6 Alternatives to Extended Power Uprate

6.1 Section Summary

This Section describes the evaluation of the generation alternatives to the power uprate project at Prairie Island.[21] Minn. R. 7849.0120 requires that a Certificate of Need must be granted to an applicant upon determining that four principal criteria are met. The second of these criteria states that:

> *"a more reasonable and prudent alternative to the proposed facility has not been demonstrated by preponderance of the evidence on the record,…."*

The analysis in Section 4 "Alternatives to the Continued Operation of Prairie Island" clearly indicates that the continued operation of Prairie Island will provide significant financial benefits to our customers and significant environmental benefits to the state and region. Granting our request for additional dry cask storage to support the continued operation is necessary to realize those benefits and is a prerequisite to our proceeding with the power uprate. The power uprate project proves to be a unique opportunity for us to cost-effectively meet our customers' future energy needs and the environmental goals of the legislature by acquiring additional low-cost, carbon-free base load energy.

This section discusses the following alternatives and findings and Table 6-8 at the end of this chapter provides the requirements for Minn. R. 7849.0250 in tabular format:

- **Selection of alternatives.** Our analysis included a review of alternatives that do not rely on the construction of a central power station, as well as alternatives that have similar energy and capacity characteristics as Prairie Island. We also allowed Strategist to select the lowest cost generic units available to fill the capacity need in the "unconstrained" case.

- **Alternatives to power uprate.** Our analysis identified two feasible alternatives to the power uprate: a 164 MW biomass plant and a 164 MW long-term coal purchased power agreement ("PPA"). Additionally,

[21] This section provides the information regarding alternatives required by Minn. R. 7849.0250(B).

Strategist selected a 160 MW natural gas combustion turbine in the "unconstrained" case.

- **Costs of alternatives.** Our analysis indicates that the proposed power uprate is considerably more cost-effective than the alternatives considered under a wide spectrum of model assumptions.
- **Environmental impacts of alternatives.** Our analysis indicates that the proposed power uprate will result in significantly lower system emissions than all the alternatives evaluated.

6.2 Need Discussion

The analysis contained in this section focuses on how best to meet our customers' growing demand for energy. Our system demand and energy requirements continue to grow at approximately 1 percent per year, or 133 MW and 556 GWH. This estimated growth is after factoring in our compliance with the aggressive new RES and DSM legislation. By 2010, we estimate we will have a 126 MW deficit that will grow to over a 2,800 MW deficit by 2022. Assuming our request to relicense Prairie Island another 20 years and our request for additional dry cask storage are granted, this analysis considers the option of implementing an extended power uprate project at Prairie Island that will result in an addition 82 MW of output from each unit.

6.3 Methodology for Evaluating Alternatives

The evaluation of the power uprate employs the same methodology used in the Certificate of Need for the Monticello Power Uprate project (Docket No. E002/CN-08-185).

To determine the alternatives to the power uprate, we followed a two-step screening process.

- First, we reviewed alternatives that do not rely on the construction of a central power station.
- Second, we performed a qualitative screening to identify alternatives that have similar energy and capacity characteristics to Prairie Island. Alternatives that were not reasonably applicable to the need or that were

deemed to be excessively risky or costly were screened out from further consideration.

Based on the results of the qualitative screening, we selected options to model in Strategist for a more thorough quantitative assessment along with the Prairie Island power uprate. (See Section 4 for a more detail description of the Strategist planning software used for quantitative evaluation.)

6.3.1 Evaluation Criteria

Four evaluation criteria were ultimately considered during the evaluation of alternatives process. The first two, Reliability and Applicability, were considered during the second step of the Qualitative analysis; the second two, Cost and Environmental Impacts were considered during the Quantitative analysis. Each are defined below.

- Reliability — Prairie Island has a record of high reliability. Prairie Island also has a 5-year average capacity factor of 90.2 percent and the uprate is not expected affect this level of performance.

- Applicability — The 164 MW Prairie Island power uprate project will help fill NSP's growing capacity needs. Our forecast shows we have a resource deficit starting in 2010 that steadily grows to over 2,800 MW in 2022. The low-cost base load energy from this project will help keep NSP's average costs down and will provide a hedge against natural gas prices.

- Cost — We compared the cost of the power uprate to the other available alternatives considered. In addition, the costs for the Prairie Island extended power uprate project are more certain and involve less risk than other projects.

- Environmental Impacts — Power uprate at Prairie Island will reduce carbon emissions. As a non-carbon producing generation source, Prairie Island is superior to fossil fuel alternatives that produce carbon from an emissions perspective. Since Prairie Island is a low-cost energy resource, it is dispatched prior to other fossil fuel plants in our analysis. This remains true even after power uprate. Continued use of Prairie Island does not increase carbon like fossil fuel replacement alternatives, and the power uprate project displaces carbon that would have been emitted if a fossil fuel source were implemented in place of the power uprate project.

In addition, the continued use of an existing power plant site eliminates the need to develop greenfield sites for new generation facilities.

6.3.2 Non-Construction Alternatives

The Certificate of Need Rules require that we evaluate several alternative approaches to meeting the need that do not rely on the construction of a new central power station. We examined the following types of alternative approaches.

6.3.2.1 Demand-Side Management

As discussed in Section 4, DSM includes both Conservation and Load Management Programs, which are presented in detail in Appendix C.

Consistent with the Next Generation Energy Act of 2007, we are committed to achieving a 1.1 percent energy reduction as our CIP/DSM goal. Meeting this goal will be very challenging. We will likely launch new conservation programs as well as expand existing programs to meet the 1.1 percent target. Such aggressive expansion of DSM programs will push the limits of achievable potential in our service territory and creates significant uncertainty regarding the size and timing of actual savings.[22] Until we have implemented our plan to meet the 1.1 percent target and gained some experience operating a significantly larger DSM portfolio, it is unreasonably risky to rely on increased DSM in order to replace the energy and capacity from the Prairie Island uprate project. If the DSM alternative was selected and the company failed to achieve the necessary savings, we would be forced to buy replacement capacity and energy from the market.

Therefore, the Company concludes that additional DSM saving beyond our target of 1.1 percent is not a feasible alternative to the power uprate project.

6.3.2.2 Increased Efficiency of Existing Facilities

We have identified and are pursuing uprate/upgrade projects for our existing generation resources including the Monticello and Sherco generation plants and

[22] Our forecast already includes the assumed DSM savings necessary to meet our aggressive 1.1 percent target and still forecasts a deficit starting 2010.

have incorporated estimates of these projects in this analysis. Our next three largest plants King, Riverside, and High Bridge are all part of our Metro Emission Reduction Program ("MERP") and have either undergone or will undergo modifications to reduce their emissions and increase their electrical output. Between the MERP plants, the Monticello Power Uprate CON, this CON for power uprate, and our proposed changes at Sherco, we have already increased the MW output of our six largest power plants. This leaves few opportunities for additional efficiency projects and therefore increased efficiencies at existing plants were not considered further.

6.3.2.3 Long-Term Purchased Power

Long-term purchased power agreements have historically been an important part of our resource mix. We are unaware of a specific long-term purchase opportunity, but we did model an estimate of a long term PPA from a coal-based resource to include as a possible alternative. The hypothetical coal PPA price was modeled to have the same cost, performance, and emission characteristics of a new conventional coal plant. The PPA may have similar capacity and energy characteristics to the uprate and therefore was selected for inclusion in the quantitative evaluation.

6.3.2.4 Short-Term Purchased Power

Historically, we have depended on short-term power purchases to cover about the last 5 to 10 percent of our projected capacity and energy needs. While there are some concerns about firm transmission service and about the continued recognition of MISO Network Transmission service being approved for accreditation of resources by MAPP, we believe the same level of short-term power purchases can be achieved for the near future.

Our resource planning process explicitly recognizes the level of short-term purchases that can reliably contribute to our overall resource portfolio. (The 2007 Resource Plan analysis (and this analysis) incorporates 750 MW of short-term purchases.) We will continue to pursue short-term power purchases as a valuable portion of our power supply portfolio. However, our assessment is that it would be too risky to extend further into the short-term market than is already accounted for. Therefore, short-term purchases are not a prudent resource option to meet the current need.

6.3.2.5 New Transmission Lines

Additions to or improvements in the electric transmission system are not viable alternatives to the Prairie Island power uprate proposal. The underlying assumption with this alternative is that additional transmission infrastructure would provide access to additional capacity resources. However, since the capacity construction boom of the late 90's there had been relatively little capacity built in the region. The result has been very tight capacity markets with little or no excess capacity available. Thus, no opportunities exist for new transmission to bring in additional capacity.

6.3.2.6 Distributed Generation

Pursuant to Minn. Stat. § 216B.2426, the use of distributed generation was also considered to meet the need. However, we are not aware of available distributed generation resources in the quantities that would be necessary to fill the current need. We reviewed the distributed generation information requests and analyses we performed (DOC-18 and DOC-19) in the Monticello Spent Fuel Storage Certificate of Need (Docket No. E002/CN-05-123). Our review indicated that a significant percentage of the distributed generation from those analyses was either wind or DSM. Considering the new RES and DSM legislation, once those two resources were excluded, the main sources of distributed generation to be considered were biomass, biodiesel and small hydro. Based on available cost estimates, these distributed generation resources are not likely to be cost-effective alternatives and were therefore excluded from further consideration.

However, while we did not identify individual distributed generation projects that would meet the 164 MW need, we did model a 164 MW biomass alternative for comparison purposes. Due to its size though, we did not categorize it as distributed generation.

Pursuant to the Commission's July 28, 2006 order in the 2004 Resource Plan, the Company has contracted with a consultant for a new study of distributed generation. This study, together with related studies initiated by the 2007 Legislature, will define what a comprehensive distributed generation strategy would entail and will help identify the total potential for distributed generation within our service territory.

6.3.2.7 Reduced Project Size

The power uprate project will net a capacity increase of approximately 164 MW. This is the optimal, achievable capacity increase at the Prairie Island facility. If any reduction in the capacity of the project were feasible, it would result in higher costs per MW and would also require additional projects to meet our customers' growing needs. Therefore, alternative smaller uprate projects were not deemed reasonable.

6.3.2.8 No Facility

If the power uprate project were not undertaken and no other alternative were pursued, there would be a 164 MW gap in our capacity coverage and the system would be significantly short on energy. Our system shows a capacity deficit starting in 2010 and growing to over 2,800 MW by 2022. Due to our requirement to provide safe, adequate and reasonable electric service pursuant to Minn. Stat. § 216B.04, "no facility" is not an option as we would experience a deficit in 2011 and beyond if the proposal or an alternative is not undertaken.

6.3.2.9 Summary of Non-Construction Alternatives

The results of the qualitative screening for alternatives that are not based on central power stations are summarized in Table 6-1. Our assessment shows that a long-term power purchase agreement is the only alternative approach that might be a reasonable alternative to the Prairie Island power uprate.

Table 6-1: Alternative Approach Screening Summary

Does this technology have the characteristics to be a reasonable alternative? + Likely O Possibly - Not likely								
	Demand Side Management	Increased Efficiency of Existing Facilities	Long-Term Power Purchases	Short –Term Power Purchases	New Transmission Lines	Distributed Generation	Reduced Project Size	No Facility[23]
Applicability: Does this resource have characteristics similar to the Prairie Island Uprate Project?	O	-	+	O	-	-	-	-
Reliability: Will this resource be available as needed and provide benefits to the grid?	-	-	+	-	-	O	-	-
Is this approach feasible?	**No**	**No**	**Yes**	**No**	**No**	**No**	**No**	**No**

6.3.2.10 Qualitative Screening of Alternatives

The qualitative screening was further performed by grouping resource alternatives into three categories: fossil fuel resources, renewable resources and emerging technologies. Appendix D presents detailed descriptions of the fossil fuel, renewable resource and other emerging generation technologies screened along with a discussion of the evaluation factors for each technology. The conclusions of that screening process are discussed below.

[23] The No-Facility scenario allows Strategist to pick the most applicable resource from those available when it is needed. This is called the "unconstrained" scenario.

6.3.2.11 Fossil Fuel Technology Screening

Fossil fuel technologies considered in the screening include an integrated gasification combined cycle (IGCC), a coal-fired boiler, and a natural gas-fired advanced combined cycle. These units have similar operating characteristics to the Prairie Island project and are potentially viable alternatives. Even though the fossil fueled alternatives have similar operating characteristics, the IGCC, coal, and combined cycle units cannot economically be built to the appropriate 164 MW scale. Additionally, the advanced combined cycle is currently not a commercially viable technology. Table 6-2 summarizes the initial evaluation of each fossil fuel technology's characteristics.

Table 6-2: Characteristics of Fossil Fuel Technologies

	IGCC	Coal-Fueled Boiler	Advanced Natural Gas-Fueled Combined Cycle
+ Likely	**O Possibly**		**- Not likely**
Applicability: Does this resource have appropriate characteristics to meet 2011 need	-	-	-
Reliability: Will this resource be available as needed and provide benefits to the grid?	-	-	-
Is further consideration warranted?	**No**	**No**	**No**

6.3.2.12 Renewable Resource Technology Screening

Renewable resource technologies considered as potential alternatives include wind, solar, biomass, hydropower, and landfill gas. Table 6-3 summarizes the initial screening of each renewable resource technology's characteristics.

Table 6-3
Initial Screening of Renewable Resource Technologies

Does this technology have the characteristics to be a reasonable alternative? + Likely O Possible - Not Likely					
	Wind	**Solar**	**Biomass**	**Hydro-power**	**Landfill Gas**
Applicability: Does this resource have appropriate characteristics to meet 2011 need?	-	-	+	O	O
Reliability: Will this resource be available as needed and provide benefits to the grid?	-	-	O	-	-
Is further consideration warranted?	**No**	**No**	**Yes**	**No**	**No**

A biomass-fueled resource may have the appropriate characteristics and reliability to fill the same need as the power uprate project and was included as an alternative for further evaluation.

6.3.2.13 Emerging Technology Screening

Other technologies screened as potential alternatives include fuel cells, microturbines and several energy storage technologies. Table 6-4 summarizes the initial screening of these emerging technologies.

Table 6-4: Initial Screening of Emerging Technologies

Does this technology have the characteristics to be a reasonable alternative? + Likely O Possibly - Not likely			
	Fuel Cells	**Micro-Turbines**	**Stored Energy**
Applicability: Does this resource have appropriate characteristics to meet the need?	O	O	O
Reliability: Will this resource be available as needed and provide benefits to the grid?	-	-	-
Is further consideration warranted?	**No**	**No**	**No**

None of the emerging technologies warrants further consideration as an alternative to the Prairie Island power uprate project.

6.4 Quantitative Modeling or Alternatives

As a result of the qualitative screening process, we identified two alternatives that have operating characteristics similar to the Prairie Island power uprate project; a 164 MW Biomass Plant and a 164 MW long-term coal PPA. In addition, an "unconstrained" scenario was included as an alternative to the Prairie Island power uprate project. The unconstrained scenario consisted of allowing Strategist to select lowest-cost generic units available to fill the capacity need. Strategist selected a 160 MW natural gas combustion turbine ("CT"). The CT selected and other existing resources were used to generate the equivalent energy of the Prairie Island power uprate project.

The next step was to more thoroughly evaluate the economic and environmental factors associated with each alternative through a series of modeling scenarios. The scenarios were then tested to determine their sensitivity (Sensitivities) to changes in various input variables.

6.4.1 Base Case

The Prairie Island power uprate project was first compared against the selected alternatives using the 'base case' assumptions in Strategist. This base case assumes Prairie Island's life extension is approved through 2033/2034. The base case assumptions are the same assumptions used for the base case in our 2007 Resource Plan and the Monticello Power Uprate Certificate.[24] The base case assumptions include the reference case expansion plan, the median fuel forecasts, the 1.1 percent DSM goal and the 30 percent RES, \$20/ton CO_2 hedge value, and no externalities.

6.4.2 Prairie Island Power Uprate Project

The Prairie Island power uprate project is described in detail in Chapter 3. In summary the project will increase the capacity of the Prairie Island nuclear facility by approximately 164 MW through enhanced steam production. The uprate project for Unit 1 will be completed during the 2012 refueling outage and Unit 2 will be completed during the 2015 outage. Total cost in nominal dollars are forecasted to be \$322 million, or approximately \$2,011 per kW.

[24] The base case uses the same forecast, individual plant information, externality values, and fuel forecasts, and assumes compliance with the RES and DSM legislation.

6.4.3 Hypothetical 164 MW Biomass Plant

A 164 MW base load type biomass plant was determined to be a reasonable alternative to the Prairie Island power uprate project. Such a plant will have roughly the same capacity and energy characteristics, but lower expectations for reliability and availability due to technology and fuel supply considerations. The capital costs for a new biomass plant are expected to be similar to other base load type steam plants. This analysis assumed that a plant commissioned in 2013 would cost $3,182 per kW or $522 million. The fuel costs and operating characteristics were based on our existing plants and fuel forecasts.

6.4.4 Hypothetical 164 MW Coal PPA

The cost and availability of a 164 MW long term coal-based PPA are highly speculative. This scenario assumed a capacity charge equivalent to the levelized revenue requirements of a new plant and energy charges equivalent to the cost of fuel at a 10 mmBtu/MWh heat rate plus small variable O&M costs. The contract is assumed to deliver 164 MW continuously for a 20-year period. It is expected that a coal-based contract would be structured such that responsibility for the associated emissions would be assigned to the buyer. The emission rates for the hypothetical coal PPA are based on typical emission rates for our existing coal units.

6.4.5 Unconstrained

The "unconstrained alternative" alternative is not a specific resource. In this scenario, the Strategist model is allowed to select the most cost-effective combination of resources from the available generic resources including coal, natural gas combined cycle, and natural gas simple cycle resources. In this analysis, the capacity need was filled by the addition of natural a gas CT. New and existing resources filled the energy needs.

6.5 Economic Comparison of Alternatives

Table 6-5 below presents a comparison of the differences in the present value of revenue requirements (PVRR) for the Prairie Island upgrade project and the selected alternatives under the base case assumptions. The Prairie Island uprate is considerably more cost effective than the alternatives considered. Nuclear capacity at a price of about $2,000/kW proves to be economically superior to all other generation capacity that could be employed. The biomass alternative shows to be particularly uneconomic due to high capital, fuel, emission costs. This analysis made the conservative assumption that CO_2 emissions from biomass would be subject to the same regulations as other types of fuel and therefore had the fuel CO_2 hedge value applied to them. This adds $610 million to the PVRR of the biomass alternative using the $20/ton CO_2 hedge value.

Table 6-5: Present Value of Revenue Requirements (PVRR) Base Case Assumptions ($ millions)

	Prairie Island Uprate Project	164 MW Coal PPA	164 MW Biomass	Unconstrained
PVRR	**$61,356**	**$61,974**	**$62,535**	**$61,875**
PVRR difference from Prairie Island Project	**-**	**$619**	**$1,179**	**$519**

6.6 Sensitivity Analysis

In order to determine how changes in our assumptions impact the costs or characteristics of different alternatives, numerous assumptions were changed and the Strategist model was rerun. If the lowest-cost option is extremely sensitive to changes in assumptions, we may propose an alternative that is less sensitive to assumption changes, but slightly more costly. Under the base case assumption the Prairie Island power uprate project was determined

to be the least-cost option. Under all sensitivities the power uprate project was determined to be the least-cost resource. The sensitivities tested were:

- Load Growth
- Fuel Price
- Externality Costs
- Carbon Regulation Costs
- MISO Market Interactions
- Capital Cost Escalations

The sensitivity changes performed for the power uprate project evaluation are the same as those discussed in Section 4 "Alternatives to Continued Operation of Prairie Island".

Table 6-6 presents the results of the sensitivities analysis. The leftmost column lists the PVRR result for the Prairie Island uprate project. The remaining columns list the differences from the Prairie Island project for each of the selected alternatives.

Table 6-6: Power Uprate Sensitivity Analysis

	Prairie Island Uprate Project	**164 MW Coal PPA**	**164 MW Biomass**	**Unconstrained (Natural Gas CT)**
	PVRR	PVRR Differences From the Prairie Island Uprate Project		
Base Case	$61,356	$619	$1,179	$519
Low Load	$60,139	$617	$1,177	$496
High Load	$62,859	$518	$1,182	$546
Coal+20 percent	$62,275	$619	$1,181	$529
Gas+20 percent	$63,964	$619	$1,189	$648
Nuclear+20		$603	$1,164	$504

	Prairie Island Uprate Project	164 MW Coal PPA	164 MW Biomass	Unconstrained (Natural Gas CT)
	PVRR	PVRR Differences From the Prairie Island Uprate Project		
percent	$61,711			
Coal-20 percent	$60,424	$619	$1,178	$509
Gas-20 percent	$59,522	$619	$1,171	$407
Nuclear-20 percent	$61,071	$633	$1,193	$533
Low Externalities	$61,495	$620	$1,181	$521
High Externalities	$61,558	$620	$1,182	$522
CO_2 $9/ton	$56,948	$449	$836	$434
CO_2 $40/ton	$69,344	$931	$1,809	$699
MISO On	$61,248	$617	$1,174	$488
Capital Cost Escl. 3 percent	$62,795	$607	$1,192	$510
Capital Cost Escl 5 percent	$66,149	$583	$1,218	$488

The sensitivity analysis shows that the Prairie Island uprate is the least-cost alternative under a wide spectrum of model assumptions. The coal PPA alternative comes closest to being economically competitive under the low CO_2 cost assumption and the unconstrained case improves considerably under the assumption of low natural gas costs. However none of the assumption sensitivities change the result that the Prairie Island power uprate is the lowest cost alternative.

6.7 Rate Impact

The base case PVRR savings for the Prairie Island uprate project are $519 million in comparison to the next lowest cost alternative, which was the

addition of a natural gas CT from the unconstrained scenario. The "unconstrained" scenario fills the capacity need with combustion turbine capacity and fills the energy from existing resources, which translates to a modest impact on rates. For the period 2008-2035, the average annual cost savings of the uprate is $64 million. During this same period the average annual sales are forecasted to be 59,900 GWh. The result is an average decrease of about $0.0011 kWh or 0.85 percent.

Because the PVRR differences for the coal PPA and biomass alternatives were even higher, the average rate impact would be even larger for the Prairie Island power uprate in comparison to those alternatives.

6.8 Emission Comparison of Alternatives

Table 6-7 presents a comparison of the total system emissions for each alternative evaluated in this filing. Emission totals were calculated summing the forecasted emissions from our entire existing and planned generation fleet over the study period 2008 to 2035. The table compares differences between the total emissions for the preferred plan and each of the alternatives considered by setting the Prairie Island Power Uprate project as the baseline (in other words "0") and by showing how much higher or lower other alternatives are.

Table 6-7: Total System Emissions for Each Alternative

2008 – 2035 Emissions Differences	**NOx** Tons	**PM10** Tons	**CO_2** Tons	**SO_2** Tons	**VOC** Tons	**CO** Tons
Prairie Island Uprate Project	0	0	0	0	0	0
164 MW Coal PPA	24,110	3,158	32,290,370	39,616	578	4,767
164 MW Biomass	103,722	4,701	65,357,790	21,551	837	18,498
"Unconstrained" Natural Gas Combustion Turbine	7,580	1,370	16,059,200	9,526	283	2,235

The Prairie Island power uprate project is projected to result in significantly lower system emissions than all the alternatives evaluated.

6.9 Operating Information of Alternatives

Table 6-8 contains the operating information of the alternatives to the Prairie Island Power Uprate project required by Minn. R. 7849.0250.

Table 6-8: Power Uprate Alternatives Operating Information

Rule Reference	Description	Coal PPA Alternative	Biomass Alternative	Unconstrained Optimization (Gas CT + System Energy)
Capacity		164 MW	164 MW	168 MW
Annual Capacity Factor		• 95%	• 86%	• 88.8% - 97% • Modeled such that system energy replaces the energy from the IP EPU.
Typical Availability		• 95% • Assumed 5% forced outage rate	• Assumed 5% forced outage rate. • Assumed 4 weeks of maintenance per year.	• Because energy is from anywhere in Xcel's existing system, availability is 100%
7849.0250 A (1)	Nominal generating capability	164 MW	164 MW	168MW
7849.0250 A (2)	Operating Cycle	Baseload	Baseload	Peaking unit for capacity plus system energy equivalent to a 164 MW baseload unit.
Anticipated annual capacity factor		• 95%	• 86%	• 88.8% - 97% • Modeled such that system energy replaces the energy from the PI EPU.

Table 6-8: Power Uprate Alternatives Operating Information				
Rule Reference	**Description**	**Coal PPA Alternative**	**Biomass Alternative**	**Unconstrained Optimization (Gas CT + System Energy)**
7849.0250 A (3)	Type of fuel used	• PPA contract based on characteristics of coal plant	• Wood	• System energy primarily from coal and gas units.
7849.0250 A (3)	Availability of fuel	• The alternative was model to have sufficient fuel to meet its 95% capacity factor.	• The alternative was model to have sufficient fuel to meet its 95% capacity factor.	• Subject to typical system wide fuel availability.
7849.0250 A (3)	Alternative fuels	None	None	• None
7849.0250 A (4)	Anticipated heat rate (efficiency) (ISO Conditions)	Energy costs estimated based on an assumed heat rate of 10mmBtu /MWh	17mmBtu/MWh	• 8.38mmBtu/MWh based on implied gas heat rate.
7849.0250 C (1)	Capacity Costs In $/kW	$2,924/kW	$3,182/kW	$589/kW
7849.0250 C (2)	Service Life	2014 to 2034	2014 to 2034	2014 to 2034
7849.0250 C (3)	Estimated Average Annual Availability	95%	87%	100%
7849.0250 C (4)	Fuel Costs ($/kWh)	$0.0178/kWh	$0.0204/kWh	$0.0411/kWh

Table 6-8: Power Uprate Alternatives Operating Information				
Rule Reference	**Description**	**Coal PPA Alternative**	**Biomass Alternative**	**Unconstrained Optimization (Gas CT + System Energy)**
7849.0250 C (5)	Variable Operating And Maintenance Costs ($/kWh)	$0.00223/kWh	$0.0057/kWh	$0.0057/kWh
7849.0250 C (6)	Total Cost ($/kWh)	$0.0959/kWh	$0.1477/kWh	$0.0805/kWh
7849.0250 C (7)	Estimated Effect On Rates System-Wide Assuming Test Year Beginning With Proposed In-Service Date	$0.0025/kWh	$0.0035/kWh	$0.0017/kWh
7849.0250 C (8)	Efficiency Expressed In Heat Rate	10 mmBtu /MWh	17 mmBtu /MWh	8.38 mmBtu/MWh based on implied gas heat rate.

6.10 Alternatives Evaluation Summary

Prairie Island Power Uprate is the best alternative available from both a financial and an environmental perspective.

We evaluated an exhaustive list of alternatives in selecting this project. First, we qualitatively screened a wide range of approaches and technologies to identify potential viable resources for meeting our resource needs. Next, for the resource alternatives that were found to be feasible, we conducted a quantitative analysis of the economic and environmental factors associated with each resource. We also allowed Strategist to pick the best generic resource based on cost. The Prairie Island power uprate performed the best on both the economic and environmental analysis. We are pleased to have identified a resource that meets our needs and furthers the environmental and policy goals of the Company and the State.

7 Additional Spent Fuel Storage Environmental Information

7.1 Section Summary

This section provides environmental information as required in the Commission's application content rules for nuclear waste storage facilities (Minn. R. Parts 7855.0640 to 7855.0670) and feasible alternatives. Minn. R. 7855.0640 outlines environmental information to be provided for the proposal and any alternative sites.

Construction of the two additional concrete pads to accommodate additional cask storage capacity at the Prairie Island ISFSI is not expected to disturb any additional land area. Therefore, the environmental impact of the additional pads and casks is minimal. The only potential environmental affect of the additional pads and cask involves storm water run-off. However, no additional storm water permitting is required for the project.

The environmental impacts of the continued operation of the Prairie Island plant are addressed in Appendix J, the Environmental Report for the License Renewal Application to the NRC.

7.2 Existing ISFSI Site Description

As discussed in Section 5, the additional casks contained in this proposal will fit within the footprint of the existing ISFSI. Alternate sites at Prairie Island were evaluated when the existing ISFSI was permitted by the State. Alternative sites were not re-evaluated for this application. For convenience, the environmental information for the existing site is presented in this Section.

7.2.1 Topography

The Prairie Island Nuclear Generating Plant (Plant) site is situated on the southeastern portion of Prairie Island, an outwash terrace above the Mississippi River. The Plant site is located at an elevation of about 690 feet above mean sea level (msl), about 15 feet above the normal pool elevation of the river. The general area is nearly level, with a local relief ranging from about 675 feet above

msl (along the river frontage) to about 700 feet above msl. There are a few scarps along the Mississippi River shoreline that have resulted from river scouring. Figure 7-1 is an aerial view of the site, and Figure 7-2 is the USGS topographic map of the site area. *(Due to their size, all Figures in the Section are located at the end of the Section.)*

7.2.2 Soils

Figure 7-3 presents the soils map for the Plant and the ISFSI site, using the US Department of Agriculture, Natural Resources Conservation Service (NRCS) soil taxonomy system, which groups soils into categories based on each soil's morphology (appearance and form). Classification is based on climatic, chemical and physical soil properties observed in the field or inferred from those observations, or from laboratory measurements. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, thickness of the root zone, consistency, moisture equivalent, slope, and permanent cracks. Beginning with the broadest, these categories are the Order, Suborder, Great Group, Subgroup, Family, and Series. The soil series consists of soils with horizons that are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

For land use planning purposes, soils are further subdivided into mapping units, which are also called "phases of series." These mapping units are not considered as a classification category of the system, as soil taxonomy terminates at the series level. It is important to recognize that soil mapping units can represent a kind of soil, a combination of soils, or miscellaneous land types due to limitations imposed by the scales of county soil survey maps. This is stressed by the NRCS in the following statement: "*Enlargement of these maps…could cause misunderstanding of the detail of the mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown on a larger scale.*" Soil mapping units are named for the prominent soil series or land type within the unit.

As shown on sheet No. 8 of the Soil Survey of Goodhue County, Minnesota (Poch 1976) (Soil Survey) the Plant area is mapped with 13 mapping units. Table 7-1 lists the mapping units in the vicinity of the Plant site. The prevalent soil phases mapped in the vicinity of the Plant are Sparta loamy sand, 0 to 3 percent slopes (SpA), which is the major soil in the northern and southern

parts and Plainfield loamy sand, 0 to 6 percent slopes (PaB), which comprises most of the central area.

Alluvial land, frequently flooded (Af) and Marsh (Md) are listed by the NRCS as hydric soils. Hydric soils are defined as "*soils formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part*" (Federal Register, July 13, 1994). Hydric soil indicators are formed predominantly by the accumulation or loss of iron, manganese, sulfur, or carbon compounds. The presence of hydrogen sulfide gas is a strong indicator of hydric soil. In areas where soils are formed from parent material with low iron and manganese concentrations, features related to accumulations of organic carbon are typically used to determine hydric soils. Alluvial land, frequently flooded (Af) is mapped as narrow areas along the shorelines of Sturgeon Lake and the Mississippi River. Marsh (Md) occupies a narrow depression that extends southwest from an unnamed lagoon located south of Sturgeon Lake. While marsh soils are near the ISFSI, they are not present on the site of interest.

Of the soils shown in the vicinity of the Plant, three are mapped within the ISFSI location; these soils mapped are outlined below, as described in the Soil Survey.

Plainfield loamy sand, 0 to 6 percent slopes (PaB) – This is a nearly level to steep, excessively drained soil on benches and escarpments along major streams. This soil formed in sandy outwash. Permeability is rapid and water capacity is low in this soil, and the hazard of drought is severe with respect to crops. The hazard of erosion or soil blowing is moderate in areas without vegetative cover. This is the dominant soil mapped in the ISFSI area, comprising the entire northern and central portions of the essentially inverted triangle-shaped site.

Sparta loamy sand, 0 to 3 percent slopes (SpA) – This is a nearly level, excessively drained soil on benches of major streams. This soil formed in sandy outwash. Slopes are smooth and decline in the direction of the escarpments adjacent to the flood plain. Permeability is very rapid and water capacity is low in this soil, and the hazard of drought is severe with respect to crops. The hazard of erosion or soil blowing is also severe in areas without vegetative cover. Some deep gullies occur along escarpments where surface runoff spills over. This soil is mapped in the southern part of the ISFSI.

Alvin fine sandy loam, 0 to 3 percent slopes (AvA) – This is a nearly level, well-drained soil on river terraces. This soil formed in glacial outwash.

Permeability is moderate and water capacity is moderate and high in this soil, and the hazard of drought is moderate with respect to crops. Areas where the slope may be gently sloping have slight erosion hazard. This soil is mapped in a small area in the southeast part of the ISFSI. The mapping unit itself is a relatively large area that extends to the east from the ISFSI.

Table 7-1:
Soils Mapped in the Vicinity of the ISFSI

Map Symbol	Mapping Unit	Components of Mapping Unit	Subgroup	Order
Af	Alluvial land, frequently flooded	Stratified sand, loamy sand, silt, sandy loam, loam, sandy riverwash	NA	NA
AvA	Alvin fine sandy loam, 0 to 3 percent slopes	Alvin Series	Typic Hapludalfs	Alfisols
		Some soils less than 38" deep to gravel	NA	NA
AxA*	Ankeny sandy loam, 0 to 3 percent slopes	Ankeny Series	Cumulic Hapludolls	Mollisols
		Poorly drained soils along outer edge of flood plains	NA	NA
BrA	Burkhardt loam, 0 to 3 percent slopes	Burkhardt Series	Typic Haplaquolls	Mollisols
		Dakota Series	Typic Argiudolls	Mollisols
		Lilah Series	Psammentic Hapludalfs	Alfisols
		Salida Series	Entic Hapludolls	Mollisols
EsC	Estherville soils, 6 to 18 percent slopes	Estherville Series	Typic Hapludolls	Mollisols
		Salida Series	Entic Hapludolls	Mollisols
LlA	Lilah sandy loam, 0 to 6 percent slopes	Lilah Series	Psammentic Hapludalfs	Alfisols
Md	Marsh	Bremer Series	Typic Argiaquolls	Mollisols
		Houghton Series	Typic Medisaprists	Histosols
		McPaul Series	Mollic Udifluvents	Entisols
		Orion Series	Aquic Udifluvents	Entisols
		Alluvial land, frequently flooded	NA	NA
		Somewhat poorly drained sandy soils SW of Cannon Falls (outside of study area)	NA	NA
		Some very steep areas	NA	NA

Table 7-1, continued Soils Mapped in the Vicinity of the ISFSI				
Map Symbol	**Mapping Unit**	**Components of Mapping Unit**	**Subgroup**	**Order**
Mp	McPaul silt loam	McPaul Series	Mollic Udifluvents	Entisols
		Chaseburg Series	Typic Udifluvents	Entisols
PaB*	Plainfield loamy sand, 0 to 6 percent slopes	Plainfield Series	Typic Udipsamments	Entisols
PaD	Plainfield loamy sand, 6 to 25 percent slopes	Plainfield Series	Typic Udipsamments	Entisols
		Salida Series	Entic Hapludolls	Mollisols
		Some severely gullied areas	NA	NA
		Some very steep areas	NA	NA
SaE	Salida gravelly coarse sand, 12 to 45 percent slopes	Salida Series	Entic Hapludolls	Mollisols
SpA*	Sparta loamy sand, 0 to 3 percent slopes	Sparta Series	Entic Hapludolls	Mollisols
Zu	Zumbro loamy sand	Zumbro Series	Entic Hapludolls	Mollisols

* Mapped within the ISFSI Location

7.2.3 Geology

The Plant site occupies an outwash terrace formed on the Minnesota side of the Mississippi River. The type of bedrock beneath the area is predominantly composed of sedimentary rock of the St. Lawrence and Franconia Formations, both within the Upper Cambrian System.

The St. Lawrence Formation is comprised of tan to gray, well-cemented, thin- to medium-bedded silty dolostone and siltstone. There are also thin shale beds. The dolostone in this formation contains variable amounts of clay, silt, sand and glauconite. Thin to medium beds of very fine grained sandstone are common, particularly in the upper 20 feet of the formation. This formation is typically about 40 to 50 feet in thickness.

The Franconia Formation is mostly comprised of glauconitic, feldspathic, very fine to fine-grained sandstone. There is also green and gray shale, and pink or tan, sandy, glauconitic dolostone. Intraclasts and burrow mottling are common

in this formation. The Franconia Formation is generally coarser grained and more poorly cemented than the St. Lawrence Formation. This formation is typically about 165 to 175 feet in thickness. Three members of the Franconia Formation are recognized; these are the Reno Member, the Tomah member and the Birkmose member.

The Reno Member comprises the upper 90 to 100 feet of the Franconia Formation. It consists of very fine grained to fine-grained glauconitic sandstone interbedded with siltstone and shale.

The Tomah Member comprises the medial 40 feet of the Franconia Formation. It consists of interbedded, very fine-grained sandstone, siltstone and shale, with minor amounts of the mineral glauconite. This member is finer grained and has more shale than adjacent members.

The Birkmose Member comprises the basal 30 feet of the Franconia Formation. It consists of very fine grained to fine-grained sandstone, with abundant glauconite. Dolomite cement and sandy dolostone beds are common.

The depth to bedrock beneath the ISFSI site is about 100 feet. Overlying the bedrock is sand and gravel of the Holocene and Pleistocene age Grey Cloud terrace. The Grey Cloud terrace is comprised of coarse, clean sand and gravel derived from the Mississippi valley train and reworked by the swift water of the River Warren, an ancient river formed by the meltwater of the combined ice lobes of the Minnesota and western Wisconsin glaciers.

7.2.4 Groundwater

Generally, the movement of groundwater is toward the Mississippi River and its main tributaries. The groundwater slopes from the higher, glaciated areas toward these surface streams, generally at low gradients. Groundwater enters the river valley from along the base of the bordering bluffs in the form of springs or as subsurface flow. Beneath the flood plains and low terraces that border the Mississippi River, groundwater levels closely coincide with the elevations of the river surface, and vary with river fluctuations. The average groundwater gradient in these bottomlands is essentially parallel to the stream gradient.

Normal pool elevation, approximately on the Mississippi River adjacent to the site is controlled by Lock and Dam Number 3. Due to the permeable nature of

the sandy alluvial soils forming Prairie Island, the groundwater table responds quickly to changes in river elevation.

The groundwater table in the vicinity of PINGP is generally within 5 to 20 feet, at approximately elevation 675, of ground surface and slopes to the southwest. The ISFSI was constructed at 694 feet above mean sea level.

The Franconia Formation, which is located approximately 100 feet beneath the site, is approximately 70 ft. thick. The upper portion of this formation is used as an aquifer under shallow conditions. Much of the lower portion of this formation has very low hydraulic conductivity even under shallow conditions and is considered a confining unit.

7.2.5 Terrestrial Ecology

On November 13 and 14, 2006, the ISFSI site at the Plant was inspected for general site conditions, vegetation, wildlife habitat and proximity to cultural and ecologically sensitive areas.

The ISFSI site has been disturbed by past vegetative clearing and land grading. The observed vegetation is listed below in Table 7-2. All of the species observed were common plants of the area, and several are non-native and/or invasive species.

Table 7-2

Vegetation Observed on and near the ISFSI Site
November 13 and 14, 2006

Scientific Name	Common Name
Herbaceous	
Abutilon theophrasti	Velvetleaf
Achillea millefolium	Common yarrow
Ageratina altissima	White snakeroot
Amaranthus sp.	Amaranth

Table 7.2, continued Vegetation Observed on and near the ISFSI Site November 13 and 14, 2006	
Scientific Name	**Common Name**
Herbaceous	
Artemisia sp.	Wormwood
Bromus japonicus (=*B. arvensis*)	Field brome
Cirsium sp.	Thistle
Conyza canadensis	Horseweed
Coronilla varia	Crown vetch
Dichanthelium sp.	Witch-grass
Elymus canadensis	Canada wild-rye
Eragrostis sp.	Love grass
Lespedeza capitata	Roundheaded bushclover
Medicago lupulina	Black medick
Monarda sp.	Bergamot
Nepeta cataria	Catnip
Oenothera biennis	Common evening-primrose
Panicum virgatum	Switch-grass
Rudbeckia sp.	Black-eyed Susan, Coneflower
Setaria sp.	Bristle grass
Solidago sp.	Goldenrod
Sorghastrum nutans	Indian grass
Symphyotrichum pilosus	Hairy white oldfield aster
Verbascum thapsus	Common mullein
Verbena stricta	Hoary vervain
Trees, Shrubs and Woody Vines	
Acer negundo	Box elder
Celastrus scandens	American bittersweet
Celtis occidentalis	Common hackberry
Fraxinus pennsylvanica	Green ash
Gleditsia triacanthos	Honey locust
Juglans nigra	Black walnut
Juniperus virginiana	Eastern red cedar
L. tatarica	Tartarian honeysuckle
Pinus resinosa	Red pine (planted near existing ISFSI)

Table 7.2, continued Vegetation Observed on and near the ISFSI Site November 13 and 14, 2006	
Scientific Name	**Common Name**
Pinus strobus	White pine
Populus deltoides	Cottonwood
Prunus serotina	Black cherry
Quercus ellipsoidalis	Northern pin oak
Quercus macrocarpa	Bur oak
Rhamnus cathartica	Common buckthorn
Rhus glabra	Smooth sumac
Ribes missouriense	Missouri gooseberry
Rubus occidentalis	Black raspberry
Smilax rotundifolia	Common greenbriar
Toxicodendron rydbergii	Poison ivy
Ulmus pumila	Siberian elm
Vitis riparia	Riverbank grape
Zanthoxylum americanum	Northern prickly ash

Of the plants indicated in Table 7-2, the dominant observed species established within the limits of the ISFSI site were the herbaceous species field brome, bristle grass, velvetleaf, common yarrow, black-eyed Susan, goldenrod, white snakeroot, amaranth, wormwood, common mullein and hoary vervain. The dominant woody species were Siberian elm (the dominant upland tree in the vicinity of the Plant), black raspberry, and saplings of honey locust.

Based upon the site inspection, the vegetative cover of the ISFSI site can best be classified, in accordance with the dichotomous key provided in the Minnesota Land Cover Classification System (MLCCS) User Manual, as "*Non-native Dominated Herbaceous vegetation with Sparse Deciduous Trees*." This designation is assigned the numerical classification of 62140 in the MLCCS. As defined in the MLCCS, this classification is for habitats with 10-70% cover by trees (of which < 25% is conifer), where > 30% of non-tree cover is herbaceous and dominated by non-native species. The ground layer is often dominated by brome (as in this instance) or Kentucky bluegrass. Common shrubs include sumac and Tartarian honeysuckle, which is found throughout the Plant area. Almost any tree species can be found, but elms, cottonwoods, green ashes, box elders and bur oaks are common. As indicated in Table 7-2, all of these tree species are in the vicinity of the ISFSI site.

7.2.6 Land Use

Land use data for Goodhue County were obtained through the Minnesota Department of Natural Resources (DNR). The DNR data were derived from 1990 aerial photography. Land use was interpreted by the DNR using US Fish and Wildlife, National Wetlands Inventory maps, US Department of Agriculture Stabilization and Conservation Service (ASCS) low altitude aerial photography, and Landsat satellite imagery. (The ASCS was a former operating unit of the USDA that was grouped with other operating units in 1994 to form the Farm Service Agency.) Land Use mapping is not currently available in GIS format for Goodhue, Dakota or Pierce Counties. Therefore, it is assumed that land use within five miles of the site has a similar distribution as the County-wide data described below.

7.2.6.1 Goodhue County, Minnesota

The Plant is located in Goodhue County which is located southeast of the Minneapolis-St. Paul metropolitan area along the Minnesota-Wisconsin border. The County covers approximately 499,369 acres of land. Existing land use in the County is as follows: agricultural land - 64 percent, deciduous forests - 20 percent, grassland - 10 percent, farmsteads and other rural developments - 2 percent, areas that are urbanized or industrialized -1 percent, wetlands - 1 percent, and other – 2 percent.

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 orderly development. The ordinances require building permits, conditional use permits, plat development, zoning district controls, and variance requests. The County, however, has no formal growth control measures

7.2.6.2 Dakota County, Minnesota

Dakota County is located west of the site and covers approximately 371,200 acres. A very small portion of this County falls within five miles of the Plant. This area is classified as Vacant/Agricultural on the Dakota County Land Use and Cover map, State of Minnesota 1990. This classification comprises 74% of Dakota County. This information was compiled by the Land Management

Information Center and is the most recent Land Use data available for this county.

7.2.6.3 Pierce County, Wisconsin

Pierce County covers approximately 378,240 acres, and is currently in the first phase (data collection) of developing a countywide comprehensive plan. Pierce County GIS contains a rudimentary land cover classification of field and non-field. Additional land use mapping is not planned at this time because of the nonexistent relationship between township zoning classifications and land use.

Predominant land use within five miles of the Plant are Agricultural, and water (Mississippi River). Until a comprehensive land use plan is complete, the County's municipalities through the use of local zoning and subdivision regulations guide land development activities.

7.2.7 Water Resources

The most prominent hydrologic feature within five miles of the site is the Mississippi River. The Plant is located approximately at River Mile (RM) 798, one and a half miles upstream of Lock and Dam Number 3. Lock and Dam Number 3 is a navigation dam and lock on the Mississippi River constructed and placed in operation July 1938. The dam is made of concrete and is 365 feet long with four roller gates and more than 2,000 feet of earth embankment with a series of upstream spot dikes. The lock is 110 feet wide by 600 feet long. The system underwent major rehabilitation from 1988 through 1991. Its position on a bend in the river makes it a navigational safety hazard. The US Army Corps of Engineers has been working to remedy the problems at this location and has identified an effective and environmentally acceptable combination plan to improve navigation safety and to strengthen the Wisconsin embankments. The project was funded in FY06 and an EIS was issued in November 2006.

Mississippi River tributaries within five miles of the site include the Trimbelle River, the Vermillion River, and the Cannon River. The Trimbelle River is located east of the Plant in Wisconsin; its mouth on the Mississippi River is located about 2.7 miles to the east. The Vermillion River flows through a valley west of the Plant, and eventually becomes obscured within a complex of wetlands and lakes as it approaches the Mississippi River, where it is known as the Vermillion Slough. It enters the Mississippi River below the dam (see

Figure 7-4). The Cannon River, a major tributary to the Mississippi River, meanders eastward in a highly sinuous pattern. The Cannon River's mouth is located in a large wetland complex about three miles southeast of the Plant.

Many other wetlands, streams, lakes and ponds are depicted on US Fish & Wildlife Service, National Wetlands Inventory (NWI) mapping. The most prominent lakes are Sturgeon Lake and North Lake, located to the north of the Plant. A list of the resources mapped by the NWI is included as Table 7-3, and the NWI mapping of the area within five miles of the site is presented on Figure 7-5.

Prior to the establishment of the system utilized by the NWI, the US Fish & Wildlife Circular 39 Document (Shaw and Fredine, 1956) outlined a means of classifying the wetlands of the United States. It describes 20 types (exclusive of rivers and lakes), of which eight are found in Minnesota. These are briefly outlined below, each with a cross-reference to the type of NWI resource(s) that fall within the Circular 39 classifications.

- **Seasonally Flooded Basin or Flat -** Soil is well drained during much of the growing season. These areas are covered with water or waterlogged during variable seasonal periods. Vegetation varies greatly according to season and duration of flooding from bottomland hardwoods to herbaceous plants. Note that the term seasonally flooded does not have the same meaning in Circular 39 and NWI. NWI wetland types that fall into this category include PEMA, PFOA and PUS.

- **Wet Meadow -** Soil is saturated or nearly saturated during most of the growing season. These areas are usually without standing water during most of the growing season, but are waterlogged within at least a few inches of the surface. Meadows may fill shallow basins, sloughs, or farmland sags. Vegetation includes grasses, sedges, rushes and various broad-leaved plants. These areas may border shallow marshes on the landward side and include low prairies, sedge meadows and calcareous fens. The NWI wetland type that falls into this category is PEMB.

- **Shallow Marsh -** Soil is usually waterlogged early during the growing season. These areas are often covered with as much as six inches or more of water. Vegetation includes species of grass, bulrush and spikerush, and various other marsh plants such as pickerelweed and species of cattail, arrowhead, and smartweed. These marshes may nearly fill shallow lake basins or sloughs. They may border deep marshes on the landward side, and are common as seep areas on irrigated lands.

NWI wetland types that fall into this category are PEMC, PEMF, PSSH, PUBA and PUBC.

- **Deep Marsh -** Soil is usually covered with six inches to three feet or more of water during the growing season. Vegetation includes wild rice and species of cattail, reed, bulrush and spikerush. In open areas, species of pondweed, naiad, coontail, water-milfoil, waterweed, duckweed, waterlily or spatterdock may occur. These deep marshes may completely fill shallow lake basins, potholes, limestone sinks and sloughs. They may border open water in such depressions. Several NWI wetland types fall into this category, including L2ABF, L2EMF, L2EMG, L2US, PABF, PABG, PEMG, PEMH, PUBB and PUBF.

- **Shallow Open Water -** The soils are inundated by water usually less than 10 feet deep. Shallow ponds and reservoirs are included in this type. These habitat types may occupy shallow lake basins and may border large open water basins. The water of these habitats may be fringed by a border of emergent vegetation including species of pondweed, naiad, coontail, water-milfoil, waterweed, duckweed, waterlily, bladderwort, or spatterdock. Several NWI wetland types fall into this category, including L1, L2ABG, L2ABH, L2EMA, L2EMB, L2EMH, L2RS, L2UB, PABH, PUBG and PUBH.

- **Shrub Swamp -** Soil is usually waterlogged during the growing season and is often covered with as much as six inches of water. These occur along sluggish streams and drainage within drainage depressions, and occasionally on flood plains. Vegetation includes alders, willows, buttonbush and dogwoods. NWI wetland types that fall into this category are PSSA, PSSC, PSSF, PSSG, PSS1, PSS5 and PSS6B.

- **Wooded Swamp -** Soil is waterlogged within a few inches of the surface during the growing season. These areas are often covered with as much as one foot of water, and the water table is at or near the surface. Forest vegetation includes tamarack, northern white cedar, black spruce, balsam fir, red maple and black ash. Deciduous sites frequently support beds of duckweed and smartweed. These occur mostly in ancient lake basins, old river oxbows, flat terrains and along sluggish streams. NWI wetland types that fall into this category are PFO1, PFO5, PFO6B, PFOC and PFOF.

- **Bogs –** Soil is usually waterlogged and the water table is at or near the surface. The woody and herbaceous (or both) species support a spongy covering of mosses. Woody vegetation of these habitats includes leatherleaf, Labrador tea, cranberry and other heath shrubs, and may include stunted black spruce and tamarack. The herbaceous species may include sedges (including cottongrass) and Sphagnum mosses. These habitats are mostly on shallow glacial lake basins and depressions, flat terrains, and along sluggish streams. NWI wetland types that fall into this category are PFO2, PFO4, PFO7B, PSS2, PSS3, PSS4 and PSS7B.

As mentioned above, water resource types that are not included in the system presented in Circular 39 include rivers and lakes. The NWI describes these as follows.

- **Riverine System -** The Riverine System includes all wetlands and deepwater habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens; and (2) habitats with water containing ocean-derived salts in excess of 0.5 percent. A channel is "an open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water" (Langbein and Iseri 1960:5).

- **Lacustrine System –** The Lacustrine System includes wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographical depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30% areal coverage; and (3) total area exceeds eight hectares (ha) (about 20 acres). Similar wetland and deepwater habitats totaling less than eight ha are also included in the Lacustrine System if an active wave-formed or bedrock shoreline feature makes up all or part of the boundary, or if the water depth in the deepest part of the basin exceeds two meters (about 6.6 feet) at low water. Lacustrine waters may be tidal or non-tidal, but ocean-derived salinity is always less than 0.5 percent.

Several recreation, waterfowl and wildlife areas that make use of the abundant water resources present in the area are described in Sections 7.2.9.1 (Federally Designated Sensitive Environmental Resources), 7.2.9.2 and 7.2.9.3 (State Designated Sensitive Environmental Resources) and 7.2.11 (Cultural and R

Mapped Wetlands

The NWI maps of the following USGS quadrangles indicate numerous wetland systems within five miles of the ISFSI site:

- Diamond Bluff East, WI-MN;
- Red Wing, MN-WI;
- Welch, MN; and
- Diamond Bluff West, WI-MN

The ISFSI site is located on the Welch, MN quadrangle. There are no wetlands or other water bodies located within the boundaries of the ISFSI, although these resources are located on the Plant property. Essentially, wetlands within five miles of the ISFSI are established within the floodplains of the major river systems: the Mississippi, the Cannon and the Vermillion Rivers all have well-established and often extensive wetlands associated within their respective corridors. It is anticipated that construction of the two new ISFSI storage pads would not necessitate impacts to wetlands or water bodies. Table 7-3 lists the resources indicated on the four NWI maps. Due to the small scale of the maps, and the inherent accuracy limitations imposed by the NWI system, it is not possible to calculate wetland acreage of the resources depicted by the NWI maps.

Table 7-3
Wetland Types Mapped within Five Miles of the ISFSI Site

Wetland Symbol	System	Subsystem	Class	Subclass	Regime	Soil	Special Modifiers
L1UBHh	L - Lacustrine	1 - Limnetic	UB - Unconsolidated Bottom	H - Cobble/Gravel	-	-	h – Diked /Impounded
L1UBHhx	L - Lacustrine	1 - Limnetic	UB - Unconsolidated Bottom	H - Cobble/Gravel	-	-	h - Diked/ Impounded x - Excavated
L2AB4Gh	L - Lacustrine	2 - Littoral	AB - Aquatic Bed	4 - Aquatic Moss	G - Intermittently Exposed	-	h - Diked/ Impounded
L2UBGh	L - Lacustrine	2 - Littoral	UB - Unconsolidated Bottom	G – Sand	-	-	h - Diked/ Impounded

Table 7-3
Wetland Types Mapped within Five Miles of the ISFSI Site

Wetland Symbol	System	Subsystem	Class	Subclass	Regime	Soil	Special Modifiers
L2UBGhx	L - Lacustrine	2 - Littoral	UB - Unconsolidated Bottom	G – Sand	-	-	h - Diked/ Impounded x - Excavated
L2UBHh	L - Lacustrine	2 - Littoral	UB - Unconsolidated Bottom	H – Sand	-	-	h - Diked/ Impounded
L2USAh	L - Lacustrine	2 - Littoral	US - Unconsolidated Shore	A – Sand	-	-	h - Diked/ Impounded
R2UBG	R - Riverine	2 - Lower Perennial	UB - Unconsolidated Bottom	-	G - Intermittently Exposed	-	-
R2UBGx	R - Riverine	2 - Lower Perennial	UB - Unconsolidated Bottom	-	G - Intermittently Exposed	-	x - Excavated
R2UBH	R - Riverine	2 - Lower Perennial	UB - Unconsolidated Bottom	-	H - Permanently Flooded	-	-
R2USA	R - Riverine	2 - Lower Perennial	US - Unconsolidated Shore	-	A - Temporarily Flooded	-	-
R4SBC	R - Riverine	4 - Intermittent	SB - Stream Bed	-	C - Seasonally Flooded	-	-
R4SB3C	R - Riverine	4 - Intermittent	SB - Stream Bed	3 - Cobble/Gravel	C - Seasonally Flooded	-	-
PABFh	P - Palustrine	-	AB - Aquatic Bed	-	F - Semipermanentl y Flooded	-	h - Diked/ Impounded
PABGh	P - Palustrine	-	AB - Aquatic Bed	-	G - Intermittently Exposed	-	h - Diked/ Impounded
PEMA	P - Palustrine	-	EM - Emergent	-	A - Temporarily Flooded	-	-
PEMAh	P - Palustrine	-	EM - Emergent	-	A - Temporarily Flooded	-	h - Diked/ Impounded
PEMBh	P – Palustrine	-	EM – Emergent	-	B – Saturated	-	h – Diked/ Impounded
PEMBgh	P –	-	EM – Emergent	-	B – Saturated	g – Organic	h – Diked/

Table 7-3
Wetland Types Mapped within Five Miles of the ISFSI Site

Wetland Symbol	System	Subsystem	Class	Subclass	Regime	Soil	Special Modifiers
	Palustrine						Impounded
PEMC	P – Palustrine	-	EM – Emergent	-	C – Seasonally Flooded	-	-
PEMCh	P – Palustrine	-	EM – Emergent	-	C – Seasonally Flooded	-	h – Diked/ Impounded
PEMCx	P – Palustrine	-	EM – Emergent	-	C – Seasonally Flooded	-	x – Excavated
PEMFh	P – Palustrine	-	EM – Emergent	-	F – Semipermanently Flooded	-	h – Diked/ Impounded
PFO1A	P – Palustrine	-	FO – Forested	1 – Broad-leaved Deciduous	A – Temporarily Flooded	-	-
PFO1Ah	P – Palustrine	-	FO – Forested	1 – Broad-leaved Deciduous	A – Temporarily Flooded	-	h – Diked/ Impounded
PFO1C	P – Palustrine	-	FO – Forested	1 – Broad-leaved Deciduous	C – Seasonally Flooded	-	-
PFO1Ch	P – Palustrine	-	FO – Forested	1 – Broad-leaved Deciduous	C – Seasonally Flooded	-	h – Diked/ Impounded
PSS1A	P – Palustrine	-	SS – Scrub-shrub	1 – Broad-leaved Deciduous	A – Temporarily Flooded	-	-
PSS1C	P – Palustrine	-	SS – Scrub-shrub	1 – Broad-leaved Deciduous	C – Seasonally Flooded	-	-
PSS1Ch	P – Palustrine	-	SS – Scrub-shrub	1 – Broad-leaved Deciduous	C – Seasonally Flooded	-	h – Diked/ Impounded
PSS1Fh	P – Palustrine	-	SS – Scrub-shrub	1 – Broad-leaved Deciduous	F – Semipermanently Flooded	-	h – Diked/ Impounded
PUBF	P – Palustrine	-	UB – Unconsolidated Bottom	-	F – Semipermanently Flooded	-	-
PUBFh	P – Palustrine	-	UB – Unconsolidated	-	F – Semipermanentl	-	h – Diked/ Impounded

Table 7-3
Wetland Types Mapped within Five Miles of the ISFSI Site

Wetland Symbol	System	Subsystem	Class	Subclass	Regime	Soil	Special Modifiers
			Bottom		y Flooded		
PUBFx	P – Palustrine	-	UB – Unconsolidated Bottom	-	F – Semipermanently Flooded	-	x – Excavated
PUBFhx	P – Palustrine	-	UB – Unconsolidated Bottom	-	F – Semipermanently Flooded	-	h – Diked/ Impounded x – Excavated
PUBG	P - Palustrine	-	UB - Unconsolidated Bottom	-	G - Intermittently Exposed	-	-
PUBGh	P - Palustrine	-	UB - Unconsolidated Bottom	-	G - Intermittently Exposed	-	h - Diked/ Impounded
PUBGhx	P - Palustrine	-	UB - Unconsolidated Bottom	-	G - Intermittently Exposed	-	h - Diked/ Impounded x - Excavated
PUBGx	P - Palustrine	-	UB - Unconsolidated Bottom	-	G - Intermittently Exposed	-	x - Excavated
PUSA	P - Palustrine	-	US - Unconsolidated Shore	-	A - Temporarily Flooded	-	-
PUSAh	P - Palustrine	-	US - Unconsolidated Shore	-	A - Temporarily Flooded	-	h - Diked/ Impounded

Source: US Fish and Wildlife Service, National Wetland Inventory maps of the following USGS quadrangles: Diamond Bluff East, WI-MN; Red Wing, MN-WI; Welch, MN and Diamond Bluff West, WI-MN.

The nearest water resource into which liquid contaminants from the site could flow is located south and east of the ISFSI. The potential contaminant pathway is an excavated ditch that receives effluent from the Plant cooling towers, arranged in four parallel structures. This area between the ISFSI and the cooling towers supports a floodplain forest, the hydrology of which has been partially altered by the construction of the ditch. The forest canopy of the floodplain is dominated by box elder, green ash and eastern cottonwood. The ditch conveys cooled effluent northeasterly and into the Mississippi River.

7.2.8 Transportation

The Plant is served by a transportation system that includes US Highways, Minnesota State highways, county roads and local access roads. Figure 7-6 presents the transportation system in the vicinity of the site. U.S Highway 61 is a two and four lane roadway which runs north/south from the Minneapolis / St. Paul Metropolitan area to the junction of Minnesota State Routes 50 and 20 where it turns east to Red Wing and the Mississippi River. From US 61, County Road 19 and 18 provide direct access to the site just north of Red Wing.

Route 61 continues south from Red Wing along the Mississippi to La Crosse, Wisconsin. US Highway 63 crosses the Mississippi River at Red Wing north to Hager City, Wisconsin. Route 63 continues north to Ellsworth and ends just south of Lake Superior. Wisconsin State Highway 35 follows the Mississippi River in the vicinity of the plant. Numerous county and local roads feed the major roadway system in both Minnesota and Wisconsin.

The Red Wing Municipal Airport is located approximately seven miles southeast of the site. The Red Wing Regional Airport is located in Wisconsin, five miles East of Red Wing. The airport is currently completing a major expansion. The airport has a runway 5,010 feet long by 100 feet wide, with full night landing facilities. The airport is now an all-weather operation with state of the art Instrument Landing Systems. Minneapolis-St Paul International/Wold-Chamberlain Airport (MSP) is the closest international airport to Plant and is approximately 50 miles northwest of the site.

The Federal Aviation Administration high and low altitude enroute charts were reviewed to determine if there are air traffic corridors within five miles of the site. The site is located approximately 3 miles southwest from low altitude VFR airway V2-97 and high altitude airway J36, both which run on a similar path. V2-97 is used for primarily private airplane flights between Minneapolis/St. Paul, MN and Red Wing, MN, Winona, MN, or La Crosse, WI. J36 is primarily used for commercial jet traffic between Minneapolis/St. Paul, MN and Chicago, IL. Due to the number of flights and altitudes of these airways, there would not be a significant risk of any aircraft crashing into a storage cask at the Prairie Island ISFSI.

7.2.9 Sensitive Environmental Resources

The Plant is located on the southwest bank of the Mississippi River. The river affords the area numerous recreational, environmental and cultural opportunities.

7.2.9.1 Federally Designated Sensitive Environmental Resources

There are no National Parks, Monuments, Landmarks, Wilderness Areas, Forests, Trails or Water Fowl Production Areas within five miles of the site. The portion of the Mississippi that passes by the Prairie Island Generating Station is not federally designated as wild and scenic. Resources that have federal recognition are as follows:

The Mississippi Flyway

The Mississippi Flyway is a bird migration route that generally follows the Mississippi River in the United States and the Mackenzie River in Canada. The main endpoints of the flyway include central Canada and the region surrounding the Gulf of Mexico. Some birds even use this flyway to migrate from the Arctic Ocean to Patagonia.

Birds use this route along the Mississippi River typically because no mountains or ridges of hills block this path over its entire extent. Good sources of water, food, and cover exist over its entire length. About 40% of all North American migrating waterfowl and shorebirds use this route as well as many birds of prey. The longest migration route of any in the Western Hemisphere lies in this flyway. Its northern terminus is on the Arctic coast of Alaska and its southern end in Patagonia. During the spring migration some shorebirds travel the full length of the flyway and several species that breed north in Yukon and Alaska cover the larger part of it twice each year. This route is used by large numbers of ducks, geese, shorebirds, blackbirds, sparrows, warblers, thrushes, hawks, owls, and eagles.

Great River Road

The Federal Department of Transportation, Federal Highway Administration has designated the Mississippi River Corridor throughout the State of Minnesota as a scenic byway known as the "Great River Road." This designation, recognized by the U.S. Congress, is based upon the existence of one or more archaeological, cultural, historic, natural, recreational or scenic

qualities. In the vicinity of the Plant, the Great River Road is comprised of U.S. 61 in Hastings south to LaCrescent on the Minnesota side of the Mississippi River and Wisconsin Route 35 on the Wisconsin side of the river. This designation is attributed to certain highways and byways in order to preserve, promote and enhance the scenic, historic and recreational resources of the Mississippi River (Figure 7-7).

Mississippi National River and Recreation Area

The Mississippi National River and Recreation Area (MNRRA), a unit of the National Park Service, extends southward to the border of Dakota and Goodhue Counties, but is approximately 5.5 miles from the Plant at its closest point.

7.2.9.2 Minnesota Designated Sensitive Environmental Resources

There are no Minnesota State Parks, Wayside Parks, Recreational Areas, State Trails, Zoos, or trout lakes or streams located within five miles of the Plant. Figure 7-7 presents the location of Minnesota state designated sensitive environmental resources. Resources that have Minnesota recognition are as follows:

State Critical Areas

There are no State Critical Areas within five miles of the Plant. The Mississippi River Critical Area Corridor extends southward to the border of Dakota and Goodhue Counties, but is approximately 5.5 miles from the Plant at its closest point. The Mississippi National River and Recreation Area (MNRRA), a unit of the National Park Service, has been designated as a State Critical Area. The boundaries of the Mississippi River Critical Area Corridor and that of MNRRA are the same.

State Wild and Scenic Rivers Program

The Cannon River from Faribault, Rice County to its confluence with the Mississippi River just north of Red Wing, was added to Minnesota's Wild and Scenic Rivers Program in 1980. The mouth of the Cannon River at the Mississippi River, the nearest the Cannon River is to the Plant, is located in a large wetland complex known as the Rice Lake Bottoms, approximately 2.7 miles south of the site. The purpose of the State Wild and Scenic Rivers Act (Minn. Stat. § 103F.301 et seq.) is to preserve and protect the outstanding

scenic, recreational, natural, historical, and scientific values of certain Minnesota rivers and their adjacent lands. The Act's intent is not to restore pre-settlement conditions, but rather to prevent intensive development and recreational overuse from damaging these rivers. The legal extent of lands covered by the program is a maximum of 320 acres per each river mile on both sides of the river. All state, local, and special governmental units (councils, commissions, boards, districts, agencies, etc.), and all other authorities must exercise their powers to further the purpose of the act and adopted management plans. Since the Cannon River does not pass directly by the site, management plans associated with this river do not affect the Plant.

The Cannon River has been designated as a Minnesota Wild and Scenic River because of its outstanding scenic and recreational value. The portion of the river within five miles of the site is considered to be "scenic." The scenic designation is attributed to those rivers that exist in a free-flowing state and where adjacent land is largely undeveloped. Regulations, which are generally more restrictive than shore-land rules, have been established to protect the river in its present condition. In addition, the Cannon Valley offers a diversity of recreational opportunities to area residents. Biking, camping, hunting, and fishing attract thousands of people each year. As described in the Red Wing Comprehensive Plan, the city recognizes the importance of maintaining the Cannon Bottoms in its natural state.

State Forests

The Richard J Dorer Memorial Hardwood State Forest surrounds the Plant. According to the DNR Internet site, state forest campgrounds have evolved from traditional camping areas within working forests. They provide access to many self-directed activities in forested areas. Unlike state parks, forest campgrounds do not have resident managers, organized nature programs, or modern facilities such as showers and flush toilets. They are semi-modern areas, designed to furnish the basic needs and provide opportunities for recreationists to pursue a variety of unstructured outdoor activities. Campgrounds are patrolled regularly to provide security and service to visitors. While camping is allowed throughout state forests, there are no designated state forest campgrounds near the Prairie Island site. All designated campgrounds in the forest are south and southeast of the site.

Only 45,000 acres of the nearly 2 million acres of this state forest are owned by the state of Minnesota. The use of mountain bikes, horses, OTVs and ATVs is restricted to designated trails only.

State Scientific and Natural Areas

The DNR oversees the Scientific and Natural Areas (SNA) program which serves to preserve natural features and rare resources of exceptional scientific and educational value. SNAs are open to the public for nature observation and education, but are not meant for nor do they support intensive recreational activities. The DNR has identified three types of SNAs in the state of Minnesota: Prairie grasslands, deciduous woods, and coniferous forest. Within five miles of the Plant, there are two SNAs that are designated as the deciduous woods type. These are described below:

- Cannon River Turtle Preserve – The Cannon River Turtle Preserve, created in 1985, is located along a significant reach of the lower Cannon River. The closest the Cannon River Turtle Preserve is to the Plant is its eastern limit in Harliss, Goodhue County, about 3.2 miles south of the Plant. This 909-acre area contains floodplain forest dominated by silver maple and cottonwood. The site supports habitat for the state-listed threatened wood turtle, which nests on the river's sand bars. This area is accessed by the Cannon Valley Bike trail.

- Spring Creek Prairie – The Spring Creek Prairie SNA is located approximately five miles south-southeast of the Plant. This 145-acre site consists of sandstone and limestone outcrops overlooking open, sandy draws where streams once cut their way down to the Mississippi. At the south edge of the SNA, a small maple-basswood community thrives with maiden-hair fern, hepatica, trillium, blood root, and other woodland species. The southwest-facing bluff gives rise to a bedrock bluff prairie as it climbs to a narrow ridge top. The silvery bladderpod, a state-endangered species, grows in one of its largest known populations.

State Wildlife Management Areas

Wildlife Management Areas (WMAs) are part of Minnesota's outdoor recreation system and are established to protect and enhance land and water bodies that have a high potential for wildlife production, public hunting, trapping, fishing, and other compatible recreational uses. Much of the wildlife managers' work is directed toward protecting and enhancing wildlife habitat on WMA lands. For instance, prairie and grasslands are planted to provide prime nesting cover critical to waterfowl and pheasant production. Wetlands are restored and enhanced to benefit waterfowl and other wetland wildlife species.

- Gore's Pool #3 – Gore's Pool #3 is located three miles north of the Plant. This 6,449-acre site consists of flood plain marshes, forest and backwater marshes associated with the Mississippi and Vermillion Rivers. The purpose of this WMA is to preserve this natural resource and provide recreational opportunities (fishing and boating) in this unique environment, as well as provide habitat for waterfowl and furbearers. There are three boat launches located within the area and its vicinity. There is a designated Migratory Waterfowl refuge at the southern end of the property, which is off limits to all recreational activities.

- Espen Island – Espen Island is located about 4.9 miles south of the Plant. This 13-acre site is comprised of bottomland hardwood forest. The purpose of the area is primarily for forest wildlife species and riparian/riverine wildlife species. Wildlife viewing and hunting for small game and waterfowl are allowed in this area.

State Canoe and Boating Rivers

The state of Minnesota administers several canoe and boating rivers. Two of these are within five miles of the Plant site and are described below

- **Cannon River -** The Cannon River has few rapids and several dams. Downed trees and logjams are hazards in high water. The river varies in width from 50 to 200 feet. Stream flow usually peaks in early April. Very heavy rains can cause the river to flood. From Faribault to its mouth, the Cannon falls 280 feet, an average of 4.8 feet per mile.

  Bounded by rolling hills, bluffs, farmland and woods in its upper reaches, the Cannon River enters a broad gorge below Cannon Falls, where it is flanked by bluffs up to 300 feet high.

- **Mississippi River (Hastings to the Iowa border) -** From Hastings, Minnesota to the Iowa border the river requires some paddling skills in order to avoid snags and downed trees, especially in the backwaters. Motorboats and barges often throw large waves that can "swamp" canoes. Because the river is so wide, the current can be deceptively swift.

  Spring runoff normally brings the river to its highest flow of the year. Though some stretches are fast and can be dangerous, others are

restrained by dams and have little current. The water level in this stretch is always sufficient for canoeing, though winds can be strong.

This segment of the river is towered on the right and left by spectacular bluffs. The main river channel will be along the east bank at times and along the west bank at other times. Extensive backwaters often extend to the bluffs on the side opposite the main channel.

7.2.9.3 Wisconsin Designated Sensitive Environmental Resources

There are no Wisconsin State Parks, Wayside Parks, Recreational Areas, State Trails, Zoos, or trout lakes or streams located within five miles of the Plant. Figure 7-7 presents the location of Wisconsin state designated sensitive environmental resources. Resources that have Wisconsin recognition are as follows:

State Natural Areas

The SNA Program is administered by the Wisconsin Department of Natural Resources' Bureau of Endangered Resources and advised by the Natural Areas Preservation Council. The purpose of SNAs is to protect outstanding examples of native natural communities, significant geological formations, and archaeological sites. They harbor natural features essentially unaltered by human-caused disturbances or that have substantially recovered from disturbance over time. SNAs also provide the refuges for rare plants and animals. More than 90% of the plants and 75% of the animals on Wisconsin's list of endangered and threatened species are protected on SNAs.

Public use of SNAs is two-fold: scientific research and compatible recreation. These areas are not appropriate for intensive recreation such as camping or mountain biking, but they can accommodate low-impact activities such as hiking, bird watching, and nature study. As such, many SNAs contain few or no amenities such as parking areas, restrooms, or maintained trails.

- Trenton Bluff Prairie (Area #136) – Trenton Bluff Prairie State Natural Area is located in Wisconsin just north of Hager City and roughly four miles from Plant. This site is owned by the Wisconsin DNR and was established as a State Natural area in 1977. Trenton Bluff Prairie is comprised of two separate dry prairies situated on steep Mississippi River sandstone bluffs, which are capped by massive limestone cliffs and are some of the best examples of prairie remaining in the region. The

western unit has two prairie openings separated by a wooded draw, while the steeper eastern portion contains open cliff which transitions to shrubby oak woods. The bluff summit rises some 300 feet above the flat, sandy river terrace below with vertical cliffs. Dominant grasses include Indian grass, little blue-stem, big blue-stem, side-oats grama, and needle grass. Near the far western edge of the area, several Great Plains species can be found: foothill bladder-pod prairie sage-wort, ground plum, plains muhly, and prairie larkspur. The state-threatened prairie thistle is also found here. The upper cliff area has numerous outcrop crevices that harbor several fern species including slender lip fern and smooth cliff brake. Animal species of concern that inhabit this area include the state-listed endangered peregrine falcon, bullsnake, hognose snake and two butterfly species – olive hairstreak and Reakert's blue.

7.2.10 Historic and Archaeological Resources

The Plant is located adjacent to the Prairie Island Indian Community Reservation. In 1936, the federal government officially recognized Prairie Island Indian Community (PIIC) as a reservation for the Mdewakanton, awarding them 534 acres. The Prairie Island Indian Community is a Federally Recognized Indian Tribe organized under the Indian Reorganization Act (25 USC 476). Currently, the reservation population is approximately 160, while the total enrollment of the tribal community is 486. The Tribal government employs about 100 members on a variety of service projects. The PIIC owns and operates Treasure Island Resort and Casino, employing about 1500 people.

The Treasure Island Resort and Casino includes a 250-room hotel and convention center that is currently being expanded to include an additional 230 rooms (Treasure Island Resort and Casino undated). The expansion includes a 24-lane bowling center and a multi-use event center with a maximum seating capacity of 2,800. Treasure Island Resort and Casino offers gaming, dining, live entertainment, a 95- space RV park, a 137-slip marina to accommodate visitors arriving by the Mississippi River, and sightseeing and dinner cruises on their river boat (Minnesota Indian Affairs Council 2006).

There are six National Register historic sites located within five miles of the Plant. Five of the sites are in Goodhue County and one is in Pierce County Wisconsin. These properties are listed on Table 7-4 and located on Figure 7-8. There are no Minnesota Historical Society Sites within 5 miles of the site.

No archaeological resources are known to exist at the existing site. According to original licensing documents no archeological resources were found in the vicinity of the ISFSI site during investigations conducted during the licensing.

Table 7-4
National Register Sites within Five Miles of the Plant

Name of Historic Site	Location	Approximate Distance from the Plant	Comments
Bartron Archaeological Site	Undisclosed location on Prairie Island	0-1 miles	Prehistoric site
Metro Archeological District	Pierce County Wisconsin Restricted Address	1-2 miles	810 acres prehistoric site
Mendota to Wabasha Military Road	Cannon Bottom Road, Red Wing, MN	2-4 miles	48 acre military roadway
Alexander Anderson Estate	West of Red Wing on U.S. 61	2-4 miles	50 acres, brick, stone structure of architecture and engineering significance
Cross of Christ Lutheran Church	U.S. 61 Red Wing	4.5 miles	50 acres, architecture, engineering, religious significance.
Silvenale Site	Goodhue County Restricted Address	4-5 miles	No Information available

7.2.11 Cultural and Recreational Resources

This section identifies areas within five miles of the site designated by regional or local authorities as having recreational, cultural, or scientific significance.

7.2.11.1 Federal and State Cultural and Recreational Resources

Federal and State resources that have designated cultural and recreational value are identified and discussed in Section 7.2.9 above. Those resources include:

- Great River Road
- Mississippi National River and Recreation Area

- Minnesota State Wild and Scenic Rivers Program
- Minnesota State Forests
- Minnesota State Wildlife Management Areas
- Minnesota State Canoe and Boating Rivers

7.2.11.2 County and Local Parks and Recreational Areas

There is one county designated park and recreational area within five miles of the Plant. The A.P. Anderson County Park is located approximately 4.5 miles south of Plant. There are no other known county operated resource areas located within five miles of the site. Goodhue and Pierce Counties maintain numerous boat launches and hiking, biking and snowmobiling trails within 5 miles of the site. There are no county forests located within 5 miles of the Plant.

The Red Wing Wildlife League manages and operates 2,800 acres of bottomland and floodplain just south of Plant along the Mississippi River. As the largest landowner in Goodhue County, the League funds restoration and maintenance of its land through membership dues, charitable gambling, donations and usage fees. On its property the League supports hunting, fishing and an environmental learning center.

Red Wing has numerous community parks and playgrounds located within the city limits and along the river, however these are all located greater than five miles from Plant. A portion of the Cannon Valley Trail is located within five miles of Plant. This trail, which follows the Cannon River offers biking, hiking, in-line skating, skateboarding and cross-country skiing opportunities. As discussed in Section 7.2.10, the Prairie Island Indian Reservation supports several recreational resources including a marina and camp ground.

The City of Red Wing, as part of its Comprehensive Plan published in 2006 has developed policies for the continued development and enhancement of parks, trails, open space and public art. These policies are focused on conserving and establishing a network of "Green Infrastructure" in order to improve quality of life for its citizens and provide wildlife habitat.

7.2.12 Demography

Population information was obtained from Census Bureau Topologically Integrated Geographic Encoding and Referencing system (TIGER) /Line File, Version 2000. The 2000 TIGER/Line file uses town and city boundaries as of January 1, 2000. Figure 7-9 presents this data for the permanent population within 50 miles of the Plant by minor civil divisions. Each civil division is color coded by range of population. Based upon this information, the total permanent population within 50 miles of the Prairie Island Plant is calculated to be 2,949,234. This estimate is slightly conservative since, where the 50-mile radius bisects a civil division; the entire population of the civil division has been included.

The License Renewal Application Environmental Report prepared by Nuclear Management Company, LLC (NMC) provides detailed information on demographic characteristics within 50 miles of the site.

A report entitled "Evacuation Time Estimate Study for the Prairie Island Nuclear Generating Plant Emergency Planning Zone" was prepared in September of 2003 by TOM COD Data Systems for NMC. This report provided both the 50-mile EPZ population data and the 10-mile EPZ data. The 10-mile EPZ population is presented in Table 7-5. The sub areas represent the approximate distance and direction from the plant.

Table 7-5
Permanent Population for Sub Areas in the Prairie Island 10-Mile EPZ***

SubArea	Population based on 2000 U.S. Census
Goodhue County (MN)	
2 (171 Pierce County; 281 Goodhue County)	452
5S	2,981
5W	697
10SE	14,203
10SW	729
Dakota County (MN)	
10W	3,584
Pierce County, (WI)	
5E	870
5N	308
10NW	1,388
10N	422
10NE	1,497
10E	2,110

Table 7-5
Permanent Population for Sub Areas in the Prairie Island 10-Mile EPZ***

SubArea	Population based on 2000 U.S. Census
GoodhueCounty MN Total	18,891
Dakota County, MN Total	3,584
Minnesota Total:	22,475
Pierce County WI Total	6,776
Total 10-Mile EPZ Permanent Population	29,241

*** Source: TOM COD Date Systems, Evacuation Time Estimate Study for Prairie Island Nuclear Generating Plant Emergency Planning Zone, 2003.

7.3 Wastes and Emissions

Minnesota Rule 7855.0650 requires information relating to wastes and emissions from the facility. The dry storage system used at the Prairie Island ISFSI (TN-40 and TN-40HT casks), including the proposed expansion, is a passive system that does not have any discharges associated with it. The following section lists requirements of the rule and provides information for categories that apply to this proposal.

7.3.1 Radioactive Wastes

There will be no radioactive wastes produced or released by operation of the facility. The spent fuel is stored in metal casks (both TN-40 and TN-40HT) that are sealed and closed before the cask leaves the Auxiliary Building to ensure that no radioactive materials can escape. In addition, the casks are continually monitored to ensure that the inert helium gas inside the cask has not escaped.

Additionally, Minnesota Statutes § 116C.83, Subd. 5 – Water standards, establishes that the requirements of Section 116C.76 – Nuclear waste depository release into groundwater, Subd. 1, clauses (1) to (3), applies to an independent spent fuel storage installation. Such an installation must be operated in accordance with those standards. There is no liquid, solid, or gaseous radioactive waste associated with the ISFSI and no release to or contamination of the groundwater.

7.3.2 Human Exposure Due to Operation

7.3.2.1 Direct Radiation

The spent fuel in the casks will emit low levels of radiation to the environment surrounding the site. This is a result of the heavy neutron and gamma shielding provided in the cask design as well as shielding afforded by the 17 foot high earthen berm that surrounds the ISFSI. Due to this shielding, and the distances from the ISFSI to the nearest residences (0.45 mile NW of the ISFSI to the nearest residence), radiation doses to the population around the site will be extremely low. Radioactive material associated with the spent fuel to be stored is completely contained in the casks, so that no radioactive material is released from the spent fuel to the environment under both normal and postulated accident conditions (e.g., earthquakes, tornadoes, fires, etc). Therefore, there would be no uptake of radioactive material by personnel working onsite or people living nearby by means of inhalation or ingestion, and contamination of soil in the vicinity of the site would not occur. Further discussion of radiation issues are presented below and in Appendices E and F of this application.

7.3.2.1.1 On-site Radiation Doses

While shielding is provided in the design of the casks, personnel will receive some radiation exposure during spent fuel handling, cask loading, preparing casks for storage, onsite transport operations, and placement of the casks at the ISFSI. The requirements of 10 CFR 20 for protecting personnel from radiation exposure and minimizing exposures will be strictly adhered to during all activities related to spent fuel storage.

7.3.2.1.2 Off-site Radiation Doses

Figure 7-10 illustrates portions of the Prairie Island site boundary, which is also the Prairie Island exclusion area boundary and the ISFSI controlled area boundary defined in 10 CFR 20.1003 and 10 CFR 72.3. The nearest residence from the ISFSI is located 0.45 mile NW of the ISFSI. The annual radiation dose resulting from spent fuel storage operations to the nearest residence is expected to be quite low and will meet the restrictive criteria set forth in 10 CFR 72.104 as well as U.S. EPA standards 40 CFR 190.

The Prairie Island ISFSI is currently designed and licensed to store up to 1,920 spent fuel assemblies in 48 of Transnuclear's TN-40 metal storage casks (each cask holds 40 spent fuel assemblies). As discussed in Section 4.8, we have submitted an application to the NRC to amend the ISFSI license to permit use of the enhanced TN-40HT storage cask. An amendment will be submitted in the future to increase storage beyond the 48 casks currently licensed. Not only would dose rates increase from those previously analyzed as a result of the greater number of casks stored at the ISFSI, but also due to use of the TN-40HT storage system which has the capability to store "hotter" spent fuel than the TN-40 cask, i.e. high burnup > 45,000 MWD/MTU.

This Petition proposes to store up to a total of 64 TN-40 and TN-40HT casks at the existing ISFSI site. A conservative dose rate calculated from the proposed ISFSI to the nearest resident using Prairie Island specific spent fuel was calculated to be 0.36 mrem/annually. Note that some of the conservatisms in this calculation include assuming all the fuel as been burned to an exposure of at least 50,000 MWD/MTU and less decay than will actually occur. This calculation shows that the dose rates to the nearest resident will be significantly less than that used in the radiation risk assessment contained in Appendix F.

The analyses of normal, off-normal, and accident conditions (Section 8 of the Prairie Island ISFSI SAR) have shown that, owing to the robust design of the TN-40 casks, no credible conditions can breach the TN-40 cask confinement boundary, including the double lid seals. There are no changes in the enhanced version of the cask, i.e. the TN-40HT that will alter this conclusion.

7.3.2.2 Radiation Protection Program

A radiation protection program is implemented at the Prairie Island ISFSI, in accordance with the requirements of 10 CFR 72.126. The program is based upon the extensive radiation protection program in effect at the Plant. The Plant's radiation protection program is applied to the ISFSI, where applicable, to address the specific radiation protection needs of the ISFSI.

The primary goal of the radiation protection program is to minimize exposure to radiation such that the total individual and collective exposure to personnel in all phases of ISFSI design, construction, operation and maintenance are kept As Low As Reasonably Achievable (ALARA). This is achieved by integrating ALARA concepts into design, construction, and operation of the facility.

Trained personnel develop and implement the radiation protection program and assure that all procedures are followed to meet company and regulatory requirements. Training programs in the basics of radiation protection and exposure control are provided to all facility personnel whose duties require working in radiation areas.

Three basic objectives of the ALARA program are:

1. Protection of Personnel, including surveillance and control over internal and external radiation exposure and maintaining the exposure of all personnel within permissible limits and as low as reasonably achievable (ALARA).

2. Protection of the Public, including surveillance and control over all conditions and operations that may affect the health and safety of the public. All activities related to the storage of spent fuel are controlled to ensure off-site doses are ALARA, including monitoring by means of an environmental radioactivity monitoring plan.

3. Protection of the Facility, including monitoring the facility for physical changes and trends that could lead to exposure hazards and determining changes or improvements needed to maintain exposure ALARA.

The radiation protection staff is responsible for and has the appropriate authority to maintain occupational exposures as far below the specified limits as reasonably achievable. Formal reviews are performed periodically to determine how exposures might be reduced. The program ensures that spent fuel storage facility personnel receive sufficient training and have sufficient authority to enforce safe station operation. Modifications to operating and maintenance procedures, as well as spent fuel storage facility equipment and facilities will be made when they will substantially reduce exposures at a reasonable cost. The program will also ensure that adequate equipment and supplies for radiation protection work are provided.

We are committed to a strong ALARA program. Spent fuel storage facility personnel are trained and updated on ALARA practices and dose reduction techniques. Design, operation and maintenance activities are reviewed to ensure ALARA criteria are met for the spent fuel storage facility. The ALARA program ensures that:

1. An effective ALARA program is administered at the spent fuel storage facility that appropriately integrates management philosophy and NRC regulatory requirements and guidance.

2. Spent fuel storage facility design features, operating procedures and maintenance practices are in accordance with ALARA program guidelines; and that written reviews of the radiation protection program ensure the objectives of the ALARA program are attained.
3. Pertinent industry and research information concerning radiation exposure of personnel are reflected in the design and operation of the facility.
4. Appropriate experience gained during the operation of nuclear power stations relative to in-plant radiation control is factored into revisions of procedures to assure that the procedures continually meet the objectives of the ALARA program.
5. Necessary assistance is provided to insure that operations, maintenance, and decommissioning activities are planned and accomplished in accordance with ALARA objectives.
6. Trends in spent fuel storage facility personnel and job exposures are analyzed in order to permit corrective actions to be taken with respect to adverse trends.

Prairie Island personnel are responsible for ensuring that activities are planned and accomplished in accordance with the objectives of the ALARA program. Staff ensures that procedures and their revisions are implemented in accordance with the objectives of the ALARA program, and ensure compliance with applicable requirements of 10 CFR 72 and 10 CFR 20.

Operational requirements for surveillance are incorporated into the storage system design. The storage systems are configured in the ISFSI array to allow ease of surveillance and are heavily shielded to minimize occupational exposure.

The spent fuel storage facility contains no systems that process liquids or gases. Therefore, maintaining exposures ALARA requires only the proper management of the storage and transportation systems.

7.3.2.2.1 Storage System Design Description

A description of the ISFSI, including layout and characteristics is provided in Section 3.

The ISFSI has a number of design features, which ensure that exposures are ALARA, including the following:

- There will be no radioactive systems in the spent fuel storage facility other than the storage casks.
- The spent fuel is stored inside sealed, heavily shielded TN-40 and TN-40HT casks. The most significant radiation protection design consideration is the heavy gamma and neutron shielding to minimize personnel exposures.
- The storage casks contain no active components requiring periodic maintenance or surveillance.
- The casks will be loaded, sealed, and decontaminated prior to transfer to the spent fuel storage facility. Decontamination of the cask exterior before leaving the Auxiliary Building minimizes exposure of personnel to surface contamination.
- The fuel will not be unloaded nor will the casks be opened at the spent fuel storage facility.
- The fuel will be stored dry inside the casks, therefore no radioactive liquid is available for leakage.
- The casks will be sealed airtight, so that no radioactive gases or particulates are available for release. Radioactive gaseous releases are not considered credible due to the lid seal design with double metal O-ring seals whose interspace is pressurized with helium above cask cavity pressure by means of the overpressure tank, with seal interspace pressure continuously monitored.
- An annunciator panel monitoring cask pressure is located outside of the ISFSI protected area. This minimizes time required for periodic cask surveillance and reduces personnel exposure.
- The ISFSI site is within the exclusion area of the Plant site. The location of the ISFSI is of sufficient distance from frequently occupied areas of the Plant such that the dose contribution to plant personnel from the ISFSI is not significant.

In addition, the ISFSI is not normally occupied. Therefore, no personnel areas, equipment decontamination areas, contamination control areas, or health

physics facilities need be located at the ISFSI. These types of facilities are available at the Plant.

7.3.2.2.2 Shielding

The storage cask provides the majority of the radiation shielding in the storage system. The TN-40 and TN-40HT casks are designed with materials and of sufficient thickness to keep dose levels within the requirements specified in 10 CFR 20 and 10 CFR 72. No special features or remote handling of the casks at the ISFSI are required. In addition to the heavy shielding of the spent fuel provided by the TN-40 and TN-40HT casks, an earthen berm surrounds the ISFSI, providing substantial additional shielding of direct radiation. The berm is a minimum of 17 feet high. The berm essentially eliminates the direct radiation component of both neutron and gamma radiation, leaving only "skyshine" radiation, or radiation that travels upwards from the storage casks and is reflected back down to the ground off the atmosphere, which represents a small fraction of the total radiation emitted from a cask.

7.3.2.2.3 Radiation Monitoring System

There are no credible events that could result in releases of radioactivity from the TN-40 or TN-40HT cask cavity, nor in unacceptable increases in direct radiation due to loss of cask shielding. Therefore, area radiation and airborne radioactivity monitors are not required at the ISFSI. Thermo-luminescent Dosimeters (TLDs) are located on the outer (nuisance) fence around the ISFSI, used to record dose rates at positions along this fence. Workers and visitors entering the storage facility are provided with dosimetry to accurately measure and record radiation dose exposure.

7.3.2.2.4 Emergency Plan

Emergency response for accidents associated with the Prairie Island ISFSI is governed by the Prairie Island Emergency Plan, which complies with 10 CFR 72.32 requirements for ISFSI emergency planning. The Prairie Island Emergency Plan, which is used for any radiological emergencies that may arise at the ISFSI, describes the organization, assessment actions, conditions for activation of the emergency organization, notification procedures, emergency facilities, equipment, training, provisions for maintaining emergency preparedness, and recovery criteria for off-normal and accident conditions.

7.3.3 Non-Radioactive Solid and Liquid Wastes

The ISFSI contains no systems that process non-radioactive solids or liquids. There will also be no water or sewage services at the ISFSI.

7.3.4 Non-Radioactive Gaseous and Particulate Emissions

Dry storage of spent fuel is a passive operation, which requires no air or water resources. Ambient air is used for natural convective cooling of the fuel casks, but it is not consumed nor is its quality compromised.

7.3.4.1 Air Quality

The air quality in Goodhue County is generally very good. The U.S. Environmental Protection Agency (EPA) has adopted ambient air quality standards (AAQS) for six air pollutants known as criteria pollutants. In addition, the Minnesota Pollution Control Agency (PCA) has adopted standards for the criteria pollutants as well as for hydrocarbons and hydrogen sulfide. Ambient air monitoring data collected by the PCA at several monitoring stations throughout the state are used to determine whether or not these AAQS are being met. Areas where the standards are attained are referred to as "attainment" areas and those areas not attaining the standards are called "nonattainment" areas. This project is located in the Southeast Minnesota-La Crosse (Wisconsin) Interstate Air Quality Control Region, which is in attainment for all criteria pollutants.

Emissions during construction and from infrequent vehicular traffic will not result in significant effects on air quality at the ISFSI site.

7.3.4.2 Clean Air Act

The Clean Air Act requires an application for Construction of a Stationary Source per 40 CFR Part 61, Subpart A, which establishes National Emission Standards for Hazardous Air Pollutants (NESHAPs). However, there are no stationary sources added for this project, therefore, no applications will be required.

7.3.5 Fugitive Dust

The only sources of fugitive dust will be from construction activities and will be controlled by wetting exposed soil areas and covering stockpiles. During operation of the ISFSI, the only fugitive dust source will be that produced by the train car during the infrequent delivery of casks to the site. This is considered to be a negligible source of fugitive dust.

7.3.6 Non-Radioactive Discharge to Water

The ISFSI does not have any non-radioactive discharges to water. There are no dewatering requirements anticipated during construction.

7.3.7 Runoff and Receiving Waters

Section 401 of the Clean Water Act requires that any applicant for a Federal license or permit which includes construction or operation activities that may discharge into any surface waters must provide certification from the state in which the discharge originates or will originate, that such discharge complies with the Federal Water Pollution Control Act per 33 USC § 1341 and 40 CFR Part 122. No additional discharge or runoff to receiving waters is anticipated for the Prairie Island ISFSI; therefore no certification or additional permitting requirements are expected.

7.3.8 Heat Rejection

Each TN-40 cask is designed and licensed to reject up to 27 kW (0.675 kW per assembly) of heat generated by the spent fuel. The Prairie Island ISFSI Technical Specifications ensure that these maximum heat load requirements are not exceeded by specifying the following limits on characteristics of Plant spent fuel permitted to be stored in the ISFSI:

Minimum cooling time	10 years
Maximum assembly average burnup	45,000 MWD/MTU
Maximum initial enrichment	3.85 wt% U-235

Each TN-40HT cask will be designed and licensed to reject up to 32 kW (0.80 kW per assembly) of heat generated by the spent fuel. The cask will be licensed for the following limits on characteristics of Plant spent fuel:

Minimum cooling time	12 years
Maximum assembly average burnup	60,000 MWD/MTU
Maximum initial enrichment	5.00 wt% U-235
Maximum heat load	0.80 kW

Magnitudes of 27 kW for the TN-40 and 32 kW for the TN-40HT of heat rejection to the atmosphere per cask will not adversely affect the surrounding environment.

7.3.9 Noise

A sound level survey was conducted on November 15-16, 2006 to document the existing ambient sound levels at the closest residents to the plant. This data was used to assess the noise impact of the construction and operation of the spent fuel storage facility. The plant was operating during the ambient survey, but the cooling towers were not. The wind was mostly calm to 3.5 mph from the north, the temperature around 39° F, with overcast skies and a 46% RH.

7.3.9.1 Noise Standards

The State of Minnesota has noise standards found in Minnesota Rule 7030.0040, Subp. 2. These rules limit the daytime L50 sound level to 60 dBA1. The L50 is the sound level exceeded 50 percent of the time.

7.3.9.2 Ambient Sound Levels

Six noise measurement locations were used and are shown in Figure 7-11. The measured ambient sound level data are summarized in Table 7-6. As indicated in the table the daytime sound levels are mostly controlled by local traffic and trains. The highest sound levels were at Location #3 near the casino, which were in the 43-46 dBA range because of casino related traffic. The quietest levels were generally the more distant locations, such as #1 and #6, which were mostly in the 32-36 dBA range, or about 10 dBA quieter than the levels near the casino. Locations #2 and #4 were in between, in the range of 40 dBA.

The power plant was only audible at Location #1, with what sounded like ventilation fan noise.

Table 7-6: Summary of Measured Ambient L90s

	Daytime				Ambient Noise Sources
LOCATION	11-15-06		11-16-06		
	Morn.	Aftnoon	Morn.	Aftnoon	
#1. C. Suter Residence	34	34.6	31.9	32.3	Vents from plant
#2. 1754 Messiah Rd.	38.2	40.7	37.8	37.5	Local vehicle and train traffic
#3. Casino parking lot	42.5	46.1	43.8	43.3	Local vehicle and train traffic and casino vent fans on roof
#4. 1960 Edoka St.	39.9	41.7	40	39.9	Local vehicle and train traffic
#5. 1824 Edoka St.	35.3	35.7	32.2	33.5	Local vehicle and train traffic
#6. 5390 Sturgeon Lake Rd.	36.1	33.1	34.5	40.7	Local vehicle and train traffic

7.3.9.3 Construction Sound Levels

The first phase of construction will consist of excavation and site preparation for the duct banks and the new storage pads. The second phase of construction will include concrete trucks pouring the duct banks and pads.

The construction equipment used in the analysis is listed in Table 7-7 by phase. The 50 ft Lmax sound level for each item of equipment is as per Thalheimer2. This maximum level occurs only when the equipment is operating at full power. However, not all equipment will be operating all the time, and, when operating, will often be in a quieter, low power mode. An "Acoustic Usage Factor" (AUF) was therefore applied to the maximum sound level to correct the levels for the time the equipment is not operating at full power.

The AUF for the tabulated equipment is 40 percent or –4 dBA2. The reduced corrected sound levels were then converted to sound power levels, which represents the total acoustical energy of the source. The sound power levels were used in a computer model to calculate the expected sound levels at the nearest noise sensitive receptors. The calculation took into consideration hemispherical spreading and atmospheric absorption.

Table 7-7: Construction and Operation Equipment Sound Levels and Acoustic Usage Factors

Equipment	Phase 1	Phase 2	Phase, Operation	Lmax , 50 ft. dBA	Acoustic Usage Factor
Bulldozer	1			85	-4 dB
Scraper	1			85	-4 dB
Dump Trucks	2			84	-4 dB
Grader	1			85	-4 dB
Backhoe	1			80	-4 dB
Concrete Trucks		1		85	-4 dB
Water Truck	1			84	-4 dB
Light Trucks	1			55	-4 dB
Front End Loader			1	80	-4 dB
Cask Transport Vehicle			1	84	0

The predicted sound levels for residences near the Construction Site are shown in Table 7-8 for the two phases of construction, along with the existing operation and ambient sound levels. It can be seen that the predicted levels are higher than the ambient sound levels at all locations. However, all the construction sound levels are well below the Minnesota daytime code limit of 60 dBA2.

Table 7-8: Comparison of Construction and Operational Sound Levels with Daytime Ambient L_{90}s.

LOCATION	Phase 1 L_{eq}	Phase 2 L_{eq}	Operational L_{eq}	Lowest daytime L_{90}	Max dBA above ambient
#1. C. Suter Residence	47.9	41.2	43.2	31.9	16
#2. 1754 Messiah Rd. Residence	54.0	47.3	49.2	37.5	16.5
#3. Casino parking lot	44.5	37.8	39.8	42.5	2
#4. 1960 Edoka St. Residence	47.3	40.6	42.6	39.9	7.4
#5. 1824 Edoka St. Residence	51.5	44.8	46.7	32.2	19.3
#6. 5390 Sturgeon Lake Re. Res.	48.0	41.3	43.3	33.1	14.9

7.3.9.4 Operational Sound Levels

During normal operation the ISFSI has no operation activities and therefore has no noise impact on the area. The expansion of the ISFSI will not result in any increase in sound levels during operation. When spent fuel is moved from the plant to the concrete pad there is some noise impact due to the operation of a truck or front end loader.

To be conservative, the Front End Loader was given an AUF of zero dB and the Truck was assigned a value of –4 dB. Table 7-8 presents the estimated operational sound level in the community. All of the operational sound levels at the receptors are well below the Minnesota daytime code limit of 60 dBA.

7.3.9.5 Conclusions

The construction and operational sound levels of the facility will be above the existing residential daytime L90 sound levels but well below the Minnesota daytime code limit of an L50 of 60 dBA.

Additional survey information, including the times of data collection, the L10 and L50 levels, and the audible noise sources are given in Tables 7-9 through 7-12.

Table 7-9: Morning Sound Level Survey, November 15, 2006
Ten Minute Samples

LOCATION	TIME	L_{90}	L_{50}	L_{10}	L_{eq}	Controlling Noise Sources
#1. C. Suter Residence	10:15a.m.	34	35.8	40.3	48.1	Vent fans from plant
#2. 1754 Messiah Rd. Residence	10:36a.m.	38.2	39	41.2	40.4	Local vehicle and train traffic
#3. Casino parking lot	11:25a.m.	42.5	44.5	52.1	48.1	Local vehicle and train traffic and casino vent fans on roof
#4. 1960 Edoka St. Residence	11:45a.m.	39.9	41.6	46.1	49.8	Local vehicle and train traffic
#5. 1824 Edoka St. Residence	12:02p.m.	35.3	36.8	42.6	39.1	Local vehicle and train traffic
#6. 5390 Sturgeon Lake Re. Residence	12:51p.m.	36.1	42.9	53.4	58.6	Local vehicle and train traffic

Table 7-10: Afternoon Sound Level Survey, November 15, 2006
Ten Minute Samples

LOCATION	TIME	L_{90}	L_{50}	L_{10}	L_{eq}	Controlling Noise Sources
#1. C. Suter Residence	13:25p.m.	34.6	38.4	43.6	49.8	Vent fans from plant
#2. 1754 Messiah Rd. Residence	15:02p.m.	38.1	39.1	41.4	40.6	Local vehicle and train traffic
#3. Casino parking lot	14:40p.m.	46.1	50.8	56.2	53.3	Local vehicle and train traffic and casino vent fans on roof
#4. 1960 Edoka St. Residence	13:45p.m.	41.7	45.4	54	49.1	Local vehicle and train traffic
#5. 1824 Edoka St. Residence	14:02p.m.	35.7	38.6	43.3	40	Local vehicle and train traffic
#6. 5390 Sturgeon Lake Re. Residence	14:21 p.m.	33.1	35.4	38.1	36.6	Local vehicle and train traffic

Table 7-11: Morning Sound Level Survey, November 16, 2006
Ten Minute Samples

LOCATION	TIME	L_{90}	L_{50}	L_{10}	L_{eq}	Controlling Noise Sources
#1. C. Suter Residence	9:15a.m.	31.9	34.6	67	63.3	Vent fans from plant
#2. 1754 Messiah Rd. Residence	8:50a.m.	37.8	39.4	47.4	47.5	Local vehicle and train traffic
#3. Casino parking lot	7:31a.m.	43.8	43.9	56.2	52.1	Local vehicle and train traffic and casino vent fans on roof
#4. 1960 Edoka St. Residence	8:16a.m.	40	42.8	50.1	54	Local vehicle and train traffic
#5. 1824 Edoka St. Residence	8:33a.m.	32.2	33.8	37	35	Local vehicle and train traffic
#6. 5390 Sturgeon Lake Re. Residence	7:50a.m.	34.5	38.2	41.4	40.3	Local vehicle and train traffic

Table 7-12: Afternoon Sound Level Survey, November 16, 2006 Ten Minute Samples

LOCATION	TIME	L_{90}	L_{50}	L_{10}	L_{eq}	Controlling Noise Sources
#1. C. Suter Residence	12:20p.m.	32.3	34.4	38.2	36	Vent fans from plant
#2. 1754 Messiah Rd. Residence	12:44p.m.	37.5	39	44.4	48.6	Local vehicle and train traffic
#3. Casino parking lot	13:16p.m.	43.3	47.2	56.5	53	Local vehicle and train traffic and casino vent fans on roof
#4. 1960 Edoka St. Residence	13:35p.m.	39.9	42.4	47.8	49	Local vehicle and train traffic
#5. 1824 Edoka St. Residence	13:53p.m.	33.5	35.9	39.4	37.1	Local vehicle and train traffic
#6. 5390 Sturgeon Lake Re. Residence	14:14p.m.	40.7	43.3	48.5	46.2	Local vehicle and train traffic

7.4 Pollution Control and Safeguards Equipment

In the following section, we provide information on the pollution controls and safeguards as required in Minnesota Rule 7855.0660.

7.4.1 Management of Radioactive Materials

Radioactive materials will be sealed in a cask via a double metallic seal bolted lid. Analyses of normal, off-normal, and accident conditions in spent fuel storage system Safety Analysis Reports have determined that no credible conditions can breach the cask shell or fail the double metallic seals. The casks are designed and tested to meet the criteria of ANSI N14.5 with leakage rates not exceeding 1 E-5 standard cubic centimeters per second (scc/sec). The casks are designed to maintain confinement integrity during normal conditions of storage, and off-normal and postulated accident conditions, including earthquake, tornado, tornado missile, and drop of the storage cask.

7.4.2 Contingency Plans in the Event of an Accidental Release of Radioactive Materials

An emergency plan is required for the Prairie Island spent fuel storage facility, in accordance with 10 CFR 72.32(c). The 10 CFR 50.47 emergency plan already in effect for the nuclear power plant is applied to the ISFSI and was modified to address potential accidents associated with the ISFSI. The Prairie Island emergency plan describes the organization, assessment actions, activation of the emergency organization, notification procedures, emergency facilities, training, provisions for maintaining emergency preparedness, and recovery criteria for off-normal and accident conditions.

7.4.3 Recycling Methods to Dispose of Solid or Liquid Wastes

The Prairie Island spent fuel storage facility contains no systems that produce either solid or liquid wastes. Therefore, no recycling methods are proposed or required for this facility.

7.4.4 Emission Control Devices and Dust Control Measures

There are no air emissions expected from the site. Although the construction and operational sound levels during cask transfer at the site will be above the existing daytime L90 ambient sound levels, they will be well below the Minnesota daytime code limit of an L50 of 60 dBA. Therefore no noise impact will occur at the nearest noise sensitive receptors and no noise control devices will be required.

The only sources of dust will be from construction activities and will be controlled by wetting exposed soil areas and covering stockpiles. During operation of the ISFSI, the only fugitive dust source will be that which is produced by the train car during the infrequent delivery of casks to the site. This is considered to be a negligible source of fugitive dust.

7.4.5 Water Pollution Control Equipment and Runoff Control Measures

The ISFSI will not have any pollution discharges to water during operation and therefore will not require any water pollution control equipment. Since the site expansion will not add any wastes to storm water, it is expected that the quality of the runoff will be similar to the existing runoff quality. The expansion will

add a little more than an acre of impervious surfaces, which will not absorb runoff. Therefore, the quantity of runoff will slightly increase. This runoff will be directed toward natural flow routes around the facility. Energy absorbing controls such as riprap and sediment controls will be used to minimize erosion into these natural flow routes.

Section 401 of the Clean Water Act requires that any applicant for a Federal license or permit which includes construction and operation activities that may discharge into any surface waters must provide certification from the state in which the discharge originates or will originate, that such discharge complies with the Federal Water Pollution Control Act per 33 USC § 1341 and 40 CFR Part 122. No additional discharge or runoff to receiving waters is anticipated for the Prairie Island ISFSI; therefore no certification or additional permitting requirements are expected.

The proposed expansion of the pads at the Prairie Island ISFSI is not expected to disturb any additional undisturbed land area; therefore no additional storm water permitting is expected at this time.

7.4.6 Spill and Leak Prevention Measures

The storage system is designed with a double metallic seal bolted lid so that there are no leaks of any radioactive materials. The facility will also contain no restroom facilities or any other wastewater generating processes that could involve a spill or leak. Therefore, no spill or leak prevention measures are required.

7.4.7 Heat Rejection Reduction Methods

The TN-40 casks are designed and licensed to reject up to 27 kw (0.675 kW per assembly) of heat generated by the spent fuel. The TN-40HT casks are designed and will be licensed to reject up to 32 kW (0.80 kW per assembly) of heat generated by the spent fuel. Magnitudes of 27 kW for the TN-40 and 32 kW for the TN-40HT of heat rejection to the atmosphere per cask will not adversely affect the surrounding environment and no heat rejection reduction methods will be applied to the facility.

7.4.8 Other Equipment or Measures to Reduce Effects of Facility on the Environment

The facility will have negligible effect on the environment, therefore no additional equipment or measures are required.

7.4.9 Environmental Monitoring

7.4.9.1 Radiation Monitoring System

According to 10 CFR 72.126(b), radiological alarm systems must be provided in accessible work areas as appropriate to warn operating personnel of radiation and airborne radioactive material concentrations above a given set point and of concentrations of radioactive material in effluents above control limits. However, significant airborne radioactivity releases are precluded by the cask design in which the closures are sealed by double metallic seals and confirmed by the storage system testing criteria that conforms in ANSI N14.5. Therefore, airborne radioactivity monitoring is not required for the ISFSI.

According to 10 CFR 72.126(c)(2), areas containing radioactive materials must be provided with systems for measuring the direct radiation levels in and around these areas. Adequate radiological monitoring will be provided by portable survey instruments during cask handling and for other activities. Thermo-luminescent Dosimeters (TLDs) are located on the outer (nuisance) fence that surrounds the ISFSI, to monitor cumulative direct radiation levels over predetermined time intervals as part of the environmental monitoring program. Personnel entering the ISFSI radiation restricted area will be provided with dosimetry to accurately measure, record, and report exposure on an individual basis.

In addition to the radiation monitoring required by the NRC, the Minnesota Department of Health continuously monitors radiation levels.

7.5 Estimates of Induced Development

In this section, we provide information regarding induced development as required by Minnesota Rule 7855.0670.

7.5.1 Vehicular Traffic During Construction and Operation

7.5.1.1 Traffic from Construction

Construction of the two new pads will consist of earthwork, structural fill and concrete materials being brought to the site, delivery of equipment and supplies, and daily construction workers commuting to the sites in the morning and afternoon on work days during an assumed shift length of 8 hours, at least five days per week for a duration of a few weeks. The traffic estimates represent a reasonable approximation of the construction traffic that can be anticipated as a result of this project.

The initial construction will include excavation and structural fill for the storage pads. These activities will take a maximum of 1-week duration (5 working days) to complete. The storage pads must be supported by structural fill. The area of the pads is 216 ft x 18 ft. The typical depth required for fill is around 3 ft. The volume of fill is 216 x 18 x 3 = 11,664 cu ft per pad or 864 CY total. The smallest truck (end dump) has a volume of 10 CY versus a larger truck (belly dump) of 20 CY. Assuming the smallest truck is used since it is a small site, the total number of truck trips will be 864 / 10 = 87 total trips. At least 3 trucks are assumed per hour depending on whether the location of the gravel pit can accommodate the site (this is not a strenuous level - more trucks could be used to increase the trips per hour). This will require 87 trips / 3 trucks per hour / 8 hours per day = 4 workdays to provide the fill. The total daily traffic will be 24 trips plus commuting traffic.

Following excavation of the in-situ soil and placement of the structural fill, each pad will require formwork in preparation of concrete pouring during week 2. The total rebar tonnage will be approximately 150 tons. Assuming a typical flatbed payload of 25 tons, an estimated 6 truck trips will be required to deliver the rebar. The total daily traffic will be 6 trips that will occur over 1 to 2 days plus commuting traffic for the workers.

Each storage pad is 216 ft x 18 ft x 3 ft, which has a volume of 432 CY. Therefore, the total required concrete would be 432 x 2 = 864 CY. Concrete is also used for the duct bank that must be run from the pads to the alarm monitor building. Assuming the duct bank is 2 ft high x 3 ft wide and is 260 ft long to the east pad and 540 ft to the west pad, then the volume of concrete is [2 x 3 x 260 + 2 x 3 x 540]/27 = 178 CY. A typical cement truck can hold 8 to 10 CY. Assuming it can hold only 8 CY, the number of total cement truck trips required is (864 + 178) / 8 = 131 trips. If it is assumed that only 3 trucks

deliver per hour during a workday of 8 hours, then it will require 131 / 3 trips per hour / 8 hours per day = 6 workdays to pour all the concrete. The total daily traffic will be 24 trips plus commuting traffic. This activity would occur during the last part of week 2 and primarily during week 3.

Following concrete placement there will be fill replacement of the structural fill that was removed around the pads and pulling of the monitoring wiring between the alarm monitoring building and pads. It is estimated that fill replacement, performed by up to 2 heavy equipment operators, will take no more than 2 days. Wire placement could take up to one week and will require 1 to 2 light truck trips per day. These activities will be performed during week 4. During this period the total daily traffic will primarily be only commuter traffic.

In addition to material and equipment deliveries, an average construction labor force of 4 workers per day is projected. There will also be 2 project management personnel who currently work at the Plant and will not add to the impact of the traffic due to the construction work. The peak number of construction labor workers, occurring during concrete placement, will be 5 workers. The average number of construction labor workers per day will be approximately 6.

It is anticipated that workers will commute to and from the construction site on a daily basis utilizing individual passenger vehicles and light trucks. The number of workers will add up to an additional 6 trips/day average on the Prairie Island access roads.

7.5.1.2 Traffic from Operation

During operation, there will be no increase in traffic since there are no additional full time workers at the ISFSI. (Table 7-13). When a cask campaign is engaged (typically a week long) the only vehicles added to the facility will be the cask transport vehicle. This vehicle operates solely on the Plant property. No other significant traffic increases are expected during operation.

Table 7-13 Summary of Additional Traffic

	Added Daily Traffic Construction Vehicles Max. (vehicles/day)	Commute 1-hour morn 1-hour evening (vehicles/day)
Construction	24	6
Operation	None	None

7.5.2 Work Force During Construction and Operation

7.5.2.1 Work Force During Construction

Construction of two new Prairie Island ISFSI pads will involve earthwork to excavate the pad area, placement of structural fill under the pad area before pouring and around the pads after pouring, form and pour the storage pads and ductbank, and installation of electrical wiring. Equipment could typically include bulldozers, scrapers, dump trucks, graders, water trucks, cement trucks, and light vehicles (pickup trucks). The work will be performed over a 1-month period, during daytime hours and is estimated to require approximately 13 workers (Table 7-14) including equipment operators, laborers, electricians, iron-workers, concrete finishers, and construction supervision staff.

Table 7-14 Estimated Construction Labor Force 1-Month Project Duration

SPECIALTY	NO. OF WORKERS	CONSTRUCTION PERIOD
Project Engineer	1	Weeks 1 – 4
Construction Manager	1	Weeks 1 – 4
General Superintendent	1	Weeks 1 – 4
Earthwork Equip Operators	2	Weeks 1 and 4
Iron Workers (rebar)	2	Week 2
Cement Truck Operators	2	Weeks 2-3
Concrete Finishers	2	Weeks 2-3
Electricians	2	Week 4
Total	13	

7.5.2.2 Work Force During Operation

The proposed expansion of the ISFSI will not require the addition of any workers. Transfer of the spent fuel will involve placing the storage cask loaded with spent fuel in the cask transport vehicle in the Auxiliary Building, moving it to the ISFSI site, placing the cask in the storage pad, and connecting the overpressure monitoring system. This process requires an 8-man crew. These activities are conducted during daytime hours and only occasionally every other year. The ISFSI is not normally manned and has no workers other than security personnel.

7.5.3 Impacts to Utilities and Public Services

The ISFSI is a low use type of facility. The only electrical demand is for operation of the facility lighting, security systems, and state owned radiation monitors. The additional pads and storage casks will not increase the electrical demands of the site. No new utilities will be required.

Since the proposal calls for increasing the storage within the footprint of the existing ISFSI, there is no need to alter the access road. Therefore, no additional public access roads will be required for the facility.

7.5.4 Water Usage During Construction and Operation

Water may be used to provide dust control during excavation of in situ soil and placement of fill for the pads. A typical water truck holds approximately 7500 gallons of water. The dust control activities are estimated to use less than 1 truck load per day over a total of 7 days of the 1 month project during earthwork activities. Assuming the truck makes 1 trip per day then 7,500 gallons could be used per day. Over a 7-day period a total of up to 52,500 gallons could be used. This is a gross over estimation however, since the total volume of water is expected to be much less.

The water is expected to be from the closest source, the Mississippi River, which is located a few feet away.

The ISFSI contains no restroom or any other type of system that uses water. Therefore, during operation, no water is used by the facility.

7.5.5 Impacts on Agricultural Lands

Since the proposal calls for increasing the storage within the footprint of the existing ISFSI, no agricultural land will be lost due to the construction of the additional storage pads.

7.5.6 Impacts on the Local Population

Since the proposal calls for increasing the storage within the footprint of the existing ISFSI, no relocation of people is required.

Figure 7-1

Site

PRAIRIE ISLAND NUCLEAR PLANT

0 125 250 500 750 1,000 Feet

1 inch equals 500 feet

Shaw Environmental Inc.

Prairie Island Spent Fuel Storage
Certificate of Need

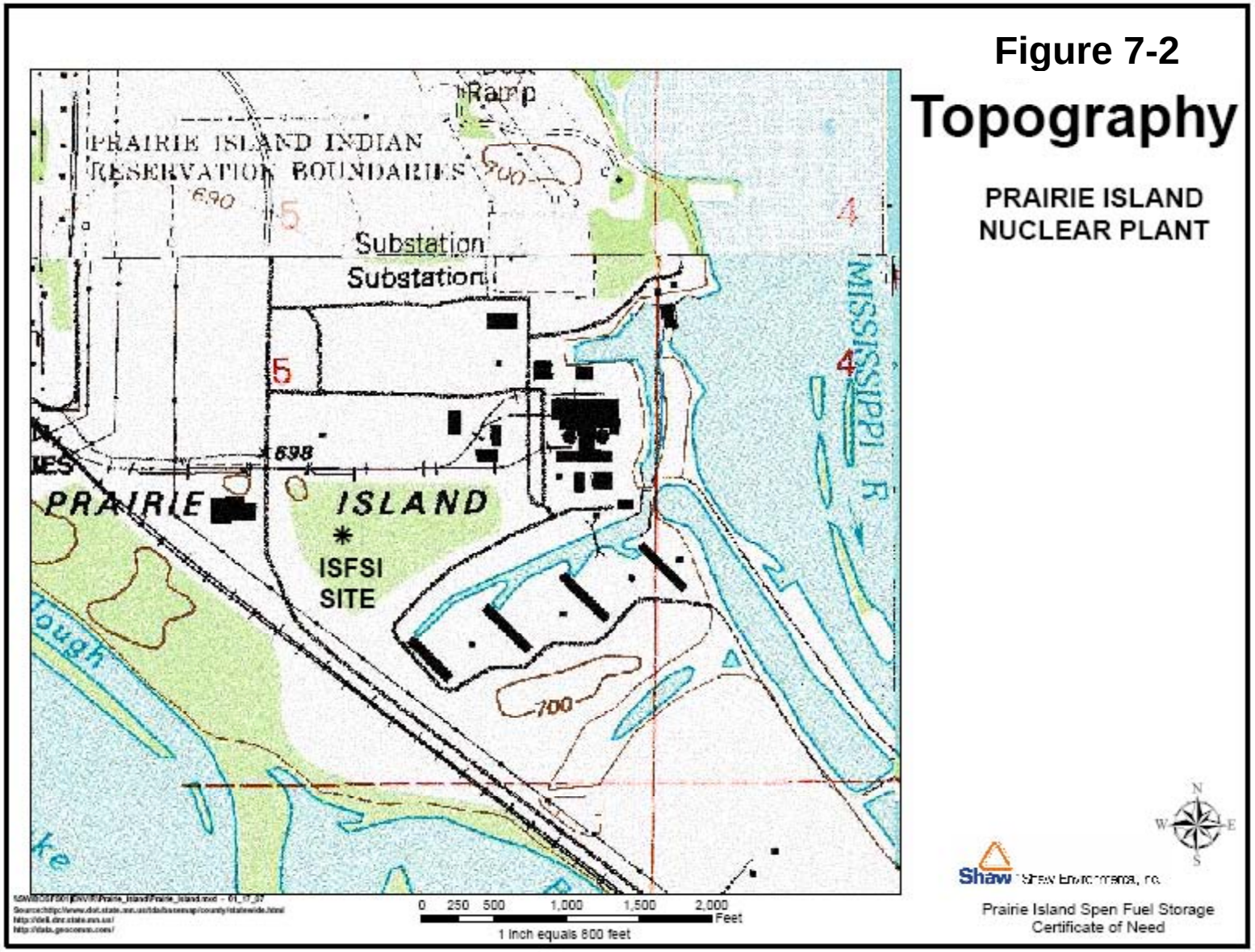
Figure 7-2
Topography
PRAIRIE ISLAND
NUCLEAR PLANT
Ramp
PRAIRIE ISLAND INDIAN
RESERVATION BOUNDARIES
690
5
Substation
Substation
5
4
4
MISSISSIPPI R
698
PRAIRIE
ISLAND
ISFSI
SITE
700
0 250 500 1,000 1,500 2,000
Feet
1 inch equals 800 feet
N
W
E
S
Shaw
Prairie Island Spen Fuel Storage
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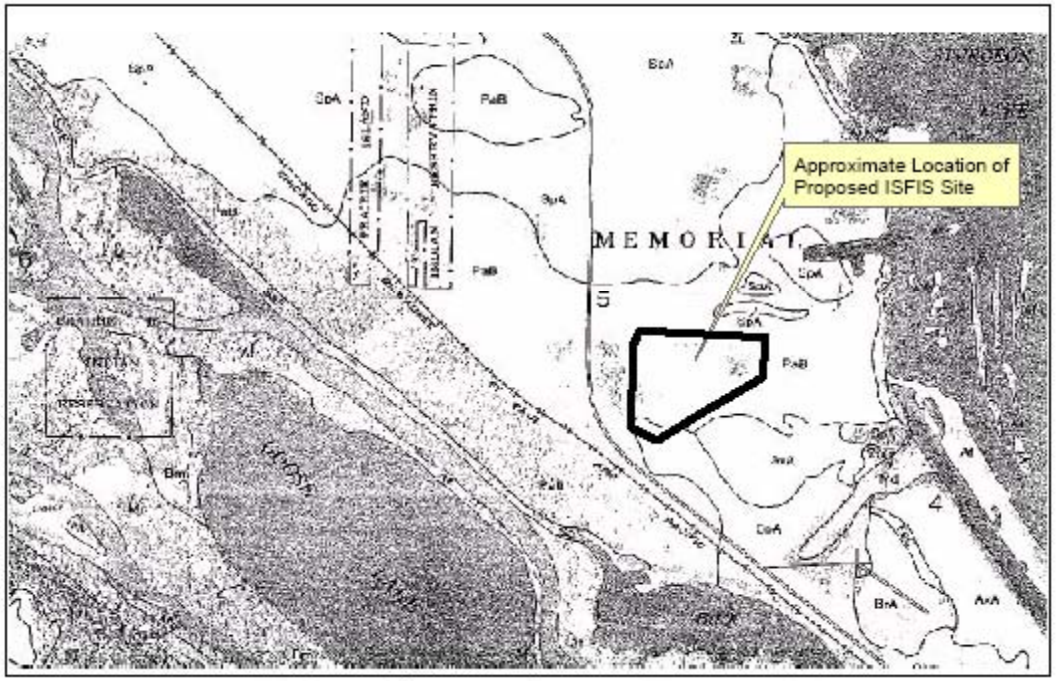
Figure 7-3

Soils

PRAIRIE ISLAND NUCLEAR PLANT



Legend

Af	Alluvial land, frequently flooded
AvA	Alvin fine sandy loam, 0 to 3 percent slopes
AxA	Ankeny sandy loam, 0 to 3 percent slopes
BrA	Burkhardt loam, 0 to 3 percent slopes
EsC	Estherville soils, 6 to 18 percent slopes
LlA	Lilah sandy loam, 0 to 6 percent slopes
Md	Marsh
Mp	McPaul silt loam
PaB	Plainfield loamy sand, 0 to 6 percent slopes
PaD	Plainfield loamy sand, 6 to 25 percent slopes
SaE	Salida gravelly coarse sand, 12 to 45 percent slopes
SpA	Sparta loamy sand, 0 to 3 percent slopes
Zu	Zumbro loamy sand

Source: Sheet Number 8, *Soil Survey of Goodhue County, Minnesota* (Poch 1976)

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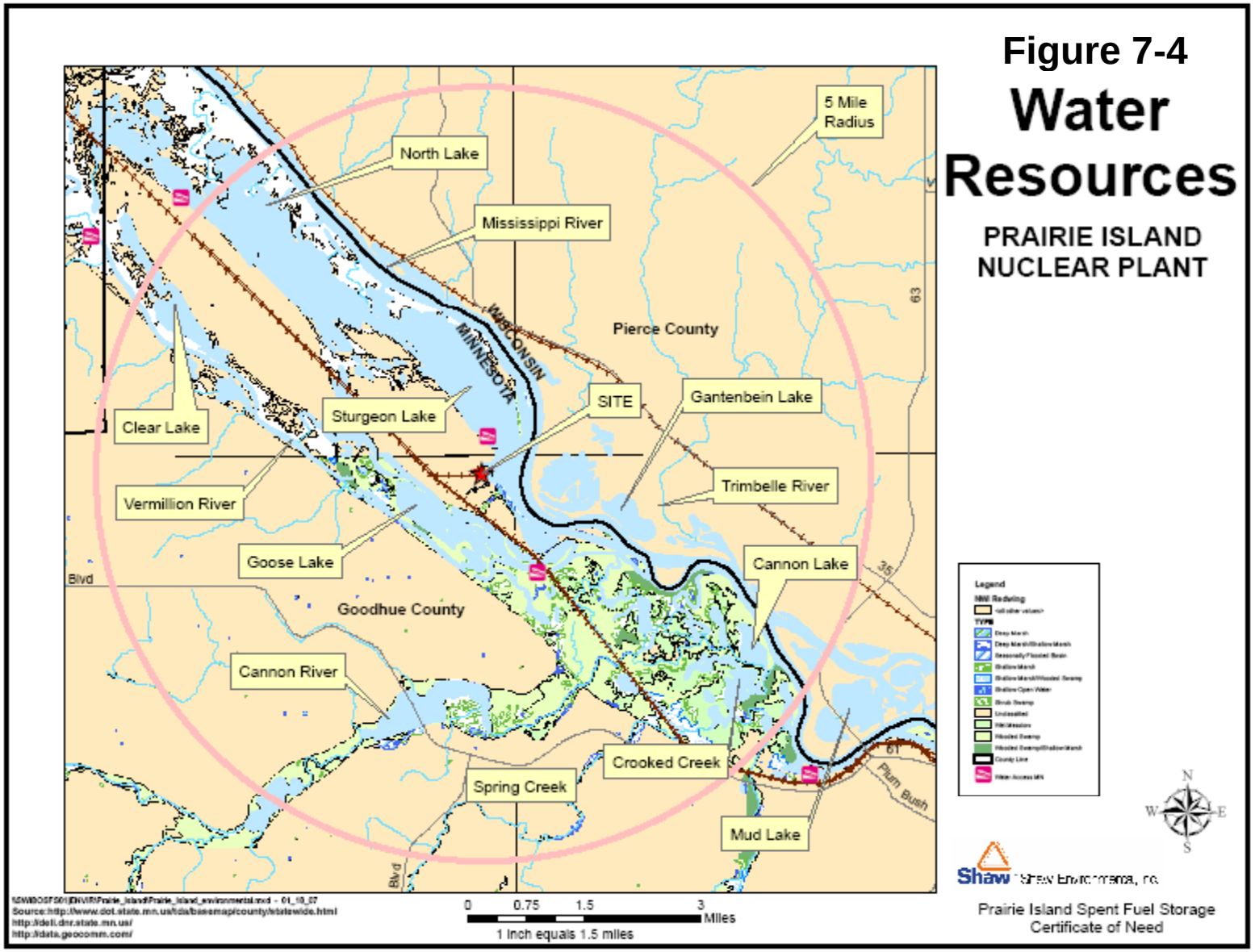
Figure 7-4
Water Resources
PRAIRIE ISLAND NUCLEAR PLANT
5 Mile Radius
North Lake
Mississippi River
WISCONSIN
MINNESOTA
Pierce County
SITE
Gantenbein Lake
Sturgeon Lake
Clear Lake
Trimbelle River
Vermillion River
Goose Lake
Cannon Lake
Goodhue County
Cannon River
Crooked Creek
Spring Creek
Mud Lake
Plum Bush
Blvd
0 0.75 1.5 3 Miles
1 Inch equals 1.5 miles
Shaw
Prairie Island Spent Fuel Storage
Certificate of Need

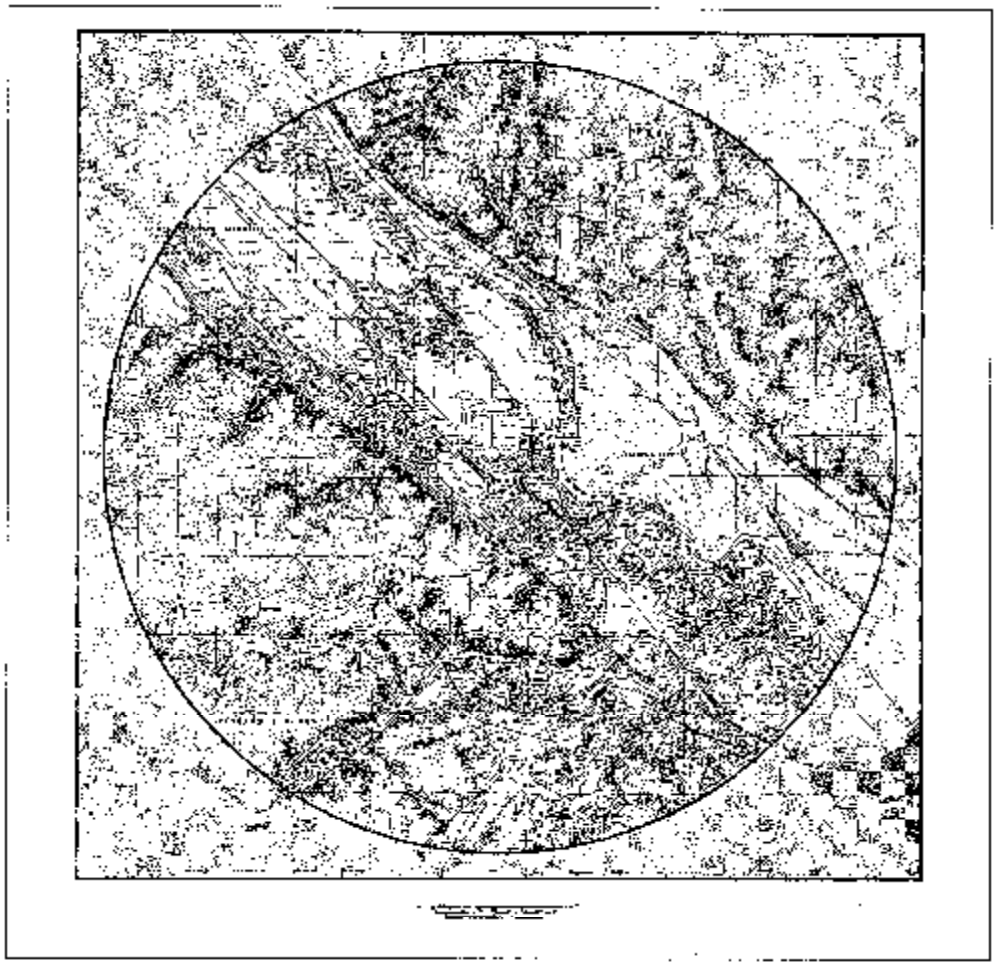

Figure 7-5

Wetland Resources

PRAIRIE ISLAND NUCLEAR PLANT

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Prairie Island Spent Fuel Storage
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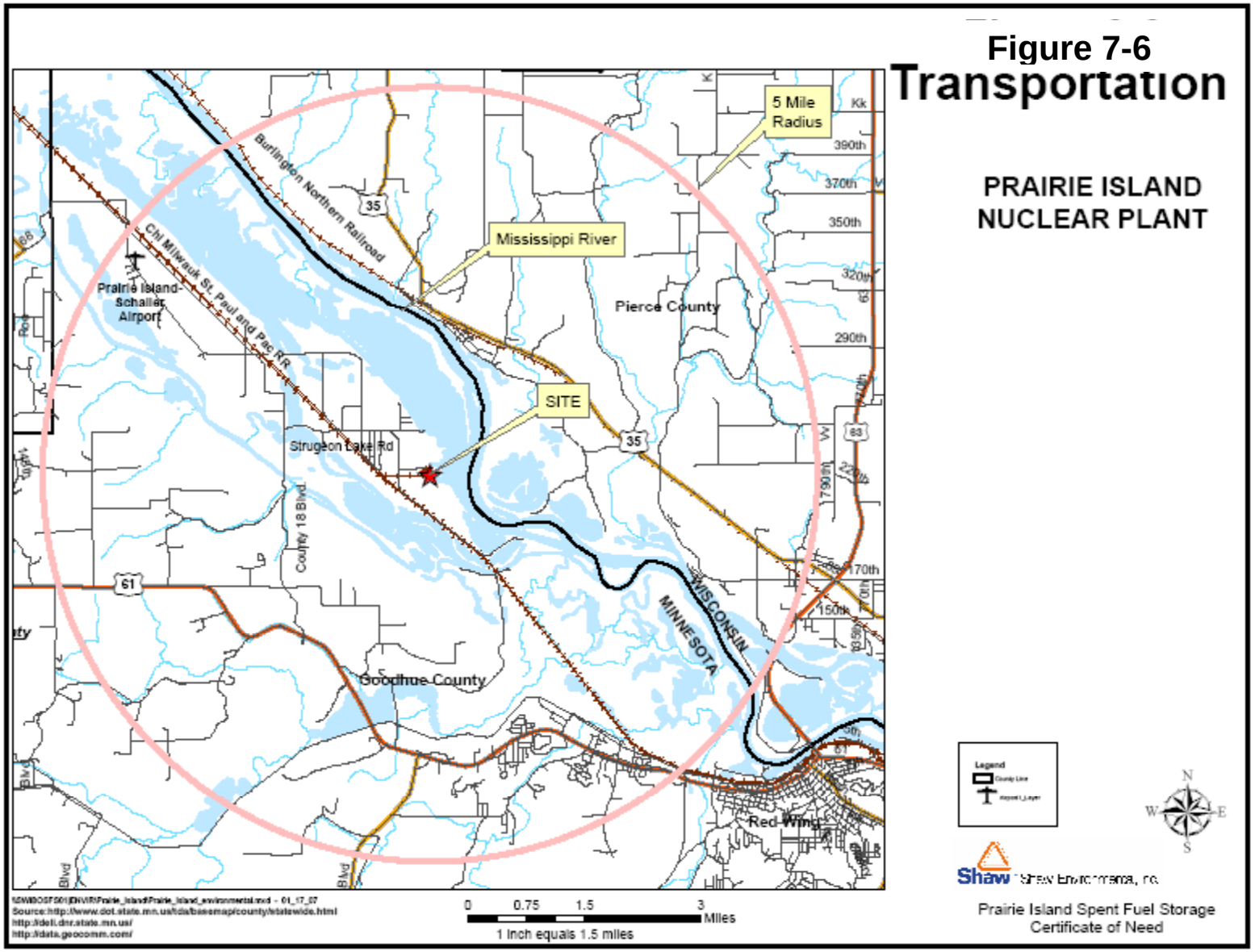
Figure 7-6
Transportation
PRAIRIE ISLAND
NUCLEAR PLANT
5 Mile Radius
Mississippi River
SITE
Burlington Northern Railroad
Chi Milwauk St Paul and Pac RR
Prairie Island-Schaller Airport
Pierce County
Goodhue County
Strugeon Lake Rd
County 18 Blvd
WISCONSIN
MINNESOTA
Red Wing
390th
370th
350th
320th
290th
170th
150th
35
61
63
Legend
N
S
E
W
0
0.75
1.5
3
Miles
1 Inch equals 1.5 miles
Shaw
Prairie Island Spent Fuel Storage
Certificate of Need

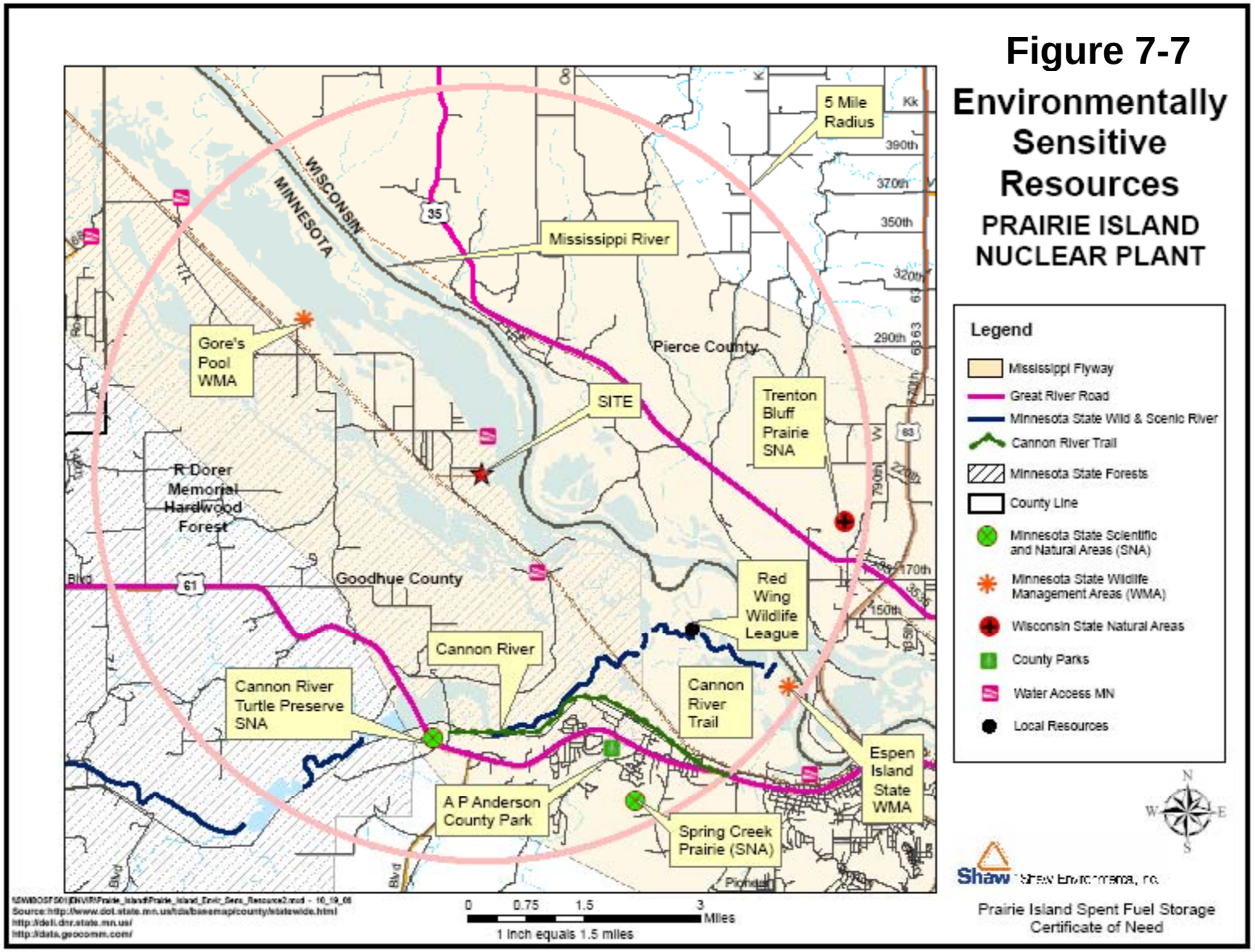
Figure 7-7
Environmentally Sensitive Resources
PRAIRIE ISLAND NUCLEAR PLANT
5 Mile Radius
WISCONSIN
MINNESOTA
Mississippi River
Gore's Pool WMA
Pierce County
SITE
Trenton Bluff Prairie SNA
R Dorer Memorial Hardwood Forest
Goodhue County
Red Wing Wildlife League
Cannon River
Cannon River Turtle Preserve SNA
Cannon River Trail
Espen Island State WMA
A P Anderson County Park
Spring Creek Prairie (SNA)
Legend
Mississippi Flyway
Great River Road
Minnesota State Wild & Scenic River
Cannon River Trail
Minnesota State Forests
County Line
Minnesota State Scientific and Natural Areas (SNA)
Minnesota State Wildlife Management Areas (WMA)
Wisconsin State Natural Areas
County Parks
Water Access MN
Local Resources
0 0.75 1.5 3 Miles
1 inch equals 1.5 miles
Shaw
Prairie Island Spent Fuel Storage
Certificate of Need

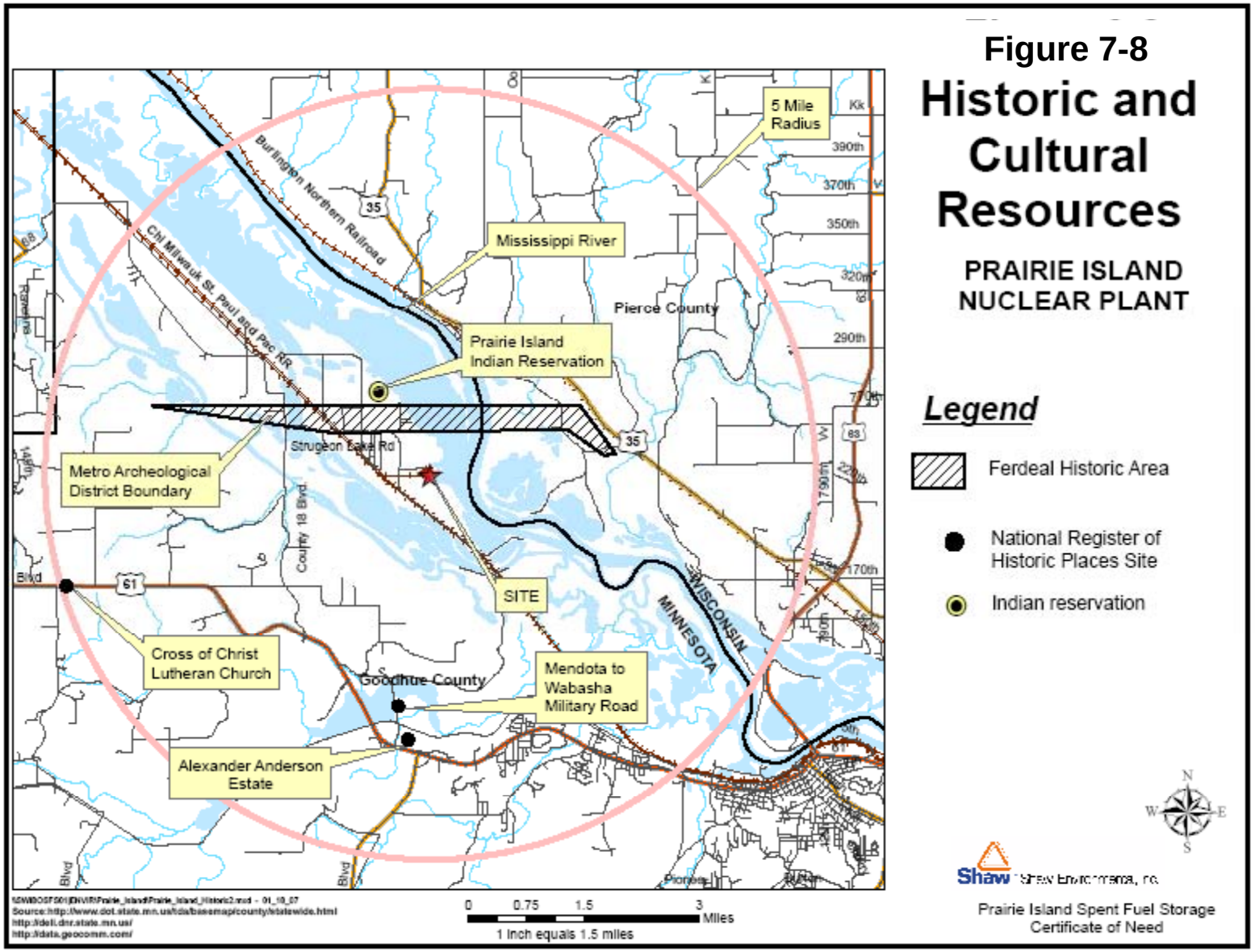
Figure 7-8
Historic and Cultural Resources
PRAIRIE ISLAND NUCLEAR PLANT
Legend
Ferdeal Historic Area
National Register of Historic Places Site
Indian reservation
5 Mile Radius
Mississippi River
Burlington Northern Railroad
Chi Milwauk St. Paul and Pac RR
Pierce County
Prairie Island Indian Reservation
Strugeon Lake Rd
Metro Archeological District Boundary
County 18 Blvd
SITE
WISCONSIN
MINNESOTA
Cross of Christ Lutheran Church
Goodhue County
Mendota to Wabasha Military Road
Alexander Anderson Estate
0 0.75 1.5 3 Miles
1 Inch equals 1.5 miles
Shaw Environmental, Inc.
Prairie Island Spent Fuel Storage Certificate of Need

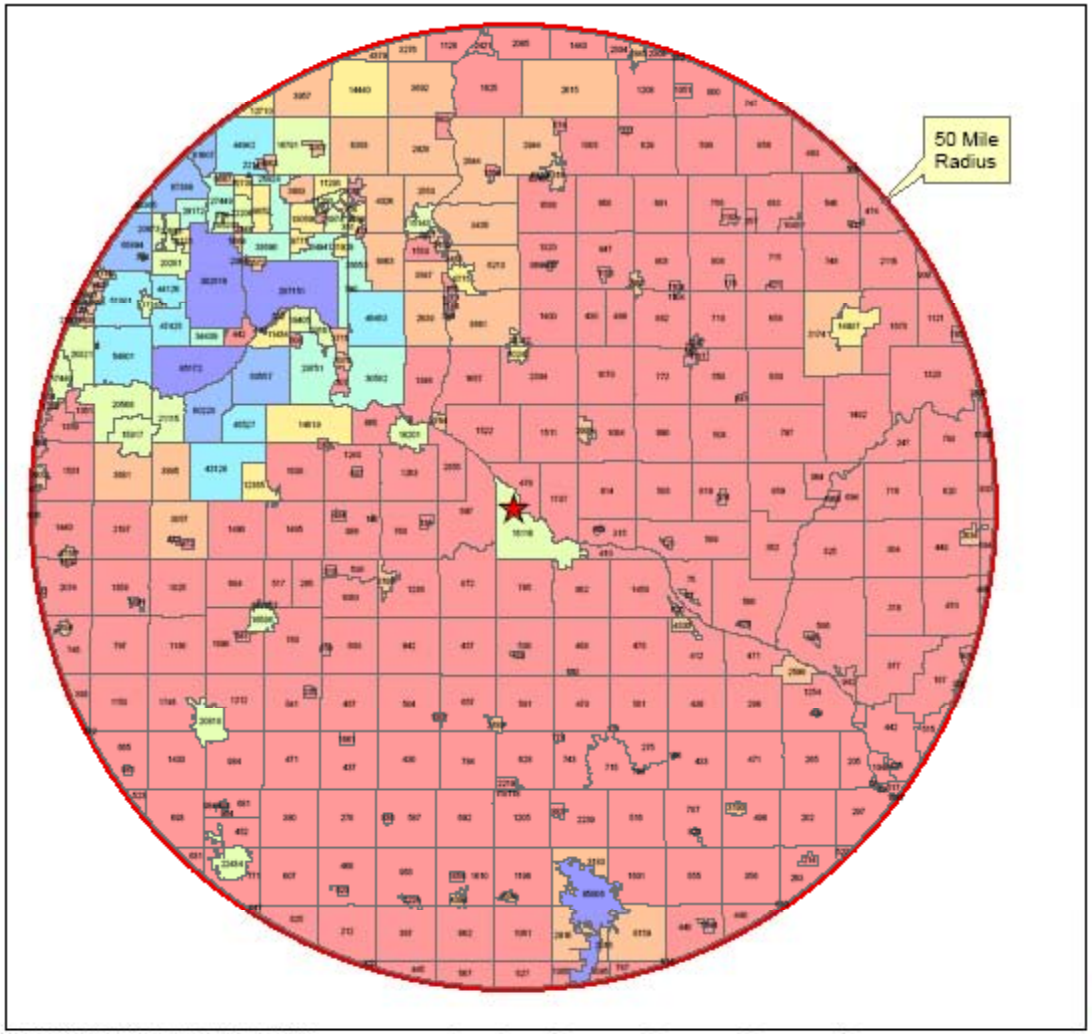

Figure 7-9
Population

PRAIRIE ISLAND NUCLEAR PLANT

Minor Civil Divisions 2000 Census Data

Legend

POPULATION
- 0 - 2500
- 2501 - 7500
- 7501 - 15000
- 15001 - 25000
- 25001 - 35000
- 35001 - 55000
- 55001 - 85000
- 85001 - 382618

Total Population Within 50 Miles 2,949,234

N W E S

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Prairie Island Spent Fuel Storage
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Figure 7-10 Prairie Island ISFSI Site Boundaries

(Boundary Shown in Red)

Figure 7-11 Noise Measurement Locations

8 Power Uprate Environmental Information

8.1 Section Summary

This section discusses the environmental impacts of the proposed uprate project and provides the environmental data required under Minn. R. Parts 7849.0310, 7849.0320 and 7849.0340. The environmental impacts of the power uprate project and the alternatives are listed in Tables 8-12 and 8-13 at the end of this section.

The proposed power uprate project will not have any significant negative environmental impacts. Environmental impacts of the power uprate will include:[25]

- a significant reduction carbon emissions, as compared to the alternatives;
- an increase in water use by up to approximately 10 percent, but not above the currently permitted level;
- a slight increase in circulating water outfall temperature, but not above the limits currently set by the MPCA; and
- a slight increase in radioactive releases, but by no more than 10 percent and well below current limits.

[25] Xcel Energy has provided conservative estimates of the extent of the adverse impacts of the proposed power uprate project. As the Company completes detailed design and engineering activities, it will confirm that the conservative estimates presented bound the actual impacts.

8.2 Power Uprate Project Environmental Information

8.2.1 Land Requirements (Minn. R. 7849.0320(A))

The Prairie Island uprate project will not increase the land requirements for the generating plant and does not result in any activity that will change or otherwise modify the present requirements for land use at the site. The project does not involve the construction of any new facilities, access roads, parking areas; lay down areas, or onsite transmission/distribution equipment to support power uprate activities at Prairie Island. Except for transportation of equipment and routine disposal of waste, power uprate maintenance activities will be confined to the inner-plant security fenced area. The power uprate will not affect the storage requirements for above- or below-ground tanks. Other lands located outside the inner security fence will not be modified or changed to support power uprate activities. The Project will not involve changes to any aesthetic resources and will not impact lands with historical or archaeological significance.

It is our intent to salvage the old turbine components and other equipment that are being replaced. No radioactive contaminated equipment is expected.

8.2.2 Traffic

Plant modifications to accomplish power uprate will be completed primarily during planned refueling outages in 2012 and 2015 for Unit 1 and Unit 2 respectively. We do not expect the number of workers at the Plant to be significantly higher during the refueling outages when power uprate is implemented than during nonpower uprate refueling outages. There are approximately 500 additional workers on-site during a typical refueling outage. It is estimated the power uprate construction will increase that by a few dozen more. Since the power uprate project will only minimally increase the number of workers at Prairie Island during the outages, the additional traffic generated is negligible. Power uprate equipment deliveries will involve similar types of equipment deliveries as have been made for past refueling outages. After the project has been implemented, the on-going operation of the plant will not require additional employees and traffic will not differ from current levels.

8.2.3 Water Use for Alternate Cooling Systems

8.2.3.1 Ground Water

The power uprate will not involve significant increases in groundwater consumption and thus will not affect groundwater resource permit limits.

Groundwater use is governed by water appropriation limits of the Minnesota Department of Natural Resources (MDNR). Prairie Island uses ground water for potable and industrial use from six wells installed within the alluvial aquifer located on the Plant property. Five of these wells are permitted by the MDNR. The sixth well does not require a water appropriation permit because it is below the minimum flow requirements of 10,000 gallons per day or 1,000,000 gallons per year set by MDNR. Although the maximum combined pumping rate equals approximately 850 gpm, ground water appropriation permit numbers 69-171-G, 78-5153, 86-5114, and 96402, limit the usage to a total of 354.7 million gallons per year for the five wells. Over a recent period of five years (2003 through 2007), the maximum usage was 61.6 million gallons in 2005 (See Table 8-1). Assuming a 10 percent increase in groundwater use applied to the maximum annual usage over the past five years of 61.6 million gallons in 2005, the projected maximum use would be approximately 68 million gallons or 129.4 gpm.

Any increases in makeup to plant systems from these sources are expected to be minor, and operation within the allowable permit limits will continue. The maximum 68 million gallons is still significantly less than the 355 million gallons per year permit limit. Thus, the power uprate project will not affect compliance with the permit limits. A more realistic calculation based on the average usage the past four years of 52.3 million gallons per year would indicate a reasonably expected usage of 57.5 million gallons per year.

Table 8-1: Reported Pumping Permit Appropriation (MGY)

Year	2003	2004	2005	2006	2007
Reported	41.9 MGY 128.63 acre ft 79.72 gpm	54.6 MGY 167.62 acre ft 103.60 gpm	61.6 MGY 189.11 acre ft 117.20 gpm	58.6 MGY 179.90 acre ft 111.49 gpm	44.8 MGY 137.53 acre ft 85.24 gpm

8.2.3.2 Surface Water Appropriation

Based on a range of assumptions, the power uprate will increase surface water appropriations by approximately 1300-acre ft/year. This increase is within the limits of the current surface water permit.

Surface water use at Prairie Island is in accordance with the water appropriation limits of the MDNR. Under surface water appropriation permit number 69-0172, amended in June 1995, Prairie Island draws water from the Mississippi River for plant condenser cooling and auxiliary water systems, such as service water cooling, intake screen wash, and fire protection. Prairie Island may withdraw up to 235,000 million gallons of water per year from the Mississippi River. Over a period of five recent years (2001 through 2005), a maximum of 207,650 million gallons of water was withdrawn, occurring during the year 2005.

The circulating water system removes heat for the generating plant. Excess heat from the steam leaving the turbine is transferred to circulating water flowing through the condenser tubes. Based on seasonal limitations heat is transferred to the environment either by the use of the cooling towers, discharge to the river or a combination of cooling towers and river discharge. Operating restrictions are governed by the National Pollutant Discharge Elimination System (NPDES).

The average annual river water withdrawal for years 2000-2005 was 849 cfs (614,880 acre-ft/yr). The estimated average annual water loss due to evaporation and drift is approximately 39 cfs (28,245 acre-ft/yr) with 810 cfs being returned to the river.

Assuming that evaporative rate is proportional to the proposed power increase of about 10 percent, the power uprate could potentially cause an increase in evaporation rate to about 43 cfs. The water loss of 43 cfs by evaporation is about 0.23 percent of the 18,380 cfs average Mississippi River flow and is approximately 1 % of the lowest annual mean of 4,367 cfs. Based on this comparison, it is concluded that any impacts caused by higher evaporative losses of 43 cfs from the Mississippi river is very small and has insignificant impact on the Mississippi River flow.

8.2.4 Water Discharges (Minn. R. 7849.0320(F))

8.2.4.1 Water Discharge Flow Rates

The power uprate will not result in any increase in wastewater discharges beyond those allowed under the current applicable permits.

Wastewater discharges are regulated by the State of Minnesota through the NPDES permit. The NPDES permit is periodically reviewed and re-issued by the Minnesota Pollution Control Agency (MPCA). The NPDES permit for Prairie Island, permit number MN0004006, was issued on June 30, 2006 and expires on August 31, 2010. The NPDES permit authorizes discharges and intakes and imposes limits and/or monitoring/reporting requirements for the discharges listed in Tables 8-2. No changes to the discharge permit requirements, other than administrative and descriptive changes, are necessary to implement the power uprate.

Table 8-2: Surface Water Discharge Streams

Stream	Description	Maximum Flow	Average Flow
SD 001	Condenser/circulating water and Cooling Water	864	503
SD 002	Steam Generator blowdown	0.576	0.012
SD 003	Radioactive waste Effluent	0.230	0.002
SD 004	Reverse Osmosis Effluent (Monitoring and Reporting requirements only)	0.244	0.051
SD 005	U 1 Turbine Building sump	0.360	0.030
SD 006	U 2 Turbine Building sump	0.360	0.030
SD 010	Misc Plant Floor Drains	0.015	0.001
SD 012	Intake Screen wash (Monitoring and Reporting Requirements Only)	3.2	2.0
WS 001 & SW 002	Combined U 1/U 2 Cooling water	69	25

Specific limits for each discharge as imposed by the NPDES permit are summarized below. None of these limits described below will require modification to implement the power uprate.

(SD 001) Condenser/Circulating Water and Cooling Water

The total discharge flow limits are summarized below in Table 8-3.

Table 8-3: NPDES Discharge Flow Limits Permit Limits (millions gallons per day)

Dates	Limiting Flow (mgd)	Notes
April 15 to30	97**	River Flow < 15,000 cfs
April 15 to 30	194**	River flow > 15,000 cfs
May 1 to 31	194**	
June 1 to 15	259**	
June 16 to 30	517.5**	
Balance of year	N/A	

Million Gallons Day (mgd); Gallons Per Minute (gpm); Cubic Feet Second (cfs)

****** This flow limit may be exceeded if required to maintain condenser inlet temperature to less than 85 F, provided (a) the additional flow to achieve the necessary inlet temperature is minimized, and (b) cooling towers are operating to the maximum extent possible.

There are no anticipated changes to the river intake flow limits for operation after power uprate implementation. The river intake flow limits given in the current NPDES permit will allow for sustained operation after power uprate.

8.2.4.2 Water Discharge Temperature

The power uprate project will result in slight increases in circulating water outlet temperature, but will be managed by cooling towers that can operate in various modes or derating the plant to meet permit requirements for water appropriations and thermal discharge. These increases will not result in any significant impacts to the environment.

Thermal limits in the current permit (issued on June 30, 2006) are keyed to temperatures in the Mississippi River up-and downstream of the plant, which are referred to 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) Prairie Island is required to operate cooling towers in such a way that:

> Discharge temperature requirements are such that the river downstream of the plant shall not exceed a daily average of 86° F

Additionally, the water temperature below Lock and Dam 3 (Outfall SD 001) shall not be raised by more than 5 degrees above ambient (upstream) temperature.

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

In addition, Plant operating procedure has administrative targets for canal discharge temperature of 95° F in summer and 85° F in winter.

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). 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 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. 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. The intake and discharge modifications were completed in 1983.

8.2.4.3 Circulating Water System

As previously discussed, Prairie Island 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.

The 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. 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. Bypass gates permit a continuous flow in the event that traveling screens become clogged with debris. 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 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.

8.2.4.4 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. 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.

Operation of Prairie Island'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° 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° F for five consecutive days. From the spring trigger point through the fall trigger point, Prairie Island 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° F above ambient, (2) the cooling water discharge can not exceed a daily average temperature of 86° F, and (3) if the daily average ambient river temperature reaches 78° 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 cannot be raised above 43° F for an extended period of time. If the receiving water temperature exceeds this 43° F limit for two consecutive days, we must notify the Commissioner and the MN DNR. The Commission may require us to operate the cooling towers or take alternative action to meet the 43° F criterion (NPDES Permit No. MN0004006).

Prairie Island is equipped with a deicing system to prevent the formation of ice on trash racks, traveling screens, and bypass gates. Warm water is pumped from the discharge canal to the intake screen house via a 30-inch-diameter pipe buried below the frost line. The warm water is discharged at the bottom of the approach canal, directly in front of the intake screen house.

After project implementation, the heat rejected by the condenser will increase. This will result in a corresponding increase in the circulating water outlet temperature for a given system flow rate. The steam cycle heat dissipation is

provided by the circulating water system and the cooling tower system and is the source of thermal discharges from the Plant. No physical modifications or operational changes are required for these systems to implement the power uprate.

The temperature increase across the intake and plant discharge is highest in fall and winter, when once-through cooling is employed. (During the winter, the plant is on partial recirculation to maintain condenser inlet temps >45° F and discharge temps at Lock & Dam #3 from exceeding 43° F.) The temperature increase is lowest in summer and during periods of low river flow, when NPDES permit limits necessitate cooling tower use.

During open cycle operation (late summer and fall) at rated circulating water system flow, it is conservatively estimated that the uprate will result in an increase in temperature of water entering the discharge canal by less than 3° F. During closed cycle and modified helper cycle operation, mathematical modeling shows the water temperature increase will be less than 0.5° F due to increased heat removal in the cooling towers The resultant increase in downstream river temperature in the modified helper cycle mode of operation due to EPU is therefore expected to be less than approximately 0.2° F, even under low river flow conditions. The calculated maximum temperature increase of 3° F at the discharge canal inlet would be experienced during months when cooling tower operation is not required to meet NPDES permit temperature requirements. This resultant discharge canal temperature increase is well bounded by seasonal variations.

To determine the ambient river water temperature, assess the plant's thermal output, and assure compliance with NPDES thermal discharge requirements, river water is monitored by Prairie Island at multiple locations. Temperatures are monitored in the main river channel (upstream), Sturgeon Lake (upstream), the plant intake structure, the discharge canal, and immediately downstream of Lock and Dam Number 3. The highest temperatures at the station upstream of the plant intake structure were 81.0˚F in 2000 (July 9), 86.0˚F in 2001 (August 8), 82.1˚F in 2002 (July 8), 79.8˚F in 2003 (August 22), 78.4˚F in 2004 (July 22), and 82.7˚F in 2005 (July 16). The highest temperature measured over the same period downstream of the plant at the Lock and Dam Number 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 99.0˚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.

Thermophilic bacteria generally occur at temperatures from 77°F to 176°F, with maximum growth at 122°F to 140°F. 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.

During the early 1980s, Prairie Island identified the presence of the parasitic amoeba *Naegleria* 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, Prairie Island conducted chlorination and subsequent dechlorination of the circulating water system in August 1980, September 1981, and August 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. Prairie Island continues to periodically chlorinate the circulating water system to control microbiological organisms and zebra mussels in accordance with the NPDES permit requirements.

Given the thermal characteristics at the Prairie Island discharge and the fact that Xcel Energy periodically chlorinates the circulating water system, we do not expect a less than 3° F inlet temperature increase to result in any significant increase in harmful thermophylic organisms in the discharge canal. 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.

Given the information presented, the slight increases in circulating water outlet temperature due to power uprate will not involve any changes in compliance with the present discharge temperature limits established by the MPCA and will not result in any significant impacts to the environment.

8.2.4.5 Water Quality Monitoring

Water quality monitoring programs are detailed in the Prairie Island Monitoring Plan in accordance with the NPDES permit. Effluent limitations and monitoring requirements for the discharges are an integral part of the NPDES permit. Each outfall identified in the permit requires continuous flow monitoring when discharging along with monitoring of the contaminants and pollutants.

The power uprate will not introduce any new contaminants or pollutants and will not significantly increase the amount of any one of the potential contaminants presently allowed for release.

Each outflow is discussed in detail below:

SD 001 Biocide Treatments

Chlorine and bromine may be used for biocide treatment of the circulation water flow through the plant. The NPDES permit regulates residual bromine and chlorine for release to the river. Increased discharge temperatures after the uprate could potentially increase biological growth and need for biocide treatment, but the change in outlet temperatures are small (less than 3° F), and not expected to result in a significant change.

In any case, for operation after the uprate, conditions, residual oxidant levels will be controlled using existing procedures and equipment, and no changes to the permit are required.

SD 002 Steam Generator Blowdown Discharges

The NPDES permit has established Steam Generator Blowdown compliance limits for Total Suspended Solids (TSS). Steam generator blowdown is targeted to a nominal flow as a percentage of feedwater flow. After the uprate, feedwater flow may increase by about 10 percent, in proportion to the power level increase. This increase is not expected to have any significant impact on TSS for this stream, as the feedwater flowing to the steam generators is demineralized water. As shown in Table 8-4, a significant margin exists between the actual TSS values for current operation and the TSS limits.

Table 8-4: Measure steam Generator Blowdowns TSS vs. TSS limits

Measurement date	Calendar quarter Average (kg/day)	Calendar quarter Average (mg/l)	Daily Maximum (kg/day)	Daily Maximum (mg/l)
Limit	26.0	30	217	100
September 2006	0.001	2.8	0.001	4.6
December 2006	<0.001	<1.0	<0.001	<1.0

Even with an increase of about 10 percent by volume in blowdown discharges for operation after the uprate, the Plant will remain in compliance with TSS limits.

SD003 Radwaste Treatment Effluent

The NPDES permit has established radwaste treatment effluent compliance limits for TSS. Radwaste treatment is an offline process and is independent of the operating power level. Radwaste treatment relates to general plant design and material of construction, operating experience with leaking fuel, outage practices and site ALARA practices. Operation after power uprate implementation is therefore expected to have an insignificant impact on the amount of TSS in the liquid radwaste effluent.

As shown in Table 8-5, a significant margin exists between the actual TSS values for current operation and the TSS limits.

Table 8-5: Measured Radwaste Treatment Effluent TSS vs. TSS limits

Measurement date	Calendar Quarter Average (kg/day)	Calendar Quarter Average (mg/l)	Daily Maximum (kg/day)	Daily Maximum (mg/l)
Limit	20	30	86.9	100
September 2006	<0.001	<1.0	<0.001	<1.0
December 2006	0.001	1.6	0.001	1.8

The power uprate project is not expected to have any significant impact on TSS for the radwaste treatment effluent stream, and compliance with the TSS limits will continue.

SD 004 Reverse Osmosis ("RO") Effluent

RO Effluent is currently monitored for flow, and does not have established compliance limits. Typically, demineralized makeup flows at Prairie Island are limiting during startup, shutdown, and outages (i.e., for flushing and filling operations). Therefore, RO effluent is not expected to significantly change following the uprate, and monitoring will continue as required by the NPDES permit.

SD 005 and SD 006 Unit 1 & Unit 2 Turbine Building Sump

The NPDES permit has established turbine building sump discharge compliance limits for total recoverable oil and grease and TSS.

Turbine building sump flows and TSS relate to house-keeping practices, leaking equipment, and effectiveness of oil separators. None of these activities relate to the operating power level in the reactor. Thus, the uprate is not expected to have any significant impact on compliance with the requirements of the NPDES permit.

SD 010 Miscellaneous Floor Drains Discharge

The NPDES permit has established miscellaneous floor drains discharge compliance limits for total recoverable oil and grease and TSS.

Miscellaneous floor drain discharge flow rates and TSS relate to house-keeping practices, leaking equipment, and effectiveness of oil separators. None of these activities relate to the operating power level in the reactor. Thus, the power uprate is not expected to have any significant impact on compliance with the requirements of the NPDES permit.

SD012 Intake Screen Backwash and Fish Return

Intake screen backwash is currently monitored for flow only and does not have any established compliance limits. Since NPDES intake flow limits and operating intake flow limits are not affected by the uprate; screen backwash and fish return are not expected to change significantly.

Other- Storm Water, Dredging, and Land Treatment

The NPDES permit also regulates other site feature activities such as storm water, dredging, and land treatment. The uprate will not require any change in storm water discharge, dredging frequencies and land treatment.

8.2.4.6 Mississippi River Thermal Plume

The thermal plume is normally formed by the cooling tower blowdown during spring, summer, and fall. During the winter season, helper cycle operation is typically used, subject to permit limitations on downstream river temperature and the need to deice intake screens and other associated equipment (see previous comments, plant does not typically operate open cycle during the winter). Thus, the size and characteristics of the thermal plume vary over the course of the year, depending on the mode of operation of the circulating water system. The current permit limits act to minimize the size of the plume and resultant stress to aquatic biota when the ambient river temperatures are high.

Mississippi River aquatic communities upstream of Lock and Dam No. 3 have been monitored since 1970 to determine if Prairie Island operations were having an effect on distribution, abundance, and overall health of aquatic biota.

Operational monitoring of the fish populations in the vicinity of Prairie Island have continued, after the Plant's section 316(a) and 316(b) studies were completed, to gauge the effectiveness of the intake and discharge modifications in reducing entrainment, impingement, and cold shock impacts.

The monitoring has demonstrated that the thermal discharge resulting from past operation of Prairie Island has not caused appreciable harm to any aquatic organisms, and that the protection and propagation of a balanced, indigenous biota has been maintained.

The uprate will not alter the water volume requirements for the heat dissipation system, and operation will continue to be within the temperature limits established by the NPDES permit. Therefore, after power uprate, the discharge plume is expected to continue to cause neither appreciable harm nor adverse levels of impact to aquatic biota.

8.2.4.7 Cold Shock

Cold shock is caused by an unplanned shutdown, and the probability of an unplanned shutdown is independent of power uprate. The projected increase in discharge canal inlet temperature of less than 3° F during open cycle operation at uprate conditions does not result in a significant increase in the overall discharge canal temperature, and the magnitude of the temperature decrease in a cold shock situation is not significantly changed. The cold shock concerns of river fish species have been reduced at Prairie Island by the construction of a discharge structure at the end of the discharge canal and by the construction and operation of the intake screenhouse. The discharge structure and intake screens limit the number of fish in the discharge canal and reduce the impact of cold shock on aquatic species of the river.

8.2.4.8Impingement and Entrainment

Section 316(b) of the Clean Water Act (CWA) requires any standard established pursuant to 301 or 306 to require the location, design, construction, and capacity of cooling water intake structures to reflect the best technology available for minimizing adverse environmental impacts .

The current Prairie Island NPDES permit reflects major modifications in design and operation of the Cooling Water Intake Structure ("CWIS") made in the early 1980s to minimize entrainment and impingement mortality and constitutes the current CWA Section 316(b) determination for the Plant. In addition to the hardware changes to the CWIS structure, the NPDES permit also imposes limits on Plant withdrawal of cooling water over the April 15 to June 30 period:

April 15 – 30	97 mgd	when river flow < 15,000 cfs
April 15 – 30	194 mgd	when river flow > 15,000 cfs
May 01 – 31	194 mgd	
June 01 – 15	259 mgd	
June 16 – 30	517.5 mgd	

The design changes and flow/withdrawal restrictions in spring and early summer are intended to reduce both entrainment and impingement mortality.

NPDES permit No. MN 0004006, chapter 6, section 4.1, contains specific requirements related to intake screen operation. The Plant is allowed to operate with a 3/8-inch mesh screen from 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".

The power uprate does not introduce any significant changes to the screen wash, service water, or circulating water flow requirements and does not involve any changes to the water appropriation requirements of the NPDES permit.

The impacts of impingement and entrainment for operation at current power level are small and implementation of the power uprate will not effect impingement and entrainment significantly. Therefore, there is not expected to be any significant increases in the mortality of drift organisms above present levels due to the power uprate.

8.2.5 Radioactive Releases (Minn. R. 7849.0320(G))

The uprate project will not result in any significant increase in radioactive releases.

The uprate will not introduce any new or different radiological release pathways and the uprate will not result in radiological levels above the safe thresholds established by the NRC and in the Technical Specifications for the Plant.
The radioactive waste systems at Prairie Island are designed to collect, process, and dispose of radioactive wastes in a controlled and safe manner. The design bases for these systems during normal operation is to limit discharges in accordance with 10 CFR 20 and to satisfy the design objectives of Appendix I to 10 CFR 50. These limits and objectives will continue to be adhered to after the power uprate.

8.2.5.1 Gaseous Wastes

Gaseous radioactive wastes principally include activation gases and fission product radioactive noble gases resulting from process operations, gases used for tank cover gases, gases collected during venting, and gases generated in the radiochemistry laboratory.

During normal operation, the gaseous effluent treatment systems process and control the release of gaseous radioactive effluents to the environment, and there is almost no discharge of radioactive gaseous waste. However, during refueling and maintenance operation, when the primary system is open to the building atmosphere, small quantities of noble gases, halogens, tritium, and particulate material are removed by the ventilation systems.

The gaseous waste management systems include the off-gas system and various building ventilation systems. This air is monitored for radioactivity before it is released. Whenever radioactivity is present, the ventilation air is passed through absolute filters to remove particulate material. The air effluent releases are very small fraction of 10 CFR Part 20 limits.

Implementation of the proposed power uprate does not significantly increase the total inventory of gas normally processed in the gaseous waste management system since the plant system functions are not changing and the volume inputs remain the same.

Prairie Island expects that the concentration of radionuclides in the gaseous radioactive effluents streams would, at most, linearly increase with power as a result of the proposed uprate, by approximately 10 percent. Even with a 10 percent increase, the radioactivity associated with the discharge would still remain well below the estimates provided in Prairie Island's Updated Safety Analysis Report ("USAR") and Final Environmental Statement ("FES"), issued by U. S. Atomic Energy Commission (predecessor agency to NRC) in May of 1973.

Table 8-6: Annual Gaseous Releases

	Noble Gases Curie (Ci)	Particulate & Iodines Curie (Ci)
Actual releases Average over 5 years (2001 -2005)	11.15	163.8 E-06
USAR	3400	0.528
FES	7200	0.330

8.2.5.2 Radiation Levels and Offsite Dose

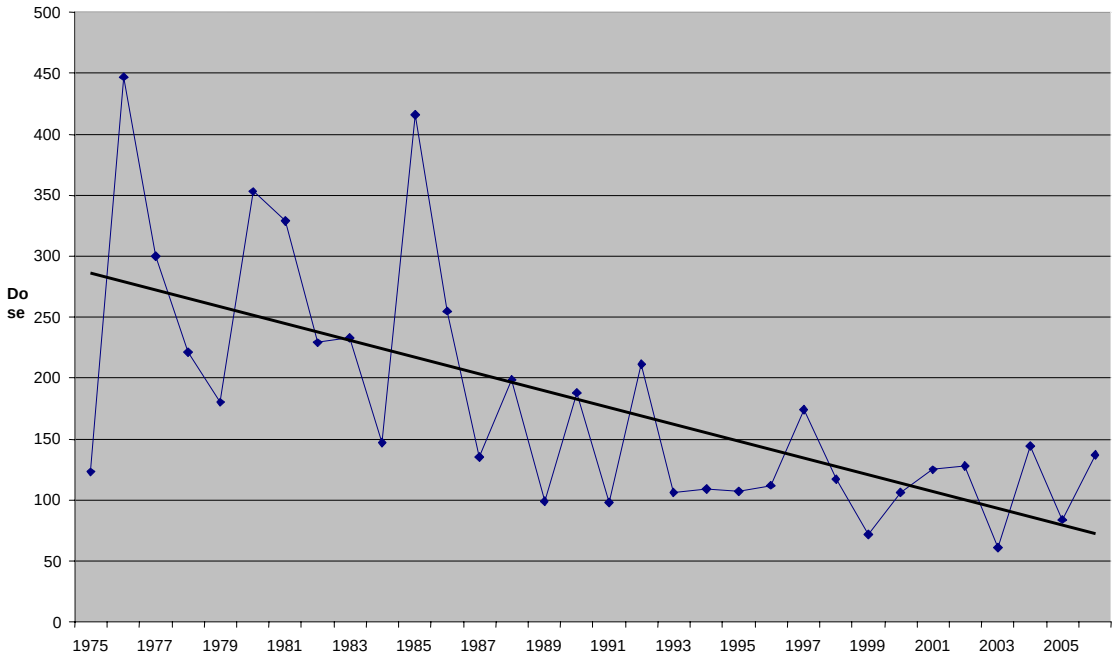
8.2.5.2.1 Operating and Shutdown In-Plant Radiation

The proposed uprate is being expected to increase in-plant radiation dose rates linearly with the increase in core power level by approximately 10%. These higher dose rates should not increase the annual average collective occupational doses more than 10 percent. Figure 8-1 below shows the annual collective dose rate for Prairie Island from 1975 through 2006. The trend line shows that the collective annual dose at the plant has been steadily decreasing. The average annual collective dose rate from 1975 (first full year of 2 unit operation) through 2006 was 175 rem. The average annual collective dose rate from 2002 through 2006 was 110.8 rem. A 10 percent increase would raise the 2002-2006 average by 11 rem for a total of approximately 122 rem. This is still well below the lifetime average annual collective dose rate of 175 rem.

Plant programs and administrative controls, such as conservatism used in the original design basis reactor coolant system source terms, conservatism used in designing plant shielding, and the PINGP Station Radiation Protection Program will ensure that occupational doses will remain within the regulatory limits of 10 CFR Part 20, with the expected 10 percent increase.

Prairie Island dose reduction programs will also compensate for possible increases in individual doses due to the uprate. The plant radiation protection program will be used to maintain individual doses As Low As Reasonably Achievable ("ALARA"). Routine plant radiation surveys required by the radiation protection program will identify increased radiation levels in accessible areas of the plant and radiation zone postings will be adjusted if necessary. Time within radiation areas is controlled under the radiation protection program. Administrative dose control limits are established well below regulatory criteria and provide significant margin to that allowed by regulatory dose limits.

Figure 8-1 Collective On-Site Dose



8.2.5.2.2 Offsite Doses

8.2.5.2.2.1 Radiological Effluent Doses

The uprate is expected to increase the production and activity of liquid and gaseous effluents by approximately 10 percent. The increase in activity levels is generally proportional to the percentage increase in core thermal power. This slight increase does not affect the large margin to the offsite dose limits established by 10 CFR 20.

Over a recent five-year period (2001 through 2005), the average "Total Body" and "Organ" doses to the off site members of the general public, as reported in the "Annual Radiological Environmental Monitoring Program Report", are bounded by FES and original plant Environmental Report estimates, as well as the dose limits of 10 CFR 50. See Table 8-7 below.

Table 8-7: Radiological Effluent Doses

	Gaseous Effluent		Liquid effluent	
	Total Body Mrem/year mrem/year	Organ	Total Body Mrem/year mrem/year	Organ
Average over recent five years 2001 to 2005	0.0026	0.073	0.0026	0.0043
FES	0.6	2.8	0.65	0.7
NSP 1971 Environmental Report	14.46	24.36	5.18	6.82
10CFR 50 Appendix I	30	30	6.0	20

For the five-year period (2001 through 2005), the average, "Total Body" and "Organ" dose to the off site member of general public from the gaseous and liquid effluents, is only a small fraction of the estimates provided in the FES and Environmental Report, as well as 10 CFR Part 50 Appendix I limits.

The Prairie Island Technical Specifications, part of the Plant's operating license, implement the guidelines of the 10 CFR 50 Appendix I which are well within the 10 CFR 20 limits.

Additionally, Prairie Island's Technical Specification 5.5.4, "Radioactive Effluent Control Program", requires a program that conforms to 10 CFR 50.36a for the control of radioactive effluents and for maintaining the doses to members of the public from radioactive effluents as low as reasonably achievable.

The uprate does not create any new or different sources of offsite dose from Prairie Island operation and does not involve a significant increase in present radiation levels. Therefore, it is concluded that under uprate conditions, offsite doses will remain well within regulatory criteria with insignificant environmental impact.

8.2.5.2.2.2 Postulated Accident Doses

Prairie Island will be required to reanalyze the Postulated Accident Doses to members of the public under power uprate conditions as part of its NRC license amendment request. These calculations will be reviewed by the NRC and the staff's evaluation and acceptance will be presented in the Safety Evaluation Report ("SER").

The NRC's acceptance criteria for radiological consequences analysis using the Alternative Source Term are based on 10 CFR 50.67. The newly calculated doses for postulated accidents following the uprate, using the Alternative Source Term are expected to be well blow the NRC regulatory limits of 10 CFR 50 and Reg. Guide 1.183. Therefore, the effect of the uprate calculated for postulated accident doses is expected to be insignificant.

8.2.6 Radioactive Wastes

8.2.6.1 Radioactive Solid Wastes

The solid radioactive waste system collects, processes, packages, and temporarily stores radioactive dry and wet solid wastes before they are shipped off-site for permanent disposal. Prairie Island produces dry active waste (paper, plastic, wood, rubber, glass, floor sweepings, cloth, and metal), sludge, oily waste, bead resin and filters. Any increase in the volume of solid waste due to the uprate would be insignificant because the uprate would neither alter installed equipment performance nor require changes in system operation or maintenance. See Table 8-8 below.

With power uprate, any increase in volume of solid waste would be expected to be due to increases in disposal of bead resins and filters. This volume increase would not be significant, although the amount of radioactivity in the waste would be expected to linearly increase with power level (i.e. by approximately 10 percent). Even with increases in the activity level of about 10 percent, it is predicted that the results will remain bounded by the associated activity assumed in the FES.

Table 8-8: Annual Low Level Radioactive Solid Waste

	Volume Cubic Feet	Activity Curie (Ci)
Actual Annual Releases Average over 5 years 2001 to 2005	15,597	343
FES	14,925	16,450

In recent years (2004 and 2005), the solid waste volume generated at Prairie Island has been above the quantity considered in the FES. This increase in volume was temporary. It was a direct result of the disposal of the retired equipment associated with the Unit 1 Steam Generator Replacement and the Unit 1 and 2 Reactor Vessel Head Replacement projects.

In spite of temporary increases in waste volumes above the estimated value in FES, the associated level of radioactivity (343 Ci), when increased by 10 percent (34.3 Ci) for a total of 377.3 Ci, remains well bounded by the assumed value (16,450 Ci) in the FES.

8.2.6.2 Radioactive Liquid Waste

The liquid radioactive waste systems are designed to process the waste through filtration and ion exchange, measure and evaluate all radionuclide concentrations, and based on results, reprocess it through the radioactive waste system for further purification, or discharge it to the environment as liquid radioactive waste effluent in accordance with State and Federal regulations.

During normal operation, the liquid effluent treatment systems process and control the release of liquid radioactive effluents to the environment, such that the radioactivity associated with the liquid effluent and doses to individuals offsite are maintained well below the limits of 10 CFR Part 20 and 10 CFR Part 50, Appendix I limits.

The uprate will not significantly increase the inventory of liquid normally processed by the liquid waste management system. This conclusion is based on the fact that system functions are not changing and the volume inputs remain the same.

Prairie Island expects that the discharge liquid effluent radioactivity level would increase no more than approximately 10 percent as a result of the uprate. Even

with this increase of about 10 percent, the maximum liquid effluent radioactivity level will remain bounded by the quantities originally considered in the FES. See Table 8-9 below.

Table 8-9: Annual Liquid Effluent Releases

	Activity Curie (Ci)	Tritium Curie (Ci)
Actual releases Average over 5 years 2001-2005	0.0984	626
10 Percent Increase	0.00984	62.6
Total	0.1082	688.6
FES	10	2000

8.2.6.3 Reactor System Wastes

It is not anticipated that the reactor system wastes will increase proportionally to the power increase as the solid or liquid wastes might. Unlike at a boiling water reactor, a pressure water reactor like Prairie Island does not contain the consumable items such as control rods and local range power monitor components that would constitute the reactor system wastes.

Thus, the environmental impact due to generation of radioactive waste from the power uprate project is insignificant.

8.2.7 Non-Radioactive Solid Wastes (Minn. R. 7849.0320(H))

Construction activities associated with the power uprate will generate non-radioactive solid wastes. The volume will be comparable to the waste generated during a typical refueling/maintenance outage. No ongoing solid waste generation will be generated due to the power uprate after construction activities have been completed.

8.2.8 Noise (Minn. R. 7849.0320(I))

The power uprate project will not result in any significant changes to the character, sources, or energy of noise generated at Prairie Island. The new equipment necessary to implement the uprate project will be installed within existing plant buildings. No significant increases in ambient noise levels are

expected within the plant. This includes the upgraded high-pressure turbine, which will operate at the same speed as the original equipment. The effect of the additional period of cooling tower operation on ambient noise levels is not significant. No new significant noise-generating equipment will be installed outside the plant.

8.2.9 Workforce (Minn. R. 7849.0320(J))

Construction activities for the power uprate project are expected to occur primarily during refueling outages in 2012 for Unit-1 outage and 2015 for Unit 2 outage). The size of the workforce during the two refueling outages when power uprate is implemented is not expected to change significantly from the size of the workforce during a normal refueling outage.[26] There is no impact from power uprate on the size of the Plant's workforce during periods of normal operation.

8.2.10 Transmission Facilities (Minn. R. 7849.0320(K))

Pending completion by MISO of the formal power flow and stability studies, the full scope of modifications to the transmission grid required to accommodate the power uprate are not known with certainty. However, preliminary studies have indicated that the steady state power flow is supported satisfactorily by the existing system, even taking into account additional generation in the MISO queue. Dynamic stability studies have not been completed to date.

8.3 Power Uprate Project and Alternatives Environmental Information Comparison

Tables 8-10 and 8-11 contain the environmental information required by Minn. R. 7849.

[25] Power uprate may result in a few dozen additional employees on-site during refueling; however, this is an insignificant amount in relation to the approximately 500 additional personnel who will be on-site for the refueling. This extra workforce is not unusual and has been seen in the past during large outages such as the Steam Generator Replacement overhauls in 2004.

Table 8-10: Power Uprate Environmental Information Summary		
Rule Reference	**Description**	**Prairie Island Power Uprate**
7849.0320 A	Land Requirements	No increased land usage
7849.0320 B	Traffic	No increased levels during construction or normal operation
7849.0320 E (1)	Water Use Maximum	Within permitted levels. Maximum estimated increase of 10 percent
7849.0320 E (1)	Max. Pumping Rate	6 existing ground water wells • 2 - 100 gpm pumps • 2 - 45 gpm pumps • 1 - 10 gpm pump • 1 - 22 gpm pump No new wells or increase from existing wells required
7849.0320 E (1)	Annual Appropriation	Increase surface water appropriations by approximately 1300 acre ft/yr (346.6 acre-ft/year). The increased use is within the limits of the current surface water permit
7849.0320 E (1)	Annual Consumption	Assuming an increase in open cycle consumption of 20% is required for the proposed power uprate, an increase in days of cooling tower operation to 150 days/year, and nominal values of cooling tower flow, the estimated consumption would be 7,700 acre-ft/year.
7849.00320G	Radioactive Releases	• Maximum estimated increases of 10 percent. • Solid increase of 34 curies • Liquid increase of 63 curies • Gaseous increase of o 1.115 curies noble gases o 1.638 E-07 curies particulates and iodines

Table 8-10: Power Uprate Environmental Information Summary		
Rule Reference	**Description**	**Prairie Island Power Uprate**
7849.0320 H	Non-Radioactive Solid Wastes Produced	• Construction activities associated with the power uprate will generate non-radioactive waste. • The volume will be comparable to the waste generated during a typical refueling/maintenance outage. • No ongoing non-radioactive solid wastes will be generated due to power uprate.
7849.0320 I	Noise	• Power uprate does not result in any significant changes to the character, sources, or energy of noise generated at Prairie Island.
7849.0320 J	Work Force	• No significant change to the size of workforce normally utilized at Prairie Island during construction or normal operation.
7849.0320 K	Transmission Requirements	• No know impact on the environment due to transmission at this time. Working within MISO process.

Table 8-11: Power Uprate Alternatives Environmental Information				
Rule Reference	**Description**	**Coal PPA Alternative**	**Biomass Alternative**	**Unconstrained Optimization (Gas CT + System Energy)**
7849.320 A	Land Requirements	150Acres	150Acres	100Acres
7849.320 B	Traffic	Rail traffic for coal delivery and auto traffic for staffing	Rail or truck traffic for fuel delivery and auto traffic for staffing	Minimal increased traffic to staff one CT.
7849.320 E (1)	Water Use Maximum	133,000gal/hr	133,000gal/hr	109,000gal/hr
7849.320 E (1)	Max. Pumping Rate	Unknown if the unit would utilize ground or surface water. During operation the unit would consume approximately 133,000gal/hr	Unknown if the unit would utilize ground or surface water. During operation the unit would consume approximately 133,000gal/hr	Unknown if the unit would utilize ground or surface water. During operation the unit would consume approximately 109,000gal/hr
7849.320 E (1)	Annual Appropriation	Unknown if the unit would utilize ground or surface water. During operation the unit would consume approximately 133,000gal/hr	Unknown if the unit would utilize ground or surface water. During operation the unit would consume approximately 133,000gal/hr	Unknown if the unit would utilize ground or surface water. During operation the unit would consume approximately 109,000gal/hr
7849.320 E (1)	Annual Consumption	1,100million gal / yr	1,100million gal / yr	44million gal / yr
7849.320 H	Non-Radioactive Solid Wastes Produced	Unit would produce approximately 5 tons of ash per hour.	Unit would produce approximately 10 tons of ash per hour.	None
7849.320 I	Noise	Boiler and steam turbines create significant noise	Boiler and steam turbines create significant noise	Combustion turbines create significant noise.
7849.320 J	Work Force	10-15 full time employees	10-15 full time employees	2 full time employees
7849.320 K	Transmission Requirements	Transmission requirements would be site specific.	Transmission requirements would be site specific.	Transmission requirements would be site specific.

9 Denial Would Adversely Affect Adequacy, Reliability, and Efficiency of Energy Supply System

9.1 Section Summary

The Commission must determine that four principal criteria are met when granting a Certificate of Need (Minn. R. 7855.0120) for additional dry cask storage and Certificate of Need (Minn. R. 7849.0120) for a power uprate. The four criteria are similar for both Certificates of Need.

Our Application for approval of the Prairie Island dry cask storage and power uprate projects meets all four principal criteria. This section addresses the first criterion (Subpart A) that:

Minn. R. 7855.0120, subd. (A).
"the probable result of denial would be an adverse effect upon the future adequacy, reliability, or efficiency of energy supply to the applicant, to the applicant's customers, or to the people of Minnesota and neighboring states."

Minn. R. 7849.0120, subd. (A).
"the probable direct or indirect result of denial would be an adverse effect upon the future adequacy, reliability, safety, or efficiency of energy supply to the applicant, to the applicant's customers, or to the people of Minnesota and neighboring states, considering"

Xcel Energy is one of the primary electrical systems serving Minnesota and neighboring states. Prairie Island plays a critical role in meeting our customers' needs in a cost-effective manner with carbon-free emissions. Prairie Island represents approximately 10 percent of the production capacity used to meet electrical demand and provides nearly 18 percent of the energy delivered to our customers.

In our 2004 Resource Plan, we identified a 1,125 MW deficit in 2015. During the Resource Plan review process, we discussed that the implementation of the Prairie Island and Monticello power uprate projects were contingent upon the successful approval of operating license extensions and additional dry cask storage.[26] The Commission subsequently approved our resource plan and instructed us to seek the necessary government approvals to obtain additional

[26] We filed a Application for license extension for Monticello in March 2005 and the NRC approved it on November 8, 2006. The number of additional casks necessary to support Monticello's power uprate project were not known at the time we filed for Monticello's dry cast storage facility.

MWs from the Monticello, Prairie Island and Sherco generating plants to reduce that deficit.[27] The deficit was further reduced as a result of increased demand-side management ("DSM").

To allow for the continued operation of Prairie Island after the end of its current operating licenses in 2013 and 2014, we must obtain both the renewal of operating licenses from the NRC and approval for additional storage capacity from the Commission. We filed an application with the NRC on April 15, 2008 to renew Prairie Island operating licenses for an additional 20 years.[28] However, in addition to the renewed operating licenses from the NRC, approval for additional storage capacity from the Commission is necessary to continue to operate the plant during the license extension.

The shutdown of Prairie Island in 2013-2014 would adversely affect the future adequacy, reliability, safety and efficiency of the energy supply to our customers. In 2007 Prairie Island produced almost 9 million megawatt-hours of base load electric power. This represents approximately 18 percent of the energy consumed by our customers across the five-state area. If additional storage casks are not obtained, Prairie Island would need to be replaced and decommissioned.

The analysis in this Application is consistent with the analysis in our 2007 Resource Plan. The analysis concludes that the best replacement for Prairie Island, taking into account environmental impacts and cost-effectiveness, would be two 600 MW nature gas combined cycle units. The replacement of Prairie Island with these units would result in a significant increase in emission of air contaminants and overall electricity costs.

As noted in our 2007 Resource Plan and discussed in Section 1 of this Application, we have a deficit starting in 2010 that steadily grows to over 2,800 MW by 2022. The proposed continued operation of Prairie Island and the implementation of the power uprate helps us fill the deficit by providing highly reliable capacity, low-cost, carbon-free energy for many years. Even with the continued operation of Prairie Island, our 2007 Resource Plan also identifies a need for 3,800 MW of natural gas intermediate and peaking resources over the planning horizon.[29] All of these needs were identified after assuming we would add 2,600 MW of wind resources by 2020 to comply with the RES statute and in

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[27] Ordering paragraph 11, Docket No. E002/RP-04-1752, Order dated July 28, 2006.

[28] A copy of the entire Application is available on the NRC and Xcel Energy websites.

[29] The expansion plan resulting from the reference case. It does not consider identified uprates/upgrades or life extension of Manitoba Hydro contract.

addition to an increase from our current level of DSM savings of 0.8 percent to 1.1 percent of retail sales due to the passage of the Next Generation Energy Act of 2007.

Approval of the additional dry cask storage at Prairie Island, and implementation of the power uprate will contribute to our efforts to insure an adequate, reliable and efficient energy supply for our customers, the people of Minnesota and those in neighboring states. Even with the increased commitment to DSM and wind energy, our system is growing and we need additional resources. By gaining additional MW from an existing carbon-free generation source, we can meet our customers' growing energy needs at a reasonable cost while keeping us on the path to achieve the 30 percent carbon reduction goal by 2025.

Denial of our Certificates of Need will have an adverse effect on the adequacy, reliability and efficiency of our energy supply to the region. Denying this CON would increase the probability of inadequate regional generation capability, reduce the reliability of our system, and negatively affect the Company's ability to comply with statutory and regulatory requirements of the Next Generation Energy Act of 2007.

9.2 Forecasting and System Planning

Xcel Energy operates our five-state system in our northern service territory on a system-wide basis. The forecast used to determine the system's resource needs takes into consideration our customers' needs in Michigan, Minnesota, North Dakota, South Dakota and Wisconsin. In determining those needs, we forecast the number of customers and MWh sales by customer class for each of the five-state jurisdictions separately and then aggregate them. The use of a five-state system forecast is appropriate for planning purposes and is consistent with the forecast approved in the 2004 Resource Plan and previous Certificates of Need.

Minn. R. 7849.0270, subp. 2(A) requires data on the annual electric consumption of *Minnesota* customers (emphasis added). A forecast of only Minnesota customers' needs is of little value for system planning purposes. Therefore, the growth of our system depicted in this chapter is the five-state system forecast.[30]

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[30] Minn. R. 7849.0270, subp. 2 (A) and subp. 3 and Minn. R. 7849.0270, subp. 3(D) require the submittal of the statistical tests used to prepare the forecast. Since Xcel Energy forecasts peak demand and energy for the five-state system by customer class for each state jurisdiction, the data is voluminous (>1,000 pages). Therefore, we have not included the information required by Minn. R. 7849.0270, subp. 3(D) with this Application, but will provide it on CD upon receiving an information request from the Office of Energy Security.

9.3 Demand and Energy Forecasts are Increasing

9.3.1 Current Peak Demand and Energy Forecast

Our most recent forecast of peak demand for electrical power from customers in our five-state upper Midwest system is shown in Figure 9-1. Consistent with the previous forecast approved in the 2004 Resource Plan, we anticipate that the demand for electrical power will continue to grow in the future. The base demand forecast in Figure 9-1 has not been adjusted for our very successful load management programs. The net forecast reflects our anticipated peak after adjusting for the load management programs.

We currently project energy growth of 1.1 percent or 556 GWH per year and demand growth of 1.2 percent or approximately 133 MW per year[31]. The energy and demand forecasts incorporate a methodology change involving our accounting for DSM savings versus previous forecasts filed. Prior to our 2007 Resource Plan submittal, embedded DSM from past programs was included in the forecast, but the forecasts did not incorporate estimated saving from future DSM programs. Starting with the 2007 Resource Plan our forecasts include an estimate of future DSM savings. The effect of this methodology change is discussed in detail in our 2007 Resource Plan. The methodology used to develop the forecast demand and energy and other forecast details required by Minnesota Rule 7849.0270 are provided in Appendix B: System Demand and Capability Data.

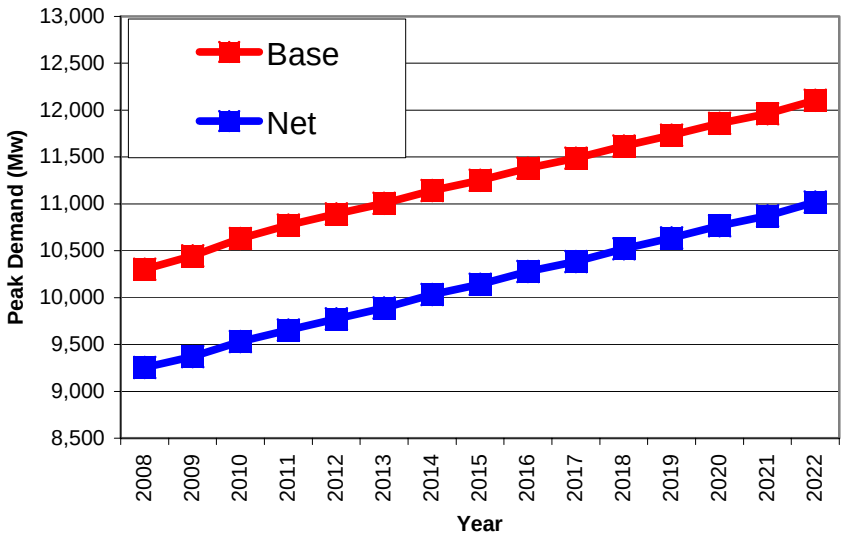
The projected demand growth after complying with the DSM and RES requirements will result in a deficit of 126 MW in 2010 that grows to 2,886 MW by 2022 (Table 9-1). The Prairie Island dry cask storage and power uprate projects provide the needed capacity in the most economic manner and also provide significant benefits towards carbon reduction by displacing energy from existing fossil fuel sources with carbon-free energy going forward.

[31] Base energy growth is based on the 50 percent forecast and base demand growth is based on the 90 percent forecast. The data depicted in Figure 8-1 is the 90th percentile Base (uninterrupted) and Net (interrupted) Peak Demand forecast.

Table 9-1: Surplus/(Deficit) Projections

Year	MW
2008	102
2009	83
2010	(126)
2011	(75)
2012	(228)
2013	(395)
2014	(597)
2015	(1,195)
2016	(1,779)
2017	(1,877)
2018	(2,038)
2019	(2,220)
2020	(2,353)
2021	(2,503)
2022	(2,886)

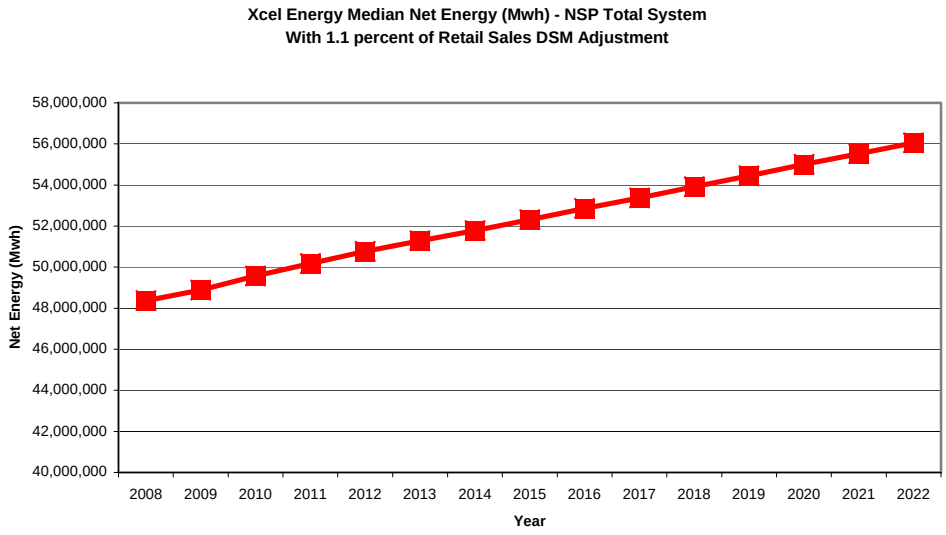
Figure 9-1:
Xcel Energy 90th Percentile Base and Net Summer Peak Demand (MW)
NSP Total System - With 1.1% of Retail Sales DSM Adjustment



As seen in Figure 9-2, like the increasing demand forecast, the energy forecast is also growing. After accounting for DSM, the energy forecast grows at an

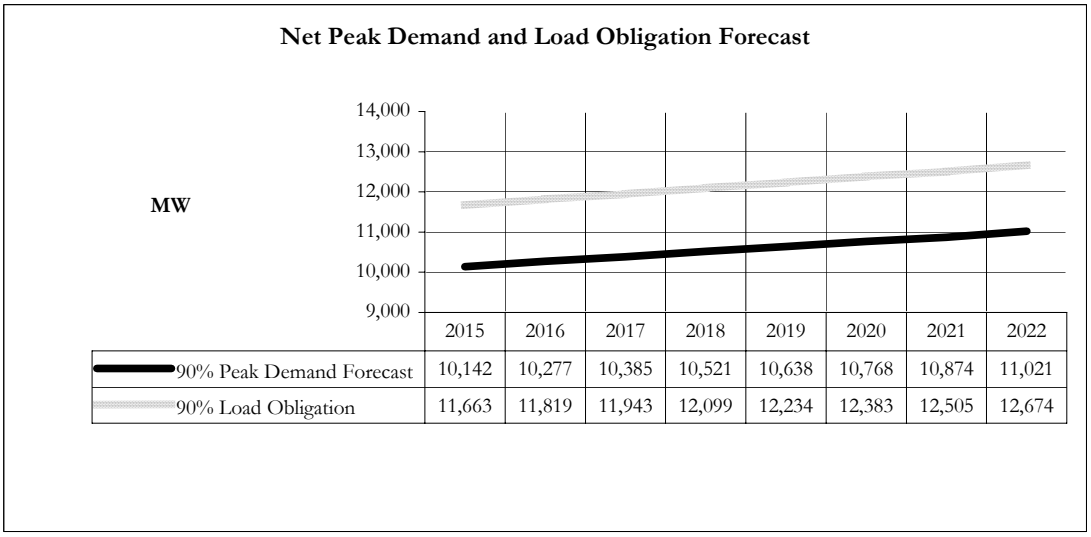
average rate of 1.1 percent. This 1.1 percent annual growth rate equates to an average annual growth of 556 GWh per year on our five-state system.

Figure 9-2: Native Energy Requirements Forecast



In order to determine the generation needed to serve our load determined in Figure 9-1 and meet the MAPP reserve capacity obligations, a 15 percent reserve margin must be added. (Figure 9-3.)

Figure 9-3: Net Peak Demand and Load Obligation



	2015	2016	2017	2018	2019	2020	2021	2022
90% Peak Demand Forecast	10,142	10,277	10,385	10,521	10,638	10,768	10,874	11,021
90% Load Obligation	11,663	11,819	11,943	12,099	12,234	12,383	12,505	12,674

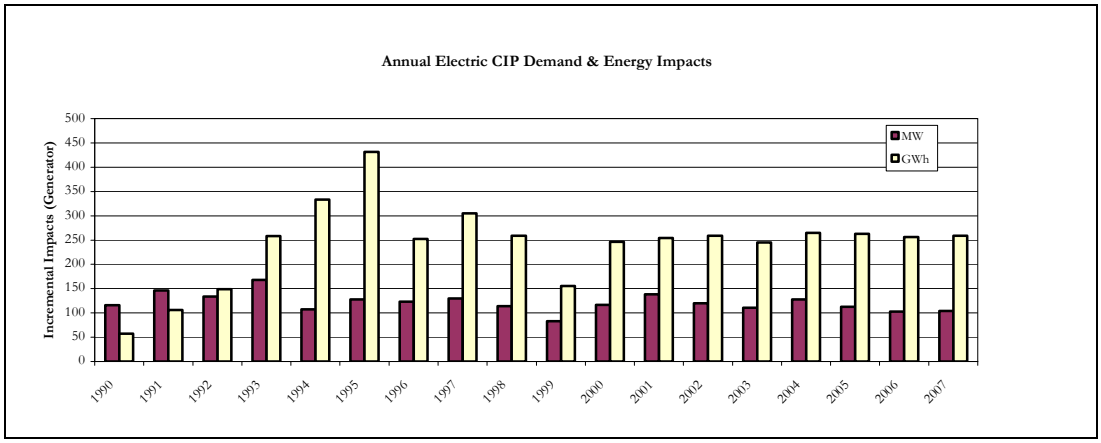
The solid black line in Figure 9-3 illustrates the peak demand level that is likely to be exceeded 10 percent of the time. The black line includes embedded DSM from past programs and future savings estimates from conservation and load management programs. The dashed line is the amount of generation that will be necessary to meet the forecasted demand plus a 15 percent reserve margin.

9.3.2 Forecasts Rely on Continued Aggressive DSM

Our forecasted demand is not growing as a result of promotional activities to sell electricity. We do not have programs promoting the sale of electricity: we have programs that promote the conservation of electricity. The forecast information presented in this section already takes into account the aggressive peak demand and energy savings goals set in our 2007/2008/2009 CIP Triennial Plan for 2008 and 2009. The forecast also assumes we achieve a 1.1 percent reduction in sales from DSM in 2010 and beyond, consistent with the Next Generation Energy Act of 2007.

To meet our demand-side management goals, we have devoted significant resources to our DSM programs, resulting in some of the most significant DSM achievements in the United States. Between 1990 and 2006 in Minnesota, we have achieved nearly 4,100 GWh of energy savings and 2,100 MW of peak demand savings due to our DSM programs, as reflected in Figure 9-4. Of the 2,100 MW of peak demand savings, approximately 875 MW have been controlled through our load management programs. The net peak demand line in Figure 9-3 reflects those load management capabilities.

Figure 9-4: CIP Demand and Energy Impacts[32]



[32] All years have been approved except 2007.

Our current demand and energy-savings goals were approved as part of our 2007-2009 Triennial Plan. Specifically, we are committed to achieving 762 GWh and 271 MW of savings between 2007 and 2009. In our Triennial Plan, we developed two new Business programs, Industrial Efficiency and Segment Efficiency (focused on Commercial Real Estate), as well as one new Residential program, the Home Performance Pilot. Including these three new programs, the Company proposed the goals found in Table 9-2 for our 2007-2009 CIP Triennial Plan. We will continue to evaluate our existing programs and look for ways to better serve customer markets in order to meet the aggressive requirements of the Next Generation Energy Act of 2007.

Table 9-2: DSM Goals as Approved in 2007/2008/2009 CIP Triennial Plan*

	2007	2008	2009	Total
Budget	$45,504,799	$47,002,224	$48,350,183	$140,857,206
Generator kW	87,300	90,980	92,809	271,089
Generator kWh	238,213,749	259,635,189	264,114,597	761,963,535

*Please note that these goals were proposed in the Company's CIP Triennial Plan Errata, filed September 13, 2006 in Docket No. E,G002/CIP-06-80 and approved by the OES on November 29, 2006.

Figures 9-5 and 9-6 indicate our historical commitment to achieving and exceeding its DSM goals. The Company fully expects to meet its CIP energy and demand savings goals in future years.

Figure 9-5: CIP Electric Energy Savings, 2000-2009[33]

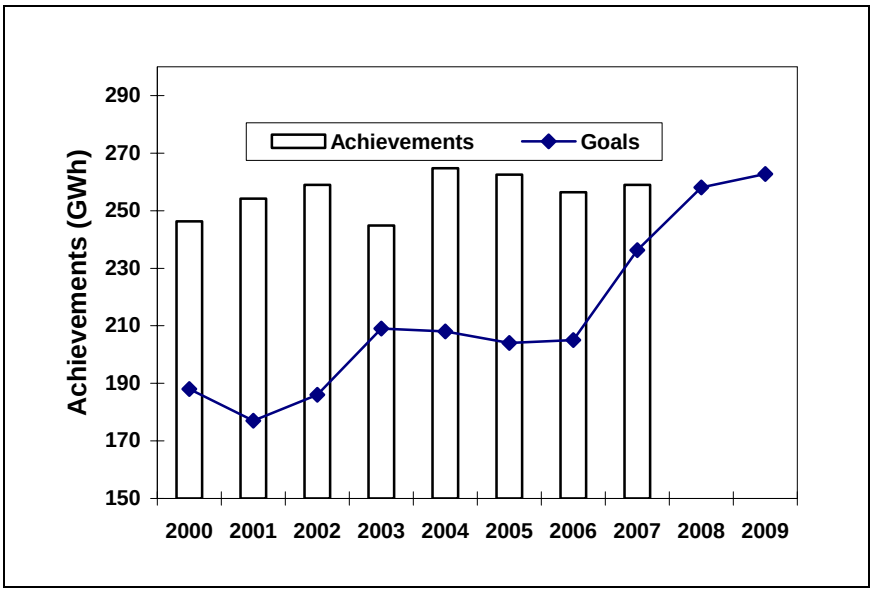
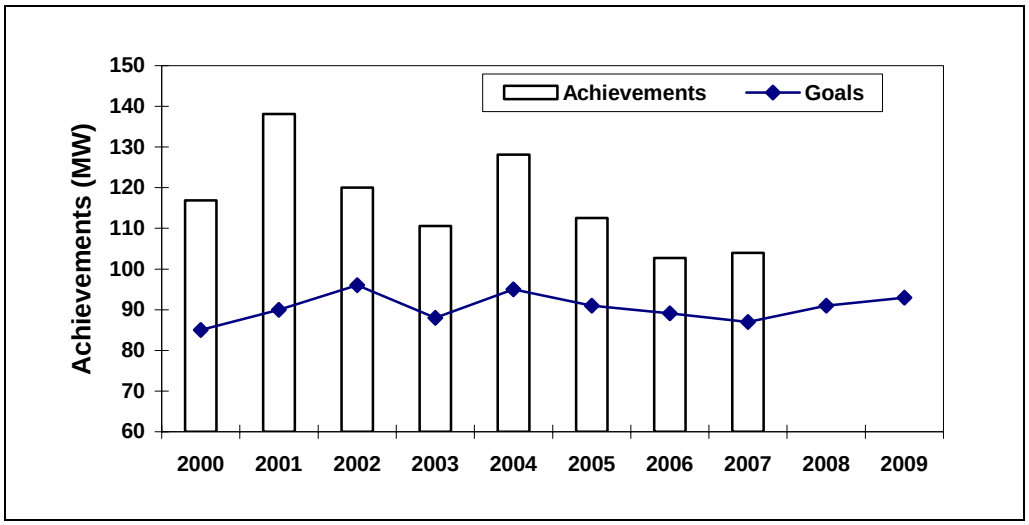


Figure 9-6: CIP Electric Demand Savings, 2000-2009[34]



Additional detail on our conservation and load management programs is presented in Appendix C.

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[33] *Ibid.*

[34] *Ibid.*

9.3.3 Demand and Energy Obligations Include MAPP Reserve Capacity Obligation

The Company is obligated as a member of the MAPP to provide a 15 percent reserve margin, so that adequate backup resources are available to all MAPP members in the event of critical equipment failures on the regional system. In this way, upper midwest power suppliers pool together to ensure the reliability of service to their customers. By pooling resources, total production capacity reserve can actually be reduced. Without the 15 percent reserve commitment from all power suppliers, each company would have to provide a higher level of backup resources to ensure the equivalent reliability of its own system. The solid line on Figure 9-7 reflects the 15 percent reserve capacity obligation, calculated after conservation and load management forecasts are applied to the peak demand forecast.

9.3.4 Meeting Customers' Energy Needs

We meet our customers' needs for electricity with a combination of Company-owned-and-operated generating facilities, and long- and short-term power purchases. To ensure that the actual demand and associated MAPP capacity reserve requirements can be met, we plan our generation supply to meet the 90 percent forecast probability level. Notwithstanding MAPP requirements to maintain a 15 percent reserve margin, we are required under Minn. Stat. § 216B.04 to supply safe, adequate, efficient and reasonable electric service to all customers in our exclusive service territory. The assumption to plan capacity to the 90 percent probability was based on the decreasing availability of capacity reserves in the region and the increasing constraints on the transmission system seen in recent years.[35]

Our most recent forecast of available resources is illustrated in Figure 9-7.

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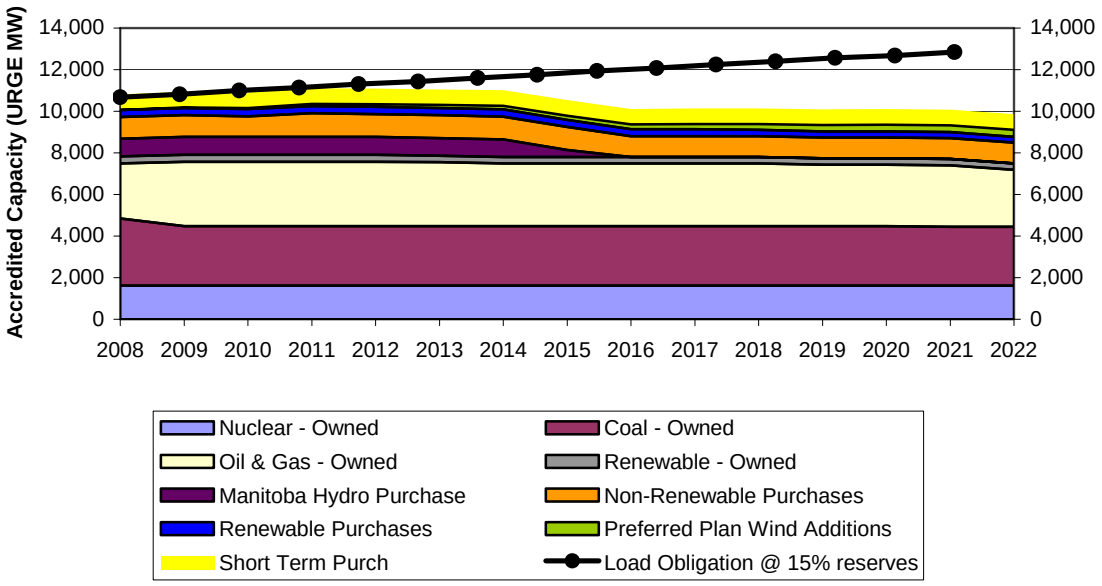
[35] The change to using the 90 percent probability for capacity planning is further explained in Appendix J of this Application.

Figure 9-7: Requirements and Resources



9.3.5 Compliance

Our obligation is to provide sufficient resources to meet our customers' growing energy needs while complying with the requirements of the Next Generation Energy Act of 2007 and the Commission's Order to pursue the uprates from our 2004 Resource Plan. As we determine how best to meet the increased generation needs of our customers, we must do so in a manner that also furthers our compliance with the legislature's 30 percent carbon reduction goal by 2025. The Prairie Island dry cask storage and power uprate projects provide unique opportunities to continue utilizing and expand operation of a carbon-free resource with low-cost capacity and energy.

9.4 Consequences of Project Delay

The Prairie Island nuclear generating plant cannot operate without a license form the NRC. The existing operating licenses will expire in 2013 and 2014. The replacement of 1,100 MW of energy and capacity with similar characteristics will take years to build and permit. Due to the size and importance of Prairie Island as resource, a delay in determination of additional dry storage to support continued operation of Prairie Island is not feasible. We must either decide to

continue to operate the plant an additional 20 years or begin the process of securing the necessary energy and capacity to replace it.

We plan to implement the power uprate at the Prairie Island Plant only if the NRC extends the Plant's operating licenses until 2033 and 2034 and the Commission approves our proposal for addition dry casks at the existing ISFSI. Due to the nature of nuclear power production and the importance of Prairie Island to the system, the only time the construction for the power uprate can take place is during a refueling outage. Refueling outages are scheduled approximately every 18 to 20 months at the Prairie Island plant. The most significant power uprate work will be performed during the 2012 and 2015 refueling outages. Detailed outage construction and refueling schedules are determined years in advance of an outage to minimize plant down time: minimizing plant down time minimizes the cost of replacement power. Delaying this schedule would significantly affect the maintenance, construction and refueling analyses performed. Project delay would also decrease the number of years the power uprate project could provide benefits to customers. During the delay period, customers would not benefit from the availability of the lower cost energy and the environment would not benefit from the increased operation of a carbon-free base load facility.

Denial or delay of the Prairie Island dry cask storage and power uprate projects will have an adverse effect upon the future adequacy, reliability, or efficiency of energy supply to our customers and the region. Additional capacity is required on our system starting in 2010 and the deficit grows steadily. The additional capacity of a highly reliable base load facility complements the significant amount of wind to be added to the system. The low-cost carbon free energy from Prairie Island replaces energy from existing natural gas-fired generation, freeing them up to dispatch as necessary to complement the wind.

10 Projects Benefits Society

10.1 Section Summary

The Prairie Island dry cask storage and power uprate projects benefit society by meeting the overall state energy needs in an economically and environmentally responsible manner, thereby supporting future development in Minnesota and the region.

A Certificate of Need must be granted to an applicant upon determining that four principal criteria are met (Minn. R. 7855.0120 and 7849.0120). This section addresses the third criterion (Subpart C) that:

Minn. R. 7855.0120, subd. (C).
"by a preponderance of the evidence on the record, the proposed facility, or a suitable modification of the facility, will provide benefits to society in a manner compatible with protecting the natural and socioeconomic environments, including human health."

Minn. R. 7849.0120, subd. (C).
"it has been demonstrated by a preponderance of the evidence on the record that the consequences of granting the certificate of need for the proposed facility, or a suitable modification thereof, are more favorable to society than the consequences of denying the certificate, considering."

10.2 Society Benefits from Reliable, Low Cost, and Environmentally Benign Electricity Sources

Minnesota law establishes parameters to ensure that utilities select and implement resources that provide reliable energy at reasonable prices and with minimal impact on the environment. Our peak demand and energy requirements are growing at an average 1.2 percent and 1.1 percent, respectively per year.[36] We have a statutory obligation under Minn. Stat. § 216B.04 to plan our system to reliably serve our customers.

We have added base load generation in smaller increments over the years in the form of conservation and purchased power from renewable energy projects. We will be adding significant amounts of additional wind resources to our system due to the RES legislation. As the 2007 Resource Plan indicates, we will need to add a significant amount of natural gas resources to complement the additional wind energy. Additional base load nuclear energy helps diversify our generation mix,

[36] These estimates are based on 50 percentile energy forecast and 90 percentile net demand forecast.

which helps mitigate risk. The proposed projects will benefit society by enhancing our ability to provide our customers with reliable, low-cost, carbon free energy.

The proposed projects will also contribute significantly towards our carbon reduction goals and our corporate goal to be leading environmental utility. The additional casks will allow us to operate Prairie Island an additional 20 years: the power uprate will provide an additional 164 MW of low-cost, reliable, and carbon-free energy. A low-cost supply is an economic driver to our customers as well as state and regional economies. The proposed projects also provide benefits in a manner compatible with protecting the natural and socioeconomic environments.

10.3 Provides Value to Ratepayers

Continued and expanded operation of Prairie Island is the most cost-effective alternative for providing the additional capacity and energy our customers need. The projects provide reliable and relatively low-cost electricity with minimal air quality impacts and further diversify our generation portfolio. Continuing and increasing the output from an existing generation facility provides efficiencies and more fully utilizes the existing transmission infrastructure. The Prairie Island projects provide our customers with low-cost, carbon-free energy and capacity round-the-clock. The high availability of Prairie Island helps offset the intermittency of the significant amount of new wind resource that will be added to our system by replacing the use of some existing natural gas fired generation. This frees up the natural gas generation to be used in conjunction with the intermittency of the wind. The projects also provide a hedge against additional exposure to natural gas fuel costs and future environmental regulations. Considered together, the low-cost carbon free resource provides great value – economic and environmental – to ratepayers.

10.4 Use of Existing Infrastructure

Prairie Island is an existing generating facility and the changes necessary to achieve the additional 164 MW of output will take place within the confines of the existing buildings. Similarly the additional casks will be located completely within the boundary of the existing ISFSI site. The plant and ISFSI site footprints will not be expanded and no greenfields will be affected by the projects. Although additional storage involves the construction of two concrete storage pads within the ISFSI site, we will not need to construct or modify any building footprint, access roads, parking areas, or lay down areas to support the projects.

The projects will utilize the existing transmission facilities to transport electricity from the plant to the electrical grid. It is not known at this time if any transmission enhancement will be necessary and if so, what they are. Final determination of the necessary transmission system changes to support the increased generation at Prairie Island will be addressed in the appropriate MISO studies.

10.5 Lower Emissions

Prairie Island does not emit significant levels of any of the criteria pollutants or green house gases that are emitted from coal or other fossil fuel burning plants. If additional storage capacity for spent nuclear fuel is not obtained, however, we will be forced to shut down the Plant starting in 2013. Replacement of Prairie Island with the "best" replacement of two 600 MW combined cycle units would result in a substantial increase in emission of air contaminants, in particular, the emission of an additional 88 million tons of carbon.

Similarly, the Prairie Island uprate project will result in over 16 million less tons of carbon being emitted to the atmosphere as compared to the next "best" alternative - a natural gas combustion turbine.

10.6 Health and Safety

The increased spent fuel storage and power uprate will not result in on-site or off-site radiological dose levels above the safe thresholds established by the NRC and in the Technical Specifications for Prairie Island. The increased spent fuel storage and power uprate projects will not introduce any new or different radiological release pathways. The uprate will not increase the number of fuel assemblies to be handled at each refueling. Larger diameter fuel rods do not increase the probability of an operator error or equipment malfunction that would result in an uncontrolled radioactive release.

Traffic safety will not be degraded because the projects will not result in a long-term change to the routes, number of trips, types of vehicles, or speed compared to current conditions. Any changes affecting traffic will be temporary in nature to accommodate delivery of equipment for the projects.

10.7 Jobs

Continued operation of Prairie Island will ensure the continued employment of the highly skilled and dedicated work force at the Plant. The 600 plus permanent work

force at Prairie Island benefits the entire community as active, involved, tax paying citizens participate and contribute to the greater social fabric of the community. The Prairie Island projects will also employ a number of construction workers over the projects' construction periods. These high-skilled, high-paying positions add significant limited-time economic benefit to the local economy.

10.8 Supports Future Economic Development

Historically, Xcel Energy has maintained low electric rates relative to utilities in other regions of the United States. As a result, Minnesota and the region have been able to attract industrial concerns and maintain steady economic growth. Our Prairie Island projects will allow us to continue to reliably serve our customers' energy needs while maintaining favorable rates to support future economic development in Minnesota and the surrounding states. The Prairie Island projects were the lowest-cost alternatives – even under a wide variety of sensitivities were considered. Investing in additional assets at the Prairie Island plant will increase the asset value of Prairie Island and will also provide additional property tax revenues.

10.9 Provides Tax Benefits

It is anticipated that the Prairie Island spent fuel storage and power uprate projects will provide significant tax benefits - local, state and federal. The continued operation of Prairie Island will result in increased state and federal income taxes being paid by the Company of an estimated $380 million over the 20-year continued operation of the plant. In addition, there will be a significant increase in the local property tax payments due to the significant investment that will occur at the plant due to the continued operation and the power uprate project.

11 Project Compliance

11.1 Section Summary

The Prairie Island additional dry cask and power uprate projects serve the overall state energy needs, foster state energy policy and comply with all applicable rules and regulations.

A Certificate of Need must be granted to an applicant upon determining that four principal criteria are met as defined in Minn. R. 7855.0120 and 7849.0120. This section addresses the fourth criterion (Subpart D) in that:

Minn. R. 7855.0120, subd. (D).
"that it has not been demonstrated on the record that the design, construction, operation, or retirement of the proposed facility will fail to comply with those relevant policies, rules, and regulations of other state and federal agencies and local governments."

Minn. R. 7849.0120, subd. (D)
"the record does not demonstrate that the design, construction, or operation of the proposed facility, or a suitable modification of the facility, will fail to comply with relevant policies, rules, and regulations of other state and federal agencies and local governments."

11.2 Projects are Consistent with Minnesota Energy Policy

11.2.1 Legislative Preference

The Minnesota legislature has determined that:

"The following energy sources for generating electric power distributed in the state, listed in their descending order of preference, based on minimizing long-term negative environmental, social, and economic burdens imposed by the specific energy sources are:

1. *wind and solar;*
2. *biomass and low-head or refurbished hydropower,*
3. *decomposition gases produced by solid waste management facilities, natural gas-fired cogeneration, and waste materials or byproducts combined with natural gas;*
4. *natural gas, hydropower that is not low-head or refurbished hydropower, and solid waste as a direct fuel or refuse-derived fuel; and*

5. *coal and nuclear power."*[37]

Xcel Energy supports an energy policy that balances the impact of energy use and production on the environment, with the costs and reliability of various resource options. We believe a diverse portfolio that includes reliance on renewable resources and demand-side management best meets this objective. The selection of the Prairie Island projects over the alternatives considered is consistent with the State's Energy Policy priorities.

First, we reduced our forecast 1.1 percent starting in 2010 to reflect our commitment to the DSM requirements of the Next Generation Energy Act of 2007. Then, compliance with the nation's most aggressive renewable energy standard was assumed. This amounted to adding 200 MW of wind to our system per year. The projects were then compared to hypothetical biomass, natural gas, and coal generation. The additional dry cask storage scenario to support life extension and the power uprate project prove to be the most economical alternatives produce the greatest amount of carbon reduction, and have the least land and environmental impacts. The additional dry cask storage and power uprate projects, which modify and use an existing site to generate emission-free energy, minimizes "*negative environmental, social and economic burdens…"* when compared to the fossil-fueled alternatives considered.

The 2007 Legislature also declared the state's goal to reduce statewide greenhouse gas emissions across all sectors producing those emissions to a level at least 15 percent below 2005 levels by 2015, to a level at least 30 percent below 2005 levels by 2025, and to a level at least 80 percent below 2005 levels by 2050. (Minn. Stat. § 216H.02, subd. 1.) The modeling supporting this Application and our 2007 Resource Plan, which includes the continued operation of and uprate to the Prairie Island plant, suggests that the continued operation of Prairie Island and the implementation of the power uprate project will ensure our compliance with the state's carbon-reduction milestones.

11.2.2 Department of Commerce Policy

The Prairie Island additional dry cask storage and power uprate projects serve the State Energy Policy goals as stated in the Minnesota Department of Commerce publication *Energy Policy & Conservation Report 2004*. The four guiding principles of Minnesota energy policy are to ensure that:

1. *Minnesota has a reliable energy-provision system into the future;*

[37] Minn. Stat. §216C.051, subd. 7(c) and (d).

2. *The State's energy system meets Minnesota's economic needs;*
3. *Minnesota's energy cost remains low, compared to the rest of the nation; and*
4. *The environmental impacts of energy produced and consumed in the state are reduced.*

The goal of these guiding principles is to maintain Minnesota's current reliable, low-cost energy in order to promote job growth and economic development, while lowering the environmental impacts of the production, delivery and use of that energy."

The *Energy Policy & Conservation Report 2004* lays out seven energy policy strategies to achieve those guiding principles:

1. Continue the operation of facilities that provide safe, reliable power, low-cost power, and do not emit air pollution.
2. Encourage coal-fired power generation facilities to convert to less polluting fuels or to install state-of-the-art emissions control technologies.
3. Encourage the generation of reasonably priced, environmentally superior electricity from low-polluting or renewable fuels.
4. Enhance the state's energy delivery infrastructure to assure reliability and provide access for electricity from low cost and/or environmentally superior resources.
5. Support research, development and deployment of new, environmentally superior energy technologies.
6. Support the state's conservation programs.
7. Reduce regulatory and government barriers.

The continued and expanded operation of Prairie Island clearly addresses all four of the guiding principles by offering a low-cost, environmentally benign generation options to meet our customers' needs. Our proposals also directly addresses Strategy #1 – which is to "continue the operation of facilities that provide safe, reliable power, low-cost power and do not emit air pollution." The projects directly address #4 by adding a highly reliable, low-cost and environmentally superior resource. The passage of the 2007 DSM and RES legislation are also incorporated into our analysis through the explicit assumption that the DSM goals will be achieved and the RES will be met – which directly supports Strategies # 3 and #6.

11.2.3 Non-Proliferation Policy

The Prairie Island additional dry cask storage and power uprate projects will take full advantage of existing infrastructure. The additional casks will be added to an existing spent fuel storage facility. After completion, the additional dry cask storage will be unnoticeable. The power uprate will take place at an existing generation facility within existing buildings and it will use existing high-voltage electric transmission facilities to transport the energy generated.

The use of existing transmission facilities is consistent with the State of Minnesota's commitment to non-proliferation of transmission corridors.[38] Generation interconnection and transmission service request filings will be made at the MISO for the additional MW expected in 2012 and 2015. Any transmission upgrade identified for the additional 164 MW should be minimal and will be addressed after the completion of the appropriate MISO studies.

11.3 The Projects Comply with Federal and State Environmental Regulations

The Prairie Island additional dry cask storage and power uprate projects meet or exceed the requirements of all applicable federal and state environmental laws and regulations. The approval of seven regulatory permits are necessary to implement the additional dry cask storage and power uprate: the Certificates of Need (2) and Site Permit from the Minnesota PUC; and the Plant Operating License Amendment, the License Amendment for the TN-40HT cask, License Renewal request to renew the Prairie Island ISFSI license, and a License Amendment to increase the allowed storage beyond the current NRC approved 48 cask limit. The operation of Prairie Island after the power uprate will be within the operating limits of all other existing state and federal permits.

11.4 Carbon Risk Analysis Compliance

Order Point 16 of the Commission's Order dated July 28, 2006 from our 2004 Resource Plan (Docket No. E002/RP-04-1752), states:

> *Xcel shall discuss carbon risk analysis strategies in the November 1, 2006 base load certificate of need filing required in paragraph 10, in its next resource plan, <u>in future certificate</u>*

[38] *People for Environmental Enlightenment and Responsibility (PEER) v. Minnesota Environmental Quality Council*, 266 N.W. 2d 858 (Minn. 1978)

of need filings, and in other proceedings involving the acquisition of generation resources. (underline added)

There is significant concern over climate change policy - internationally, nationally, and at the state level. The contribution of carbon released during the combustion of fossil fuels for electric generation is often at the forefront of that discussion. There is also a significant amount of discussion surrounding the development of a market for trading carbon credits. This creates a potential regulatory risk and a cost risk when proposing to construct a fossil fuel burning power plant that emits carbon. Prairie Island does not produce carbon. The power uprate is carbon neutral on its own. Integrated into our resource mix, the addition of the Prairie Island projects will reduce carbon by eliminating the need to build new natural gas-fired generation and by reducing the use from existing fossil fuel plants. Nonetheless, we are providing a carbon risk analysis in compliance with Order Point 16 of our 2004 Resource Plan.

11.4.1 CO_2 Analysis

The issue of global climate change is in the forefront of public policy debates in the United States. Today, Congress, state legislatures, and policy makers across the country and around the world, are gradually identifying and adopting policies to address greenhouse gas ("GHG") emissions. In Minnesota, Governor Pawlenty and the Legislature have made global climate change a top priority, most notably through the Next Generation Energy Act of 2007, the Minnesota Climate Change Advisory Group, and the Midwest Regional Greenhouse Gas Reduction Accord.

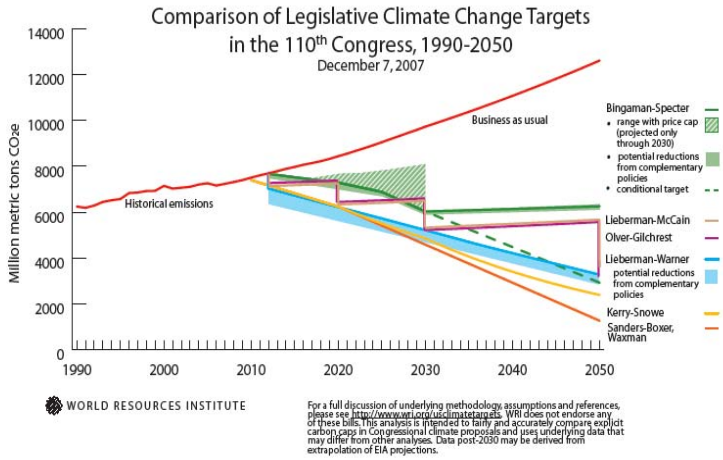
Global climate change and the likelihood of future GHG regulation underlie the approach proposed in our 2007 Resource Plan and in this Application. We believe the nation will be subject to regulations designed to reduce GHG emissions, and that those regulations will have a significant impact on the Company's operations.

Global climate change is a complex issue that affects the Company in many ways. The CO_2 analysis and discussion in this section touches on the major aspects of global climate change as a resource planning factor, beginning with federal, state and regional policy initiatives, continuing with the impacts of climate policy on our business landscape including the pricing of CO_2, and concluding with the implications on this Application.

11.4.1.1 Federal Legislative Proposals

The current Congress is considering a number of bills that address global climate change. These bills include legislation sponsored by Senator Bingaman, Senator Lieberman, Senator Boxer, and Senator Kerry, among others. The bills usually have some bi-partisan support. Although these bills vary in structure and format, most of them share several common traits. On December 5, 2007, the Senate Environment and Public Works Committee passed the American Climate Security Act sponsored by Senator Lieberman and Senator Warner. Like the other climate policy bills under consideration, the Lieberman-Warner bill would impose CO_2 emission limits on the entire economy and target some level of emission reductions by 2020. The main bills under consideration all target much more aggressive reductions by 2050. They would use a "cap and trade" policy structure – placing an overall limit on GHG emissions across the economy and allowing sources to trade emission allowances with each other to meet their emission targets. However similar, the bills vary dramatically in their particulars, including whether they incorporate "safety valves" (i.e. maximum carbon prices) and how they allocate emissions.[39] A comparison of the reductions proposed by the bills is shown in Figure 11-1.

Figure 11-1: GHG Emission Trajectories Under Proposed Federal Legislation



[39] Xcel Energy supports a national Clean Energy Portfolio Standard, which would use a mechanism similar to a renewable portfolio standard to promote the use of clean technology and limit GHG emissions from the utility industry.

Many of these programs are generally designed to reduce CO_2 emissions to levels that, according to many computer models, would put the U.S. share of global emissions on a trajectory to help stabilize atmospheric CO_2 concentrations at 450 to 550 parts per million, or roughly twice pre-industrial levels.

Most recently, on December 19, 2007, the President signed legislation that, in addition to increasing fuel economy standards for cars and light trucks sold in the United States, requires a renewable fuels standard to be established for transportation. Proposals for a national renewable portfolio standard for electric utilities were not passed in this Congress. Separately, the US Environmental Protection Agency ("EPA") was required to commence a rulemaking on mandatory reporting of GHGs through appropriations language.

Finally, in Massachusetts v. EPA, the US Supreme Court found that GHGs are pollutants under the Federal Clean Air Act, a ruling that will begin a process of regulatory determinations at the EPA that could lead to GHG regulation even if the Congress does not pass legislation.

11.4.1.2 State and Local Climate Policies

The states are not waiting for Congress to act. States throughout the country are proposing CO_2 emission reduction programs and using other policy mechanisms to address GHG emissions. In Minnesota, the Legislature and Governor Tim Pawlenty have already passed the most stringent renewable energy standard in the nation and both aggressive energy efficiency requirements and statewide GHG emission reduction goals through the Next Generation Energy Act of 2007. This also requires a plan for regulatory action and established a formal stakeholder process (the Minnesota Climate Change Advisory Group) to make recommendations on future policies related to climate change. Establishment of the RES further reinforces the regulatory process that requires CO_2 valuation in selecting generation resources in resource planning processes. Prospective state and federal climate policies have profound implications on our selection of future generation resources.

11.4.1.3 Impacts of Climate Policy on the Energy Industry

To meet the challenge of global climate change and prospective regulation while continuing to provide reasonably priced, reliable energy service to our customers, Xcel Energy and the entire industry will need to undertake significant changes.

First, because of the long planning periods that must be employed in the utility industry, we need to act early and make decisions about our resources despite the fact that climate change regulation has not yet been implemented.

Second, there is today no single "solution" that will allow us to achieve significant GHG reductions while meeting our obligation to serve our customers. We must rely on a diverse portfolio of clean resources available today to bridge the gap to a clean energy future tomorrow. Integrated transmission planning will be a critical component of this strategy because it can link utility customers to the clean energy supplies (e.g. renewable energy resources and areas with good geologic sequestration opportunities).

Third, as technologies evolve, we must have the flexibility to adjust our strategies. It is highly likely that investment in research, development and deployment will need to be reconsidered in order to meet the challenges of the new energy landscape. Today's programs may be supplanted by new approaches to innovative technology in the regulated utility context.

11.4.1.4 Carbon Dioxide Pricing

There are many GHGs, but CO_2 is the most important for policy and planning purposes. CO_2 pricing provides a suitable representation of regulatory risk and climate policy direction. The two main types of GHG emission reduction policy proposals are "cap and trade" programs that require reduced levels of emissions in conjunction with tradable emissions allowances, and "carbon tax" programs that levy a fee on GHG emissions. Both impose a price for CO_2 emissions to fossil generators in the electric power sector. A CO_2 price could come from the market for emissions reduction under a cap and trade program, or could come directly from a carbon tax. In either case, the CO_2 price imposes a new operating cost to existing and new fossil power plants.

To develop our CO_2 emissions price scenarios, we have researched publicly available analyses of mandatory greenhouse gas policies. Numerous analyses of U.S. GHG emission reduction policies have been performed and we have selected a set of analyses that we believe represent the range of current public thought about U.S. CO_2 pricing. In addition to these analytic results, we have also reviewed CO_2 price curves based on the statutory price ceiling or "safety valve" prices from three proposed federal bills. We have also included the carbon proxy cost of $9/ton used in other dockets. On December 21, 2007, in Docket No. E-999/CI-07-1199, the Commission adopted new values for CO_2 to be used in resource planning and "…all proceedings to acquire electricity generation resources to serve needs in

Minnesota." The cost range established was from $4 to $30 per ton emitted in 2012 and thereafter.

Table 11-1
Levelized Carbon Dioxide Prices From Various Sources

Scenario Name	Note	Levelized 2010-2030 $/metric ton CO2e
Bingaman '06 (EIA)	EIA analysis from January 2007 of Bingaman 2006 cap proposal, "Phased Auction" or main case. Bingaman's policy has since been updated	$9.16
Bingaman '06 (Safety Valve)	Carbon price set at statutory price ceiling (not a modeled result) from Bingaman 2006 cap proposal	$10.15
Bingaman '05 (Safety Valve)	Carbon price set at statutory price ceiling (not a modeled result) from Bingaman/NCEP 2005 cap proposal	$10.42
2003 PSCo Resource Plan Proxy Cost	2004 Settlement Agreement between stakeholders related to Comanche 3 coal plant	$12.01
Bingaman '07 (NCEP)	NCEP analysis from July 2007 of Bingaman 2007 cap proposal. Based on EIA "High Technology" case	$13.19
Lieberman '06 (EIA - Low Price)	EIA analysis from July 2007 of Lieberman-McCain S. 280 cap proposal, "Fixed 30 Percent" or high offsets case	$16.10
Lieberman '06 (US EPA - Low Price)	US EPA analysis from July 2007 of Lieberman-McCain S. 280 cap proposal, "Senate Scenario," ADAGE model	$16.24
Bingaman '07 (Safety Valve)	Carbon price set at statutory price ceiling (not a modeled result) from Bingaman 2007 cap proposal	$17.40
Lieberman '06 (US EPA - High Price)	US EPA analysis from July 2007 of Lieberman-McCain S. 280 cap proposal, "Senate Scenario," IGEM model	$22.99
MIT (Low Price)	MIT Analysis from April 2007 of a policy that includes a safety valve, titled "Core scenario: 287 bmt"	$23.72
Lieberman '06 (EIA - Medium Price)	EIA analysis from July 2007 of Lieberman-McCain S. 280 cap proposal, "S.280 Core" or medium offsets case	$25.19
Lieberman '06 (EIA - High Price)	EIA analysis from July 2007 of Lieberman-McCain S. 280 cap proposal, "No International" or low (domestic only) offsets case	$32.97
MIT (Medium Price)	MIT Analysis from April 2007 of a 1995 by 2020, 50% below 1990 by 2050 policy, titled "Core scenario: 203 bmt"	$54.79
MIT (High Price)	MIT Analysis from April 2007 of a 1990 by 2020, 80% below 1990 by 2050 policy, titled "Core scenario: 167 bmt"	$71.18

As demonstrated by the table above, there is a significant range of possible CO_2 values. Based on our research, we believe that the range of CO_2 price scenarios in the analyses shown above will encompass most likely GHG emission reduction policies. To better compare the CO_2 price curves from the analyses considered, we performed a simple levelization analysis. Levelization allows us to compare price curves from analyses and statutory "safety valve" prices with different starting years and escalation rates. To levelize the price curves, we calculated the net present value of each CO_2 price curve from 2010-2030 and then created a levelized series of annual prices from 2010 to 2030 with an equivalent net present value. We note that while these levelized values are useful for comparison purposes, we used CO_2

price curves rather than levelized values in the actual modeling for the Resource Plan and this Application. Table 11-1 above presents the levelized CO_2 price results. In light of the significant ongoing changes in the political climate regarding GHG emission regulation, we believe that the "Medium" scenario set forth below is the appropriate base case for modeling and analysis, and that the "Low" and "High" represent appropriate sensitivities.

Table 11-2: 2007 CO_2 Price Scenarios

Scenario	2008 Price ($/short ton CO_2)	2030 Price ($/short ton CO_2)	2010 Price ($/metric ton CO_2)	2010-2030 Levelized Price (nominal $/metric ton CO_2)
Low	$9.00	$16.39	$11.02	$13.34
Medium	$20.00	$32.77	$22.05	$26.69
High	$40.00	$65.54	$44.09	$53.38

By including the prices above in our various scenarios as noted in Table 11-2 above, we have evaluated the costs of different climate change scenarios. Both the additional dry cask storage necessary to support Prairie Island life extension and the power uprate projects reduce our carbon footprint in excess of 20 percent over the next 20 years. By extending the life of Prairie Island and increasing the capacity at the plant, we will reduce our exposure to the costs of future carbon regulation. We believe this analysis is a reasonable approach to incorporate the CO_2 risk analysis required by the 2004 Resource Plan Order. We believe the range of CO_2 values used in our analyses for Prairie Island are consistent with the range set by the Commission.

11.5 Compliance and Policy Summary

The expansion of an existing low-cost generation facility benefits all. The design, construction and operation of Prairie Island will comply with all policies, rules and regulations of the State of Minnesota and the NRC. The Prairie Island additional dry cask storage and power uprate projects will:

- Improve the reliability of the state's energy infrastructure;
- Contribute towards the legislature's 30 percent carbon reduction goal by 2025;
- Play an integral role in meeting Xcel Energy's resource needs;
- Operate within all existing water appropriation, water discharge, air and other operating permits;

- Utilize an existing dry storage site to store additional casks and will utilize an existing generation site to produce additional electricity;
- Comply with the requirements of Minn. Stat. § 116C.83, subd. 4, which requires that the storage of spent nuclear fuel be managed to facilitate the shipment of spent fuel out of state to a permanent or interim storage facility as soon as feasible in a manner that allows the continued operation of the power plant; and
- Provide the generation capability to meet our customer's energy needs using the most environmentally friendly and cost-efficient generation resources available; resulting in minimal cost impact to ratepayers as compared to the alternatives.