

CHAPTER 9: ALTERNATIVES (MINN. R. 7855.0610)

Commission Rules regarding CN applications for a nuclear spent fuel storage facility require applications to include “a description of alternatives available to the applicant that differ significantly from the proposed facility with respect to location, size, timing or design.” This Chapter discusses storage alternatives, including alternative technologies and alternative locations. In addition, denial of the CN would lead to closure of the Prairie Island Plant beginning with Unit 1 in 2033, requiring replacement of the capacity and energy provided by the Plant. Therefore, this Chapter also examines “generation alternatives.”¹

9.1 STORAGE ALTERNATIVES

9.1.1 Alternatives to On-Site Storage

This section of our application examines four away-from-reactor storage possibilities for spent nuclear fuel: 1) reprocessing and recycling spent nuclear fuel, 2) contracting for additional spent fuel storage capacity at an existing interim offsite spent fuel storage facility, 3) contracting for additional spent fuel storage capacity at a future interim offsite spent fuel storage facility, and 4) the availability of a federally-sponsored permanent repository for spent fuel at Yucca Mountain. We conclude that none of the four represent a viable alternative to support continued operation of the Plant Units 1 and 2 beyond 2033 and 2034, respectively. Current storage capacity of the spent fuel pool at the Plant will be exhausted in 2033.² This section of our application examines four away-from-reactor storage possibilities for spent nuclear fuel: 1) reprocessing and recycling spent nuclear fuel, 2) contracting for additional spent fuel storage capacity at an existing interim offsite spent fuel storage facility, 3) contracting for additional spent fuel storage capacity at a future interim offsite spent fuel storage facility, and 4) the availability of a federally-sponsored permanent repository for spent fuel at Yucca Mountain. We conclude that none of the four represent a viable alternative to support continued operation of the Plant Units 1

¹ It should be noted, however, that even if the instant CN were denied (i.e. the “No Action” alternative), Xcel Energy would still require additional spent fuel storage capacity in order to decommission the Plant, meaning a future CN would be required.

² Spent fuel pool storage capacity will not be able to meet dual-unit offload capability beyond 2033. Unit 1 is scheduled to retire in 2033. Upon shutting down, all the fuel will be transferred from the reactor to the spent fuel pool. Unit 1 decommissioning would start at that time.

and 2 beyond 2033 and 2034, respectively. Current storage capacity of the spent fuel pool at the Plant will be exhausted in 2033.³

9.1.1.1 Reprocessing and Recycling Spent Nuclear Fuel

When electric power companies first considered using nuclear energy to generate electricity, it was assumed that when the nuclear fuel was used up or “spent,” it would be reprocessed and recycled⁴ so that useful fuel could be extracted and used again. Approximately 96 percent of spent fuel from nuclear plants in the United States is uranium that could potentially be reused into usable fuel for electricity generation.

In 1977, President Carter, concerned about the possibility of nuclear proliferation, banned commercial reprocessing by private companies. As a result, the two private reprocessing facilities, then under final construction, were never made operational. Although the ban was eventually lifted, because of the economics of reprocessing compared to fabrication of new fuel and the political uncertainty surrounding reprocessing, there has been limited progress by private companies pursuing investment in reprocessing initiatives.

In January of 2023, Oklo, an energy company that is focused on designing and deploying advanced nuclear power plants, submitted a licensing project plan to the NRC, outlining its plans for pre-application activities in support of its license application for a commercial-scale fuel recycling facility.⁵ Oklo had been previously awarded over \$15 million in grant money by the Department of Energy’s (DOE) Advanced Research Projects Agency – Energy (ARPA-E) for its research and development in spent nuclear fuel recycling. ARPA-E has 3 goals: 1) supporting the growth of safe advanced nuclear energy with a sustainable fuel source, 2) reducing carbon emissions, and 3) assuring economic commercial viability through advanced research (www.arpa-e.energy.gov).

³ Spent fuel pool storage capacity will not be able to meet dual-unit offload capability beyond 2033. Unit 1 is scheduled to retire in 2033. Upon shutting down, all the fuel will be transferred from the reactor to the spent fuel pool. Unit 1 decommissioning would start at that time.

⁴ While the terms “reprocessing” and “recycling” of spent nuclear fuel are often used interchangeably, “reprocessing” generally refers to the process of separating fissile materials (such as plutonium and uranium) from the used fuel. “Recycling” is the process of using reprocessed fuels to create new fuels for commercial power use, or potentially for advanced reactor use.

⁵ [Oklo Inc. - Oklo Prepares for the Deployment of its Commercial-Scale Fuel Recycling Facility with the Submission of its Licensing Project Plan.](#)

In March of 2022, the DOE announced \$36 million in grant money through a program called ONWARDS, (Optimizing Nuclear Waste and Advanced Reactor Disposal Systems) for 11 projects “seeking to increase the deployment, and use of, nuclear power as a reliable source of clean energy and limit the amount of waste produced from Advanced Nuclear Reactors” (AR) ([Press Release | arpa-e.energy.gov](#)). Oklo was one of these recipients, and is the recipient most directly focused on the economic viability of a recycling facility. Development of a license application can take several years, followed by approximately two additional years for NRC review. The timing and potential completion of this project is also dependent on the research results determined by Oklo and whether it is determined that a recycling processing facility would be economically viable in the United States.

Because this potential project is at a very early stage and is not certain to go forward, and no other viable projects are currently being considered, recycling is not a viable alternative to establishing further onsite spent fuel storage at the Plant. Similarly, no reprocessing facilities currently exist, nor have any reprocessing facility licensing applications been submitted to the NRC, and as a result, reprocessing is not a viable alternative to existing onsite spent fuel storage at the Plant.

9.1.1.2 Existing off-site storage facility- General Electric in Morris, Illinois

The only facility currently storing spent fuel on a contract basis from commercial nuclear power reactors is the General Electric Morris facility in Morris, Illinois. The Company shipped 1,058 spent fuel assemblies from the Monticello Plant to the Morris facility in the 1980s, where they are currently stored under contract. The General Electric Morris facility is no longer accepting spent fuel from commercial nuclear power plants and is therefore not a viable existing off-site alternative to the ISFSI for storing additional spent fuel.

9.1.1.3 Private Centralized Interim Storage

Three privatized potential off-site storage facilities are evaluated in the following discussion. Private centralized interim spent fuel storage has received more attention in the past five years with the NRC licensing application submittals and approvals of the Integrated Storage Partners (ISP) and Holtec HI-STORE facilities. There are currently ongoing judicial and legislative challenges impacting both of these projects, however, and the timing of any potential construction activities is uncertain. We do not consider any of these proposed facilities to be a currently viable alternative to granting additional storage capacity at the Prairie Island ISFSI.

9.1.1.3.1 Private Fuel Storage, LLC

In 1997, the Company pursued an interim spent fuel storage project in Utah as part of the eight-utility consortium Private Fuel Storage (PFS). The other utilities include Southern Nuclear, Genoa FuelTech, Southern California Edison, Entergy, American Electric Power, Florida Power and Light, and First Energy. PFS proposed to build an interim spent fuel storage facility on the West Central Utah reservation of the Skull Valley Band of Goshute Indians.

Some of the Goshutes were in favor of the project for economic growth. Many others within the tribe opposed the project as well as outside groups including senators, house representatives, Utah governors, the Sierra Club and others.

Six parties, including the State of Utah, filed initial objections, contending that the NRC did not have jurisdiction via the Nuclear Waste Policy Act of 1982. Ultimately, Utah's concerns were struck down in court, finding that the state had overstated their case, and it was ruled in favor of PFS.

In February 2006, the NRC issued PFS a license for the interim storage facility. Because of PFS's lengthy NRC approval process, however, companies that were initially interested in this facility instead constructed onsite dry fuel storage facilities.

While other judicial and legislative challenges have been mounted against the PFS project, none have been successful, and the NRC license issued in 2006 remains in place.

Although the project still has a valid license from the NRC, reviving the PFS project would require the U.S. Department of the Interior's approval of the land lease and the grant of the right-of-way, compliance with NRC license conditions, and sufficient interest and commitment to use the facility by companies with spent fuel. None of these conditions are currently in place, and therefore this is not a viable alternative to establishing further on-site dry spent fuel storage at the Plant.

9.1.1.3.2 Interim Storage Partners (ISP) Consolidated Interim Storage Facility

A centralized interim storage project was initiated by Waste Control Specialists (WCS) for a site in Andrews County, Texas, adjacent to WCS's existing low-level radioactive waste and hazardous waste storage and disposal facilities. The NRC

license application for this project was filed in April 2016. In April 2017, WCS asked the NRC to suspend the review of this application. Subsequently, WCS and Orano USA (formerly Areva Nuclear Materials) formed a joint venture to license the facility. In response to letters to the NRC in June and July 2018 from the joint venture, Interim Storage Partners (ISP), the NRC restarted its review of the application. Since this time, the proposed facility has faced a number of judicial and legislative challenges.

On the judicial front, this project has been subject to litigation before the District of Columbia Circuit, the Tenth Circuit and Fifth Circuit federal courts of appeals. The D.C. Circuit, on January 25, 2023, determined that the NRC had reasonably applied its regulations and dismissed all pending matters. On February 10, 2023, the Tenth Circuit dismissed the State of New Mexico's challenge because it had not participated in the NRC licensing proceeding. The Fifth Circuit, however, ruled on August 29, 2023, that the NRC lacked authority to issue licenses for private parties to store spent nuclear fuel away from the reactor. The NRC and ISP have filed a petition for rehearing *en banc* with friend of the court support from NEI and Holtec International, Inc. The State of Texas and other parties have filed their opposition to the petition, and no decision has been made on the petition to date.

In addition to these judicial challenges, the proposed facility has faced legislative opposition. Shortly before NRC issued the ISP license, Texas enacted legislation intended to block the ISP facility.

Due to the above-described ongoing judicial and legislative challenges, ISP is not a valid alternative interim storage solution for commercial nuclear plants at this time.

9.1.1.3.3 Holtec HI-STORE Consolidated Interim Storage Facility

Holtec International Inc. has proposed the HI-STORE Centralized Interim Storage Facility for a site in Eddy and Lea Counties in southeastern New Mexico. Holtec filed an application with the NRC for this facility in March 2017. A number of appeals were filed by project opponents during the pendency of the application with the D.C. Circuit. The Court held these appeals in abeyance during the licensing proceeding. The NRC issued a license to Holtec on May 9, 2023, authorizing the company to receive, possess, transfer and store 500 canisters holding approximately 8,860 metric tons of commercial spent nuclear fuel for 40 years. Since the license was issued, the consolidated appeals at the D.C. Circuit have now been fully briefed. The D.C. Circuit is slated to hear argument on this matter on March 5, 2024.

On the legislative front, in March 2023, New Mexico approved legislation aimed at stopping the project.

Due to the above-described ongoing judicial and legislative challenges, Holtec, like ISP, is not a valid alternative interim storage solution for commercial nuclear plants at this time.

9.1.1.3.4 Conclusion

While we believe the centralized storage facilities proposed by ISP and Holtec meet all NRC regulatory requirements and would be a positive development in the management of spent nuclear fuel, we do not consider either proposed facility to be a currently viable alternative to granting additional storage capacity at the Prairie Island ISFSI at this time.

Assuming the NRC licenses received by each facility withstand the judicial challenges they face—each facility will need to work with their respective states on permitting issues and develop a business model for operations prior to construction. In addition, the Department of Energy will begin its own process to find a consent-based interim storage location over the next few months and it is unclear how this will impact the two private facilities currently licensed.

Based on history outlined above, it is virtually certain that these facilities will not be available to store fuel from the Prairie Island Plant within the necessary time frame. At Prairie Island Plant, we will need to load the next dry fuel storage containers in the 2030 timeframe to support extended power operations. At that time, the only remaining storage the facility would have would be in its pool, which would allow the facility to operate through 2033 and 2034, at which point both Unit 1 and 2 would be decommissioned, respectively. Without a set schedule or guarantee that any of the interim facilities will open in the near term, we do not believe it would be prudent to consider either of these a viable alternative to additional on-site storage at the Plant at this time. If either of these facilities become operational in the future, we would explore the possibility of shipping fuel to that site.

9.1.1.4 Yucca Mountain

The Yucca Mountain Nuclear Waste Repository was intended to be a federally-sponsored deep geological repository within Yucca Mountain, located on federal

land within the state of Nevada. Yucca Mountain has been subject to substantial opposition, but the application to license the Yucca Mountain permanent repository remains pending before the NRC, following the unsuccessful attempt by the Obama Administration to terminate the proceeding and withdraw the application. The NRC Staff's technical and environmental reviews have been essentially completed, but the adjudicatory hearings on the application before NRC Atomic Safety and Licensing Board remain suspended—with numerous contentions submitted by Nevada and other opponents remaining to be resolved before the NRC can license the project. The Biden Administration did not seek any funding for Yucca Mountain in the FY2021 or FY2022 budgets. North Las Vegas KLAS News reported that during Senate committee hearings in June 2021, Secretary of Energy Jennifer Granholm testified that the Administration does not support Yucca Mountain as a solution for nuclear spent fuel disposal but would begin a consent-based siting process in 2021. Due to political challenges, the Company does not see Yucca Mountain as a viable option for permanent spent fuel storage.

9.1.1.5 DOE Consent-Based Siting Program

In June 2023, the DOE awarded 13 contracts to consortiums consisting of university, non-profit, and private-sector partners that will work with communities interested in learning more about nuclear energy and spent nuclear fuel storage with a goal of education and transparency. Communities will participate by working with the DOE and these consortiums through a phased approach to determine whether and how being a host community could align with their goals. The three phases to this approach include: (1) planning and capacity building, (2) site screening and assessment, and (3) negotiation and implementation.

Xcel Energy is part of one of the consortiums that was awarded a DOE contract, along with the Prairie Island Indian Community and several others led by the Southwest Research Institute (SwRI). The consortium will collaborate with selected communities to educate and provide transparency around the topic of spent nuclear fuel storage with the intent to enter into the phased approach described above.

The DOE's Consent-Based Siting Program is in its initial stages. As a consortium participant, the Company will remain actively engaged with key stakeholders throughout the entire process. Once a community has accepted a host community role, the community and DOE will need to work with respective states on permitting issues and will develop a business model for operations prior to construction. It is

unclear how much can be accomplished within the 2024-2040 IRP timeline and therefore, the Company does not see this as a viable alternative to continuation of on-site storage at this time.

9.1.2 Increased Storage Pool Capacity

The Company could theoretically achieve increased storage capacity by increasing the capacity of its pool storage on site through one of three means: consolidation, re-racking or a new storage pool. None of these provide a more reasonable and prudent alternative than additional dry cask storage.

9.1.2.1 Fuel Rod Consolidation

Fuel rod consolidation is a process that reduces the volume of the fuel assemblies by disassembling and repackaging the fuel rods and assembly hardware. During this process, fuel rods are removed from the fuel assembly. Then the rods are grouped in a closer-packed array and placed in a container with similar dimensions as a fuel assembly. The assembly hardware is compacted and then packed into separate containers in the pool or in a dry storage configuration. This process could be performed in an existing spent fuel pool.

This technique has not been widely used, and the domestic nuclear industry experience has been primarily limited to demonstration projects. Consequently, the technology is not as optimized or commercially mature as other alternatives. Fuel rod consolidation would require development of a site-specific solution if implemented, which could be very complex.

Northern States Power (NSP) conducted a fuel rod consolidation demonstration project at the Plant in 1987. Although some volume reductions for spent fuel were realized, NSP found that predicted compaction ratios for assembly hardware were not achievable. Moreover, the occupational radiation dose was significantly higher than predicted because workers were subject to increased exposure from the many time-consuming and labor-intensive fuel-handling activities. NSP also found that the consolidated assembly hardware had become activated and large portions of the assembly could not be disposed of as Class C waste, which would have reduced volume. The NSP study found that consolidation would also generate significant amounts of radioactive debris. The study estimated an additional 600 cubic meters

of low-level radioactive waste containing 2,500 curies would be generated from consolidation activities. Consequently, the rod consolidation alternative was rejected as an alternative to spent fuel storage at the Prairie Island Plant.

In January 2001, the DOE's Office of Civilian Management provided a Report to the US Congress entitled *Spent Fuel Management Alternatives Available to Northern States Power Company Inc. and the Federal Government for the Prairie Island Nuclear Plant Units 1 & 2*. That report contained the following excerpt on rod consolidation at PI:

In the 1980s, DOE, the utility industry, and several nuclear equipment vendors developed consolidation processes and equipment; and several utilities undertook demonstration projects to test the processes and equipment. NSP demonstrated the consolidation of 36 assemblies at Prairie Island in late 1987. These demonstrations encountered numerous and varied difficulties, which were not easily resolvable. To date, no utility has pursued rod consolidation as a means of expanding onsite storage capacity for SNF.

The Company is not aware of any recent industry initiatives or design advances that would contradict the DOE's 2001 conclusion on rod consolidation. The Company is also not aware of any domestic nuclear plant owner that is seriously considering rod consolidation as a long-term solution to spent fuel storage. The Company concludes that consolidation is not a viable alternative to dry storage at the Plant

9.1.2.2 Re-racking

Re-racking is a process by which the existing storage racks are replaced with storage racks designed to provide a more compact array for storing the spent fuel assemblies. Re-racking has already been performed twice at the Plant, once in 1977 and again in 1981. The current licensed storage capacity of the spent fuel pool is 1386 fuel assemblies. In 1995, a feasibility study was performed to assess the potential increase in wet storage capacity via the use of state-of-the-art storage racks. The study concluded that it might be possible to gain up to 790 storage cells within the Plant's spent fuel storage pools. An increase in wet storage of 790 spent fuel assemblies is not sufficient additional storage to support 20 years of extended operations. This could potentially allow for up to thirteen years of storage, however, variables such as how the plant is operated and how many fuel assemblies are discharged during each refueling outage could impact spent fuel pool capacity. Additionally, these spent fuel assemblies will require transfer to dry fuel storage (DFS) eventually and implementing a spent fuel pool re-racking project at this point would be costly. Approximately 1,200

spent fuel assemblies will require storage in support of subsequent license renewal. Therefore, re-racking to increase pool storage is not a viable alternative to establishing dry storage at the Plant to support 20 years of extended operations.

9.1.2.3 Construct a New Pool On-site

This alternative entails constructing a new building containing a new spent fuel storage pool. The new building and pool structure would be designed and constructed to the same or higher standards as the existing spent fuel storage pool and would be licensed and regulated by the NRC. A transfer cask would be required to transfer spent fuel assemblies from the existing pool to the new pool. Under this alternative, the number of times the spent fuel assemblies are handled would most likely triple; first, to place it into a transfer cask to move it to the new pool; second, to remove it from the transfer cask to place it in the new storage pool; and third, to place it into a welded canister and then transfer cask for transport to the ISFSI or offsite storage location.

A new storage pool would require the same components as the existing pool and would rely on active cooling rather than passive cooling systems. These components would include storage racks, pool cooling and filtration systems, pool bridge crane and fuel assembly handling tools, building ventilation systems, radiation monitoring equipment and a cask decontamination area. It would take an estimated three years to design a new pool building and to complete state and federal reviews and approvals. Construction would last approximately two years, and thus, the total design and construction period would be approximately five years. The new storage pool would likely be located as close as possible to the existing spent fuel pool area.

This alternative was evaluated in the 1991 Prairie Island Certificate of Need Application. The estimates of the project costs in 1991 were on the order of \$31 million to build, \$0.5 million per year to operate, and \$50 million to decommission the pool. This estimate did not include costs associated with purchasing hardware, such as the transfer casks, or costs associated with plant personnel required to load and transport the spent fuel from one pool to the other. Additionally, should offsite interim storage or a permanent repository become available, there would then be an additional cost to load the spent fuel from the new pool into welded canisters and transfer casks to transport the spent fuel to the offsite location. As stated, the number of times the spent fuel assemblies are handled would likely triple, which will directly impact overall cost. And the only potential avoided costs would be expansion of ISFSI concrete pads if the fuel is transferred directly from the spent fuel pool to an offsite location.

As a result, constructing an additional spent fuel pool is not a viable alternative to establishing dry storage at the Plant to support 20 years of extended operations.

9.1.3 Alternative Dry Cask System Technologies

Currently, there are three types of storage system technologies available for dry storage of spent nuclear fuel. All three systems rely on passive cooling to remove decay heat from the spent fuel. The three technologies vary in the manner in which they store the spent fuel, how they accommodate the transfer of spent fuel from the power plant, and how they are transported. The three types of systems are as follows:

- Horizontal Canister Storage System
- Vertical Canister Storage Systems
- Non-Canister Storage Systems (Bolted Cask)

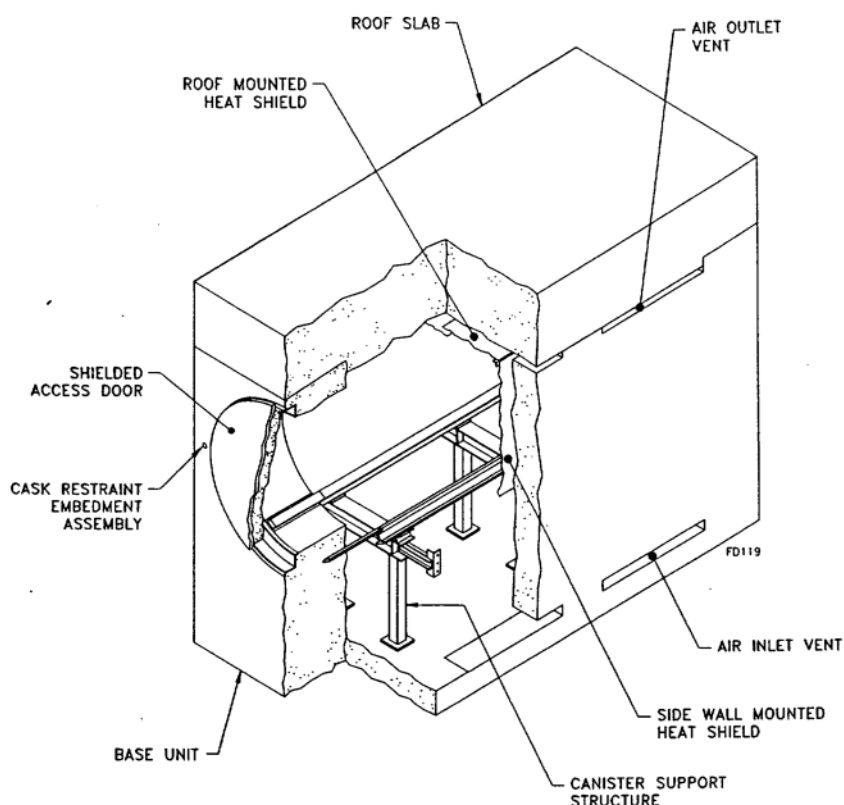
The following sections present each system and discuss their respective advantages and disadvantages. A comparison of major attributes of each system is presented in Table 9-1.

9.1.3.1 Horizontal Canister Storage System

The Company recently completed a competitive bidding process to select a new DFS system technology to store spent fuel through the remaining operations of the Prairie Island Plant.⁶ Following this competitive bidding process, the Company signed a contract with Orano TransNuclear (TN) Americas on November 29, 2023, to use the NUHOMS (NUclear HOriZontal Modular System) EOS37PTH horizontal welded canister DFS system. The contract currently supports DFS through the end of the current operating license with the first loading of the EOS37PTH anticipated in 2026. It is anticipated that this technology would be used should the Plant's operating licenses be extended. The NUHOMS EOS37PTH system consists of a welded sealed metal canister to contain spent fuel assemblies and provide the primary confinement boundary, concrete storage modules that house the canisters, a transfer cask to handle the canisters, and a transportation cask to ship the canisters offsite. The storage module, transfer cask and transportation cask provide radiation shielding and physical protection, during canister transportation, transfer, or storage.

⁶ Xcel recently signed a contract with Orano TN Americas in November 2023 to store future spent fuel assemblies in the NUHOMS EOS37 welded canisters starting in 2026. The change in technology was authorized by the PUC and filed under Docket No. E-002/CN-08-510 in August 2022.

The transfer cask is used to lift and provide radiation shielding of the canister during spent fuel loading and storage preparation activities. After the canister is loaded, it is drained, dried, inerted with helium, and welded closed. The canister is then transferred using the transfer cask, moved to the ISFSI, and loaded into the storage module for storage. The canister transfer operation occurs at the ISFSI by sliding the canister from the transfer cask into the storage module. This operation occurs in a horizontal configuration, so no overhead crane is required. The individual modules are placed on a concrete base mat next to each other to form a linear array. The modules are designed with a passive natural convection heat transfer system. The process can be reversed to transfer the canister from the storage module directly into a shipping cask. The shipping cask can be loaded onto a rail car for removal offsite.



The concrete storage modules are designed to provide passive heat transfer by natural convection from the canister through air vents built into the module. The air vents require periodic inspection to ensure they do not become blocked and a temperature monitoring system to ensure canister temperatures do not reach levels that could damage the system materials. The concrete storage module is a pre-cast reinforced

concrete structure, which is fabricated offsite and shipped to the site where it can easily be placed on a concrete storage pad.



Currently, the only horizontal system available is the TN NUHOMS. The system is used at several nuclear power plants throughout the United States as well as at several foreign reactors.

The advantages of using a horizontal canister storage system include:

- Once welded closed, the canister never needs to be opened, which avoids having to expose or handle individual spent fuel assemblies.
- All canister transfers between the transfer cask and the storage module can be performed without the use of an overhead crane.
- To ship offsite, the canister needs only to be transferred from the storage module to the shipping cask without having to unload fuel in the fuel pool.
- The canister can be transferred directly from the storage module to the shipping cask at the ISFSI without having to be moved to the Plant or other structure for access to a crane.
- The nuclear fleet has extensive experience in loading and maintaining a canister-based system as this system is currently in use at the Monticello Plant.
- The proposed private Central Interim Storage facilities are designed to storage canister-based systems, leading to the possibility of earlier shipment offsite.
- Canister-based systems have lower overall costs compared to other design.

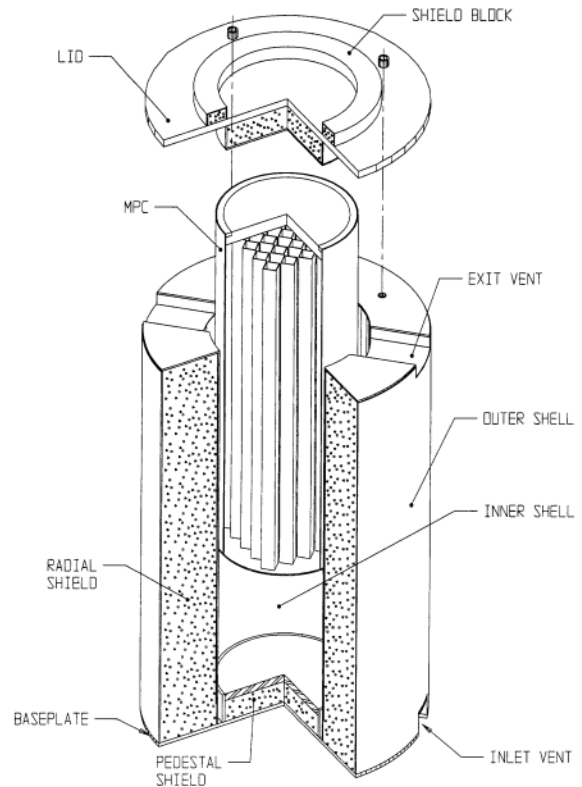
The disadvantages of using a horizontal canister storage system include:

- The canisters have to be transferred between transfer casks, storage modules and transportation overpacks which increases the radiation doses to workers.
- The canisters require welding and weld inspection, which increases storage preparation time, which in turn increases worker doses.
- A temperature monitoring system and/or vent blockage inspection are required to ensure proper heat rejection from the canister.

9.1.3.2 Vertical Canister Storage Systems

The vertical canister storage system typically consists of a welded sealed metal canister to contain spent fuel assemblies and provide the primary confinement boundary, concrete or metal storage overpacks to house the canister, a transfer cask to handle the canister, and a transportation cask to ship the canister offsite. The storage overpack, transfer cask and transportation cask provide radiation shielding and physical protection, during canister transportation, transfer, or storage. The systems are licensed under 10 CFR 72 for storage and some systems are also licensed under 10 CFR 71 for transportation as well.

The transfer cask is used to lift and provide radiation shielding of the canister during spent fuel loading, and storage preparation activities. After the canister is loaded, it is drained, dried, inerted with helium, and welded closed. The canister is then transferred from the transfer cask to the storage overpack and moved out to the ISFSI for storage. The canister transfer operation typically occurs in the rail or truck bay of the Plant.





The concrete storage overpacks are designed to provide passive heat transfer by natural convection from the canister through air vents built into the overpack. The air vents require periodic inspection to ensure they do not become blocked or a temperature monitoring system to ensure canister temperatures do not reach levels that could damage the system materials. Metal storage overpacks provide passive heat transfer by conduction through the overpack body. The overpacks are stored outdoors on a concrete pad. Concrete overpacks are shipped to the site as a steel frame where concrete is poured in-place to provide a radiation shield.

The advantages of using a vertical canister storage system are in large part similar to the horizontal canister systems and include:

- Once welded closed, the canister never needs to be opened, which avoids having to expose or handle individual spent fuel assemblies.
- To ship offsite, the canister needs only to be transferred from the storage cask to the transportation cask without having to unload fuel in the fuel pool.

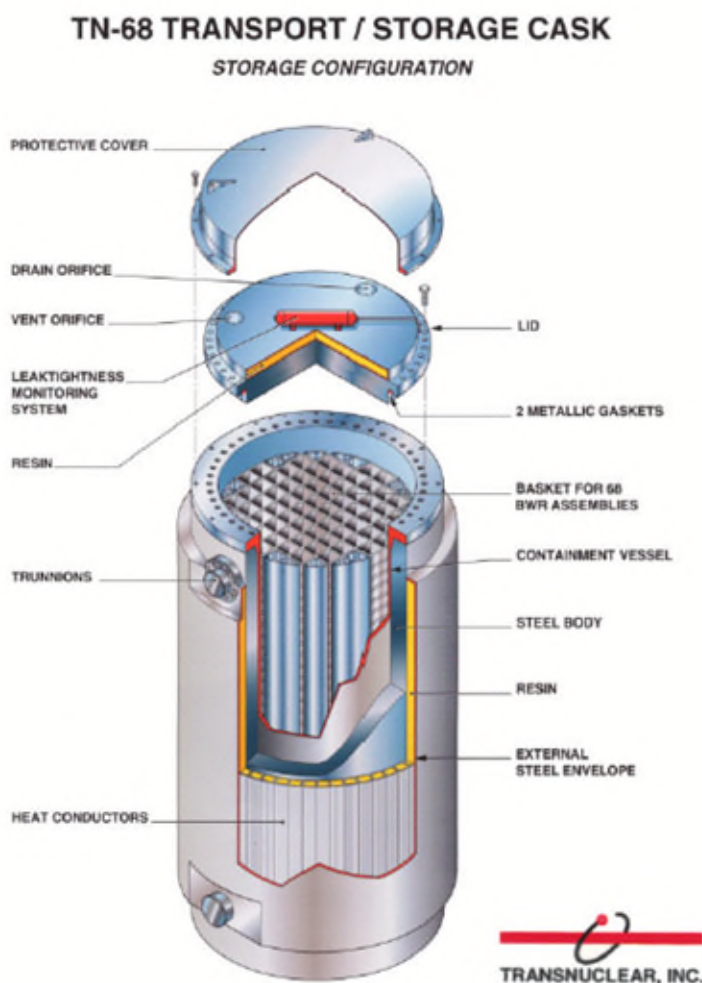
Also, largely similar to horizontal canister systems, the disadvantages of using a vertical canister storage system include:

- The canisters must be transferred between casks, which increases radiation doses to workers.

- The canisters require welding and weld inspection, which increases storage preparation time which in turn increases worker doses.
- A temperature monitoring system and/or vent blockage inspection are required to ensure proper heat rejection from the canister.

9.1.3.3 Non-Canister Storage Systems

Non-canister storage systems typically consist of a single robust metal storage component called a cask that has a lid that is bolted to the cask. The TN-40/40HT casks which are currently in use at Prairie Island Plant are an example of a non-canister storage system. The cask is licensed for storage under 10 CFR 72 and some systems are also licensed for transportation under 10 CFR 71. The cask is the primary confinement boundary. The casks are designed to store spent fuel from both Pressurized Water Reactors (e.g. Prairie Island Plant) PWRs or BWRs (e.g. Monticello Plant). The spent fuel is located in an internal basket or in storage cells dispersed throughout the cask. The casks are passively cooled and may have external cooling fins to aid in heat dissipation.



The thick metal cask body is made up of 2 steel layers in close contact. The inner layer (approximately 1.5" thick) proves confinement of the material and the inert helium atmosphere. The outer layer (approximately 8" thick) provides physical protection and radiation shielding for the spent fuel. Some designs use lead for the shielding layer instead of steel. The casks use a bolted closure consisting of a single lid with dual metallic seals. The annulus between the seals is pressurized and connected to a system that monitors the annulus for loss of pressure. The casks are stored outdoors on a concrete pad. A storage and transport cask is depicted above.

The loading process consists of inserting the cask into the pool, loading the spent fuel, removing the cask from the pool, bolting the lid, drying and inerting the cask with helium, and transporting the cask to the ISFSI.



The advantages of using a non-canister storage system at the Plant include:

- The cask is designed and licensed for both storage and shipping eliminating need to transfer spent fuel between different casks.
- The casks can be loaded and shipped directly offsite without having to repackage the fuel assemblies in the spent fuel pool or transfer a canister.
- No welding is required which reduces loading time and associated worker doses during the loading phase.

The disadvantages of using a non-canister storage system at the Plant include:

- The cost of the TN-40/TN-40HT cask has risen significantly compared to canister-based designs.
- A pressure monitoring system is required to ensure no leakage of O-ring seals in bolted storage cask lid.
- The initial design of the two private CISF facilities do not include the TN-40 in their license.

9.1.3.4 Storage System Technology Selection

As noted above, the canister-based NUHOMS EOS37PTH DFS has been selected by the Company to support operational needs for the Plant through the end of current license, and it is anticipated that the same canister-based system will be used to support license extension. The NUHOMS EOS 37PTH DFS system is an NRC-approved DFS system certified for dual-use as storage and transportation under Title 10 Code of Federal Regulations (10 CFR) § 72 and 71, respectively. This system is covered by a general NRC license as opposed to the site-specific NRC license currently issued for the TN-40/TN-40HT.

Table 9-1
Comparison of Dry Cask Storage Systems^{1,2}

Storage System	Primary Components	Transfer Method	Closure Type	Monitor Req'ts	Storage Method	Transport Method	SFA Capacity
Horizontal Canister Storage System	Metal canister Concrete storage module Transfer cask Shipping cask	Canister Transfer	Welded canister	Temp. and/or Vent Blockage	Canister in Concrete Module	Metal Shipping Cask	Up to 37 PWR
Vertical Canister Storage System	Metal canister Concrete or metal storage overpack Transfer cask Transportation cask	Canister Transfer	Welded canister	Temp. and/or Vent Blockage	Canister in Concrete or Metal Overpack	Canister in Shipping Cask	Up to 37 PWR
Non-Canister Storage System	Storage/Transportation Cask	N/A	Bolted cask w/ O-rings	Helium Pressure	Metal Cask	Metal Cask	40 PWR

NOTES:

1. Based on existing designs that are currently licensed.
2. Xcel recently signed a contract with Orano TN Americas in November 2023 to store future spent fuel assemblies in the NUHOMS EOS37 welded horizontal canisters starting in 2026. The change in technology was authorized by the PUC and filed under Docket No. E-002/CN-08-510 in August 2022.

9.2 OTHER ALTERNATIVES - ALTERNATIVE SITES

Minnesota Statutes require that spent nuclear fuel storage be limited to the plant site at which the fuel is used (Minn. Stat. 116C.83 Subd. 4b). Therefore, in order to extend the operation of the Plant, additional spent nuclear fuel storage must be established on the Prairie Island Plant site. A detailed description of the considerations used in selecting the ISFSI site is contained in the 1991 Certificate of Need application for the original construction of the ISFSI (Docket E002/CN-91-19). As set forth in the 1991 Application, alternative sites were analyzed during that process, and the current site was selected. The reasons for selecting that site have not changed, and because the current ISFSI has sufficient space to accommodate the additional storage required to extend Prairie Island Plant operation for 20 years to 2053/2054 without expanding the ISFSI footprint, there is no reason to consider alternative sites for the proposed ISFSI expansion.

9.3 GENERATION ALTERNATIVES

The Prairie Island Plant will exhaust its current nuclear spent fuel storage capacity in 2033, as previously discussed, at which point Unit 1 will decommission starting in 2033 and Unit 2 in 2034. Absent the additional storage provided by the Project, the Plant would need to close by those dates and the Company would need to replace the substantial capacity and energy the Plant provides to the system. Therefore, in addition to analyzing alternatives for spent fuel storage, the Company also examined alternatives that could replace the capacity and energy provided by the Plant – in essence, a “Generation Alternatives” scenario. The Company also performed a Nuclear Leave Behind Study to analyze the impacts to the transmission system upon the retirements of the nuclear plants. The results of this analysis are discussed in detail in the Nuclear Leave Behind Study Report, Appendix M-1 of the 2024-2040 IRP, Docket No. E002/RP-24-67 (Attached as Appendix I to this application).

Consideration of generation alternatives requires balancing of several factors, as set out in Minn. R. 7855.0120 (B), including:

- (1) the appropriateness of the size, the type, and the timing of the proposed facility compared to those of reasonable alternatives;
- (2) the cost of the proposed facility and the cost of energy to be supplied by the proposed facility compared to the costs of reasonable alternatives and the cost of energy that would be supplied by reasonable alternatives;

- (3) the effects of the proposed facility upon the natural and socioeconomic environments compared to the effects of reasonable alternatives; and
- (4) the expected reliability of the proposed facility compared to the expected reliability of reasonable alternatives.

For the purposes of evaluating generation alternatives, the Company conducted modeling to examine the benefits of extending the life of the Plant in the context of our broader 2024 IRP. We found that extending the life of the Plant is cost effective (presenting an approximate \$500 million cost savings to customers from a present value of societal cost (PVSC) perspective), supports achievement of our carbon reduction goals, and ensures that we maintain a reliable source of baseload generation. In a case where the Plant life is not extended, the capacity provided by the Plant would be most cost-effectively replaced primarily by gas combustion turbines (CTs) whereas its energy value is replaced primarily with additional wind generation. This scenario adds costs on a PVSC basis when compared to extending the life of the Plant. We also conducted a sensitivity to examine a case in which our resource mix includes 100 percent carbon-free generation by 2050. In this case the model chooses to add a mix of battery energy storage, solar, and wind resources in the planning period to achieve the carbon reduction constraint. Constraining carbon emission under this sensitivity results in even larger savings to our customers while further supporting extension of the Plant's life, and by association, the need for additional spent fuel storage.

It is also important to note that modeling cannot capture all the attributes of the various resources analyzed when compared to the Prairie Island Plant. A complete analysis of alternatives also requires consideration of factors such as: the inherent stability and reliability of maintaining a significant baseload resource like the Prairie Island Plant on the Company's system; the impact of alternatives on the Company's ability to reach its goal of carbon-free generation by 2050; the impact on the State's ability to meet its own carbon reduction goals; the diversity of resources available to meet customers' needs; the incremental risk to customers; the land requirements and associated impacts of any new generation resources; and other societal issues, including the economic benefits generated by the provision of highly skilled jobs and tax revenues to local communities. Consideration of these factors further supports the Project and maintaining the capacity and energy provided by the Plant through 2053/2054.

9.3.1 2024 IRP Baseload Case Comparison Overview

The Company filed its 2024-2040 Upper Midwest IRP on February 1, 2024, (Docket No. E002/RP-24-67). In that Plan, we examined the relative benefits of 3 scenarios testing different retirement dates for the nuclear plants currently in our generation portfolio. These Baseload Scenarios are detailed on Table 9-2.

Table 9-2
Baseload Scenarios

Plant Retirement Dates		
Scenario Name and Description	Prairie Island Plant Unit 1/Unit 2	Monticello Plant
Scenario 1 – Reference Case Maintain current planned retirement dates	2033/2034	2040
Scenario 2 – Prairie Island plant Extension Extend Prairie Island Plant 20 years; maintain Monticello Plant retirement date	2053/2054	2040
Scenario 3 – Preferred Plan – Extend All Nuclear Extend Prairie Island Plant 20 years; extend Monticello Plant 10 additional years	2053/2054	2050

All three scenarios assumed some incremental gas-fired combustion turbine (CT) generation capacity would be required to replace lost nuclear generation. The 100 percent carbon free by 2050 sensitivity was the only sensitivity run for all three scenarios that restricted carbon emitting generation sources by 2050. The results of the baseload and sensitivity modeling indicates that the Preferred Plan—extend all nuclear—would be the most prudent path forward to achieving our clean energy goals while also maintaining affordability and reliability. Extending the retirement date of the Monticello Plant will require approval by the MN PUC in the pending 2024 IRP, and if approved, the Company would file another CN application to request Monticello Plant ISFSI expansion in support of subsequent license renewal (SLR). For further discussion moving forward, recognizing that the pending 2024 IRP recommends implementation of the Preferred Plan, the focus here will be mostly on Scenario 2, extension of the Prairie Island Plant retirement date only.

The following discussion provides a comparison of the three Baseload Scenarios listed in Table 9-2. These details are also described in Chapter 5, Economic Modeling Framework, of the 2024 IRP, Docket No. E002/RP-24-67.

The Reference Case (Scenario 1) assumes all generation sources retire at their currently scheduled retirement dates, and it serves as our starting point. The Reference Case includes the following underlying assumptions:

- Approved resources, including: Sherco Solar 1, 2, and 3; Apple River, Louise and Fillmore solar projects; Wheaton Repower.⁷
- Extension of our Refuse Derived Fuel Waste to Energy Generating Plants.
- Short-term PPA extensions include: Mankato Energy Center and Cannon Falls.
- Sherco and King Tie-Line reoptimized.
- CT allowed for selection on Sherco Tie-Line.
- Optimized without market purchases/sales.
- Dispatched with access to MISO market.

Additional resource options are evaluated and optimized in the modeling and added when economic. These resource options include wind, solar, storage, firm dispatchable resources (modeled as combustion turbines), and reciprocating engines, as described in Appendix F of the 2024 IRP, Docket No. E002/RP-24-67.

We then developed two additional scenarios with varying combinations of nuclear retirement dates to optimize a strategy regarding the future of our nuclear fleet. The EnCompass model optimized a portfolio of new resources to address resulting system needs. Internal finance, energy supply, and nuclear subject matter experts worked to develop a robust set of assumptions and potential retirement dates for the nuclear retirements. These input assumptions included: ongoing capital expenditures, O&M expenses, and decommissioning and/or life extension costs. We also incorporated planning level estimates from the Nuclear Leave Behind Study conducted by the Company to determine the transmission system impacts of the nuclear plants' retirement to inform our Preferred Plan.

⁷ Wheaton Repower is subject to approval by the Public Service Commission of Wisconsin.

Scenario 2 extends the retirement dates of Prairie Island Plant Units 1 and 2 from 2033/2034 to 2053/2054. The Monticello Plant retirement date is unchanged. This scenario is designed to test the economics of extending the operational life of the Plant by 20 years. Reference Case baseline assumptions are applied.

For the “extend all nuclear” Preferred Plan scenario (Scenario 3), the Prairie Island Plant Units 1 and 2 retirement dates extend from 2033/2034 to 2053/2054, and the Monticello retirement date extends from 2040 to 2050. This scenario is designed to test the economics of extending the operational life of Prairie Island by 20 years and Monticello by 10 years. Reference Case baseline assumptions are applied.

Table 9-3 shows a summary of the Reference Case expansion plan determined to support system needs through 2035. Table 9-3 reflects the expansion plan resources selected in the model for the Reference case net of energy efficiency, demand response, and distributed solar additions.

Table 9-3: Reference Case Expansion Plan

Nameplate (MW)	2027	2028	2029	2030	2031	2032	2033	2034	2035
Standalone Storage	480	-	120	-	180	180	-	-	-
Hybrid									
Wind	400	1,800	400	-	1,200	800	600	1,600	1,000
Solar	-	-	100	400	200	-	900	-	800
Firm Peaking	748	748	-	748	-	374	374	-	748

The model was allowed to optimize the most cost-effective resources to meet customer needs including resources necessary to replace Prairie Island Plant generation. Firm dispatchable capacity is needed starting in 2027. Additional firm dispatchable resource additions are needed in 2028, 2030, 2032, 2033 and 2035, to meet load serving needs, including additional needs as a result of Prairie Island Plant retiring in 2033 and 2034.

Table 9-4 shows a summary of the Scenario 2 expansion plan, which includes the Prairie Island Plant extension, determined to support system needs through 2035. Table 9-4 reflects the expansion plan resources selected in the model for Scenario 2 net of energy efficiency, demand response, and distributed solar additions.

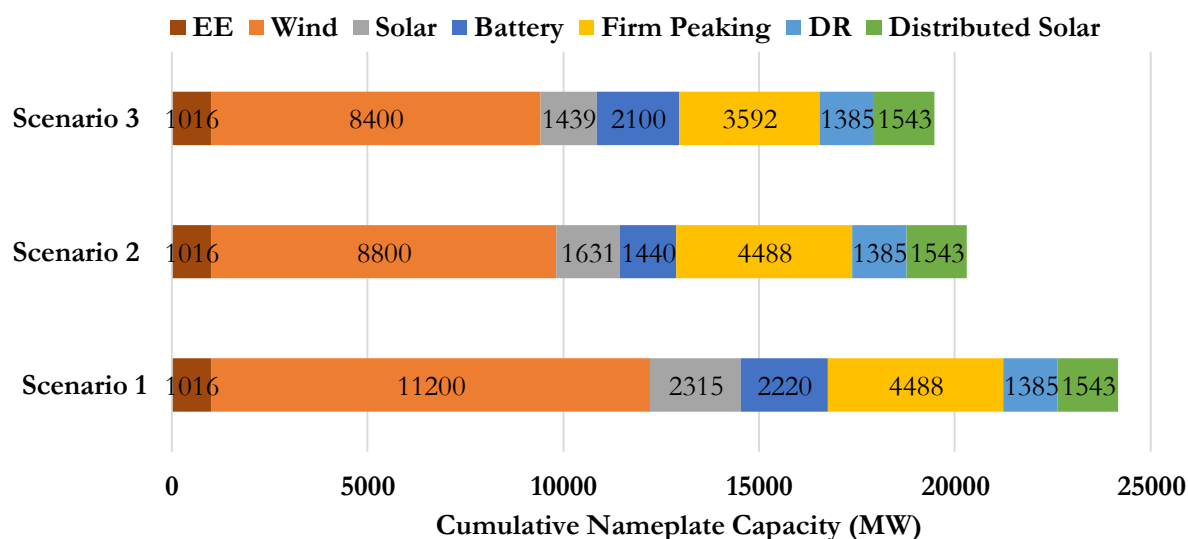
Table 9-4 Scenario 2 Expansion Plan

Nameplate (MW)	2027	2028	2029	2030	2031	2032	2033	2034	2035
Standalone Storage	480	-	120	-	180	360	60	-	60
Wind	400	2,000	800	-	800	600	600	400	200
Solar	-	-	-	500	200	300	700	-	-
Firm Peaking	748	748	-	748	-	374	-	-	-

The model was allowed to optimize the most cost-effective resources to meet customer needs. As in the reference case, firm dispatchable capacity is needed starting in 2027. However, when Prairie Island is extended, additions of firm dispatchable resources are delayed relative to the Reference Case. The firm dispatchable additions in 2033 and 2035 in the Reference Case are not needed in Scenario 2. The extension of the Plant also offsets the need for other resource additions including wind, solar, and storage.

Cumulative expansion plan additions through the 2040 planning period for all three scenarios are shown in Figure 9-1.

Figure 9-1: Expansion Plans by Scenario
(MW, Cumulative Nameplate Capacity Resource Additions
by Resource Type, 2024-2040)



As shown above in Figure 9-1, Scenario 3 results in fewer additions of firm peaking and wind capacity relative to both Scenarios 1 and 2. The extension of the nuclear

units offset additions of other resources needed for capacity and energy. While Scenario 2 includes the same amount of cumulative firm peaking resources through 2040, as discussed above, those additions are delayed by the extension of Prairie Island, and fewer firm peaking resources are needed over the 20-year life extension. The nuclear extensions offset the need for significant alternative resource additions and provide a certain and stable source of energy to our system as we transition our generation fleet away from carbon-based generation.

The Reference Case imposes an incremental cost relative to Scenario 2 on a present value of societal cost (PVSC) basis (both the Reference Case and Scenario 2 impose an incremental cost to the Preferred Plan, however, in this CN, we will focus on Prairie Island Plant extension only). These costs are highlighted in Table 9-5.

**Table 9-5: Scenario PVSC/PVRR Deltas from Reference Case
(\$2024 millions)**

PVSC Production Cost	Delta in NPV (\$m) 2024-2040	NPV (\$m) 2024-2040	Delta in NPV (\$m) 2024-2047	NPV (\$m) 2024-2047	Delta in NPV (\$m) 2024-2050	NPV (\$m) 2024-2050
Scenario 1 PVSC	\$0	\$51,037	\$0	\$63,635	\$0	\$68,788
Scenario 2 PVSC	(\$413)	\$50,624	(\$437)	\$63,198	(\$513)	\$68,275
Scenario 3 PVSC	(\$785)	\$50,252	(\$941)	\$62,695	(\$1,025)	\$67,762
PVRR Production Cost	Delta in NPV (\$m) 2024-2040	NPV (\$m) 2024-2040	Delta in NPV (\$m) 2024-2047	NPV (\$m) 2024-2047	Delta in NPV (\$m) 2024-2050	NPV (\$m) 2024-2050
Scenario 1 PVRR	\$0	\$34,678	\$0	\$44,948	\$0	\$48,927
Scenario 2 PVRR	(\$97)	\$34,581	\$291	\$45,239	\$391	\$49,317
Scenario 3 PVRR	(\$464)	\$34,215	\$46	\$44,994	\$239	\$49,166

Based on the EnCompass resource planning model, the additional costs to replace the capacity and energy of the Plant in 2033/2034 relative to extending the Plant's retirement date to 2053/2054 is approximately \$500 million on a PVSC basis from 2024 to 2050. As shown above, when the cost of emissions is not considered in the Present Value Revenue Requirement (PVRR) sensitivity, the results show that the replacement capacity added at the end of the expansion plan to replace Prairie Island Plant in Scenario 2 significantly impacts overall cost. Given current technologies, the

model makes significant additions of firm dispatchable resources in the late 2040s in anticipation of the retirement of the Plant. Under the PVRR assumptions, no cost is included on the carbon emissions from these resource additions. We expect technological advancements will provide resource options that are not currently available when the Plant nears the end of its extended operating license. Therefore, the significant firm dispatchable additions in the late 2040s may not provide a reliable indication of the costs that far out in time. As a result, we provide cost comparisons over three different time horizons. Through 2040, when resource and cost assumptions are most known, the extension of our nuclear fleet provides significant economic benefits even when the benefits of avoided emission are not included.

An additional component to the modeling results comes from the Nuclear Leave Behind Study. The study determines transmission system impacts of the nuclear plants' retirements and shows that the retirement of the Prairie Island Plant (and the Monticello Plant) removes inertia and voltage support that are needed to provide transmission system stability. In order to maintain system stability under a system fault with the retirement of the nuclear plants, additional generation must be turned on or load shed. Based on the dynamic analysis results performed in the study, significant replacement generation is needed, therefore resulting in significant costs. Additional significant costs would be incurred due to transmission line upgrades and voltage support needed to mitigate voltage violations. These details can be further reviewed in the complete "Nuclear Leave Behind Study Report." The costs are considered trade secret and hence will not be provided here. Reinforcement costs are included as capital expenditure in the modeling based on the timing of the Plant's retirement.

We conducted numerous sensitivities on the baseload scenarios considered in the 2024 IRP as discussed in Chapter 5 of the IRP, Economic Modeling Framework. Scenarios 2 and 3 resulted in net benefits in nearly all sensitivities as shown in Appendix G of the 2024 IRP, Docket No. E002/RP-24-67. One of the sensitivities performed on the three baseload scenarios that further emphasizes the need to continue to operate our nuclear fleet analyzed the impacts under a carbon constraint. The Company has set a goal to generate 100 percent carbon-free energy by 2050 (100x50). Therefore, as part of the 2024 IRP, a 100 percent carbon free by 2050 sensitivity analysis was performed and is discussed in Chapter 5 of the IRP, Economic Modeling Framework. This sensitivity highlights the importance of extending the operating license of the Plant to continue to provide a carbon-free baseload generation source on the system. Advances in technology will be critical to achieving the 100x50 goal reliably and cost-effectively. However, extension of the Prairie Island

Plant provides a critical, and certain, source of carbon-free generation. To further assess the benefits of the Prairie Island Plant (and Monticello Plant) extensions, the analysis reoptimizes our expansion plan to achieve a 100 percent carbon-free generation fleet by 2050. The results of the analysis are shown on Table 9-6.

Table 9-6
NPV Savings under 100 Percent Carbon-Free by 2050 Constraint
(\$2024 millions)

PVSC Production Cost	Delta in NPV (\$m) 2024-2040	NPV (\$m) 2024-2040	Delta in NPV (\$m) 2024-2047	NPV (\$m) 2024-2047	Delta in NPV (\$m) 2024-2050	NPV (\$m) 2024-2050
Scenario 1 – Carbon Free	\$0	\$50,703	\$0	\$62,974	\$0	\$70,930
Scenario 2 – Carbon Free	(\$298)	\$50,406	(\$385)	\$62,589	(\$1,003)	\$69,927
Scenario 3 – Carbon Free	(\$662)	\$50,041	(\$931)	\$62,042	(\$1,850)	\$69,080
PVRR Production Cost	Delta (\$m)	NPV (\$m) 2024-2040	Delta (\$m)	NPV (\$m) 2024-2047	Delta in NPV (\$m) 2024-2050	NPV (\$m) 2024-2050
Scenario 1 – Carbon Free	\$0	\$34,819	\$0	\$46,314	\$0	\$54,273
Scenario 2 – Carbon Free	(\$200)	\$34,619	(\$323)	\$45,991	(\$947)	\$53,326
Scenario 3 – Carbon Free	(\$612)	\$34,207	(\$941)	\$45,373	(\$1,865)	\$52,407

As shown in the Table 9-6, Scenario 2 results in dramatic savings of approximately \$1 billion on both a PVSC and PVRR basis. Compared to existing technologies, the extension of our nuclear fleet provides an overwhelmingly cost-effective source of carbon-free energy.

The 2024 IRP modeling shows that extending the Plant’s Unit 1 and 2 retirement dates to 2053/2054 is the solution that better balances cost, environmental, and risk/reliability objectives.

9.3.2 Natural and Socioeconomic Environment

Granting the proposed CN will have a positive impact on the natural and socioeconomic environment. As discussed in Chapter 5, the Plant's operations have a positive socioeconomic impact on its local community and the State. We employ approximately 1,100 full time employees (including security) who work in and around our host communities between the Prairie Island and Monticello Plants and the nuclear corporate office. For its part, the Prairie Island Plant specifically employs approximately 550 individuals. The 2017 NEI Report discussed in Chapter 5 also detailed the extensive benefits these plants provide to the State, including \$1 billion in economic activity each year. Annually, our nuclear fleet pays approximately \$42 million in state and local taxes, including \$22 million directly from the Prairie Island Plant. In addition to these direct economic impacts, our employees generally contribute to their communities through their charities and volunteerism. Our nuclear plant employees are no different, and we are confident that they play a large role in giving back to our communities, whether it be through the charities discussed in Chapter 5 or through other forms of civic engagement.

The Company has also worked extensively with our host communities to foster a relationship of transparency and trust. Specifically, the Company has engaged with the Prairie Island Indian Community (PIIC) since the last IRP was approved. The agreement we reached with PIIC on annual payments going forward represents a major achievement in our partnership with PIIC.⁸ This agreement results in the PIIC receiving annual payments comparable to those received by other communities hosting nuclear power plants, which receive property taxes paid by the Company. The Company and PIIC maintain a partnership through regular meetings with the Tribal Council and community to discuss key issues on legislation, strategic vision, and plant performance.

In addition to our discussions with the PIIC, the Company has long-standing partnerships with the City of Red Wing and Goodhue County. Our employees live and work in these areas, and we support the communities by providing vital tax base; supporting local nonprofits through grants, volunteering, and board service; and supporting economic development. Company leadership meets regularly with local city officials and at least semi-annually with county officials. Red Wing community breakfasts are held annually, typically at a location within the PIIC, and include school administrators, local elected officials, the Sheriff, PIIC tribal council members and

⁸ Laws of Minnesota 2023, Chapter 60-H.F.No. 2310, Section 15.

other community members, and other members of the Red Wing community. Throughout the year, we meet with various community groups and organizations to share open dialogue regarding our objectives as well as the objectives and interests of our local communities. These types of events provide an opportunity for the Company to be transparent with our strategic vision—including the future of the Plant—and hear directly from community leaders and other stakeholders throughout the region.

We are also working with our contractors to ensure that the benefits of the work they perform at our facilities benefits our host communities to the extent possible. As discussed above, in November 2023, the Company signed a contract with Orano TN Americas to manufacture NUHOMS EOS 37PTH dry fuel storage systems for the Plant through EOCL. As part of the contract, Orano has committed to provide economic benefit to our surrounding communities by hiring local concrete ready-mix plants, labor, testing services, rebar manufacturing facilities, equipment rental companies, and other construction tool and consumable companies to support project activities, thereby improving societal and socio-economic impacts in the surrounding communities.

In addition to the economic benefits discussed above, the Project and continued operation of the Plant will continue to allow the Company to minimize its impact on the environment. As discussed throughout this application, the Project enables the Company to continue providing the valuable carbon-free energy generated by the Plant to our customers, thereby enhancing environmental quality. This is consistent with the Company's environmental goals and State policy directives. In 2023, the Minnesota Legislature passed legislation requiring utilities, including Xcel Energy, to generate or procure carbon-free energy equivalent to 100 percent of its Minnesota retail sales by 2040. As described in the 2024 IRP, the law, Minn. Stat. § 216B.1691, also requires Xcel Energy to achieve interim carbon-free standards of 80 percent by 2030 and 90 percent by 2035, and a renewable energy standard of 55 percent by 2035. The Company is positioned to achieve compliance with the new legislation under our 2024 Preferred Plan. Extending the operating life of the Prairie Island Plant is crucial to meeting these regulations.

In addition, the Project itself will have a minimal impact on the surrounding area and will not pose a disruption to our neighbors or the community. As discussed in Chapter 14, during the 9-12 month construction period, the Project will employ an estimated total of 40 construction workers, with an average of 8 workers at a given

time and no more than 12 at once. No full-time staff will be required at the expanded ISFSI facility during operation beyond current plant personnel. This means that the Project will have a negligible impact on other factors required to be considered, including traffic, utilities and public services or water usage levels.

Environmental impacts are further discussed in Chapters 11 through 14, but it is important to note that environmental impacts from the Project will be minimal.⁹

9.3.3 Reliability

Extending the Prairie Island Plant is a foundational aspect of the Company's overall plan to continue providing reliable service while transitioning to a carbon-free energy mix in a way that is affordable for our customers. Our nuclear fleet provides around-the-clock grid stability, voltage support, and overall reliability. Nuclear plants have up to 24 months of fuel on site and thus are not subject to fuel supply disruptions. They also are not subject to pipeline limitations during the winter season, and they have a very strong operating history during cold and hot weather events. Additionally, our nuclear units provide vital stability for the transmission system. The Nuclear Leave Behind Study that was previously discussed identified transmission system stability risk and identified the need for significant transmission system upgrades and generation replacement.

In addition to generating carbon-free electricity, the Plant is one of our system's most reliable generation resources. The Plant operates 24 hours a day, seven days a week for extended periods of time. In fact, the Plant operated a record-setting 670 days on Unit 1 from 2018 to 2020, and a record-setting run of 704 days on Unit 2 from 2019 to 2021. The Plant has operated at an average capacity factor of 95 percent between 2020 and 2022, including a record-setting 99.98 percent in 2022 on Unit 2, a non-refueling year. Combined with the Monticello Plant, the Prairie Island Plant represents nearly 30 percent of the total electric energy (and 40 percent of the carbon-free energy) our customers required in 2022, making it a critical component of our overall generation fleet. Additionally, our nuclear fleet adds important diversity to our generation portfolio and provides a hedge against not only gas price volatility but also the uncertainty of technological development, future renewable pricing, and the future of solar capacity values. No other carbon-free resource in our generation fleet can replicate this kind of reliable performance.

⁹ The 2024 IRP evaluated life cycle emissions impacts between generation sources in Appendix Y: Life Cycle Emissions Impacts of Docket No. E002/RP-24-67.

The reliability of nuclear generation, and its continued inclusion in our diverse resource mix, is especially important during extreme weather. For example, our three nuclear units performed extremely well throughout both the 2019 polar vortex and the February 2021 cold spell. Additionally in 2022, our nuclear fleet operated at 96 percent capacity factor. This was critical in December 2022 when a historic winter storm crossed the Dakotas, Minnesota and Wisconsin, creating extreme winter conditions including blizzards and record cold temperatures that impacted not just our region, but the majority of the United States and parts of Canada. Nuclear plants are built to withstand extreme weather and have demonstrated their ability to continue operations during hurricanes and severe weather as just described. With severe weather events on the rise and reasonably expected to occur again, maintaining a diverse generation mix that ensures we can meet our obligation to provide reliable electric service in all conditions, including extended durations of extreme weather, is critical. Nuclear provides a level of stability and predictability that other generation resources cannot match.

The continued operation of the Plant will also help us to maintain a healthy ratio of firm capacity to peak demand during the 2033/2034 through 2053/2054 time period, whereas scenarios that do not include an extension of the Plant either rely on incremental gas resources to provide firm capacity or rely more heavily on variable or use-limited resources. In either case, however, we would be decreasing the diversity of generation on our system and, ultimately, making it notably less resilient.

While renewable resources are an essential component of the Company's energy transition plan, the inherent variability of renewable resources creates a need for sufficient stable energy resources, such as the Plant, to assure our ability to meet our customers' needs. To that end, as part of moving towards a carbon-free generation fleet by 2050, we have improved our operational flexibility so that we can ramp down our nuclear plants during periods of high transmission congestion and low prices, such as times when abundant renewable resources are available on our system. With flexible operations capabilities available at all three nuclear units, we can safely and efficiently flexibly dispatch as much as approximately 280 MW—or over 15 percent—of our nuclear capacity in response to the market. In fact, the Company flexibly operated our nuclear plants 14 times in 2022 and 16 times in 2023. This helps with the Company's efforts to integrate its continuing renewable additions.

In summary, as we make future resource planning decisions, it is important to consider overall system, fuel, and resource diversity and the important benefits

offered by nuclear power. Currently, nuclear power is the source of most of the country's emissions-free energy and has long been a reliable, efficient, and job-creating energy source. Because of their comprehensive safety procedures and stringent federal regulations, nuclear plants are among the most reliable energy infrastructures. The Company needs to carefully manage the transformation of its generation portfolio in order to preserve the reliability and stability of the system while moving towards a carbon-free generation portfolio, and maintaining the Plant as a resource on our system is a key piece of that plan.

9.3.4 Conclusion

For the reasons set forth above, we believe that the expansion of spent fuel storage capacity at the ISFSI is needed to support life extension of the Plant and is the least cost and best alternative for our customers, the state, the environment, and the communities we serve.

CHAPTER 10: HISTORICAL AND FORECAST DATA
(MINN. R. 7855.0620)

Each applicant for a nuclear waste storage or disposal facility shall provide five years of historical data, as well as a forecast of demand through the forecast years. The following information shall be included:

- A. for each material that would be stored in the proposed facility, the amount (in cubic meters) produced nationally and within Minnesota during each of the last five calendar years preceding the year of application;
- B. for each of the last five calendar years preceding the year of application, the year-end capacity (in cubic meters) within Minnesota and within the United States to store the materials listed in response to item A;
- C. an estimate of the amount (in cubic meters) of each material listed in response to item A expected to be produced nationally and within Minnesota during the first six forecast years, the 11th forecast year (the tenth year after the year of application), and the 16th forecast year;
- D. a list of known facilities to be added in the United States during the forecast years, including locations, design capacities (in cubic meters), and in-service dates, for storing the same types of materials that would be stored in the proposed facility;
- E. the expected years during which the material stored in the proposed facility would reach ten percent, 25 percent, 50 percent, and 100 percent of the capacity of the facility;
- F. a discussion of the methodology, statistical techniques, and data bases used in providing the forecast data required by items C and E; and
- G. any major assumptions made in supplying the information required by items A to E, and a discussion of the sensitivity of the information to changes in the assumptions.

The following information responds to Minn. R. 7855.0620, which requires five years of historical data and forecast of demand on a nuclear spent-fuel storage or disposal facility. While the rule appears to contemplate the development of spent-fuel storage facilities that would accept spent fuel from nuclear facilities anywhere in the United States, Minnesota law restricts on-site storage at Minnesota's nuclear generating plants to spent fuel generated at that facility. Minn. Stat. § 116C.83, subd. 4(b) ("the authorization for storage capacity pursuant to this section is limited to the

storage of spent nuclear fuel generated by a Minnesota nuclear generation facility and stored on the site of that facility.”) Consequently, the information provided to address section 7855.0620 is limited to information relevant to the spent fuel generated at the Prairie Island Plant.

10.1 7855.0620 (A)

For each material that would be stored in the proposed facility, the amount (in cubic meters) produced nationally and within Minnesota during each of the last five calendar years preceding the year of application.

As noted above, no material other than that generated at the Prairie Island Plant can be stored in the proposed facility. Table 1 contains the number of spent fuel assemblies that were discharged at the Plant from 2018 to 2023 and the equivalent metric tons of uranium and volume of those assemblies. Data for the Plant assumes that all assemblies contain 0.395 metric tons of uranium (MTU). A Prairie Island Plant spent fuel assembly volume is 0.158 cubic meters (160 inches long with a 7.76-inch square cross section).

Table 1
Response To 7855.0620 – Item A

Historical Annual Spent Fuel Discharges at Prairie Island	
Year	Number Of Assemblies
2019	57
2020	60
2021	56
2022	56
2023	56
Year	Equivalent Metric Tons Of Uranium
2019	22.5
2020	23.7
2021	22.1
2022	22.1
2023	22.1
	Note: Assumes approximately 0.395 MTU per assembly at Prairie Island
Year	Equivalent Cubic Meters Of Spent Fuel
2019	9.00
2020	9.48
2021	8.84
2022	8.84
2023	8.84
	Notes: Based on a Prairie Island fuel assembly 160 inches long, with a 7.76-inch square cross section = 0.158 cu meter

10.2 7855.0620 (B)

For each of the last five calendar years preceding the year of application, the year-end capacity (in cubic meters) within Minnesota and within the United States to store the materials listed in response to item A. Prairie Island Plant's licensed spent fuel storage capacity is 1,386 spent fuel assemblies.

This data is contained in the following Table 2. Conversion factors for calculating cubic meters of spent fuel are the same as those used in responding to subpart A of this Rule. The values reflect the useable storage space in the spent fuel pool. The values reflect two considerations:

1. 46 spaces in the spent fuel pool (plus installation and use of temporary fuel racks in the cask lay down area of the pool) are reserved for a full core offload at the end of life and are therefore not considered available for spent fuel storage.
2. The increase in capacity reflected in 2020 and 2022 resulted from loading 120 spent fuel assemblies in 3 dry casks each of those years. Additionally, 60 fuel assemblies were discharged from the reactor in 2020 and 56 in 2022, contributing to the total inventory as shown in the spent fuel pool for those years.

Table 2
Response to 7855.0620 – Item B

Historical Year-End Remaining Storage Capacity in the Prairie Island Spent Fuel Pool	
Year	Number of Assemblies Stored/ Remaining Storage Capacity
2019	1,025 / 361
2020	965 / 421
2021	1,021 / 365
2022	957 / 429
2023	1,013 / 373
Year	Equivalent Metric Tons of Uranium
2019	404.8
2020	381.1
2021	403.2
2022	378.0
2023	400.1
Year	Cubic Meters
2019	161.95
2020	152.47
2021	161.31
2022	151.20
2023	160.05

10.3 MINN. R. 7855.0620 (C)

An estimate of the amount (in cubic meters) of each material listed in response to item A expected to be produced nationally and within Minnesota during the first six forecast years, the 11th forecast year (the tenth year after the year of application), and the 16th forecast year.

As noted above, no material other than that generated at the Prairie Island Plant can be stored in the proposed facility. Therefore, Table 3 contains only the estimated number of spent fuel assemblies to be discharged at the Plant from 2024 to 2029 and in the years 2034 and 2039 and the equivalent metric tons of uranium and volume of those assemblies. This forecast assumes extension of the Plant's operating license to 2053/2054.

Table 3
Response to 7855.0620 – Item C

Projected Annual Spent Fuel Discharges at Prairie Island			
Year	Number of Assemblies	MTU	Volume
2024	48	19.0	7.58
2025	56	22.1	8.84
2026	57	22.5	9.00
2027	60	23.7	9.48
2028	60	22.1	9.48
2029	60	23.7	9.48
2034	60	23.7	9.48
2039	60	23.7	9.48

10.4 7855.0620 (D)

A list of known facilities to be added in the United States during the forecast years, including locations, design capacities (in cubic meters), and in-service dates, for storing the same types of materials that would be stored in the proposed facility.

There are no known spent fuel storage facilities to be added in the United States during the forecast years; however, the data provided in Table 4 lists projects that have been or are being evaluated and may accept spent fuel generated at Prairie Island Nuclear Plant at some point during extended operation of the plant (i.e., plus 20 years). This includes the DOE repository facility at Yucca Mountain as well as three

private initiatives to provide centralized interim storage. On-site facilities at existing reactors are not included as they are not licensed to store fuel from the Plant. The Yucca Mountain permanent repository is not viable politically at this time. With respect to interim facilities, although the NRC has approved licenses for private initiatives in New Mexico (Holtec HI-STORE facility) and Texas (Integrated Storage Partners (ISP) facility), these facilities are currently subject to political and legal challenges, and an eventual date for commencement of operations is not yet known.

While the Private Fuel Storage Facility proposed to be located at Skull Valley, Utah, is included in the table below for completeness, there are currently no efforts to construct or operate this facility. The two central interim storage facility applications – the ISP and HI-STORE facilities -- are the only projects with potential for future construction at this time. Additional analysis of alternative off-site storage alternatives is provided in Chapters 4.2 and 9.1.

Table 4
Response to 7855.0620 – Item D

Planned Centralized Private or Department of Energy Facilities for Spent Fuel Storage
Geologic Repository for Spent Nuclear Fuel and High-Level Waste Operator: Department of Energy Location: Yucca Mountain, Nevada Capacity: 70,000 MTU prior to operation of a second repository with present legislation. In-service date: Unknown at this time.
Private Fuel Storage, LLC Licensee: Private Fuel Storage, LLC Location: Skull Valley, Utah Capacity: 40,000 MTU In-service date: Project not being actively pursued at this time.
Orano USA and Waste Control Specialists (WCS) Consolidated Interim Storage Facility (CISF) ¹ License Applicant: Interim Storage Partners, LLC Location: Andrews County, Texas Capacity: 5,000 MTU (Phase 1) In-service date: NRC license issued 2021; project on hold in legal system
HI-STORE CISF License Applicant: Holtec International Location: Lea County, New Mexico Capacity: 8,680 MTU (Phase 1) In-service date: NRC license issued 2023; project on hold in legal system

¹ Orano USA and WCS formed a joint venture, named Interim Storage Partners, to license a CISF at the existing WCS disposal site in Andrews County, Texas.

10.5 7855.0620 (E)

The expected years during which the material stored in the proposed facility would reach ten percent, 25 percent, 50 percent, and 100 percent of the capacity of the facility.

The additional storage would be loaded in several campaigns, currently projected to occur in 2030,² 2035, 2040, and 2045. Each of these loading campaigns would install approximately 25 percent of the additional storage.

10.6 7855.0620 (F)

A discussion of the methodology, statistical techniques, and data bases used in providing the forecast data required by items C and E.

The forecasts required by items C and E were obtained from the nuclear fuel management plans for the Prairie Island Plant, specifically the timing and size of each planned refueling. Spent fuel discharges are a direct function of the number of new assemblies inserted into the core during each refueling outage. This number can vary slightly based on factors such as desired cycle length, outage length and timing, fuel design changes, and replacement power costs.

10.7 7855.0620 (G)

Any major assumptions made in supplying the information required by Items A to E, and a discussion of the sensitivity of the information to changes in the assumptions.

The major assumption is the expected number of new assemblies inserted into the core during each refueling. As noted in the response to 7855.0620 (F), slight variations in the number of discharged assemblies is possible due to operational changes. The total variation over 16 years of operation, however, would be expected to be small, in the 5-10 percent range.

Another assumption is that the Plant will continue to operate beyond the existing license expiration date of 2033/2034. If not, then decommissioning would commence

² DFS loading in support of a license extension is planned to occur in 2030 or 2032 to maintain dual-unit offload capability in the spent fuel pool. Waiting until 2032 to move spent fuel from the spent fuel pool into DFS systems adds additional risk to maintaining that margin. For example, if unforeseen circumstances prevented DFS system loading in 2032, we may violate our spent fuel pool storage capacity requirements for dual-unit offload. DFS system loading in 2030 minimizes this risk.

and all fuel in the reactor as well as the fuel remaining in the spent fuel pool would be transferred to dry storage as part of the decommissioning process.

The responses to sections A to E also assume sufficient reserve capacity is retained in the Plant's spent fuel pool for a full core discharge of fuel from both reactors.

Finally, due to the uncertainties associated with the legal challenges and time to construct and begin accepting fuel at the two licensed private centralized interim storage facilities, it is imperative that sufficient dry fuel storage capacity be put in place to ensure that the Plant is available to serve Minnesota ratepayers until 2053/2054.

CHAPTER 11: ENVIRONMENTAL INFORMATION AND ALTERNATIVE SITES

7855.0630 ENVIRONMENTAL INFORMATION REQUIRED.

Each applicant shall provide environmental data for the proposed facility and for each alternative facility described in response to part 7855.0610. The information in parts 7855.0640 to 7855.0670 relating to construction and operation of each of these facilities shall be provided to the extent that such information is reasonably available to the applicant and applicable to the particular alternative.

7855.0640 ALTERNATIVE SITES; DESCRIPTION.

The applicant shall provide a description of each alternative site, including:

- A. the nature of the terrain at the site;
- B. the general soil types at the site;
- C. the types and depths of bedrock underlying the site;
- D. the depth to groundwater at the site;
- E. the types of vegetation (forest, brush, marsh, pasture, and cropland) on the site, and the approximate percentage of each;
- F. the predominant types of land use (such as residential, forest, agricultural, commercial, and industrial) within five miles of the site, and the approximate percentage of each;
- G. lakes, streams, wetlands, or drainage ditches within five miles of the site, and any other lakes, streams, wetlands, drainage ditches, wells, or storm drains into which liquid contaminants from the site could flow;
- H. trunk highways, airports, and air traffic corridors within five miles of the site;
- I. national natural landmarks, national wilderness areas, national wildlife refuges, national wild and scenic rivers, national parks, national forests, national trails, and national waterfowl production areas within five miles of the site, as mapped on the inventory of significant resources by the State Planning Agency;
- J. state critical areas, state wildlife management areas, state scientific and natural areas, state wild, scenic, and recreational rivers, state parks, state scenic wayside parks, state recreational areas, state forests, state trails, state canoe and boating rivers, state zoo, designated trout streams, and designated trout lakes within

five miles of the site, as mapped on the inventory of significant resources by the State Planning Agency;

- K. national historic sites and landmarks, national monuments, national register historic districts, registered state historic or archaeological sites, state historical districts, sites listed on the National Register of Historic Places, and any other cultural resources within five miles of the site, as indicated by the Minnesota Historical Society;
- L. areas within five miles of the site designated by regional or local authorities as having recreational, cultural, historical, or scientific significance, as indicated by local units of government; and
- M. the estimated total population within 50 miles of the site, and a map showing the distribution of the population within 50 miles of the site.

11.0 ALTERNATIVE SITES

Minnesota law requires that spent nuclear fuel storage be limited to the site at which the fuel is used, which in this case is at the Prairie Island Nuclear Generating Plant (Prairie Island Plant or the Plant).¹ Therefore, to extend the operation of the Plant, additional spent fuel storage must be established on the Plant's property. Because there is sufficient room within the footprint of the existing Independent Spent Fuel Storage Installation (ISFSI) to provide the needed storage, and because any alternative site outside of the footprint of the existing ISFSI would result in either the same or greater environmental impacts than placing additional dry fuel storage (DFS) systems at the existing site (in that new disturbances would be required which use of the current site avoids), Northern States Power-Minnesota d/b/a Xcel Energy (Xcel Energy) has not provided a separate evaluation of alternative sites in this application.

11.1 TOPOGRAPHY AND TERRAIN

The Prairie Island Plant ISFSI is situated at 694.5 feet above mean sea level (amsl). The normal water level of the Mississippi River is 674.5 feet amsl.² The Prairie Island Plant site occupies a low island terrace formed on the Minnesota side of the Mississippi River. Other than slight sloping of the ISFSI pad (2 percent grade) to direct stormwater runoff towards drainage structures which outlet on the southwest and

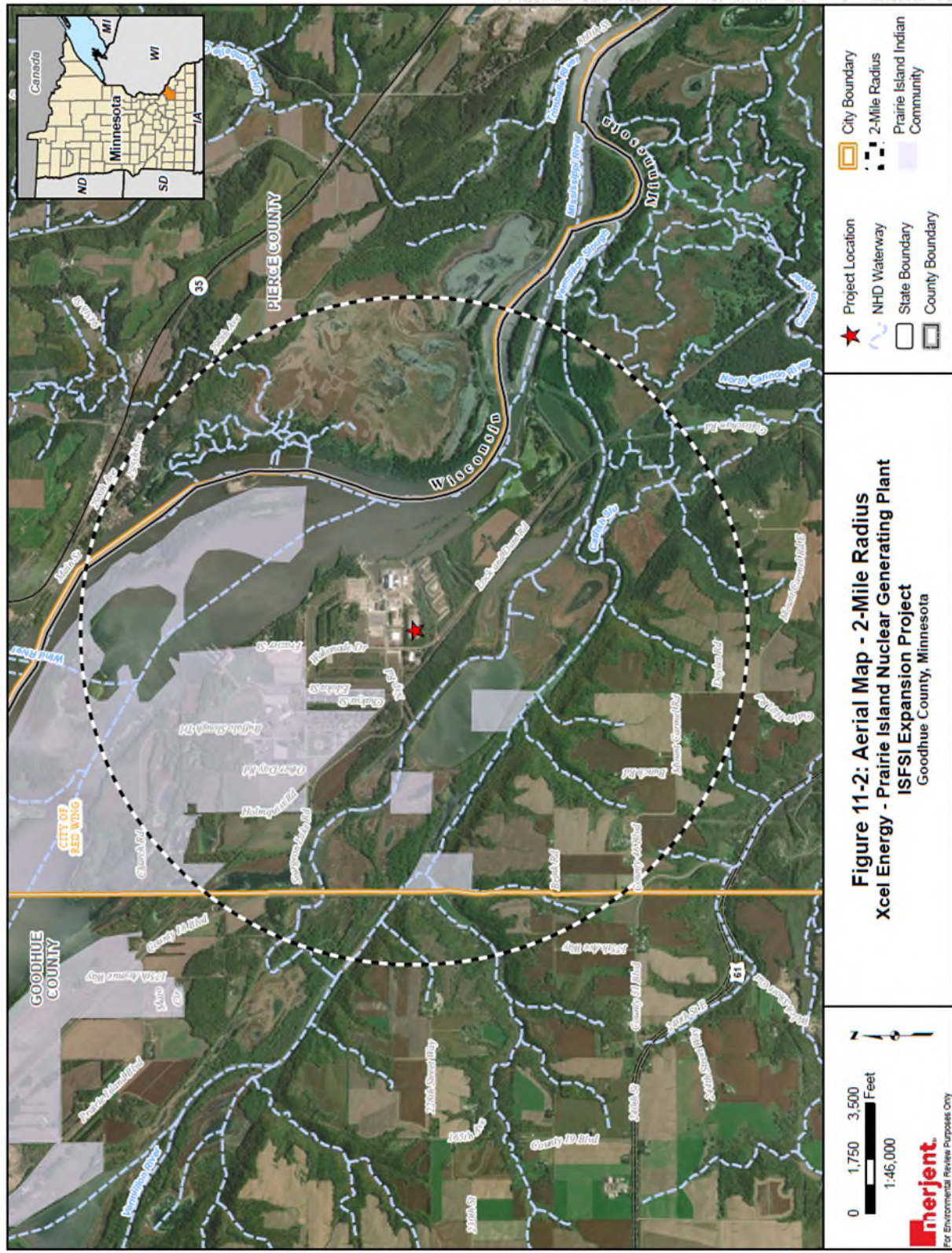
¹ Minn. Stat. § 116C.83, subd. 4.

² <https://www.nrc.gov/docs/ML2027/ML20275A342.pdf>.

southeast sides of the berm, the immediate Project area is flat with no steep slopes present.³ Figures 11-1 and 11-2 below depict aerial views of the area within one and two miles of Project, respectively.

³ Minnesota Department of Commerce. Final Environmental Impact Statement – Request for Additional Dry Cask Storage. PUC Docket No E002/CN-08-510. July 31, 2009.





The Project is located within the existing Prairie Island Plant property. The Project is not located within a shoreland overlay district or within an active agricultural area. Agricultural conservation overlays are present in the area directly adjacent to the Prairie Island Plant property boundary on the east and along the south side of the Canadian-Pacific (CP) Railroad. The ISFSI is located within the Federal Emergency Management Agency (FEMA)-designated 500-year floodplain, and FEMA 100-year floodplains are directly adjacent to the Prairie Island Plant property on the east (i.e., the Mississippi River, which is a designated FEMA floodway), south, and on the opposite side of the CP Railroad. Figure 11-3 depicts floodplain locations within five miles of the Project.

When constructing up to two new storage pads, Xcel Energy would first excavate up to 6 feet of surface material within the existing ISFSI where the new pad(s) would be placed. Xcel Energy would also remove up to 6 feet of surface material in the areas immediately adjacent to the storage pads where the new concrete approach aprons would be placed. Excavation would be limited to removal of sub-grade materials that were previously disturbed and/or placed as part of original ISFSI construction. The Project will not modify the topography within the ISFSI or the terrain of the site. Upon completion, those areas not covered by concrete will be regraded to preconstruction contours and recovered with Class 5 gravel. No site stabilization measures will be required during regular ISFSI operations and no changes to topography or terrain will occur because of the Project.



11.2 SOILS

The soils at the Prairie Island Plant, and around the ISFSI, are alluvial soils (loamy sands) which are supported by sedimentary rock of the St. Lawrence and Franconian formation.⁴ The soils at the Prairie Island Plant are all classified as Sparta Loamy Sand, with 0-6 percent slopes. These are classified as deep, excessively drained soils formed in sandy outwashes on stream terraces in areas such as river valleys. Figure 11-4 below identifies soils in the general area. Soils were mapped using the Natural Resources Conservation Service (NRCS) Web Soil Survey mapping application.⁵ Xcel Energy has performed additional studies of the ISFSI area which provide further information on soils at the ISFSI site:

- In 2014, Xcel Energy completed geotechnical exploration to characterize subsurface soil and groundwater conditions in the area of the proposed third pad. The soil conditions from three borings within the ISFSI fence line revealed 1 foot of aggregate base and about 1 foot of fill. Fill consisted of silty sand or poorly graded sand overlying native granular soils. The presence of fill indicates previous disturbance, likely from initial construction of the ISFSI. The native granular soils consisted of silty sand and poorly graded sand with silt and poorly graded sand corresponding to the American Society for Testing and Materials Classifications SM, SP-SM and SP, respectively.⁶

⁴ Ref. at 3.

⁵ <https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>.

⁶ Haugo GeoTechnical Services. Preliminary Geotechnical Exploration Report Proposed Storage Facility Prairie Island Nuclear Generating Plant Welch, Minnesota. Minneapolis, Minnesota. November 2014.



- In 2018, Xcel Energy performed a series of four Seismic Cone Penetration Test (CPT) soundings in July 2018 within the ISFSI and in the area of the third pad, prior to construction of the third pad. The fieldwork included 425 feet of CPT sounding, with anticipated termination depths of 100 to 125 feet below the ground surface.⁷ Soil types were characterized as loose sand to very dense sand. At locations CPT-1, CPT-3, and CPT-4, the probe hit refusal due to dense soil layers at depths varying from 45 feet to 56 feet below grade. CPT-2 encountered a shallower refusal at 14.8 feet below grade due to an unknown underground obstruction. The area surrounding the CPT-2 boring location exhibited reflections that suggest both large and small subsurface features from this area that would be consistent with buried debris, rubble, or concrete, including a feature approximately the width of a front-end loader and a ready-mix dump or wash-out pit. Additionally, reflections surrounding this feature suggest smaller buried anomalies or other buried debris. These finds are consistent with the PI ISFSI's history as the site of the former concrete batch plant for construction of the Prairie Island Plant.^{8,9}

Xcel Energy will perform soil analyses within the ISFSI, prior to construction, to characterize the subsurface materials. No soil corrections are anticipated to be needed during construction or operation of the proposed Project. Excavation would be limited to removing no more than 6 feet of surface material. Excavation would be limited to removal of sub-grade materials that were previously disturbed and/or placed as part of original ISFSI construction. The current ISFSI facility has had no structural issues since its construction. There are no sources of contamination associated with the ISFSI that could contaminate surrounding soils.

During construction, soil stabilization measures would consist of erosion and sediment structural controls and best management practices (BMPs). Upon Project completion, those areas not covered by concrete or asphalt would be regraded to preconstruction contours and recovered with Class 5 gravel. No additional stabilization measures would be required during regular ISFSI operations.

⁷ Braun Intertec. Ground Penetrating Radar Letter, Prairie Island Nuclear Generating Plant ISFSI Subsurface Evaluation Welch, Minnesota. Minneapolis, MN: Braun Intertec. March 29, 2019.

⁸ <https://www.nrc.gov/docs/ML1509/ML15098A026.pdf>.

⁹ Ref. at 2.

11.3 GEOLOGY AND HYDROGEOLOGY

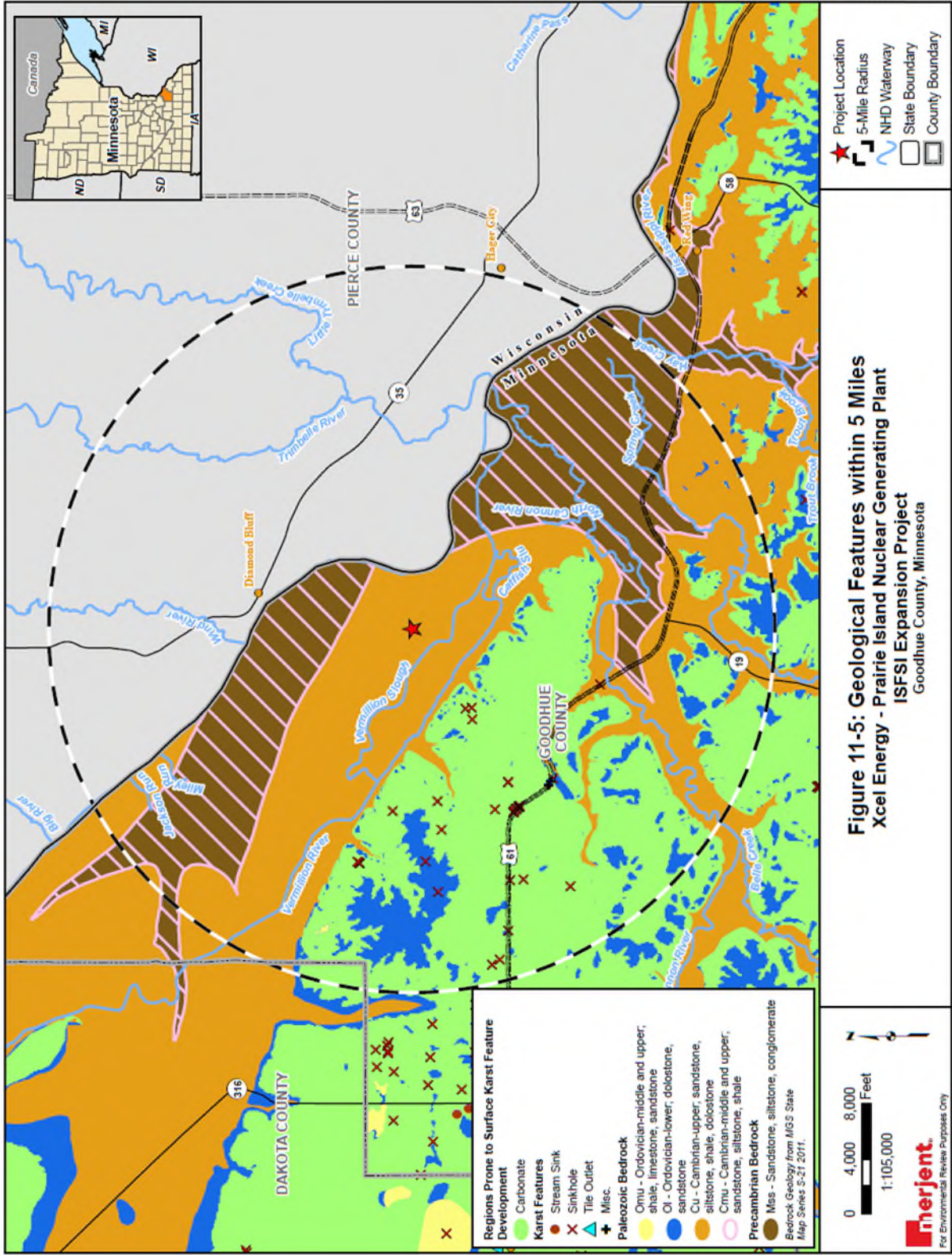
The Prairie Island Plant site occupies a low island terrace formed on the Minnesota side of the Mississippi River. The type of bedrock beneath the area is predominantly composed of sedimentary rock of the St. Lawrence and Franconia Formations, both within the Upper Cambrian System. The St. Lawrence Formation is comprised of tan to gray, well-cemented, thin- to medium-bedded silty dolostone and siltstone. 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. 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. The depth to bedrock beneath the Prairie Island Plant site is approximately 100 feet.¹⁰ Overlying the bedrock is sand and gravel of the Holocene and Pleistocene age. Figure 11-5 depicts general geological features within five miles of the Project location (in Minnesota).

No sinkholes, shallow limestone formations, unconfined/shallow aquifers, or karst conditions are known in the area. While karst is known to occur in Goodhue County, it is not mapped in areas along the Mississippi River.¹¹

When the ISFSI was originally constructed, the location where the expansion pad(s) are proposed to be placed was excavated and granular base material (gravel/sand) was installed and compacted. Excavation would be limited to removal of sub-grade materials that were previously disturbed and/or placed as part of original ISFSI construction. As the excavations would be limited to removing no more than the top 6 feet of material, the excavations would not extend beyond unconsolidated, previously disturbed materials and there would be no impact to subsurface geology.

¹⁰ Ref. at 3.

¹¹https://www.researchgate.net/figure/Minnesota-Karst-Lands-map-2006-Alexander-2015-Gao-and-Alexander-2008_fig4_306062296.



Regarding hydrogeology, the aquifers near the site consist of the water table aquifer, which is recharged by precipitation, floodwaters, snowmelt, and from underlying aquifers, and the underlying confined bedrock aquifers. The groundwater table near Prairie Island Plant is generally within 5 to 20 feet of the ground surface and slopes to the southwest.¹² The local groundwater table responds quickly to changes in river elevation.¹³ There are no known springs or seeps on the Prairie Island Plant property. Groundwater is further discussed in Section 11.6.2.

The construction of new concrete storage pads and the operation of the ISFSI will not impact groundwater resources. There are no effluents from the ISFSI. There are no borings, holes, or other channels within the ISFSI that could reach groundwater. As construction and operation of the ISFSI will not use any groundwater sources, and the excavation needed to construct the facility will not impact the groundwater table, the Project would not have impacts on hydrogeology.

11.4 VEGETATION

The Project site is located within a previously disturbed area that contains no vegetation and provides no terrestrial habitat. Table 11-1 depicts current vegetation and cover types impacted by the Project. The Project does not overlap with any sensitive vegetation communities such as Minnesota Biological Survey Sites of Biodiversity Significance, native plant communities, calcareous fens, old growth stands, native prairies, or lakes of biological significance. Sensitive vegetation communities within 2 miles of the ISFSI (in Minnesota) are depicted on Figure 11-6.

Table 11-1
Prairie Island ISFSI Expansion Project – Cover Type

	Before (acre)	After (acre)		Before (acre)	After (acre)
Wetlands	0.0	0.0	Lawn/landscaping	0.0	0.0
Deep water/streams	0.0	0.0	Stormwater Pond	0.0	0.0
Wooded/forest	0.0	0.0	Impervious Surfaces:		
Brush/Grassland	0.0	0.0	Concrete surfaces	0.0	0.6
Cropland	0.0	0.0	Asphalt drive surface	0.0	0.0

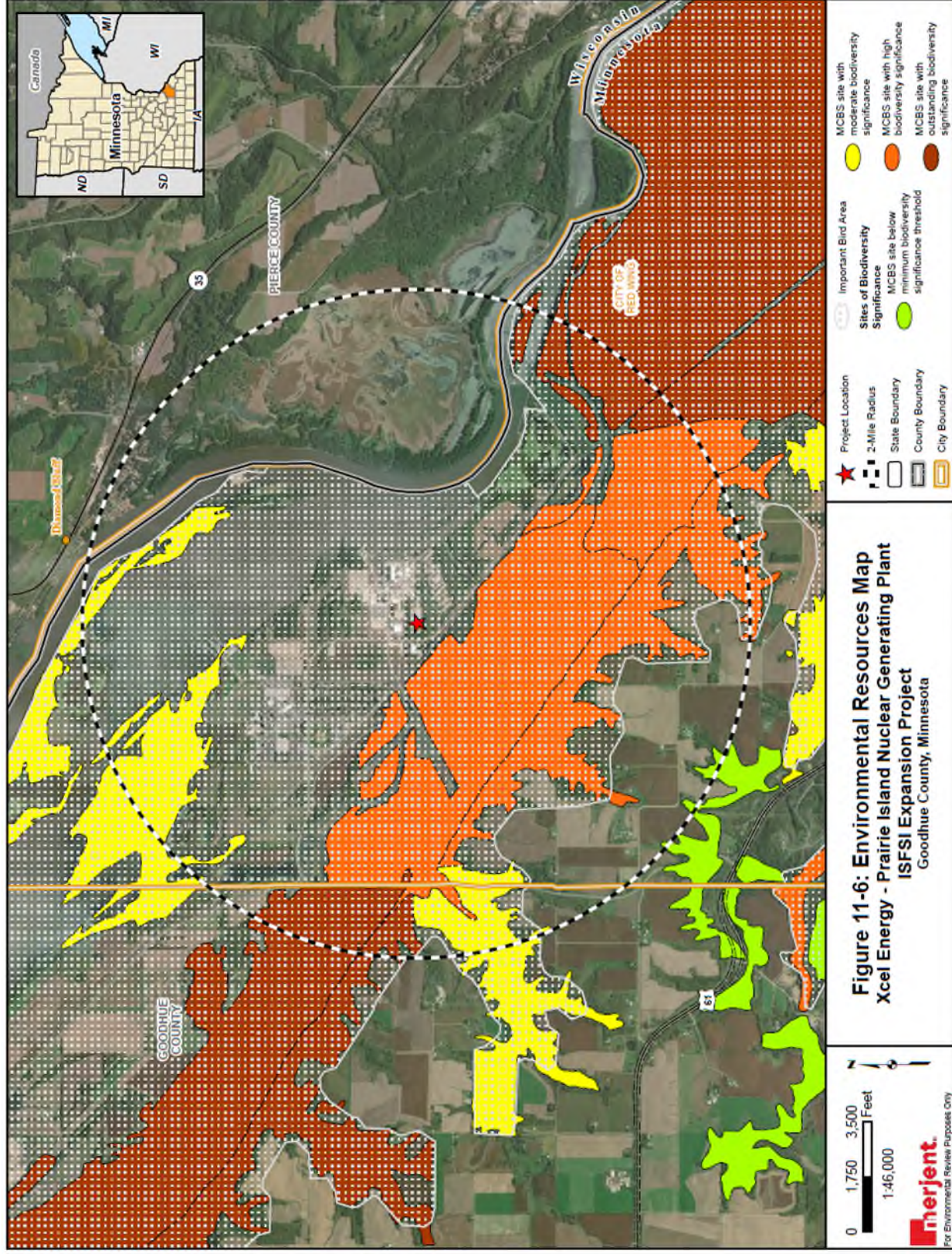
¹² Ref. at 2.

¹³ Ref. at 3.

Table 11-1
Prairie Island ISFSI Expansion Project – Cover Type

	Before (acre)	After (acre)		Before (acre)	After (acre)
			Class 5 gravel*	0.6	0.0
			TOTAL	0.6	0.6
* Class 5 gravel is considered an impervious surface. ¹⁴					

¹⁴ http://www.mncompostingcouncil.org/uploads/1/5/6/0/15602762/7-28-14_attachment_2-eor_gravel_road_pad_imperviousness.pdf.



11.5 LAND USE

The Prairie Island Plant property is located on a low island terrace associated with the Mississippi River floodplain that lies within the northwestern portion of the Red Wing city limits. The property is bordered by the Vermillion River to the west and the Mississippi River to the east. The CP Railroad runs north-south between the Prairie Island Plant property and the Vermillion River and a spur from the CP Railroad connects the rail line to the Prairie Island Plant.

Land uses and cover types within five miles of the Project were identified using National Land Cover Data (NLCD) and are presented in Table 11-2 and Figure 11-7 below. Land use in and around the ISFSI has remained the same since the facility was constructed. Some of the ISFSI area was used for the concrete batch plant and dredge material disposal area during the initial construction of Prairie Island Plant.^{15,16}

Land use in the area immediately adjacent to the Prairie Island Plant and the ISFSI is a mixture of commercial, light industrial, residential, municipal, and commercial farming. The Prairie Island Plant and the ISFSI occupy a former agricultural field and the predominant land use west and south of the site is agricultural, while the area to the east of the site is the Mississippi River. The Prairie Island Indian Community (PIIC) is immediately adjacent to the Prairie Island Plant property to the north and west and is discussed in more detail below.

Table 11-2
Prairie Island ISFSI Expansion Project – Land Use within a 5-Mile Radius

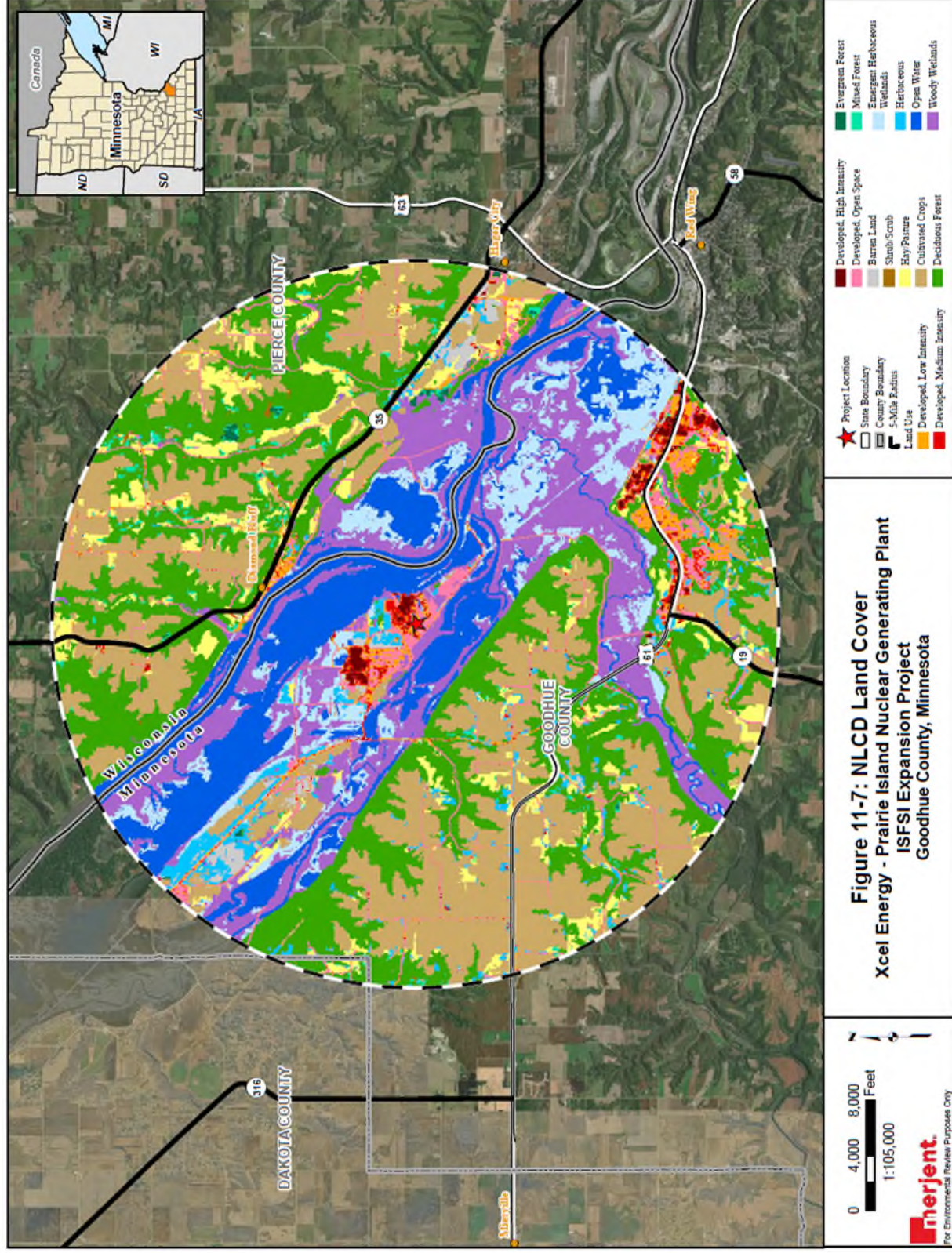
Land Use	Approximate Acreage	Percent of Total
Cultivated Crops	12,765.1	25.2%
Deciduous Forest	12,393.2	24.4%
Open Water	6,530.4	12.9%
Woody Wetlands	6,491.0	12.8%
Emergent Herbaceous Wetlands	3,160.2	6.2%
Hay/Pasture	2,768.4	5.5%
Developed, Open Space	1,942.8	3.8%
Herbaceous	1,231.5	2.4%
Developed, Low Intensity	1,229.1	2.4%

¹⁵ Ref. at 8.

¹⁶ Ref. at 2.

Table 11-2
Prairie Island ISFSI Expansion Project – Land Use within a 5-Mile Radius

Land Use	Approximate Acreage	Percent of Total
Developed, Medium Intensity	719.5	1.4%
Mixed Forest	595.0	1.2%
Barren Land	479.2	0.9%
Developed, High Intensity	277.7	0.5%
Evergreen Forest	100.2	0.2%
Shrub/Scrub	59.8	0.1%
TOTAL	50,743.1	100.0%

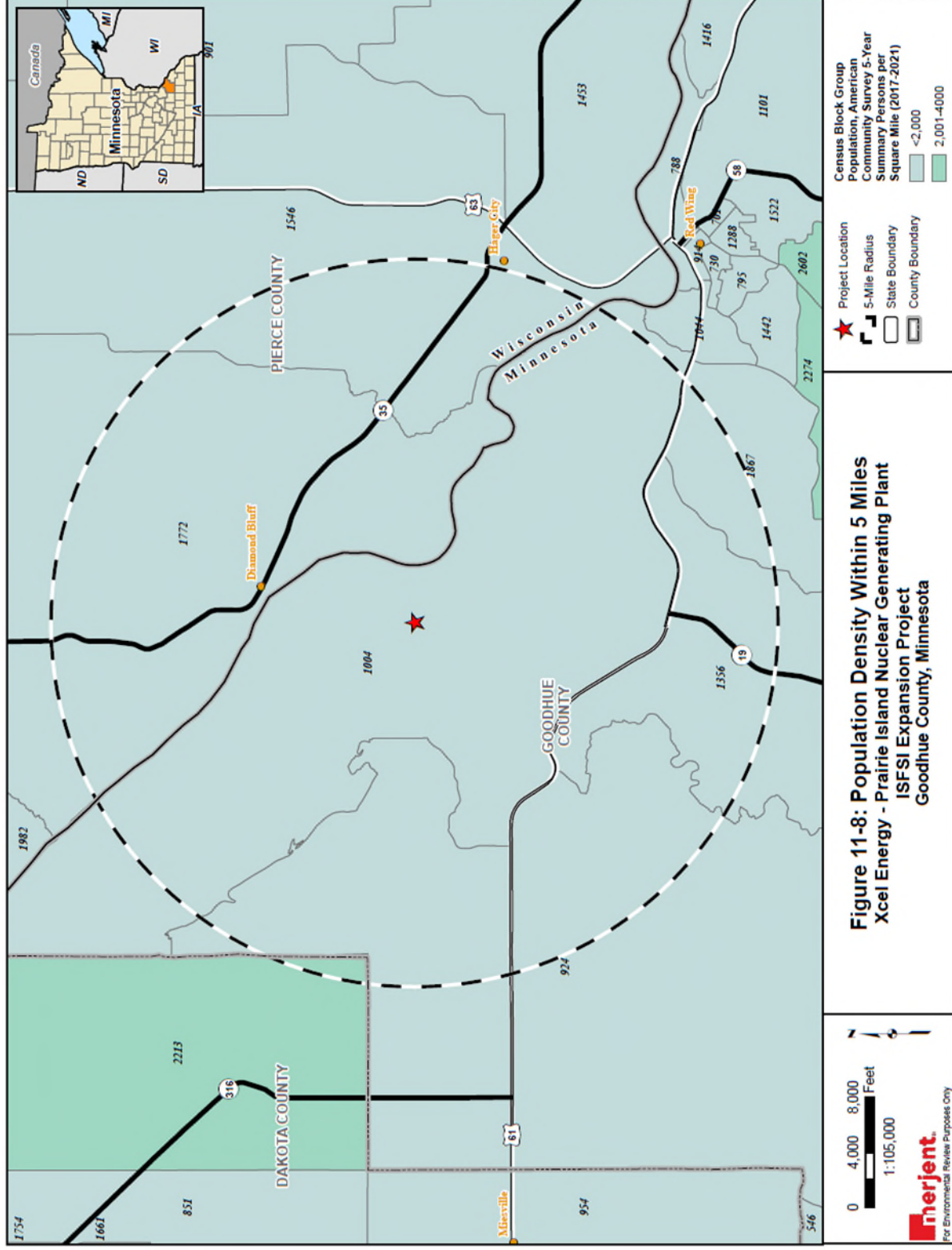


The U.S. Army Corps of Engineers (USACE) Lock and Dam No. 3 is located about 1-mile south of the Prairie Island Plant property and about 1.4 miles southeast of the ISFSI; the road to the lock and dam runs north-south past the entrance to the Prairie Island Plant. Numerous wetlands, sloughs, and basins are present along the Vermillion and Mississippi Rivers and their tributaries (refer to Section 11.6).

The largest city within five miles of the Project is Red Wing in Goodhue County, Minnesota. According to the City of Red Wing's 2040 Community Plan,¹⁷ Red Wing's land use has been defined and somewhat limited by the prevalence of rivers, floodplains, wetlands, bluffs, valleys, and steep slopes associated with the Mississippi River and its tributaries. Early settlement was concentrated around a major bend in the Mississippi River, eventually expanding to the south along the bluffs and west along Highway 61 which runs east-west through the city. In 1971, adjacent Burnside Township was annexed, expanding the size of the city to more than 40 square miles. Red Wing currently has a population of 16,547.¹⁸ Figures 11-8 and 11-9 below depict population density within 5 and 10 miles, respectively, of the Project.

¹⁷ <https://www.red-wing.org/846/Red-Wing-2040-Community-Plan>. Accessed July 2023.

¹⁸ <https://www.census.gov/quickfacts/fact/table/redwingcityminnesota,goodhuecountyminnesota,MN/PST045222.%20Accessed%20January%202023>. Accessed January 2024.





The 2040 Community Plan outlines goals for encouraging residential and commercial development within the city, as well as preserving valuable open space and agricultural land. Current land use within Red Wing is heavily weighted toward open space, agricultural, and rural residential uses.¹⁹ Open space areas include rivers, creeks, wetlands, bluffs, valleys, and prairie landscapes that are primarily located between Highway 61 and the Mississippi River. Agricultural and rural residential areas are prevalent along the north and south sides of Highway 61 throughout much of the former Burnside Township area. Urban, residential, and commercial development in Red Wing is predominantly located along the Highway 61 corridor and the historic downtown area. The 2040 Community Plan specifically calls out the Prairie Island Plant as a vital economic resource, providing 56 percent of total tax revenues for the community.²⁰

As stated above, the PIIC is immediately adjacent to the Prairie Island Plant property to the north and west and about 0.5-mile northwest of the ISFSI site at the nearest point. The PIIC is the ancestral homeland of the Mdewakanton Band of Eastern Dakota. The PIIC Tribal Council has jurisdiction over land uses within the reservation. Development within the PIIC includes residential areas, various community buildings, a wastewater treatment plant, Treasure Island Resort and Casino, the Prairie Island Sports Complex, and elements of the PIIC Net Zero Project, a community carbon reduction effort. The Net Zero Project has a goal of achieving net zero carbon emissions within the community and gaining energy resiliency and sovereignty within the next few years.^{21,22} The Net Zero suite of projects is currently under development and the solar photovoltaic and geothermal energy projects are almost complete.^{23,24}

Sturgeon Lake Road and Wakonade Drive (which becomes Lock and Dam Road after it passes by the Prairie Island Plant) separate the PIIC from the Prairie Island Plant property. Additionally, NSP Road and the CP Railroad spur run between the ISFSI and the PIIC. The immediate area surrounding the ISFSI is forested, which creates a natural vegetative buffer between the ISFSI, the PIIC, and public roads.

¹⁹ Ref. at 17.

²⁰ Ref. at 17.

²¹ <https://prairieisland.org/who-we-are/our-land/net-zero>

²² <https://sahanjournal.com/climate-environment/prairie-island-indian-community-nuclear-concern-powers-new-emissions-plan/>

²³ <https://prairieisland.org/uploads/PIIC-Net-Zero-2023-Progress-Report.pdf>.

²⁴ <https://sahanjournal.com/climate-environment/prairie-island-indian-community-celebrates-green-future/>

The Treasure Island Resort and Casino is the closest business to the Prairie Island Plant ISFSI and is approximately 1 mile north of the site. The hotel has 788 rooms and is the second largest hotel in the state. The amphitheater, opened in 2017, holds concerts and events for up to 16,000 people.²⁵ The PIIC also owns and operates Dakota Station, a gas station and convenience store that is approximately 1 mile northwest of the ISFSI.²⁶ The Prairie Island Sports Complex is also about 1 mile northwest of the ISFSI. Additional facilities within the PIIC, and within a 1-mile radius of the site, include the Lower Island residential area, the PIIC Land & Environment Office, a church, a clinic, a community center, an education building, an elder center, a fitness center, pow-wow grounds, a public safety building, a community garden, the tribal court, the tribal government administration building, a water treatment facility, wastewater treatment facility, and elements of the PIIC Net Zero Project.

Residential development is handled through land assignments provided to individual assignees by the PIIC Tribal Council. Each assignee is granted lifetime use of the land. Assignees of new land assignments (i.e., newly developed with no existing dwellings) have 1 year to make improvements (i.e., construct or place a home on the assignment). The nearest resident is approximately 0.45 mile northwest of the ISFSI, within the PIIC.²⁷

Reservation and trust lands are not subject to state or local land use jurisdiction and Indian tribes are free to develop independent land-use policies and management plans. Certain portions of the undeveloped areas of Prairie Island (both on- and off-reservation) are used for traditional ceremonies, medicinal plant gathering, prairie restoration, the PIIC Edwin Buck Jr. Memorial Buffalo Project, wild rice restoration, hunting, fishing, and other recreational activities.^{28,29}

Xcel Energy has worked with the PIIC on a number of projects to provide information that supports land management, restoration, and enhancement efforts on Prairie Island. Among the projects is a medicinal and culturally important plant study conducted in 2008 and 2009 within the Prairie Island Plant property boundary.³⁰ Xcel Energy continues to actively engage PIIC regarding land use activities that occur on

²⁵ <https://www.ticasino.com/>

²⁶ Ref. at 2.

²⁷ Ref. at 2.

²⁸ <https://prairieisland.org/who-we-are/our-culture/buffalo-project>.

²⁹ Ref. at 2.

³⁰ Ref. at 2.

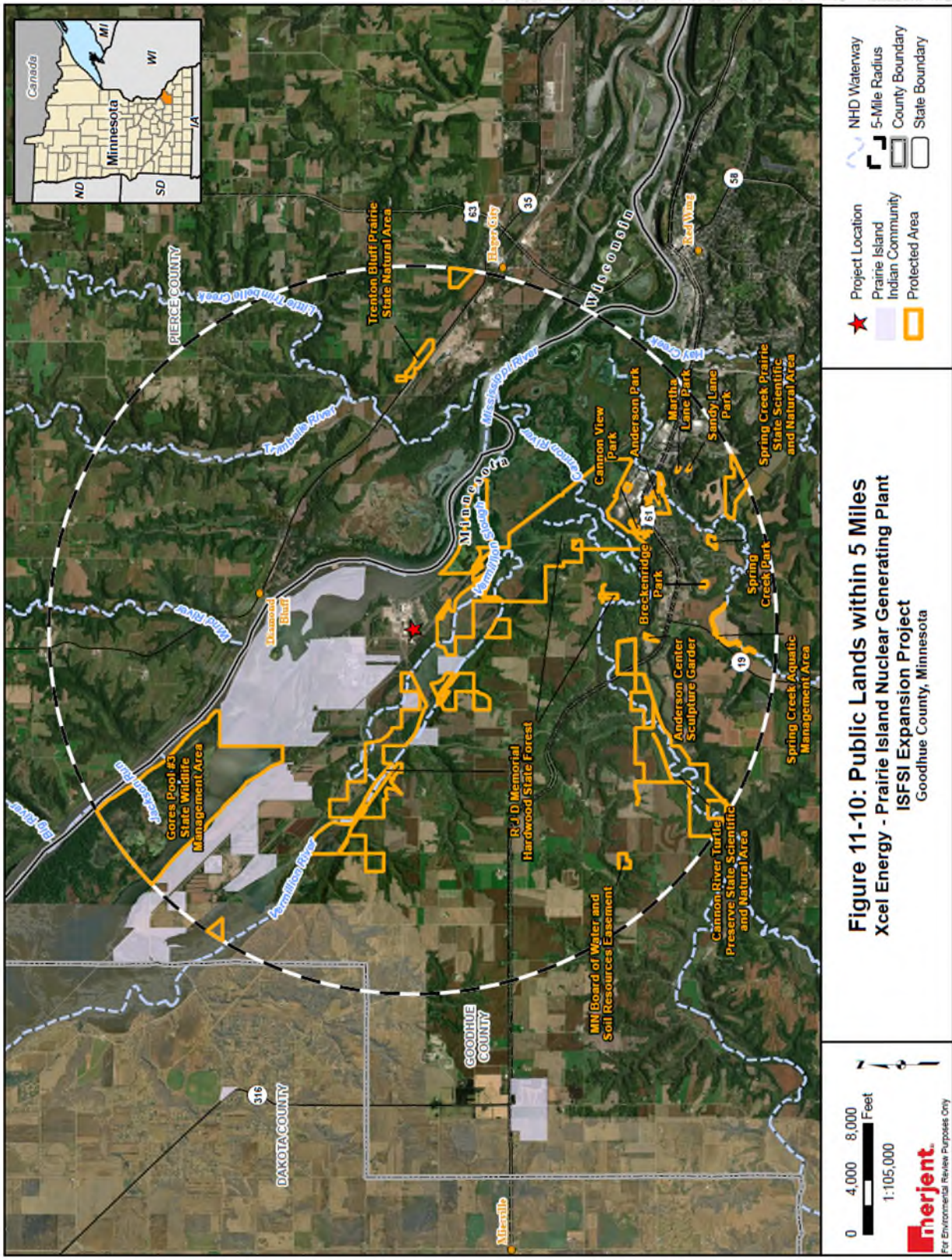
the Prairie Island Plant property and within the ISFSI per the Xcel Energy's Cultural Resource Management Plan (CRMP).

Public Lands

Public lands within five miles of the Project were identified using Minnesota Department of Natural Resources (MDNR) data and the U.S. Geological Service (USGS) Protected Areas Database. Table 11-3 below provides a list of public lands and Figure 11-10 below shows public lands within five miles of the Project. Additional details about designated public lands within five miles of the Project are provided in Section 11.8.

Table 11-3
Prairie Island ISFSI Expansion Project--Public Lands Within a 5-Mile Radius

Designated Land	Owner	Distance to Project (miles)	Direction to Project
Spring Creek Aquatic Management Area	MDNR	4.0	S
Trenton Bluff Prairie State Natural Area	Wisconsin Department of Natural Resources and Private	3.4	E
Cannon River Turtle Preserve State Scientific and Natural Area (SNA)	MDNR	2.8	S
Spring Creek Prairie State SNA	MDNR	4.6	S
RJD Memorial Hardwood State Forest	MDNR	0.3	S
Gores Pool #3 State Wildlife Management Area (WMA)	MDNR	0.8	SE
Anderson Park	City of Red Wing	3.6	S
Breckenridge Park	City of Red Wing	4.0	S
Cannon View Park	City of Red Wing	3.4	S
Martha Lane Park	City of Red Wing	4.2	S
Sandy Lake Park	City of Red Wing	4.4	S
Spring Creek Park	City of Red Wing	4.2	S



11.6 WATER RESOURCES

11.6.1. Surface Waters and Wetlands

Figure 11-11 depicts surface waters and wetlands within five miles of the Project. Water resources were mapped using the National Wetlands Inventory (NWI), the USGS National Hydrography Dataset (NHD), and the MDNR Public Waters Inventory (PWI) Basin and Watercourse datasets. There are no waterbodies or wetlands located within the ISFSI site.

The Mississippi River, Vermillion River, U.S. Lock and Dam #3 Pool, and Sturgeon Lake are adjacent to the Prairie Island Plant. Both the Vermillion and Mississippi Rivers are designated PWI watercourses and most of the tributaries, wetlands, sloughs, and basins along them are also designated as PWI watercourses, basins, or wetlands.^{31, 32} The Mississippi River also is designated as a State Water Trail.³³ Typically, the Mississippi River is kept at a water level higher than that of the Vermillion River and discharge from Lock and Dam 3 tends to be at its peak in the spring and summer.

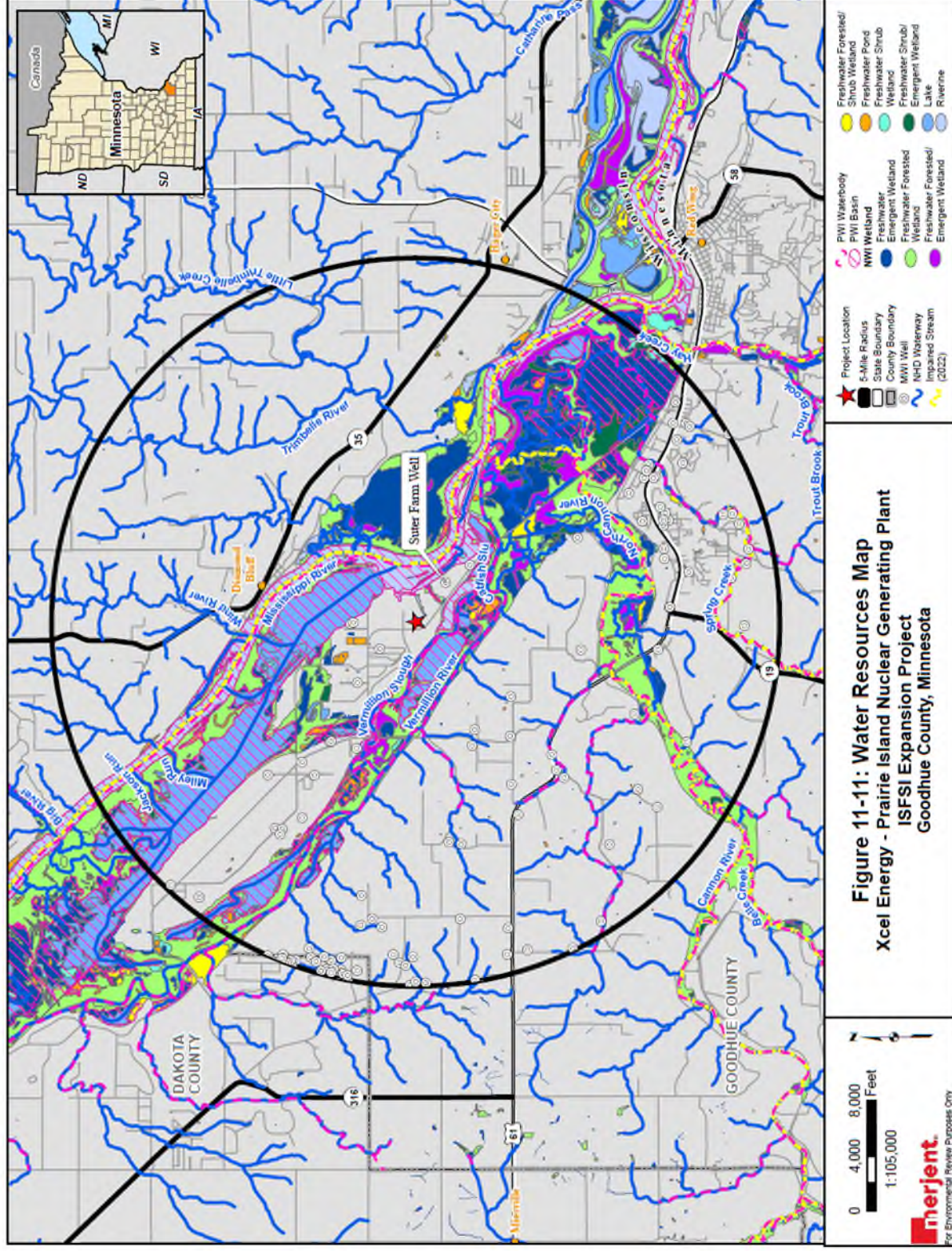
Several additional surface waters are within five miles of the Prairie Island Plant and the ISFSI. The Cannon River enters the Mississippi River just south of Lock and Dam No. 3. The Cannon River is designated as a State Wild and Scenic River and a State Water Trail. Rice Lake Complex is a large wetland complex located at the confluence of the Cannon and Mississippi Rivers.

The Project is not near trout streams/lakes, wildlife lakes, migratory waterfowl feeding/resting lakes, or outstanding resource value waters. The Vermillion River, Vermillion Slough, Mississippi River, and Sturgeon Lake are the only waterbodies within one mile that are listed in the Minnesota Pollution Control Agency (MPCA) draft 2024 list of impaired waters.

³¹ Xcel Energy, 2019. U.S. Nuclear Regulatory Commission, Prairie Island Independent Spent Fuel Storage Installation, ISFSI Site-specific License Amendment Request, Environmental Report Supplement. May 8, 2019.

³² https://files.dnr.state.mn.us/waters/watermgmt_section/pwi/GOOD_PWILIST.PDF.

³³ <https://www.dnr.state.mn.us/watertrails/mississippiriver/index.html>. Accessed July 2023.



The Prairie Island Plant has an existing National Pollutant Discharge Elimination System (NPDES) Permit from MPCA which authorizes the discharge of stormwater associated with industrial activity from the Prairie Island Plant and the ISFSI.

The ISFSI was designed with a slight slope to the southwest and southeast corners. From there, stormwater travels through two metal pipes to riprap outfall structures outside of the berm. Once stormwater is outside of the berm, stormwater flows overland through a minor swale to a “landlock ditch.” Stormwater runoff during construction and operation is expected to be relatively unaffected by the Project. The area impacted by expansion activities is currently covered in Class 5 gravel, which is considered an impervious surface; therefore, the installation of the Project components would not increase the impervious nature of the area.

As the area of construction within the ISFSI will be less than one acre in size, Xcel Energy will not be required to obtain MPCA NPDES/State Disposal System permit coverage for stormwater discharges that occur during construction activities. Nevertheless, Xcel Energy will implement BMPs and erosion and sediment controls to ensure contaminated stormwater runoff does not leave the construction area. Construction BMPs and sediment and erosion control devices would prevent the occurrence of point discharges from the site into any conveyances that could permit sediment or silt-laden runoff into natural flow routes that discharge into nearby surface waters. Perimeter controls, such as silt fence and/or straw wattles, would be installed to ensure sediment or silt-laden runoff does not leave the construction area. Controls would be installed and maintained in accordance with manufacturer specifications and repaired or replaced when found to be no longer functioning properly. Potential pollutants that could result from construction activities will be related to sediment or oil and gas residue from onsite construction equipment. The Project will not expose any industrial activities or other liquid contaminants to stormwater and the existing DFS systems will remain secure during construction.

The Project will require no water resources for construction or operation. The ISFSI is not a source of contamination that could affect surface waters. Due to its location on the Prairie Island Plant site and distance from any surface waters, the ISFSI Project would not have impacts to surface waters or wetlands.

11.6.2 Groundwater Resources

The ISFSI site is located on a low island terrace associated with the Mississippi River floodplain. The aquifers near the site consist of the water table aquifer, which is recharged by precipitation, floodwaters, snowmelt, and from underlying aquifers, and the underlying confined bedrock aquifers. The groundwater table near the

Prairie Island Plant is generally within 5 to 20 feet of the ground surface and slopes to the southwest.³⁴ The local groundwater table responds quickly to changes in river elevation.³⁵

Generally, wells in the alluvial material near the Prairie Island Plant site are less than 100 feet in depth.³⁶ Xcel Energy draws groundwater for potable and industrial use from nine wells installed within the alluvial aquifer. The PIIC and Red Wing community public water supply withdraws water from groundwater sources, as do several industries in the Red Wing area.³⁷ The construction of new concrete storage pads and the operation of the ISFSI will not impact groundwater resources. There are no effluents from the ISFSI. There are no borings, holes, or other channels within the ISFSI that could reach groundwater.

According to the Minnesota Department of Health's (MDH) Minnesota Well Index,³⁸ no portion of the Prairie Island Plant, including the Project site, is located within a Drinking Water Supply Management Area or Wellhead Protection Area. Table 11-4 below identifies the wells located on the Prairie Island Plant property. The next nearest well is located approximately 0.6 miles southeast of the ISFSI on private property, also known as the Suter Farm well (as shown on Figure 11-11).

³⁴ Ref. at 2.

³⁵ Ref. at 3.

³⁶ Ref. at 31.

³⁷ Ref. at 31.

³⁸ <https://mnwellindex.web.health.state.mn.us>.

Table 11-4
Prairie Island ISFSI Expansion Project – Prairie Island Plant Property Wells

Well ID	Well Name	Well Depth	MDNR Permit No.	Well Use
256074	Training Center	154	1996-5042	Potable water, sanitary, lawn
780008	Distribution Center	231	N/A	Potable water
801757	Site Administration Building	356	2015-0785	Air conditioning, irrigation, commercial
523953	Environmental Lab Well	285	N/A	Other categories
256120	Deep Well #121	141	1969-0171	Power generation – non-cooling
256121	Deep Well #122	143	1969-0171	Potable water
463332	New Administration Building Well	160	N/A	Potable water
170784	STA/SEC Well (sealed)	67	N/A	Potable water
611076	Cooling Tower Pumphouse Well	75	1978-5153	Other power generation
402599	Old Screenhouse Well	120	1986-5114	Lubricating pump bearings
780202	Multi-Use Facility Well	258	N/A	Other special categories
807310	Flex Storage Building FP Well	160	2018-0210	Fire protection water supply

As construction and operation of the ISFSI will not use any groundwater sources, and the excavation needed to construct the facility will not impact the groundwater table, the Project would not have impacts on groundwater hydrology.

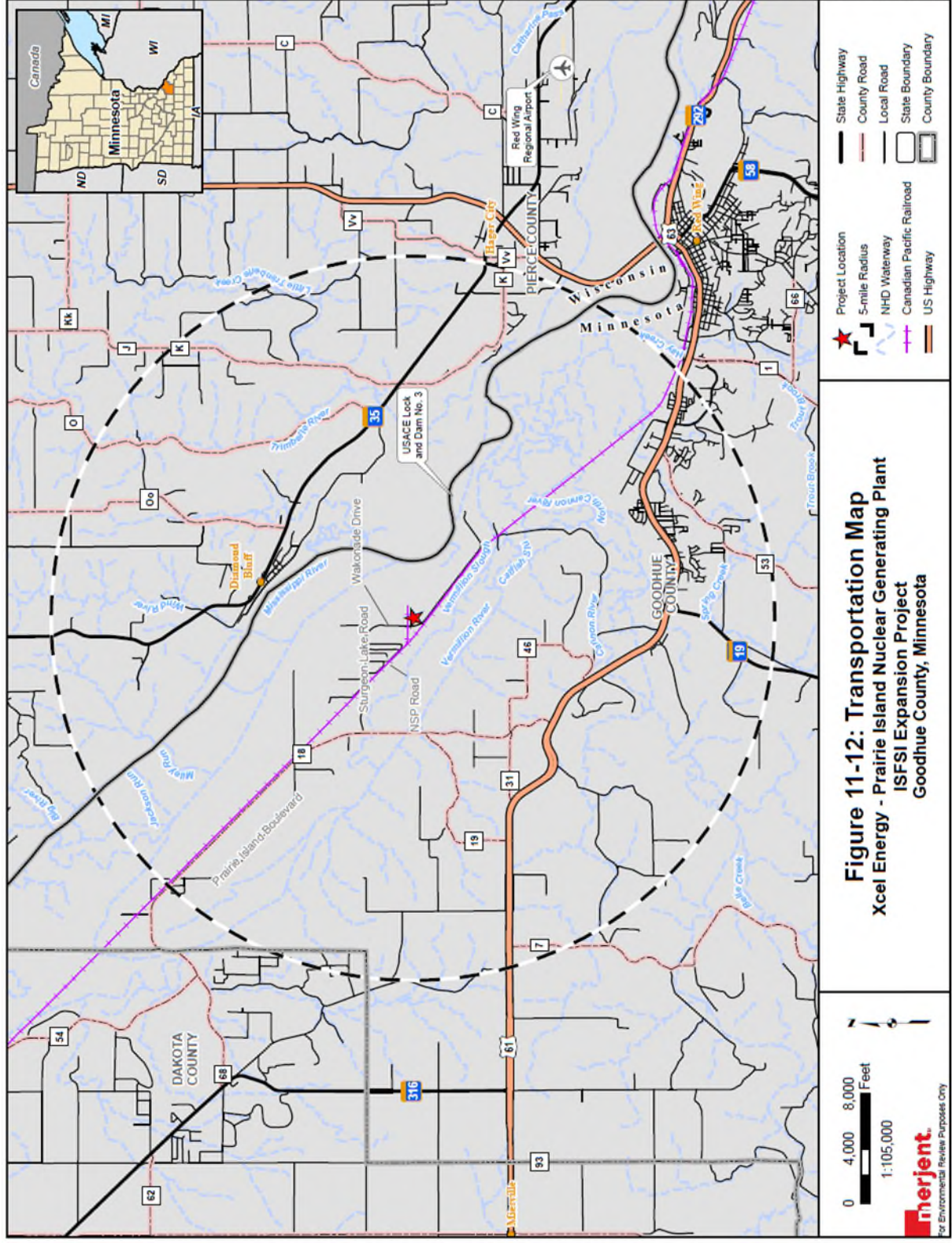
11.7 TRANSPORTATION

Figure 11-12 below depicts major roadways and transportation systems within a 5-mile radius of the proposed ISFSI Project. The only US and Minnesota state highway within five miles of the Project are US Highway 61, which travels between the town of Miesville and the City of Red Wing in the Project area, and State Highway 19, which connects to US Highway 61 between Miesville and Red Wing. Several other county roads and local roads are in the Project area. Both the PIIC facilities and the

Prairie Island Plant and ISFSI are accessed off of County Road 18/Prairie Island Boulevard and Sturgeon Lake Road. Sturgeon Lake Road continues into the PIIC, while the Prairie Island Plant and ISFSI is accessed by turning off of Sturgeon Lake Road to NSP Road. The Prairie Island Plant and ISFSI can also be accessed from the PIIC along Wakonade Drive from the north. Wakonade Drive/County Road 18 continues to the south to its terminus at Lock and Dam 3. Sturgeon Lake Road and NSP Road will experience the greatest traffic impact during construction of the project as those are the local roads by which the Prairie Island Plant and the ISFSI are accessed.

The closest airport is the Red Wing Regional Airport, which is located about 7 miles southeast of the ISFSI in Bay City, Wisconsin on the east side of the Mississippi River.³⁹ The Minneapolis-St Paul International Airport is the closest international airport to ISFSI, located about 33 miles to the northwest. There is no reasonable potential for the Project to impact these airports.

³⁹ <https://www.dot.state.mn.us/aero/airportdirectory/airportfinder/index.html>.



Xcel Energy reviewed air traffic corridors⁴⁰ in the vicinity of the Project. Flight Path V2-97 runs from the Minneapolis-St Paul metro area southeast to Red Wing and further southeast, but as it nears the Prairie Island Plant and ISFSI it is completely on the eastern side of the Mississippi River in Wisconsin. Flight Path V26 runs northeast-southwest towards Eau Claire and passes closer to the southern boundary of the city of Hastings. These are smaller flight paths used for regional travel. Due to the height of the Project (approximately 25 feet for DFS systems, and 40 feet for light poles, which are existing and will not be altered), there is no potential for the Project to impact flight paths.

In addition, Xcel Energy submitted the Project location and maximum height (the 40-foot tall existing light poles) to the Federal Aviation Administration (FAA) Notice Criteria Tool⁴¹ to determine if additional consultation with the FAA would be required under 41 CFR 77.9. The Notice Criteria Tool indicated that the Project does not exceed Notice Criteria requiring additional consultation with FAA.

The CP Railroad is located near the ISFSI; from Red Wing, it runs northwest towards the Prairie Island Plant along County Road 18 until it approaches near the Prairie Island Plant cooling towers and the ISFSI. From there, it runs further northwest towards the PIIC and then back along Highway 18 towards Hastings. A spur from the CP Railroad connects the rail line to the Prairie Island Plant. The portion of this railway is only used for material deliveries to the Prairie Island Plant. No impacts to the railway will occur as a result of the ISFSI Project.

No parking spaces are currently located at the ISFSI, nor will any be added as adequate parking exists at the adjacent Prairie Island Plant parking lots. The equipment that will be employed to construct the Project will include bulldozers, scrapers, front end loaders, graders, dump trucks, cement trucks, delivery trucks, and various small support vehicles.

During the 9-12 month concrete pad construction period between 2027 and 2029 and subsequent 3 month DFS loading campaign in 2030, a total of 40 construction workers will be needed, with a peak at any one time of 12 workers and an average of 8 workers during a 40-hour week. Additional traffic would be generated from truck deliveries. It is estimated that construction activities and deliveries would add an average of 7 trips each day. Alternative transportation methods in the area that could be used by construction personnel are limited and will not likely be used. Should

⁴⁰ www.skyvector.com

⁴¹ <https://ocaaa.faa.gov/ocaaa/external/gisTools/gisAction.jsp?action=showNoNoticeRequiredToolForm>.

concrete overpacks be constructed on-site, this will occur the year prior to dry fuel loading in the following additional approximate years (plus or minus one year): 2029 (to support loading in 2030), 2034 (to support loading in 2035), 2039 (to support loading in 2040), and 2044 (to support loading in 2045). Concrete overpack fabrication would occur over a three-month period prior to loading, with loading then taking approximately three additional months. During these periods, a total of 16 construction workers are estimated with a peak at any one time of 10 workers and an average of 6 workers during a 40-hour week.

The number of construction workers needed for this Project is small, compared to the over 800 full-time, contract, and security employees at the Prairie Island Plant. Construction activities will be conducted during daytime hours.

The addition of 10-12 vehicles (peak construction force) on local roadways during construction and operations activities will not create any construction-related traffic impacts. No traffic impacts will occur during operation of the Project.

11.8 RECREATIONAL AND VISUAL RESOURCES

11.8.1 National Resources

No national natural landmarks, national wilderness areas, national wildlife refuges, national wild and scenic rivers, national parks, national forests, national trails, and national waterfowl production areas are located within five miles of the Prairie Island Plant. No federally designated public lands would be impacted by the Project and no mitigation measures specific to these resources are proposed.

11.8.2 State Resources

The Mississippi River is designated as a State Water Trail and the Hastings to Iowa portion of the river is adjacent to the eastern boundary of the Prairie Island Plant.⁴² The Cannon River is about 2.5 miles south of the Prairie Island Plant. This river is designated as a State Water Trail and as was added to Minnesota's Wild and Scenic Rivers program in 1980.⁴³ These features are shown on Figure 11-11. State Water

⁴² Ref. at 33.

⁴³https://www.dnr.state.mn.us/waters/watermgmt_section/wild_scenic/wsrivers/cannon.html#:~:text=Designation,confluence%20with%20the%20Mississippi%20River.

Trails in Minnesota provide opportunities for public recreation in the form of canoeing, kayaking, and paddleboarding, and some also have adjacent campgrounds that are open to the public. The intent of the State Wild and Scenic Rivers Act is to preserve and protect the outstanding natural, historical, recreational, scenic, and scientific values associated with certain Minnesota rivers and adjacent lands through the prevention of intensive development and overuse.

The Richard J. Dorer Memorial Hardwood State Forest is located about 0.3 mile south of the Prairie Island Plant (see Figure 11-10). This state forest consists of over one million acres of forested land located along the Mississippi River and Great River Road bluffs in southeastern Minnesota and provides access to state water trails including the Mississippi and Cannon Rivers.⁴⁴ Opportunities for public recreation include boating, canoeing, kayaking, camping, hunting, picnicking, snowshoeing, cross-country skiing, horseback riding, and all-terrain vehicle use.

The Spring Creek Aquatic Management Area (AMA) is located about 4.0 miles south of the Prairie Island Plant (see Figure 11-10). AMAs in Minnesota are designated to protect, preserve, and study critical shoreland habitat while still allowing public access for recreation. The Spring Creek AMA consists of four subunits, all of which are open for public angling.⁴⁵

The Gores Pool #3 State Wildlife Management Area (WMA) is located about 0.8 mile southeast of the Prairie Island Plant along the Mississippi River (see Figure 11-10). This WMA was established to protect and preserve a large, unbroken area of floodplain forest habitat while also providing public hunting access.⁴⁶ Opportunities for public recreation include hunting, fishing, hiking, and boating.

Minnesota Scientific and Natural Areas (SNAs) are intended to protect, preserve, and study native plant communities, rare species, and geologic features.⁴⁷ The Spring Creek Prairie SNA is about 4.6 miles south of the Prairie Island Plant (see Figure 11-10) and was established to protect and preserve a variety of native plant communities and endangered plant species.⁴⁸ Recreational opportunities in the Spring Creek Prairie SNA include birding, hiking, photography, snowshoeing, and cross-country skiing.

⁴⁴ https://www.dnr.state.mn.us/state_forests/forest.html?id=sft00033#homepage.

⁴⁵ https://www.dnr.state.mn.us/amas/detail_report.html?id=AMA00222.

⁴⁶ https://www.dnr.state.mn.us/wmas/detail_report.html?id=WMA0000700.

⁴⁷ https://www.dnr.state.mn.us/snas/what_are.html.

⁴⁸ <https://www.dnr.state.mn.us/snas/detail.html?id=sna01080>.

The Cannon River Turtle Preserve State Scientific and Natural Area is about 2.8 miles south of the Prairie Island Plant (see Figure 11-10). This SNA was established to preserve and protect a stretch of the Cannon River downstream of Welch, Minnesota, that provides potential nesting areas of turtles; some portions of this SNA are seasonally designated as sanctuary areas.⁴⁹ Recreational opportunities in the Cannon River Turtle Preserve SNA include birding, hiking, photography, snowshoeing, and cross-country skiing. This SNA is also open for biking on designated trails and hunting.

Trenton Bluff Prairie State Natural Area is located about 3.4 miles east of the Prairie Island Plant in Pierce County, Wisconsin (see Figure 11-10). This State Natural Areas was established to protect and preserve dry prairie areas situated along the sandstone bluffs and limestone cliffs of the Mississippi River valley.⁵⁰ Recreational opportunities include hiking, fishing, cross-country skiing, hunting, trapping, foraging, scientific research, and wildlife viewing.

No state critical areas, state parks, state scenic wayside parks, state recreational areas, state trails, state zoos, designated trout streams, or designated trout lakes are located within five miles of the Project site. Due to the Project's distance from state parks and management areas in the vicinity, no impacts are anticipated.

11.8.3 County and Local Resources

The following county and local parks and recreational areas are located within 5.0 miles of the Prairie Island Plant. These features are also shown on Figure 11-10:

- Anderson Park: Anderson Park is located about 3.6 miles south of the Prairie Island Plant, near the intersection of Johnson Avenue and Highway 61 in the City of Red Wing. The park consists of athletic fields, tennis courts, soccer fields, a play structure, and hiking paths that link to the Cannon Valley Trail.
- Breckenridge Park: Breckenridge Park is located about 4.0 miles south of the Prairie Island Plant.
- Cannonview Park: Cannonview Park is located about 3.4 miles south of the Prairie Island Plant between the Cannon River and Highway 61 in the City of Red Wing. The park consists of a play structure, benches, and open space.

⁴⁹ <https://www.dnr.state.mn.us/snas/detail.html?id=sna01030>

⁵⁰ <https://dnr.wisconsin.gov/topic/statenaturalareas/TrentonBluffPrairie>

- **Martha Lane Park:** Martha Lane Park is located about 4.2 miles south of the Prairie Island Plant, within a residential area near the intersection of Martha Lane and Carol Lane in the City of Red Wing. The park consists of a play structure and open space.
- **Sandy Lake Park:** Sandy Lake Park is located about 4.4 miles south of the Prairie Island Plant within a residential area near the intersection of Spring Street and Graves Drive in the City of Red Wing. The park consists of a play structure, basketball court, and open space.
- **Spring Creek Park:** Spring Creek Park is located about 4.2 miles south of the Prairie Island Plant, north of the intersection of County 53 Boulevard and Peaceful Ridge Road. The park consists of community gardens, a play structure, and open space.

No other areas designated by regional or local authorities as having recreational, cultural, historical, or scientific significance, as indicated by local units of government, are located within five miles of the proposed ISFSI Project. Due to the Project's distance from county and local parks and recreation areas in the vicinity, no impacts are anticipated.

11.9 HISTORIC AND ARCHAEOLOGICAL RESOURCES

Xcel Energy first evaluated the cultural resources in the area by requesting a file search from the Minnesota State Historic Preservation Office (SHPO) for the Project area and a surrounding five mile-radius, restricted by the Mississippi River northeast of the Project area. The results of the site file search were cross-checked against the Office of the State Archaeologist (OSA) online database to confirm the site information and determine the distance between recorded sites and the Project area. Xcel Energy submitted a Project review request letter to the Minnesota SHPO on July 13, 2023. The letter detailed the recorded historic and archaeology sites within five miles of the proposed Project. SHPO responded on September 7, 2023.

Eighty-four inventoried aboveground properties are located within five miles of the Prairie Island Plant, including 28 houses, 14 farmsteads, and several churches, stores, dams, commercial buildings, highway segments and bridges. Prairie Island is also listed as an historic landscape. These properties represent the early Euro-American settlement and development of the area, both private enterprise and public infrastructure. Three of these historic properties are listed on the National Register

of Historic Places (NRHP) as shown in Table 11-5. There are no aboveground historic sites within the Project boundary or within a one mile radius. The SHPO concurred with this assessment in its September 7, 2023 response to Xcel Energy; however, SHPO noted that there may be sites within this review area that have not yet been identified and noted that the Prairie Island Plant itself is nearing the age where it could be considered for listing in the NRHP (50 years).

Table 11-5
Prairie Island ISFSI Project – Historic Properties listed on the NRHP
Within 5 Miles of the Project

Historic Property Name	Year Listed	Approximate Distance from Project	Description
Alexander P. Anderson Estate – Tower View	1977	3.5 miles	Georgian Revival styled house built in 1916 of reinforced concrete faced with brick.
Cross of Christ Lutheran Church	1980	4.7 miles	An example of the type of churches the Swedish settlers built in southeastern Minnesota.
Mendota to Wabasha Military Road: Cannon River Section	1991	2.8 miles	A well-preserved fragment of the Mendota-Wabasha Military Road located within the municipal boundaries of the City of Red Wing.

The Project area has been surveyed for archaeological resources and nearby sites have been recorded. There are no archaeological sites within the Project boundary. There are twenty archaeological sites within one mile of the Project area, including five prehistoric villages, five individual mounds, four mound groups, two farmsteads, one trading post, one pre-contact artifact scatter, one alpha site, and one lithic workshop.

There are 115 archaeology sites recorded within five miles of the Project. Of these, 47 are burial mound groups, 15 are individual mounds, 15 are lithic scatters, 13 are artifact scatters, including Pre-Contact, historic, and multicomponent sites, 11 are Pre-Contact habitation sites, two are isolated finds, one is a trading post, and one is a lithic workshop. Five sites are historic farmsteads. Five recorded sites are alpha sites, reported archaeology sites that have not been professionally field verified. The recorded archaeology sites represent the pre-contact occupation of this area as well the Euro-American occupation and development of the region. The pre-contact occupation of this region of Minnesota, where the landscape is defined by the

Mississippi River, is well-documented. A total of five archaeological sites have been determined eligible for listing on the NRHP; all five of these sites are more than 1 mile from the ISFSI. In the SHPO's September 7, 2023 correspondence to Xcel Energy, it confirmed that, "there are no recorded archaeological sites in the ISFSI Project area. In general, based upon current documentation, we understand that the level of disturbance to install additional storage pads would not exceed previously disturbed ground and therefore, we agree that the likelihood of intact archaeological sites in this location is low and additional archaeological survey for the ISFSI Project is not warranted."

11.9.1 Prairie Island Indian Community and Additional Studies

The ISFSI is located immediately adjacent to (south and southeast of) the PIIC Reservation on the ancestral homeland of the Mdewakanton Band of Eastern Dakota. The lands and waters of the PIIC are a cultural and historic resource.⁵¹ Xcel Energy has conducted numerous archaeological studies over the history of the Prairie Island Plant and remains committed to protecting the historical and cultural resources within its boundaries and working with the PIIC as a good neighbor. Xcel Energy submitted a letter to PIIC on July 13, 2023 regarding the Project. Xcel Energy and the PIIC continue to meet on a recurring basis to discuss the Prairie Island Plant.

Xcel Energy and the PIIC entered into a "Settlement Agreement Among the Prairie Island Indian Community and Northern States Power Co. Regarding Contentions 1, 6 and 11" in 2009 to address a number of PIIC concerns expressed during the plant license renewal process at that time. One commitment was to prepare and implement a CRMP to protect significant historical, archaeological, and cultural resources that may currently exist on the Prairie Island Plant site. Xcel Energy has implemented a CRMP to manage and ensure the protection of archaeological and cultural resources on the Prairie Island Plant property. The CRMP includes a discussion of existing cultural and historic resources within the Prairie Island Plant property, the activities which have potential to cause disturbance to these resources, and procedures and practices for proper review, notification, and consultation with concerned parties prior to initiating construction and excavation projects.

As part of the CRMP, Xcel Energy maintains a procedure titled *Archaeological, Cultural, and Historic Resources* that supports the protection of such resources discovered on nuclear sites operated by Xcel Energy by raising awareness about the federal and state

⁵¹ Ref. at 3.

laws which protect these resources. The procedure applies to all ground-disturbing activities on the Prairie Island Plant site, which will include the proposed expansion activities, and requires completion of an Excavation Permit and compliance with another site procedure, *Excavation and Trenching Controls*. Together, these procedures require Xcel Energy to consider site review for such resources and potential consultation with qualified archaeologists, the SHPO, and other agencies, including tribal governments, as appropriate, prior to the execution of work to protect previously undiscovered cultural resources. Finally, the CRMP includes requirements for notification and consultation with a variety of federal, state, tribal, and local agencies and entities depending on the nature and scope of planned activities.⁵²

Xcel Energy's 2011 application to the NRC for ISFSI License Renewal provides a historical background on archaeological work conducted in the Prairie Island Plant area.⁵³ The following discussion provides an update on cultural resource studies completed since the 2009 EIS.⁵⁴

- In 2009, Xcel Energy conducted a limited Phase I survey to provide baseline information about the archaeological sites within the Prairie Island Plant grounds as part of the Settlement Agreement, noted above. A secondary goal was to evaluate the disturbance within the Prairie Island Plant grounds and consider the potential for discovery of unrecorded sites. The survey attempted to identify levels of disturbance, specifically areas of disturbance that would preclude the discovery of intact archaeological deposits. The survey revisited the locations of eight previously recorded sites and recorded five newly identified archaeological sites.⁵⁵
- In 2010, Xcel Energy conducted a Phase I Archaeological Reconnaissance Survey of the ground surface surrounding the ISFSI. The purpose of the survey was to assess the nature of previous construction disturbance and determine the potential for the presence of previously undocumented cultural resources within the ISFSI footprint. The investigation was conducted per an agreement with the PIIC to ensure protection of both recorded and unrecorded cultural resources on Xcel Energy property. The project consisted of a literature review and field investigation at 8 test pits around the perimeter of the ISFSI. No

⁵² Ref. at 31.

⁵³ Prairie Island Independent Spent Fuel Storage Installation Application for Renewed ISFSI Site-Specific License, Environmental Report Supplement. Welch, Minnesota: Northern States Power Company.

⁵⁴ Ref. at 3.

⁵⁵ Ref. at 53.

prehistoric or diagnostic historic artifacts were recovered as a result of the screening of the excavated materials. Visual inspection of the exposed soil profiles in all but one of the test pits suggested that the subsurface deposits in the project area are significantly disturbed and contain limited original integrity.⁵⁶

In 2014, while engaged in the process to extend the license term of the existing ISFSI and anticipating the need for future storage in the license renewal term, Xcel Energy sponsored a Phase I archaeological investigation of some portions of the ISFSI. PIIC reviewed the work plan, provided comments, and monitored ground-disturbing activities. The study excavated 15 shovel tests (in different locations than the 2010 survey noted above), of which 10 were within the ISFSI in an area where a potential third pad would be placed (all to the south of the original two pads). The remaining 5 shovel tests were within areas that were, at the time, proposed for a turn-around area and a new DFS system transport storage facility that were not ultimately constructed. Six soil cores were also excavated to test for the potential for buried paleosols. Paleosols are older land surfaces that may contain possible evidence of human occupation but have been buried by alluvial deposition. The survey found no archaeological properties and no evidence of paleosols. The report also concluded that no additional archaeological investigations were warranted within the studied area.⁵⁷ PIIC reviewed the final reports. Concurrent with the archaeological investigations, Xcel Energy completed geotechnical exploration to characterize subsurface soil conditions (see Section 11.2).⁵⁸

- When the NRC issued its 2015 Environmental Assessment (EA) for ISFSI license renewal it stated, “[Xcel Energy] will perform subsurface archaeological surveys within the area where any new ISFSI pads will be located, to a depth expected to be excavated for construction of the new ISFSI pads. These subsurface archaeological surveys will be performed consistent with the CRMP and implementing procedures and will be completed prior to submittal of a

⁵⁶ Westwood Professional Services, Inc. Phase I Archaeological Reconnaissance Survey Report for the Proposed Upgrades to the Independent Spent Fuel Storage Facility (ISFSI) at the Xcel Energy Prairie Island Nuclear Generating Plant, Goodhue County, Minnesota. November 29, 2010.

⁵⁷ Westwood Professional Services, Inc. Phase I Archaeological Investigations for the Proposed Expansion of the Independent Spent Fuel Storage Installation and Associated Infrastructure at the Prairie Island Nuclear Generating Plant, Goodhue County, Minnesota. Eden Prairie, Minnesota: Westwood Professional Services, Inc. December 2014.

⁵⁸ Ref. at 6.

[License Amendment Request] for the ISFSI expansion”.⁵⁹ Therefore, In 2018, as it was preparing to apply to the NRC for permission to install the third pad, Xcel Energy’s consulting archaeologist, Westwood, reviewed the areas that would be disturbed for the third pad against the locations studied in 2014, to ensure compliance with the commitment memorialized in the 2015 EA. After reviewing the information provided, Westwood determined that the area of the third pad had been previously surveyed in 2014 and recommended no additional archaeological investigations.⁶⁰

- Also in 2018, Xcel Energy performed a series of four CPT soundings within the ISFSI and in the area of the proposed third pad. The fieldwork included 425 feet of CPT sounding, with anticipated termination depths of 100 to 125 feet below the ground surface.⁶¹ The findings from this work, discussed in Section 11-2, are consistent with the ISFSI site’s history as the location of the concrete batch plant used for construction of the Prairie Island Plant.

Xcel Energy is subject to commitments to conduct additional survey for the Project. When NRC issued its 2020 EA for approval of expansion to include the third pad, it stated, “In addition, the Settlement Agreement memorializes NSMP’s commitment to conduct further subsurface surveys, if further expansion of the ISFSI (up to 98 casks) is undertaken.”⁶² Now that Xcel Energy is pursuing expansion of the ISFSI storage capacity, Xcel Energy engaged its consulting archaeologist, Merjent, to review the areas that would be disturbed for the fourth and potentially fifth pad against the locations studied in 2014. Merjent determined that although the area south of the original two pads had already been surveyed in 2014, additional study would be required to adequately survey the area north of the original two pads. Xcel Energy is working with PIIC to plan this work and will complete the survey in the first half of 2024.

The previously disturbed nature of the site and the lack of historic properties has been confirmed by multiple surveys in coordination between Xcel Energy, the SHPO, and the PIIC. Xcel Energy is committed to following the CRMP for all ground-disturbing activities on the Prairie Island Plant site, including those at the ISFSI, and engaging PIIC in all items related to cultural resources on Prairie Island Plant. Because the

⁵⁹ Ref. at 8.

⁶⁰ Ref. at 31.

⁶¹ Ref. at 7.

⁶² Ref. at 2.

proposed Project site was previously disturbed and is currently graveled, there would likely be no impacts on historic properties.

11.10 DEMOGRAPHICS

Information on demographics in Goodhue County and Red Wing was obtained from the U.S. Census Bureau's Quick Facts website.⁶³ The total population within 50 miles of the Prairie Island Plant is about 3,437,000 persons. Table 11-6 below outlines the demographics of Goodhue County and the City of Red Wing. Figure 11-13 presents the distribution of the population within 50 miles of the ISFSI.

Table 11-6
Prairie Island ISFSI Expansion Project
Goodhue County and Red Wing Demographics*

Demographics	Goodhue County	Red Wing
Population		
Population estimates, July 1, 2022 (V2022)	48,013	16,672
Population estimates base, April 1, 2020 (V2022)	47,580	16,540
Population, percent change – April 1, 2020 to July 1, 2022 (V2022)	0.9%	0.8%
Population, Census, April 1, 2020	47,582	16,547
Age and Sex		
Persons under 5 years, percent	5.5%	5.0%
Persons under 18 years, percent	21.8%	20.7%
Persons 65 years and over, percent	20.8%	20.9%
Female persons, percent	49.7%	49.8%
Race and Hispanic Origin		
White alone, percent	94.1%	88.3%
Black or African American alone, percent(a)	1.6%	3.1%

⁶³ Ref. at 18.

Table 11-6
Prairie Island ISFSI Expansion Project
Goodhue County and Red Wing Demographics*

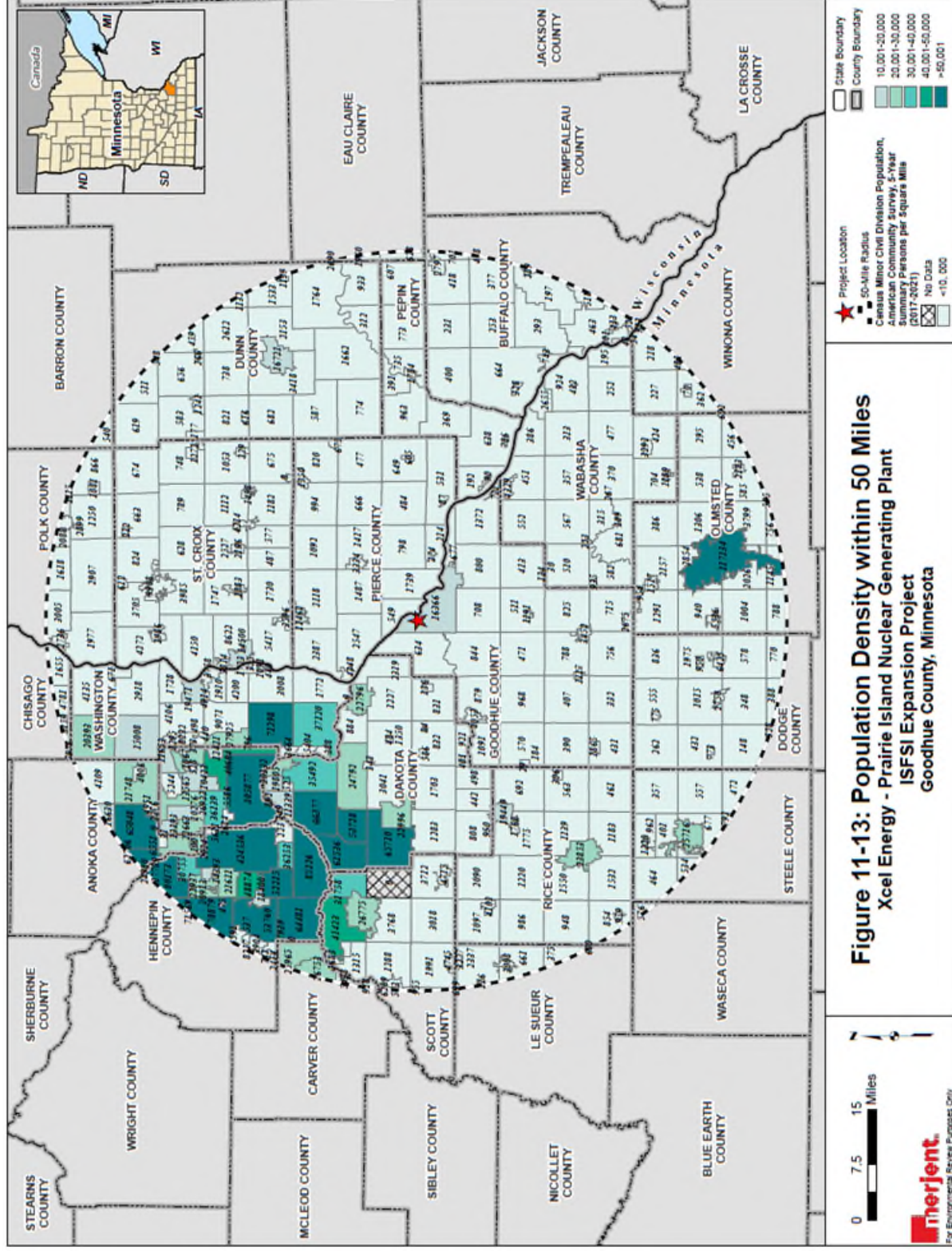
Demographics	Goodhue County	Red Wing
American Indian and Alaska Native alone, percent(a)	1.4%	1.9%
Asian alone, percent(a)	0.8%	0.8%
Native Hawaiian and Other Pacific Islander alone, percent(a)	0.1%	0.0%
Two or More Races, percent	1.9%	3.4%
Hispanic or Latino, percent(b)	3.8%	5.4%
White alone, not Hispanic or Latino, percent	91.1%	87.2%
Housing		
Housing units, July 1, 2022 (V2022)	21,206	X
Owner-occupied housing unit rate, 2018 – 2022	77.5%	71.1%
Median value of owner-occupied housing units, 2018 – 2022	\$254,500	\$212,700
Median selected monthly owner costs -with a mortgage, 2018 – 2022	\$1,682	\$1,514
Median selected monthly owner costs -without a mortgage, 2018 – 2022	\$627	\$595
Median gross rent, 2018 – 2022	\$895	\$910
Families & Living Arrangements		
Households, 2018 – 2022	19,633	7,344
Persons per household, 2018 – 2022	2.37	2.19
Living in same house 1 year ago, percent of persons age 1 year+, 2018 – 2022	88.5%	83.0%
Language other than English spoken at home, percent of persons age 5 years+, 2018 – 2022	3.5%	4.9%
Education		
High school graduate or higher, percent of persons aged 25 years+, 2018 – 2022	94.5%	92.7%

Table 11-6
Prairie Island ISFSI Expansion Project
Goodhue County and Red Wing Demographics*

Demographics	Goodhue County	Red Wing
Bachelor's degree or higher, percent of persons aged 25 years+, 2018 – 2022	27.8%	27.4%
Health		
With a disability, under age 65 years, percent, 2018 – 2022	6.0%	7.5%
Persons without health insurance, under age 65 years, percent	6.1%	10.2%
Economy		
In civilian labor force, total, percent of population age 16 years+, 2018 – 2022	65.0%	60.0%
In civilian labor force, female, percent of population age 16 years+, 2018 – 2022	60.8%	57.3%
Total accommodation and food services sales, 2017 (\$1,000)	\$373,136	\$348,073
Total health care and social assistance receipts/revenue, 2017 (\$1,000)	\$334,096	\$205,556
Total transportation and warehousing receipts/revenue, 2017 (\$1,000)	\$70,306	\$13,444
Total retail sales, 2017 (\$1,000)	\$850,477	\$346,476
Total retail sales per capita, 2017	\$18,353	\$21,102
Transportation		
Mean travel time to work (minutes), workers aged 16 years+, 2018 – 2022	25.0	21.1
Income & Poverty		
Median household income (in 2022 dollars), 2018 – 2022	\$78,338	\$65,107
Per capita income in past 12 months (in 2022 dollars), 2018 – 2022	\$40,087	\$38,098
Persons in poverty, percent	9.0%	12.6%
Source: Ref. at 18		

Table 11-6
Prairie Island ISFSI Expansion Project
Goodhue County and Red Wing Demographics*

Demographics	Goodhue County	Red Wing
<p>The vintage year (e.g., V2022) refers to the final year of the series (2020 thru 2022).</p> <p>Fact Notes:</p> <p>(a) Includes persons reporting only one race</p> <p>(b) Hispanics may be of any race, so also are included in applicable race categories</p> <p>(c) Economic Census - Puerto Rico data are not comparable to U.S. Economic Census data</p> <p>Value Flags:</p> <p>- Either no/too few sample observations available to compute an estimate, or ratio of medians cannot be calculated because one/both of the median estimates falls in the lowest or upper interval of an open-ended distribution.</p> <p>D Suppressed to avoid disclosure of confidential information.</p> <p>F Fewer than 25 firms</p> <p>FN Footnote on this item in place of data</p> <p>N Data for this geographic area cannot be displayed because the number of sample cases is too small.</p> <p>NA Not available</p> <p>S Suppressed; does not meet publication standards.</p> <p>X Not applicable</p> <p>Z Value greater than zero but less than half unit of measure shown.</p>		



CHAPTER 12: WASTES AND EMISSIONS**7855.0630 ENVIRONMENTAL INFORMATION REQUIRED.**

Each applicant shall provide environmental data for the proposed facility and for each alternative facility described in response to part 7855.0610. The information in parts 7855.0640 to 7855.0670 relating to construction and operation of each of these facilities shall be provided to the extent that such information is reasonably available to the applicant and applicable to the particular alternative.

7855.0650 WASTES AND EMISSIONS.

The applicant shall provide data on wastes and emissions associated with construction or operation of the facility, including:

- A. the types and estimated amounts of solid, liquid, and gaseous radioactive wastes that will be produced by the facility, and the level of radioactivity of each in curies per year;
- B. an analysis of human exposure to ionizing radiation attributable to operation of the facility, taking account of the pathways of radioactive releases to humans;
- C. the types and estimated amounts of nonradioactive solid and liquid wastes that will be produced;
- D. the types and estimated amounts of nonradioactive gaseous and particulate emissions into the air that will occur during full operation from each emission source, and the location and nature of the release point;
- E. locations that may be sources of fugitive dust and the nature of each source;
- F. the nature and estimated amount of nonradioactive discharges to water, and the locations, routes, and final receiving waters for any discharge points;
- G. any area from which runoff may occur, potential sources of contamination in the area, and receiving waters for any runoff;
- H. the sources and estimated amounts of heat rejected by the facility; and
- I. the maximum noise levels (in decibels, A scale) expected at the property boundary and the expected maximum increase over ambient noise levels.

12.1 RADIOACTIVE WASTES

The Prairie Island Nuclear Generating Plant (the Prairie Island Plant) currently stores spent fuel assemblies in 50 TN-40/TN-40HT dry casks on the Independent Spent Fuel Storage Installation (ISFSI) (each cask holds up to 40 spent fuel assemblies). Spent fuel stored on the ISFSI results in radiation exposure to onsite workers and to offsite members of the public. Increasing the number of dry fuel storage (DFS) systems stored on the ISFSI will increase the radiological impact. A study was performed to estimate the radiation levels due to an expanded ISFSI with 99 DFS systems (assumed to consist of 55 TN-40/TN-40HT casks and 44 new technology DFS systems).¹ This will provide the needed storage to support Prairie Island Plant operation until the end of the current license (2033/2034) and storage to support subsequent license renewal, which would allow the Prairie Island Plant to operate until 2053/2054. The study used maximum contact dose rates from 3 potential new technology DFS system options to determine bounding doses due to the expanded ISFSI. The study was conducted before the new technology DFS system was selected, but the study was conducted using conservative assumptions so that doses associated with the new technology system would be bounded by doses determined in the study.

12.2 HUMAN EXPOSURE TO RADIATION DUE TO OPERATION

The spent fuel and all associated radioactive material will be completely contained in stainless steel canisters with welded closures, 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.).² Therefore, there will be no uptake of radioactive material by personnel working onsite or people living nearby by means of inhalation or ingestion, and the soil in the vicinity of the site will not be contaminated by the operation of the ISFSI. Additionally, due to the heavy neutron and gamma shielding provided by the storage overpack design, the spent fuel in the canisters will emit only low levels of radiation into the environment surrounding the site. As discussed below, due to this shielding, and the relatively large distances from the ISFSI to the nearest residences (over 700 meters), radiation doses to the population around the site will be extremely low, and indistinguishable from normal background radiation. Additional details on what radiation is and potential health impacts, which are analyzed to be minimal from the ISFSI, can be found in

¹ Sargent and Lundy report SL-018015, Rev. 0, “Dose Study to Support ISFSI Certificate of Need,” Appendix B.

² Radioactive material emits radiation. No radioactive material will escape the sealed canisters, but low levels of radiation (primarily gamma rays) are emitted from the external surface.

Appendix F: Radiation Primer, Appendix G: Update to Risk Assessment, and Appendix H: Initial Risk Assessment.

12.2.1 On-site Radiation Doses

While shielding is provided by the design of the DFS system, spent fuel storage facility personnel receive radiation exposure during spent fuel handling, canister loading, closure welding, draining, drying, onsite transport operations, and placement for storage on the ISFSI. The requirements of 10 CFR 20³ for protecting personnel from radiation exposure and minimizing exposures are strictly adhered to during all activities related to spent fuel storage. Workers and visitors entering the ISFSI are provided with dosimetry to accurately measure and record radiation dose exposure. Additionally, the ISFSI has dosimetry around the controlled access fence to record radiation doses quarterly as part of the existing radiological environmental monitoring program.

There would be increases in dose rates and collective doses to plant personnel who work near the ISFSI as additional spent fuel is added to the ISFSI. The Company operates under the conditions and practices of its Radiation Protection Program to ensure that all ISFSI related work results in radiation exposures that are As Low As Reasonably Achievable (ALARA) in order to minimize occupational doses (pursuant to 10 CFR 20). Regardless of the amount of fuel stored at the ISFSI, the Company will ensure that each worker's annual exposure is below the regulatory limit in 10 CFR 20.1201 of 0.05 Sv (5 rem) Total Effective Dose Equivalent (TEDE).

12.2.2 Off-site Radiation Doses

Potential offsite doses associated with the ISFSI include normal direct doses due to storage of spent fuel on the ISFSI, doses due to leakage of airborne radionuclide activity from ISFSI spent fuel storage containers, and doses due to accidents which involve the spent fuel storage containers on the ISFSI.

Normal Doses

The nearest residence from the ISFSI is 0.45 miles (724 m) northwest from the ISFSI site. The dose analysis study calculates a maximum dose to the nearest resident of 22.1 mrem/yr in 2046 due to an ISFSI with 99 casks and includes dose contributions from uranium fuel cycle operations at the reactor site and planned discharges of radioactive

³ U.S. Code of Federal Regulations, 10 CFR 20, Standards for Protection Against Radiation.

material.⁴ This dose is a small fraction of the annual dose attributed to background radiation from natural and man-made sources. According to the NRC, the annual average dose per person from all natural and man-made sources is about 620 mrem.⁵ The 22.1 mrem/yr dose is less than the 10 CFR 72.104(a)⁶ and 40 CFR 190.10(a)⁷ limit of 25 mrem/yr. The maximum calculated dose rate in 2046 at the nearest site boundary is 1.79 mrem/hr⁸. The dose rate is less than the 10 CFR 20.1301(a)(2) limit of 2 mrem/hr. Calculated doses are conservatively determined and represent bounding values. Once the ISFSI is fully loaded, the dose rates associated with the ISFSI will constantly decrease due to the radioactive decay of the spent fuel.

Leakage

The NRC defines normal, off-normal, and accident conditions to which storage systems are required to be designed. NUREG-2215⁹ states in Section 9.4.4 (Confinement Analysis) that “Generally, as discussed below in the review procedures, the applicant evaluates the allowable leakage rate for its radiological consequences and its effect on maintaining an inert atmosphere within the storage container. However, the analyses discussed below are unnecessary for a storage container, including its closure lid, that is designed and tested to be “leaktight” as defined in American National Standards Institute (ANSI) N14.5, “American National Standard for Leakage Tests on Packages for Shipment of Radioactive Materials.”” The TN-40/TN-40HT cask system is leak tested in accordance with ANSI N14.5.¹⁰ Additionally, a calculation for complete loss of the TN-40 storage cask confinement capability was postulated and the results were found to be negligible.¹¹ The 3 new technology systems reviewed in the study are tested to meet the “leaktight” criteria of ANSI N14.5. As a result, there will be no normal, off-normal nor accident doses associated with leakage, as defined by the NRC for the purposes of licensing a storage container, involving the TN-40/TN-40HT and new technology systems.

⁴ Ref. at 1.

⁵ Doses In Our Daily Lives | NRC.gov <https://www.nrc.gov/about-nrc/radiation/around-us/doses-daily-lives.html>.

⁶ U.S. Code of Federal Regulations, 10 CFR 72, Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste.

⁷ U.S. Code of Federal Regulations, 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operations.

⁸ Ref. at 4.

⁹ U.S. Nuclear Regulatory Commission, NUREG-2215, April 2020, Standard Review Plan for Spent Fuel Dry Storage Systems and Facilities.

¹⁰ American National Standards Institute, ANSI N14.5-1977, National Standard for Leakage Tests on Packages for Shipment of Radioactive Materials.

¹¹ Prairie Island Independent Spent Fuel Storage Installation Safety Analysis Report, Revision 20.

Doses Due to Accident Releases

NUREG-1140, “A Regulatory Analysis on Emergency Preparedness for Fuel Cycle and Other Radioactive material Licensees” calculates the releases and doses associated with a DFS system accident, the NRC’s “worst case scenario” for operation of an ISFSI.¹² The assumed accident for the analysis is an accident that results in the removal of the lid of a dry cask in which all 24 of the fuel assemblies are damaged. The fuel assemblies are assumed to release 10 percent of the Kr-85 (Krypton-85) and 1 percent of the I-129 (Iodine-129) that have been removed from the core 5 years earlier. NUREG-1140 states that while other dry cask storage systems may contain more than 24 fuel assemblies, it is reasonable to assume that a single accident would not damage a larger number of fuel assemblies than the 24 fuel assemblies assumed in the accident scenario.¹³ The NUREG-1140 analysis concluded that this accident had insignificant consequences to the public health and safety. The effective dose equivalent due to the accident is calculated to be 0.003 rem (3 mrem) at 100 m. The nearest site boundary from the Prairie Island Plant ISFSI is 110 m from the western edge of the ISFSI. The off-site radiation dose from the accident scenario is well below the federal limits and the EPA’s protective action guide limits.

12.2.3 Radiation Protection Program

A radiation protection program is required at the Prairie Island spent fuel storage facility. The extensive 10 CFR 20 radiation protection program already in effect for the nuclear power plant has been applied to the ISFSI (per 10 CFR 72.212(b)(6)), to address the specific radiation protection needs of the ISFSI and to follow the requirements of 10 CFR Part 72.126.

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 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.

¹² U.S. Nuclear Regulatory Commission, NUREG-1140, A Regulatory Analysis on Emergency Preparedness for Fuel Cycle and Other Radioactive Material Licenses.

¹³ Note that the existing TN-40/40HTs that are stored at the Prairie Island Plant hold 40 spent fuel assemblies and the new Orano EOS-37PTH DFS systems hold 37 spent fuel assemblies.

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 shipment and storage of spent fuel will be controlled by an environmental radioactivity monitoring plan to ensure off-site doses are ALARA.
3. Protection of the Facility, including monitoring the facility for physical changes 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 that sufficient authority to enforce safe station operation is provided. 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.

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 ensure 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 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, that procedures and their revisions are implemented in accordance with the objectives of the ALARA program, and that applicable requirements of 10 CFR 72 and 10 CFR 20 are complied with.

12.2.4 Emergency Plan

The requirements for an emergency plan for the ISFSI are identified in 10 CFR Part 72.32. The emergency plan is prepared in accordance with these regulations and 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.

12.3 NON-RADIOACTIVE SOLID AND LIQUID WASTES

Construction of the Project will result in generation of non-radiological solid waste. Xcel Energy will need to dispose of the materials excavated to construct the Project as well as normal construction debris (e.g., trash, waste parts). Trash would be collected in appropriate, leak-proof waste dumpsters or bins, and disposed of properly offsite by a licensed waste transporter.

Liquid wastes generated during construction may consist of construction equipment fluids, such as gasoline, diesel fuel, and mechanical lubricants, and/or concrete wastes. Chemicals potentially onsite during construction will consist of construction equipment fuels and fluids, such as gasoline, diesel fuel, and mechanical lubricants. Construction equipment will be inspected prior to use to ensure all connections and hoses are in working order. Spill response equipment, such as drip pans and absorbents, will be on site in the event of spills or leaks. Any spills or releases will be managed in accordance with the Prairie Island Plant Spill Prevention, Control, and Countermeasure (SPCC) Plan and with state and federal spill response and reporting regulations. Any onsite fueling that occurs will be attended at all times. Used oils or other equipment liquids will

be stored in lidded containers appropriate for the contents and labeled. Wash water generated from cleaning any equipment that comes in contact with concrete pours will be contained in a leak-proof container or impervious liner (i.e., a compacted clay liner that does not allow washout to enter ground water) and the liquid allowed to evaporate or be disposed of at an approved location. The Prairie Island Plant has processes in place to address management of waste produced by construction and operation activities at the facility.

During operations, sealed DFS systems will store spent nuclear fuel. The DFS systems are completely passive, and no solid or liquid wastes will be generated during operation aside from minor trash, which will be collected in appropriate, leak-proof waste dumpsters or bins, and be disposed of properly offsite by a licensed waste transporter.

12.4 NON-RADIOACTIVE GASEOUS AND PARTICULATE EMISSIONS

Emissions during construction will be limited to short-duration activities related to operation of construction equipment (e.g., bulldozers, scrapers, front-end loaders, graders, dump trucks, cement trucks, and delivery trucks/trailers).

Pad construction is expected to occur over 9 to 12 months between 2027 and 2029. It is anticipated that it will take 3 months for the first DFS loading campaign in 2030. Vehicle emissions during construction are expected to be negligible. Should concrete overpacks be constructed on-site, this will occur the year prior to dry fuel loading in the following approximate years (plus or minus one year): 2029 (to support loading in 2030), 2034 (to support loading in 2035), 2039 (to support loading in 2040), and 2044 (to support loading in 2045). Concrete overpack fabrication would occur over a three-month period prior to loading, with loading then taking approximately three additional months. During operations, the spent fuel would be moved from the Prairie Island Plant to the ISFSI facility with the DFS system transport vehicle. Should concrete overpack fabrication occur on-site, the overpacks would be moved a short distance from the area they are fabricated to the ISFSI. These activities will be intermittent and will not result in long lasting effects on air quality in the immediate Project area. Minor vehicle emissions will occur during operation of the ISFSI; however, the Project will not generate any stationary air emissions during operation and will not have impacts on air quality. Dry storage of spent fuel is a passive operation and therefore the operation of the ISFSI will not generate any gaseous or particulate emissions.

Total greenhouse gas (GHG) emissions for construction activities are estimated to be approximately 305 tons of carbon dioxide (CO₂) for initial pad construction and 20 tons of CO₂ during the Project's operational term, for a total of 325 tons of CO₂; calculations are shown in Table 12-1 and 12-2 below.

Table 12-1
CO₂ Emissions from Construction Equipment for
Storage Pad Construction

Equipment	Diesel Fuel Used (gallon/hour)	Equipment Operating Hours for Pad Construction (hours)^a	CO₂ Emission Factor (kilogram/gallon)	Conversion Factor (kilogram/ton)	CO₂ Emissions from Pad Construction (tons)^b
Bulldozer	10	120	10.2	907.185	13.5
Soil Compactor	8	120	10.2	907.185	10.8
Cement Truck	5	2,304	10.2	907.185	129.5
Dump Truck	5	1,920	10.2	907.185	107.9
Grader	8	80	10.2	907.185	7.2
Semi-Trailer	10	320	10.2	907.185	36.0
TOTAL					304.9
^a Takes into account the total estimated number of hours that each type of equipment will operate over the course of the construction project. ^b Total emissions are rounded to the nearest whole number.					

Table 12-2
CO₂ Emissions from Construction Equipment for
Concrete Overpack Fabrication

Equipment	Gallons of Diesel Fuel Used (gallon/hour)	Equipment Operating Hours for Each Round of Concrete Overpack Construction (hours) ^a	CO ₂ Emission Factor (kilogram/gallon)	Conversion Factor (kilogram/ton)	CO ₂ Emissions from Each Round of Concrete Overpack Construction (tons) ^b	CO ₂ Emissions from Four Rounds of Concrete Overpack Construction (tons) ^b
Cement Truck	5	24	10.2	907.185	1.3	5.4
Semi-Trailer	10	160	10.2	907.185	3.6	14.4
TOTAL					4.9	19.8
^a Takes into account the total estimated number of hours that each type of equipment will operate over the course of the construction project. ^b Total emissions are rounded to the nearest whole number. Note: These emissions will not be realized as part of the Project if the concrete overpacks are not constructed at the Prairie Island Plant.						

For reference, Minnesota Administrative Rule 4410.4300, Subpart 15, Part B, requires preparation of an Environmental Assessment Worksheet for stationary source facilities generating 100,000 tons or more of GHGs annually or increasing GHG emissions by 100,000 tons or more annually. Therefore, the 305 tons of CO₂ emissions as a result of construction and the 20 tons of CO₂ emissions as a result of operation of the Project are negligible.

12.5 FUGITIVE DUST

Construction of the Project could generate small amounts of dust. Earth-moving equipment such as bulldozers, scrapers, and graders would clear/excavate the area where the concrete pads would be placed. Concrete trucks would then deliver concrete to the site, and pumping trucks will place it. Xcel Energy may need to control fugitive dust during construction by applying water to exposed soil areas and covering spoil piles with tarps. Fugitive dust from construction activities will be short in duration and intensity.

There is presently no dust produced during the operation of the ISFSI, and only minimal fugitive dust is anticipated in future operations. Minor fugitive dust may be produced by the DFS system transport vehicle driving on gravel road surfaces during loading campaigns. As such, no appreciable dust impacts will occur, and no mitigation will be required during operation.

12.6 NON-RADIOACTIVE RUNOFF, POTENTIAL SOURCES OF CONTAMINATION, AND DISCHARGE TO RECEIVING WATERS

The Mississippi River, Vermillion River, and Sturgeon Lake are within one mile to the ISFSI. The cooling tower discharge canal is to the southeast of the ISFSI; it discharges into the Mississippi River. As discussed in Section 11.6.1, the Vermillion River/Vermillion Slough, Mississippi River, and Sturgeon Lake are proposed 2024 Minnesota Pollution Control Agency (MPCA) 303(d) waters with impairment parameters that include polychlorinated biphenyls in fish tissue and aluminum. Sturgeon Lake has impairment parameters for sulfates due to its use for wild rice production. Construction of the Project will not contribute to the existing impairment status in any of these waterbodies or result in discharges to receiving waters.

Regarding potential sources of contamination in the area, according to the MPCA's What's in My Neighborhood (WIMN) web-mapper, one inactive State Assessment Site is located on the Prairie Island Plant property. The State Assessment Site consists of a resin disposal site that was registered in 1987 and closed in 1998. There are also storage tanks located at the Prairie Island Plant, but no indication of any release from these tanks. WIMN identifies two potential contamination sites within a two mile radius of the Project. The two sites include a closed petroleum leak site located at the Prairie Island Security VBS Project, and an AC Express site that had three underground tanks, all of which have been removed. All other WIMN occurrences within two miles are not potential sources of contamination. No other existing contamination, or potential environmental hazards, such as soil or ground water contamination, abandoned dumps, closed landfills, or hazardous liquid or gas pipelines, are present near the Project site. Figure 12-1 below depicts MPCA WIMN sites within 2 miles of Project.

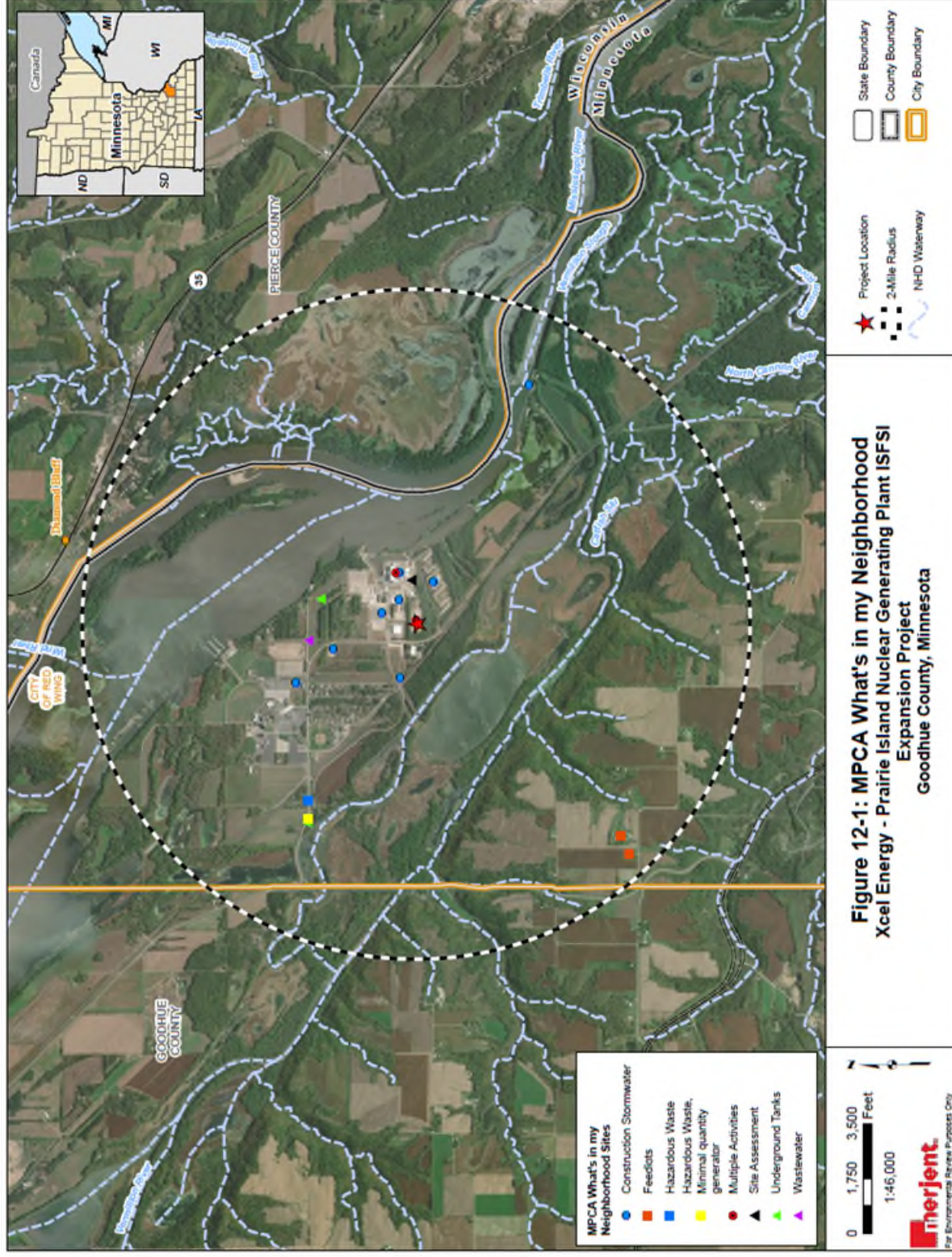
As discussed below, stormwater resulting from construction and operation of the project will be handled onsite.

12.6.1 Stormwater – Construction

As the area of construction will be less than one acre in size, the Company will not be required to obtain MPCA NPDES/State Disposal System (SDS) permit coverage for

construction stormwater discharges. The Project would not expose any industrial activities to stormwater or produce any new impervious area.

The ISFSI is surrounded, except for an opening to allow travel in and out of the ISFSI, by a large earthen berm. Within the ISFSI, stormwater is directed by grade to the southwest and southeast corners, where stormwater travels through two metal drainage pipes which outlet to riprap structures outside of the berm. Once stormwater is outside of the berm, stormwater flows overland through a minor swale to a “landlock ditch.” The landlock ditch is an extensive ditch system that originates to the southwest of the Prairie Island Plant site and receives stormwater from multiple Prairie Island Plant areas. During construction it is estimated that most stormwater will drain into the surrounding soils. Construction best management practices (BMPs) and sediment and erosion control devices will prevent the occurrence of point discharges from the site into any conveyances that could permit sediment or silt-laden runoff into natural flow routes that discharge into nearby receiving waters. Perimeter controls, such as silt fence and/or straw wattles, will be installed to ensure sediment or silt-laden runoff does not leave the property. Controls will be installed and maintained in accordance with manufacturer specifications and repaired or replaced if found to be functioning improperly.



12.6.2 Stormwater – Operations

As stated above, the existing ISFSI was designed with a slight slope to direct runoff to the perimeter of the ISFSI to the southwest and southeast corners, where stormwater travels through two metal drainage pipes which outlet to riprap structures outside of the berm. The Project would be constructed with the same slopes and no work would need to occur to accommodate the Project.

Because the site would not introduce any pollutants to stormwater, it is expected that the quality of the stormwater runoff produced during operations would be similar to the existing runoff quality. Stormwater runoff during operations is expected to be relatively unaffected by the installation of the Project.

The area impacted by Project activities is currently covered in Class 5 gravel, which is considered an impervious surface; therefore, the installation of the concrete pads and aprons will not increase the impervious nature of the area. All stormwater runoff from the ISFSI will continue to flow to the existing stormwater systems. As such, no appreciable change in stormwater runoff during operations is anticipated due to the Project and no additional stormwater retention capacity is necessary.

12.7 HEAT REJECTION

DFS systems are passive with no active heat rejection required. By the time they are placed in the DFS systems, the used fuel assemblies have decayed sufficiently such that natural conduction and convection is sufficient to remove the heat generated by the assemblies. Depending on the specific system design, periodic monitoring of air inlets/outlets or temperatures is required.

Current DFS system designs licensed by the NRC are designed and licensed for heat loading of up to approximately 50 kW per DFS system. This level of heat generation will have no adverse impact on the local environment.

12.8 NOISE

Construction of the Project will create a temporary source of noise. Construction activities associated with the Project will be performed with standard heavy equipment such as track-excavators, backhoes, cranes, bulldozers, dump trucks, and cement trucks with maintained exhaust systems. Sound will also be generated by trucks and other light vehicles traveling in and near areas under construction. The changing

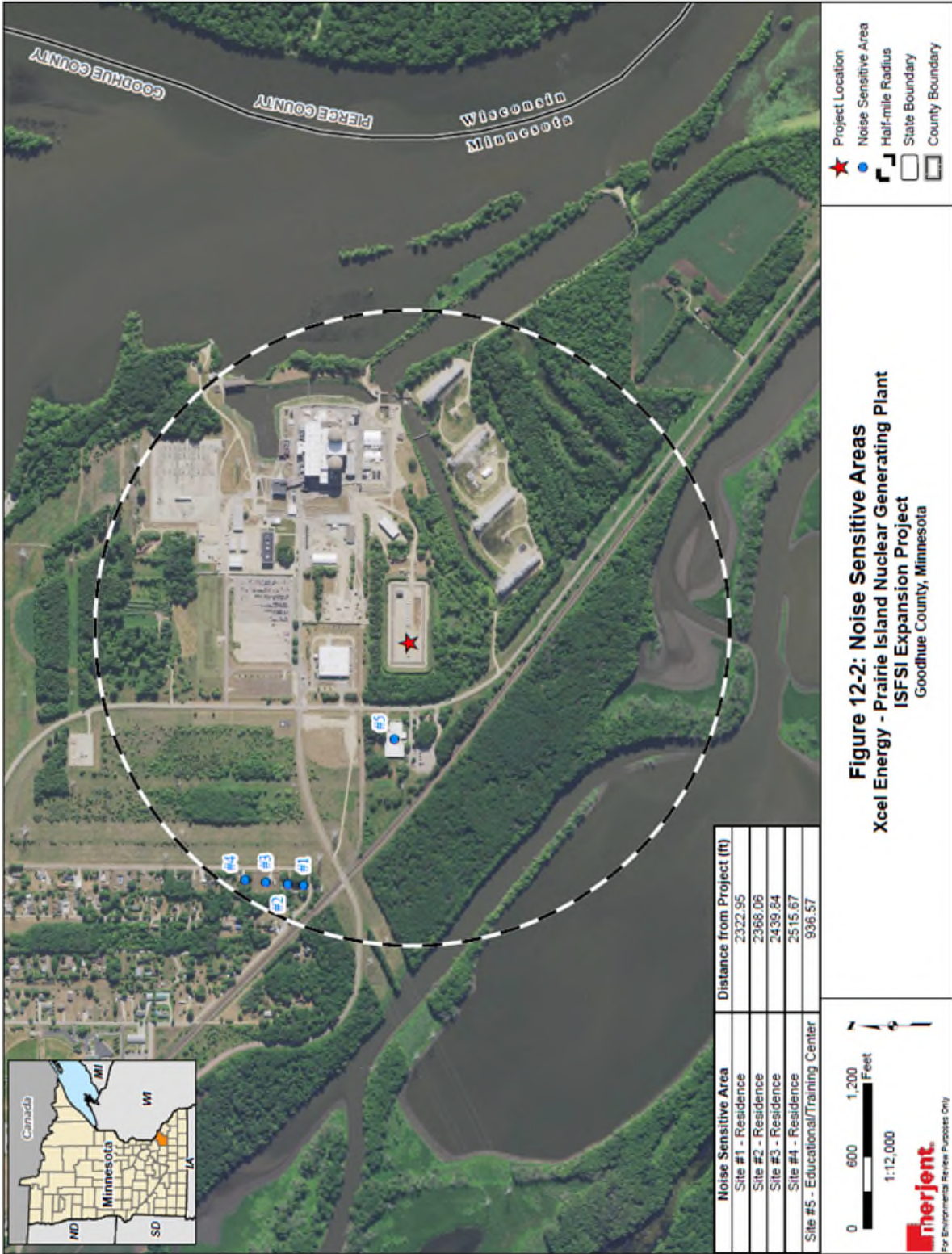
number and type of construction equipment at construction sites will result in varying levels of sound.

Outdoor sound levels change continually because of the temporal and spatial variations of sound sources. The temporal variation in the resulting sound levels is described by statistical levels in the form L_x , where L_x designates a sound that exceeds the level L for x percent of the sampling duration. Minnesota has established noise pollution rules under Minnesota Administrative Rule 7030: Noise Pollution Control. These rules quantify noise levels over a one-hour period where L_{10} is the noise level that is exceeded for 10 percent (6 minutes) of the hour, and L_{50} is the noise level exceeded for 50 percent (30 minutes) of the hour. Stationary limits for residential areas are the most stringent as shown in Table 12-3 below.

Table 12-3
Prairie Island ISFSI Project – Noise Rules for Noise Classification Areas

Noise Classification	Daytime (7AM-10PM) (dBA)		Nighttime (10PM-7AM) (dBA)	
	L10	L50	L10	L50
Area 1 (Residential)	65	60	55	50
Area 2	70	65	70	65
Area 3	80	75	80	75

Sensitive receptors, or noise-sensitive areas (NSAs), are defined as homes, schools, churches, or any location where people reside or gather. The NSAs nearest to the Project are several residential homes located approximately 0.5 mile to the northwest within the Prairie Island Indian Community (PIIC). Figure 12-2 below depicts the nearest present-day NSAs in the proposed Project area. Noise typically associated with the ISFSI is not audible. The earthen berm around the ISFSI mutes noise generated by the transport vehicle during spent fuel transfer activities.



Ambient sound level data was collected in the vicinity of the Prairie Island Plant in 2006 as shown in Table 12-4 below.¹⁴ The purpose of the survey was to document the existing ambient sound levels at the closest residential receptors, to be used in identifying potential noise impacts due to the future construction and operation of the expanded ISFSI. There has been no substantial change to the level or quality of noise in the area since the time of this data collection. The plant was operating during the ambient surveys, but the cooling towers were not. The morning L90s varied from 31.9 to 43.8 A-weighted decibels (dBA) and the afternoon L90s varied from 32.3 to 46.1 dBA depending on location. Ambient noise levels are highly dependent on location. For example, daytime ambient noise levels at the Prairie Island Casino are in the range of 45 dBA, due primarily to casino related traffic. Daytime ambient noise levels at rural residences are in the range of 35 dBA.

Table 12-4
Prairie Island ISFSI Project – Summary of Measured Ambient L₉₀s

Location	Morning		Afternoon		L _{dn} ^a	Controlling Noise Sources
	11/15/06	11/16/06	11/15/06	11/16/06	dBA	
5016 Lock and Dam Rd/C. Suter Residence	34	31.9	34.6	32.3	39.4	Vents from Prairie Island Plant
1754 Messiah Rd.	38.2	37.8	40.7	37.5	44.6	Local vehicle and train traffic
Casino parking lot	42.5	43.8	46.1	43.3	49.8	Local vehicle and train traffic and casino vent fans on roof
1960 Edoka St.	39.9	40	41.7	39.9	46.5	Local vehicle and train traffic
1824 Edoka St.	35.3	32.2	35.7	33.5	40.3	Local vehicle and train traffic

¹⁴ Final Environmental Impact Statement – Request for Additional Dry Cask Storage. MPUC Docket No E002/CN-08-510. July 31, 2009.

Table 12-4
Prairie Island ISFSI Project – Summary of Measured Ambient L₉₀s

Location	Morning		Afternoon		L _{dn} ^a	Controlling Noise Sources
	11/15/06	11/16/06	11/15/06	11/16/06	dBA	
5390 Sturgeon Lake Rd.	36.1	34.5	33.1	40.7	42.0	Local vehicle and train traffic
^a The morning and afternoon measured ambient L ₉₀ s were used to calculate L _{dn} , with the morning values assumed to be representative of “nighttime” values and the afternoon values representative of “daytime” values.						

As indicated in Table 12-4 above, the residual morning and afternoon L₉₀s are mostly controlled by local vehicle traffic and trains. The measured sound levels at the Casino Parking Lot were the loudest, due to casino related traffic. Locations at 5016 Lock and Dam Rd and 5390 Sturgeon Lake Rd. were generally the quietest as these locations are farther from the casino. The change in sound level from morning to afternoon varied from 0.1 to 6.2 dBA. Prairie Island Plant activities were only audible at 5016 Lock and Dam Rd.

The predicted sound levels for residences near the Project are shown in Table 12-5 below, in which it is assumed one dump truck, one grader, one water truck, and one light truck are operating simultaneously. Some citizens may experience noise impacts of 10-20 additional dBA due to construction activities depending on location; other citizens would experience no increase in noise. For those citizens who are impacted, the additional noise impact is limited in extent and duration. The impact would be below the Minnesota daytime code limit of 60 dBA. Construction would not affect nighttime noise levels as it would be limited to daylight hours (7:00 a.m. to 10:00 p.m.) as defined by Minnesota Administrative Rule 7030.0020.

Table 12-5
Prairie Island ISFSI Project – Summary of Construction Sound Levels and
Daytime Ambient L_{90s}

Location	Measured Ambient Daytime Sound Levels¹ (L₉₀) dBA	Sound Level Attributable to Construction (L₅₀) dBA	Estimated Total Daytime Sound Level (L₅₀) dBA	Calc'd Increase Over Existing Sound Level (L₅₀) dBA
5016 Lock and Dam Rd. C. Suter Residence	33.5	48.3	48.4	15.0
1754 Messiah Rd.	39.1	50.0	50.3	11.2
Casino parking lot	44.7	46.0	48.4	3.7
1960 Edoka St.	40.8	47.9	48.6	7.8
1824 Edoka St.	34.6	50.3	50.5	15.9
5390 Sturgeon Lake Rd.	36.9	48.0	48.3	11.4
¹ The average measured ambient afternoon L ₉₀ measured at each location.				

Construction of the storage pads would create a temporary source of noise during the 9-12 month construction window. Sound generated during construction of the Project would be greatest in the immediate vicinity of construction activities and would diminish with distance from the work area and would come and go depending on the phase of construction. The construction noise levels of the ISFSI would be below the MPCA 60 dBA L₅₀ noise threshold.

During operations, the DFS systems would be moved from the PINGP to the ISFSI facility with the DFS transport vehicle. Concrete overpack construction (should it occur on-site) and transport to the ISFSI would occur in 2029 (to support loading in 2030), 2034 (to support loading in 2035), 2039 (to support loading in 2040), and 2044 (to support loading in 2045). Concrete overpack fabrication would occur over a three-month period prior to loading, with loading then taking approximately three additional months. There would be no change in operation activities; therefore, there would be no operational impacts on sound levels at the NSAs due to the Project. Therefore, there would be no measurable noise impacts as a result of the Project and no mitigation measures are proposed.

**CHAPTER 13: POLLUTION CONTROL AND SAFEGUARDS
EQUIPMENT****7855.0630 ENVIRONMENTAL INFORMATION REQUIRED.**

Each applicant shall provide environmental data for the proposed facility and for each alternative facility described in response to part 7855.0610. The information in parts 7855.0640 to 7855.0670 relating to construction and operation of each of these facilities shall be provided to the extent that such information is reasonably available to the applicant and applicable to the particular alternative.

7855.0660 POLLUTION CONTROL AND SAFEGUARDS EQUIPMENT.

The applicant shall provide data regarding pollution control and safeguards equipment, including:

- A. the provisions that will be made for management of radioactive materials;
- B. a description of contingency plans to reduce the effects of an accidental release of radioactive materials;
- C. the methods that will be used to recycle or dispose of solid or liquid wastes;
- D. the types of emission control devices and dust control measures that will be used;
- E. the types of water pollution control equipment and runoff control measures that will be used;
- F. the measures that will be taken to prevent spills or leaks of pollutants, or to minimize the effects of spills or leaks on the environment;
- G. the methods that will be used to reduce the effects of heat rejected by the facility;
- H. any other equipment or measures, including noise control or erosion control, that will be used to reduce the effects of the facility on the environment; and
- I. I. the types of environmental monitoring, if any, that are planned for the facility and a description of any relevant environmental monitoring data already collected.

13.1 MANAGEMENT OF RADIOACTIVE MATERIALS

Radioactive materials will be sealed in a steel canister and welded closed prior to being located at the ISFSI¹. 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 canister shell or fail the double seal welds at the canister closure. Seal welded canisters and bolted-lid casks designed by the major storage system vendors licensed by the NRC, including the Orano EOS 37PTH and TN-40/40HTs respectively, are designed and tested to meet the extremely restrictive “leak tight” criteria of ANSI N14.5 (which requires leakage rates not exceed 1 E-7 standard cubic centimeters per second (scc/sec)), or the alternative criteria set forth in Interim Staff Guidance (ISG) 18, such that leakage from the seal welded canister or bolted-lid cask is not considered credible for normal and accident conditions. The spent fuel canisters are totally seal-welded pressure vessels with no bolted closure or mechanical seals. The canisters’ redundant closures are designed to maintain containment integrity during normal conditions of storage, and off-normal and postulated accident conditions, including earthquake, tornado, missile, and drop/tip-over of the transfer cask and storage system. Closure welds are inspected using non-destructive examination techniques to ensure their integrity. No mechanistic failure results in a breach of, and associated leakage of radioactive material from the canister confinement boundary.

A generic analysis of potential on-site and off-site consequences of accidental releases associated with the operation of an ISFSI is contained in NUREG-1140, “A Regulatory Analysis on Emergency Preparedness for Fuel Cycle and Other Radioactive Material Licensees”. The accident assumed for the analysis was the removal of the lid of a dry cask containing 24 damaged pressurized water reactor (PWR) spent fuel assemblies. It was assumed that the fuel had been removed from the reactor core five years earlier and that 10 percent of the Kr-85 (Krypton-85) and 1 percent of the I-129 (Iodine-129) were released.

The NUREG-1140 analysis concluded that this postulated accident involving an ISFSI has insignificant consequences to the public health and safety. The maximum dose to a member of the public off-site due to an accidental release of radioactive materials under this scenario was calculated to be .003 rem at 100 meters. The

¹ There are currently 50 TN-40/40HT TN Americas LLC (Orano) welded-lid casks stored in the Prairie Island Plant ISFSI. Under the current operating license, a total of 55 TN-40/40HTs will be stored in the ISFSI. These DFS systems are also authorized by the NRC and have a Safety Analysis Report indicating there is no credible condition that can breach the containment enclosure.

calculated dose is within the 1 rem effective dose equivalent EPA Protective Action Guideline and the 10 CFR 72.106 limit of 5 rem to the whole body or 50 rem to the maximally exposed organ from any design basis accident.

13.2 CONTINGENCY PLANS IN THE EVENT OF AN ACCIDENTAL RELEASE

An emergency plan is required for the Prairie Island Plant spent fuel storage facility, in accordance with 10 CFR 72.32(c). The 10 CFR 50.47 emergency plan already in effect for the Prairie Island Plant is applied to the ISFSI. The Plant's 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.

13.3 METHODS FOR THE RECYCLING OR DISPOSAL OF SOLID OR LIQUID WASTES

Construction of the Project will result in the generation of non-radiological liquid and solid wastes that need to be managed. Liquid wastes generated during construction may consist of construction equipment fluids, such as gasoline, diesel fuel, and mechanical lubricants, and/or concrete wastes. Equipment fluids will be collected and stored in a sealed, labeled container and recycled through a licensed contractor, as needed. Where concrete is poured onsite, wash water generated from cleaning any equipment that comes in contact with concrete pours will be contained in a leak-proof container or impervious liner (i.e., a compacted clay liner that does not allow washout to enter ground water) and the liquid allowed to evaporate or be disposed of at an approved location.

Solid wastes generated during construction will be composed of normal construction debris (e.g., trash, waste parts) and the soil excavated to construct the Project. Solid wastes will be collected in appropriate, leak-proof waste dumpsters or bins and be disposed of properly offsite by a licensed waste transporter. Erosion control devices, such as silt fence, will be installed around stockpiled soil piles to ensure soils are not washed off site until they can be properly disposed offsite by a licensed hauler. No recyclable debris is anticipated to be generated during construction of the Project. Xcel Energy has existing processes in place at the Prairie Island Plant to address management of waste produced during both construction and operational activities.

13.4 EMISSION CONTROL DEVICES AND DUST CONTROL MEASURES

13.4.1 Emission Controls

Emissions during construction will consist of typical construction equipment emissions. These are anticipated to be normal emissions from adequately maintained vehicles, as such, no emission control devices in addition to those already in place on the vehicles will be required.

The dry storage of spent fuel is a passive operation. Ambient air is used for natural convective cooling of the fuel canisters. The Project will not generate any stationary air emissions during operation and no permitting or control devices will be required.

13.4.2 Fugitive Dust

Construction of the Project could generate small amounts of dust. Earth-moving equipment such as bulldozers, scrapers, and graders would clear/excavate the area where the concrete pads and aprons would be placed. Concrete trucks would then deliver concrete to the site and pumping trucks would place it. Xcel Energy may need to control fugitive dust by applying water to exposed soil areas and covering spoil piles with tarps. Fugitive dust from construction activities will be short in duration and small in volume.

During operation, fugitive dust may be produced by the slow-moving DFS system transport vehicle driving on gravel road surfaces during future loading campaigns. Should concrete overpacks be constructed on-site, the concrete overpacks would be moved a short distance from the area where they are fabricated to the ISFSI, which could also create minor fugitive dust. This will be a negligible source of fugitive dust. As such, no appreciable dust impacts will occur.

13.5 WATER POLLUTION CONTROL EQUIPMENT AND RUNOFF CONTROL MEASURES

As the area of construction will be less than one acre in size, the Company will not be required to obtain MPCA National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) permit coverage for stormwater discharges that occur during construction activities. However, the Company will employ best management practices (BMPs) and erosion and sediment controls to manage stormwater within existing stormwater management systems.

Potential pollution that could result from construction activities will be related to sediment or oil and gas residue from onsite construction equipment. Erosion and sediment controls will be installed around the perimeter of ground-disturbing activities and at the bottom of soil piles to ensure sediment and potential pollutants are not washed from the site. Examples of such controls include silt fences and/or straw wattles. All controls will be installed and maintained in accordance with manufacturer specifications. The existing ISFSI was designed with a slight slope to direct runoff to the southwest and southeast drainage structures. From there, stormwater travels through two metal pipes to riprap outfall structures outside of the berm. Once stormwater is outside of the berm, stormwater flows overland through a minor swale to a “landlock ditch.”

The Project will not have any discharges to water during operation and therefore will not require any water pollution control equipment. Runoff will continue to be directed toward existing flow routes. Since the Project will not add any waste to stormwater, it is expected that the quality of the runoff will be similar to the existing runoff quality and impacts are not anticipated. The Project will not add any new impervious surface; therefore, stormwater quantity will not change.

13.6 SPILL AND LEAK PREVENTION MEASURES

During construction of the Project, spill equipment such as booms, absorbents, and drip pans will be onsite in the event of a spill or leak of construction equipment fluids. The Project will require portable restrooms for workers. Any spills/leaks will be cleaned up immediately and in accordance with site procedures and local, state, and federal regulations. Large volume spills or leaks are not anticipated to occur during construction because large volumes of liquid materials will not be used.

DFS systems are welded, closed canister systems that do not allow any release of radioactive materials during operation. There will be no liquid-containing drums or tanks located at the ISFSI. Therefore, no additional spill or leak prevention measures are required.

13.7 HEAT REJECTION REDUCTION METHODS

As discussed in Section 12.7, existing NRC licensed DFS systems are designed for heat loading of up to approximately 50 kW per DFS system. Magnitudes of this level of heat will not adversely affect the surrounding environment and no heat rejection reduction methods will be applied to the facility.

13.8 OTHER EQUIPMENT OR MEASURES TO REDUCE EFFECTS OF FACILITY ON THE ENVIRONMENT

Construction of the Project will have negligible effect on the environment due to the location within a previously disturbed area. Operation of the expanded ISFSI facility will neither increase nor decrease any non-radiological effects on the environment. As such, no additional equipment or measures will be required to reduce or mitigate potential impacts on the environment.

13.9 ENVIRONMENTAL MONITORING

13.9.1 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 setpoint and of concentrations of radioactive material in effluents above control limits. However, section 9.4.2 of NUREG 2215, the NRC's Standard Review Plan for Spent Fuel Dry Storage Systems and Facilities, indicates that the NRC has accepted that storage containment systems of acceptable design and construction that are sealed by welding do not require closure monitoring.² Additionally, because significant airborne radioactivity releases are precluded by the canister design in which the closures are sealed by welding and by the storage system vendor's canister design and testing criteria that conforms in ANSI N14.5 as "leak tight", monitoring for a potential radiation release is not required. NUREG 2215, section 9.4.4, n. 1. 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 canister handling and for other activities. Thermo-luminescent Dosimeters (TLDs) are mounted in various areas at the ISFSI to monitor cumulative direct radiation levels over predetermined time intervals as part of the environmental monitoring program. The TLDs should be read on a quarterly frequency to provide a record of ISFSI boundary dose. Personnel entering the ISFSI radiation restricted area will be provided with dosimetry to accurately measure, record, and report exposure on an individual basis.

² The TN-40/40HT bolted-lid DFS systems do require closure monitoring. A pressure system exists to monitor the inner seal pressure of the casks. This information is transmitted to the plant monitoring computer.

13.9.2 Temperature Monitoring

Temperature monitoring of the storage systems will be conducted in accordance with Technical Specification requirements of the DFS system license to ensure that temperatures do not exceed material limits. The modules include a temperature monitoring system consisting of thermocouples embedded in the storage module, as required by Technical Specifications. The temperature monitoring system is connected to an electronic data collection system at the ISFSI.

CHAPTER 14: ESTIMATES OF INDUCED DEVELOPMENT**7855.0630 ENVIRONMENTAL INFORMATION REQUIRED.**

Each applicant shall provide environmental data for the proposed facility and for each alternative facility described in response to part 7855.0610. The information in parts 7855.0640 to 7855.0670 relating to construction and operation of each of these facilities shall be provided to the extent that such information is reasonably available to the applicant and applicable to the particular alternative.

7855.0670 ESTIMATES OF INDUCED DEVELOPMENT.

The applicant shall provide estimates of induced developments, including:

- A. the types and amounts of vehicular traffic that will be generated by the facility due to construction activity and, later, to operational needs;
- B. the work forces required for construction and for operation of the facility;
- C. the extent to which the facility will create or add to the need for expanded utility or public services, including high voltage transmission lines, access roads, and the like;
- D. the amount of water that will be appropriated and the amount that will be consumed by the facility, the expected source of the water, and the uses for the water;
- E. the amount of agricultural land, including pastureland, that will be removed from agricultural use if the facility were constructed, and known circumstances associated with the facility that could lead to reduced productivity of surrounding agricultural land; and
- F. the number of people that will have to relocate if the facility were constructed.

14.1 VEHICULAR TRAFFIC DURING CONSTRUCTION AND OPERATION

No parking spaces are currently located at the ISFSI, nor will any be added as adequate parking exists at the adjacent Prairie Island Plant parking lots. The equipment that will be employed during construction will include bulldozers, scrapers, front end loaders, graders, dump trucks, cement trucks, delivery trucks/trailers, and various small support vehicles. Work and travel would occur during daytime hours.

During the 9-12 month concrete pad construction period between 2027 and 2029 and subsequent 3 month DFS loading campaign in 2030, a total of 40 construction workers are estimated with a peak at any one time of 12 workers and an average of 8 workers during a 40-hour week. Additional traffic would be generated from truck deliveries. It is estimated that deliveries would add an average of 7 trips each day.

Should concrete overpacks be constructed on-site, this will occur the year prior to dry fuel loading in the following additional approximate years (plus or minus one year): 2029 (to support loading in 2030), 2034 (to support loading in 2035), 2039 (to support loading in 2040), and 2044 (to support loading in 2045). Concrete overpack fabrication would occur over a three-month period prior to loading, with loading then taking approximately three additional months. During these periods, a total of 16 construction workers are estimated with a peak at any one time of 10 workers and an average of 6 workers during a 40-hour week. Additional traffic would be generated from truck deliveries. It is estimated that deliveries would add an average of 7 trips each day.

With a peak construction force of 10-12 workers, the peak hour traffic generated during the morning and evening commuting hours will be 10-12 vehicles. It is estimated that deliveries would add an average of 7 trips each day and commuting would add up to 20-24 trips (2 per round trip) each day. During peak construction activity (between the morning and evening commuting hours), it is estimated that the peak hour traffic generated due to deliveries will be three trucks. The addition of these vehicles on local roadways during construction activities will not create any traffic impacts.

Alternative transportation methods in the area that could be used by construction personnel are limited and would not likely be used. Regardless, the number of construction workers needed for this Project is small, compared to the over 800 full-time, contract, and security employees at Prairie Island Plant. Construction activities will be conducted during daytime hours.

Water will be used to provide dust control during construction of the Project. Water would be obtained from on-site wells or municipal sources and used to fill water trucks. Dust control activities are estimated to use no more than one to two truckloads of water per day during earthwork activities. Traffic from these activities would be limited to within the Prairie Island property as water will be from existing on-site wells or municipal sources.

Traffic during regular ISFSI operations will be unchanged from current levels. No additional personnel, thus no additional traffic, will result from the Project.

14.2 WORK FORCE DURING CONSTRUCTION AND OPERATION

During the 9-12 month concrete pad construction period between 2027 and 2029 and subsequent 3 month DFS loading campaign in 2030, a total of 40 construction workers are estimated with a peak at any one time of 12 workers and an average of 8 workers during a 40-hour week.

Should concrete overpacks be constructed on-site, this will occur the year prior to dry fuel loading in the following additional approximate years (plus or minus one year): 2029 (to support loading in 2030), 2034 (to support loading in 2035), 2039 (to support loading in 2040), and 2044 (to support loading in 2045). Concrete overpack fabrication would occur over a three-month period prior to loading, with loading then taking approximately three additional months. During these periods, a total of 16 construction workers are estimated with a peak at any one time of 10 workers and an average of 6 workers during a 40-hour week.

No full-time staff will be required at the ISFSI facility during operation beyond current Prairie Island Plant personnel.

14.3 IMPACTS TO UTILITIES AND PUBLIC SERVICES

The only electrical demand will be for the ongoing operation of existing ISFSI lighting and security systems. No new light fixtures or security systems will be installed. The Project will not require additional use of existing utilities, create or add to the need for expanded utility or public services, or impede the public's use of utilities or public services.

14.4 WATER USAGE DURING CONSTRUCTION AND OPERATION

If water use is required during Project construction, such as for dust control, water would be obtained from existing on-site wells or municipal sources and used to fill water trucks. Water trucks typically hold about 7,500 gallons of water. The dust control activities are estimated to use no more than from one to two truckloads per day over a 9-12 month period during pad earthwork activities. Assuming two trucks are required daily, then 15,000 gallons could be used per day. Over a 9-12 month period (60 to 80 workdays) a total of 900,000 to 1,200,000 gallons could be used; however, the actual total volume of water is expected to be much less, as dust generating ground disturbance would not be likely to occur every workday during the 9 to 12 months and during this time. Additionally, should construction occur during

winter, the use of water trucks will decrease dramatically as water is rarely, if ever, needed as a dust control measure during frozen ground conditions.

Operation of the Project will not involve the installation or abandonment of any water wells, connection to or changes in any public water supply, or the new or ongoing appropriation of any ground or surface water. If water use is required during Project operation, such as for dust control, water would be obtained from on-site wells or municipal sources. Therefore, there will be minimal to no impacts related to water use during construction or operation.

14.5 IMPACTS ON AGRICULTURAL LANDS

Because the Project will be constructed entirely on Prairie Island Plant property on a previously disturbed site, there will be no impacts to agricultural lands, including pastureland.

14.6 RELOCATION IMPACTS

Because the Project will be constructed entirely on Prairie Island Plant property on a previously disturbed site, no relocation of public or private persons or property will be required.