 | 775 |
| **2004** | 184,630,000,000 | 736 |
| **2005** | 207,650,000,000 | 841 |
| **Total Use (2000 - 2005)** | 1,202,257,000,000 | 4,860 |
| **Average annual (2000 – 2005) gallons per year (gpYr)** | **200,376,166,667 (849 cfs)** | **Ave. Annual 810 cfs** |

NSP 2001, NSP 2002, NSP 2003, NSP 2004, NSP 2005, NSP 2006

## TABLE 4.10-1
## RESULTS OF INDUCED CURRENT ANALYSIS

| Transmission Lines | Voltage (kV) | Maximum Induced Current (milliamperes) |
|---|---|---|
| Line No. 0976 – PINGP to Blue Lake | 345 | 4.43 |
| Line No. 0979 – Short connection to pre-existing Adams line | 345 | 2.39 |
| Line No. 0986 – Short connection to pre-existing Red Rock line | 345 | 2.39 |
| Line No. 0987 – PINGP to Red Rock[3] | 345 | 3.92 |
| Line No. 5302 – PINGP to Spring Creek | 161 | 0.89 |

TtNUS 2007

[3] Lines No. 0987 and No. 0986 share the corridor to Red Rock, thus the combined influence of the two lines was included in the analysis.

## 4.18 REFERENCES

AEC (United States Atomic Energy Commission). 1973. *Final Environmental Statement related to the Prairie Island Nuclear Generating Plant*. Directorate of Licensing, Washington, D.C. May.

Bodensteiner, J. 1991. "Letter to T.J. Mader, MPCA, regarding renewal of PINGP's NPDES permit and proposed changes in permit conditions." Northern States Power Company, Minneapolis. March 18.

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

EPA (United States Environmental Protection Agency). 2004. "Fact Sheet: Cooling Water Intake Structures – Section 316(b). Final Regulations for Cooling Water Intake Structures at Large Power Plants (Phase II)." Office of Water. February.

ESWQD (Environmental Services Water Quality Department). 2000. "Prairie Island Nuclear Generating Plant Environmental Monitoring and Ecological Studies Program." Annual Report.

ESWQD (Environmental Services Water Quality Department). 2001. "Prairie Island Nuclear Generating Plant Environmental Monitoring and Ecological Studies Program." Annual Report.

ESWQD (Environmental Services Water Quality Department). 2002. "Prairie Island Nuclear Generating Plant Environmental Monitoring and Ecological Studies Program." Annual Report.

ESWQD (Environmental Services Water Quality Department). 2003. "Prairie Island Nuclear Generating Plant Environmental Monitoring and Ecological Studies Program." Annual Report.

ESWQD (Environmental Services Water Quality Department). 2004. "Prairie Island Nuclear Generating Plant Environmental Monitoring and Ecological Studies Program." Annual Report.

ESWQD (Environmental Services Water Quality Department). 2005. "Prairie Island Nuclear Generating Plant Environmental Monitoring and Ecological Studies Program." Annual Report.Goodhue County Transportation Plan Steering Committee. 2004. Goodhue county Transportation Plan (2004 – 2025). June.

FWS (U.S. Fish and Wildlife Service). Undated. "America's Mussels: Silent Sentinels." Available on line http://www.fws.gov/midwest/Endangered/clams/mussels.html.

FWS (U.S. Fish and Wildlife Service). 2004a. *Higgins Eye Pearlymussel (Lampsilis higginsii) Recovery Plan: First Revision.* Prepared by FWS Great Lakes/Big Rivers Region, Ft. Snelling, MN. May.

FWS (U.S. Fish and Wildlife Service). 2004b. "Higgins Eye Pearlymussel" (Fact Sheet). Prepared by FWS Great Lakes/Big Rivers Region, Ft. Snelling, MN. May. Available on line at http://www.fws.gov/Midwest/endangered/clams/higginseye/hepm-facts.pdf.

FWS (U.S. Fish and Wildlife Service). 2006a. "Mussel Conservation Activities." From U.S. Fish and Wildlife Service's Freshwater Mussels of Upper Mississippi River system website. Available on line at http://www.fws.gov/midwest/mussel/conservation.html.

FWS (U.S. Fish and Wildlife Service). 2006b. "Life History." From U.S. Fish and Wildlife Service's Freshwater Mussels of Upper Mississippi River system website. Available on line at http://www.fws.gov/midwest/mussel/.

Goodhue County Transportation Plan Steering Committee. 2004. Goodhue county Transportation Plan (2004 – 2025). June.

Grumbles, B. 2007. "Memorandum to Regional Administrators suspending Phase II 316(b) regulation." EPA Office of Water, Washington, DC.

HDR (Henningson, Durham, and Richardson, Inc.). 1978. *Section 316(a) Demonstration for the Prairie Island Generating Plant on the Mississippi River near Red Wing, Minnesota.* Prepared for Northern States Power Company, Minneapolis. August.

IEEE (Institute of Electrical and Electronics Engineers). 1997. *National Electrical Safety Code*, 1997 Edition, New York, New York. Joklik, W. K. and D. T. Smith. 1972. *Microbiology.* 15th Edition. Meredith Corporation. New York.

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

MN DNR (Minnesota Department of Natural Resources). 2007a. "Letter from L.A. Joyal (MN DNR Natural Heritage and Nongame Research Program) to J. Holthaus (NMC) responding to request for Natural Heritage information for vicinity of proposed Prairie Island Nuclear Generating Plant (license renewal) T113N R15W Sections 4 & 5, Goodhue County." June 15.

MN DNR (Minnesota Department of Natural Resources). 2007b. "Letter from L. Joyal (MN DNR Natural Heritage and Nongame Research Program) to J. Holthaus (NMC) responding to request for Natural Heritage information for vicinity of proposed Prairie Island Nuclear Generating Plant – Transmission Lines (license renewal) Scott, Dakota, Goodhue, and Washington Counties." August 9.

MN DNR (Minnesota Department of Natural Resources). 2007c. "Environmental Review Fact Sheet Series, Endangered, Threatened, and Special Concern Species of Minnesota, Blanding's Turtle *(Emydoidea blandingii*)." Available at http://www.dnr.state.mn.us/reptiles_amphibians/turtles/blandings.html; Accessed August 29, 2007.

Mn/DOT (Minnesota Department of Transportation). 2006. "2005 Daily (Average) and Annual (Total) Vehicle Miles." Available at http://www.dot.state.mn.us/roadway/data/reports.vmt.html.

MPCA (Minnesota Pollution Control Agency). 2006. "National Pollutant Discharge Elimination System, Permit MN0004006, Prairie Island Nuclear Generating Plant." January.

Mussel Coordination Team. 2005. *Status of Implementation of Higgins Eye Pearlymussel (Lampsilis higginsii) Reasonable and Prudent Alternatives and Reasonable and Prudent Measures and Winged Mapleleaf Reasonable and Prudent Measures.* Prepared by Mussel Coordination Team (U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, National Park Service, Minnesota Dept. of Natural Resources, Wisconsin Dept. of Natural Resources, and Illinois Dept. of Natural Resources). November.

NMC (Nuclear Management Company, LLC). 2007. *Prairie Island Nuclear Generating Plant Updated Safety Analysis Report, Revision 29*. May 10.

NPS (National Park Service). 2006. "National Register Information System (NRIS) database: index by state and county." Accessed September 28, 2006.

NRC (U.S. Nuclear Regulatory Commission). 1980. "Possible Occupational Health Hazard associated with closed cooling systems for Operating Power Plants." Accessed at http://www.nrc.goc/reading-rm/doc-collections/gen-comm/info-notices/1980/in80009.html. Accessed on October 19, 2006.

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

NRC (U.S. Regulatory Commission). 2000. *Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses. Supplement 1 to Regulatory Guide 4.2.* Office of Nuclear Regulatory Research. Washington, D.C. May.

NSP (Northern States Power Company). 1981a. "Prairie Island Nuclear Generating Plant Chlorination of Circulating Water to Remove Parasitic Amoeba." Letter to D. Kriens from R. Clough. July 24.

NSP (Northern States Power Company). 1981b. "Prairie Island Nuclear Generating Plant Circulating Water Chlorination-Dechlorination Pathogenic Amoeba Control Program." Letter to D. Kriens from W. Jensen. October 14.

NSP (Northern States Power Company). 1983. "Prairie Island Nuclear Generating Plant Chlorination of Circulating Water System Fish Loss Report". Letter to H. Krosch and D. Kriens from W. Jensen. October 14.

NSP (Northern States Power Company). 1988. *DNR Water Permit Appropriations Permit #69-171.* September 7.

NSP (Northern States Power Company). 1993. *DNR Water Permit Appropriations Permit #89-5048.* March 30.

NSP (Northern States Power Company). 1995. *DNR Water Permit Appropriations Permit #96-5042.* December 20.

NSP (Northern States Power Company). 2001. *2000 DNR Annual Report of Water Use.* January 30.

NSP (Northern States Power Company). 2002. *2001 DNR Annual Report of Water Use*. January 28.

NSP (Northern States Power Company). 2003. *2002 DNR Annual Report of Water Use.* January 28.

NSP (Northern States Power Company). 2004. *2003 DNR Annual Report of Water Use.* January 16.

NSP (Northern States Power Company). 2005. *2004 DNR Annual Report of Water Use.* January 31.

NSP (Northern States Power Company). 2006. *2005 DNR Annual Report of Water Use.* February 15.

NUS Corporation. 1976. *Section 316(b) Demonstration for the Prairie Island Generating Plant on the Mississippi River near Red Wing, Minnesota.* December.

Stone & Webster (Stone & Webster Engineering Corp.). 1983. *Final System Description: Modify Circulating Water Intake and Discharge.* Denver. March.

TtNUS (Tetra Tech NUS). 2006. *Calculation Package Water Use 2000 through 2005*. Prepared by Gary Gunter. August.

TtNUS (Tetra Tech NUS). 2007. *Calculation Package for Prairie Island Nuclear Transmission Lines Induced Current Analysis.* Prepared by Chuck M. Conrad. Aiken, South Carolina. August 14.

USACE (U.S. Army Corps of Engineers). 2004. *Report of 2003 relocation of sub-adult Lampsilis higginsii reared in cages from the Mississippi and St. Croix rivers*; Conducted under Endangered Species permit TE 023308-1. Reporting Biologists: D. Kelner, M. Davis, G. Wege. January 5.

USACE (U.S. Army Corps of Engineers). 2006. *Final Integrated General Reevaluation Report and Environmental Impact Statement for Lock and Dam 3 Mississippi River Navigation Safety and Embankments.* St. Paul District, St. Paul, Minnesota. November.

USCB (U.S. Census Bureau). 2000. "State and County Quickfacts, Minnesota." Available online at http://quickfacts.census.gov/. Accessed October 2, 2006.

USGS (U.S. Geological Survey). 2006. *Water Resources Data, Minnesota, Water Year 2005.* Water Data Report MN-05-1. April 4.

UM (University of Minnesota) 2002. *Peregrine Falcon.* The Raptor Center, College of Veterinary Medicine. Available at http://www.cvm.umn.edu/raptor/info/peregrinefalcon.html. Accessed October 25, 2006.

White, C. M., N. J. Clum, T. J. Cade, and W. G. Hunt. 2002. "Peregrine Falcon (*Falco peregrinus*). The Birds of North America Online (A. Poole, Ed.)." Ithaca: Cornell Laboratory of Ornithology; Retrieved from The Birds of North American Available at http://bna.birds.cornell.edu/BNA/demo/account/Peregrine_Falcon/CONSERVATION_AND_MANAGEMENT.html. Accessed October 25, 2006.

Xcel Energy. 2004. *DNR Water Permit Appropriations Permit #78-5153*. May 5.

Xcel Energy. 2006a. *Xcel Energy Prairie Island Nuclear Generating Plant Proposal for Information Collection.* Prepared by Xcel Energy Environmental Services. July.

Xcel Energy. 2006b. *Xcel Energy Prairie Island Nuclear Generating Plant Comprehensive Demonstration Study.* Xcel Energy Environmental Services. October.