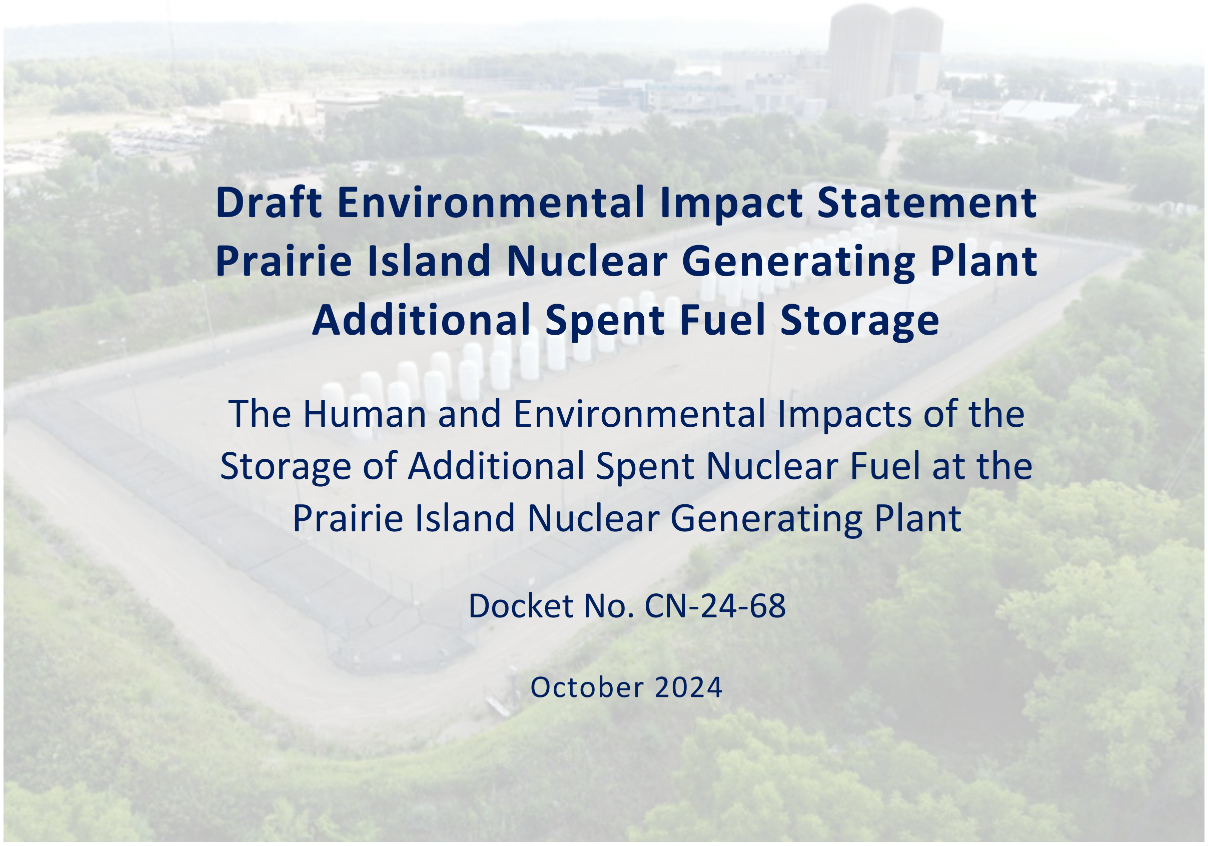

# Draft Environmental Impact Statement
# Prairie Island Nuclear Generating Plant
# Additional Spent Fuel Storage

## The Human and Environmental Impacts of the Storage of Additional Spent Nuclear Fuel at the Prairie Island Nuclear Generating Plant

Docket No. CN-24-68

October 2024

COMMERCE DEPARTMENT

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## Abstract

Northern States Power Company, d.b.a. Xcel Energy (Xcel Energy) owns and operates the Prairie Island Nuclear Generating Plant (PINGP) in Red Wing, Minnesota. Spent nuclear fuel from the plant is stored on site in an independent spent fuel storage installation (ISFSI). The Minnesota Public Utilities Commission (Commission) has authorized storage of spent nuclear fuel in the PINGP ISFSI sufficient to allow operation of the PINGP through 2033/2034.

Xcel Energy is now proposing to store additional spent fuel in the PINGP ISFSI sufficient to extend the operating life of the PINGP by 20 years – from 2033/2034 to 2053/2054. This additional storage requires installation of up to two pads within the current ISFSI to store a projected 34 additional dry fuel storage (DFS) systems that will hold approximately 1,200 spent fuel assemblies.

Xcel Energy’s proposed additional storage of spent nuclear fuel in the PINGP ISFSI requires a certificate of need (CN) from the Commission. Xcel Energy applied to the Commission for a CN on February 7, 2024. To aid the Commission in its decision-making, the Minnesota Department of Commerce (Department) must prepare an environmental impact statement (EIS) for the proposed project.

This draft EIS addresses the issues and mitigation measures identified in the Department’s July 11, 2024, scoping decision. It evaluates the potential human and environmental impacts of Xcel Energy’s proposed additional storage of spent fuel in the PINGP ISFSI and possible mitigation measures for these impacts.

This draft EIS was issued on October 31, 2024. It has been issued in draft form so that it may be improved by public comment. Comments on the draft EIS will be accepted through December 6, 2024. Comments should be sent by email, online, or U.S. mail to:

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Following the comment period, the draft EIS will be revised to incorporate comments and a final EIS will be issued. The final EIS will be used by the Commission in determining whether to grant a CN authorizing Xcel Energy's proposed additional storage.

Documents related to this project are available on (1) the Department's website: http://mn.gov/commerce/energyfacilities, select *Power Plants* and then *Prairie Island Nuclear Generating Plant Additional Spent Fuel Storage* and (2) the Commission's website: http://mn.gov/puc, select *eDockets* and enter the year (24) and docket number (68) and select *Search*.

This document can be made available in alternative formats (i.e., large print or audio) by calling 651-539-1529 (voice).

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## Acronyms and Abbreviations

| | |
|---|---|
| ALJ | administrative law judge |
| ANS | American Nuclear Society |
| ANSI | American National Standards Institute |
| BMP | best management practices |
| BRC | Blue Ribbon Commission |
| BWR | boiling water reactor |
| CFR | U.S. Code of Federal Regulations |
| CISF | Consolidate Interim Storage Facility |
| CN | Certificate of Need |
| $CO_2$ | carbon dioxide |
| Commission | Minnesota Public Utilities Commission |
| CP | Canadian Pacific |
| CRMP | Cultural Resource Management Plan |
| dBA | decibels on an A-weighted scale |
| Department | Minnesota Department of Commerce |
| DFS | dry fuel storage |
| DNR | Minnesota Department of Natural Resources |
| DOE | U.S. Department of Energy |
| DOR | Minnesota Department of Revenue |
| DTS | dry transfer system |
| EAW | environmental assessment worksheet |
| EERA | Department of Commerce Energy Environmental Review and Analysis |
| EIS | Environmental Impact Statement |
| FEMA | Federal Emergency Management Agency |
| FSAR | Final Safety Analysis Report |
| GHG | greenhouse gas |
| IPaC | Information for Planning and Consultation |
| IRP | Integrated Resource Plan |
| ISFSI | Independent Spent Fuel Storage Installation |
| ISP | Interim Storage Partners LLC |
| MDH | Minnesota Department of Health |
| MnDOT | Minnesota Department of Transportation |
| MPCA | Minnesota Pollution Control Agency |
| mrem | Millirem |
| MRS | Monitored Retrievable Storage |
| MW | Megawatt |
| NAC | noise area classifications |
| NCRP | National Council on Radiation Protection and Measurements |
| NDT | Nuclear Decommissioning Trust Fund |
| NHIS | Natural Heritage Information System |
| NPDES | national pollutant discharge elimination system |
| NRC | U.S. Nuclear Regulatory Commission |

| | |
|---|---|
| NRHP | National Register of Historic Places |
| NTSF | national transportation stakeholders forum |
| NUHOMS | project technology: Orano TN Americas LLC NUHOMS EOS 37PTH DFS |
| NUREG | U.S. Nuclear Regulatory Report |
| NWPA | Nuclear Waste Policy Act |
| OSLD | optically stimulated luminescence dosimeters |
| PFS | Private Fuel Storage, LLC |
| PIIC | Prairie Island Indian Community |
| PINGP | Prairie Island nuclear generating plant |
| PRA | Probabilistic Risk Assessment |
| PUC | Public Utilities Commission |
| PVSC | present value social cost |
| PWI | Public Waters Inventory |
| PWR | pressurized water reactor |
| REMR | Radioactive Effluent and Monitoring Report |
| RERR | Radioactive Effluent Release Report |
| RGU | Responsible Governmental Unit |
| SEIS | Supplemental Environmental Impact Statement |
| SHPO | State Historic Preservation Office |
| SLR | Subsequent License Renewal |
| SWPPP | Stormwater Pollution Prevention Plan |
| TLD | Thermoluminescent Dosimeter |
| USACE | U.S. Army Corp of Engineers |
| USFWS | U.S. Fish and Wildlife Service |
| WDHS | Wisconsin Department of Health Services |

# Executive Summary

Northern States Power Company, d.b.a. Xcel Energy (Xcel Energy) owns and operates the Prairie Island Nuclear Generating Plant (PINGP) in Red Wing, Minnesota. Spent nuclear fuel from the plant is stored on site in an independent spent fuel storage installation (ISFSI).

Xcel Energy is requesting to store additional spent fuel in the PINGP ISFSI sufficient to extend the operating life of the PINGP by 20 years – from 2033/2034 to 2053/2054. This additional storage requires installation of up to two concrete pads within the current ISFSI. A projected 34 additional dry fuel storage (DFS) systems will be placed on these pads. The DFS systems will hold approximately 1,200 spent fuel assemblies.

Xcel Energy's proposed additional storage of spent nuclear fuel in the PINGP ISFSI requires a certificate of need (CN) from the Minnesota Public Utilities Commission (Commission). Xcel Energy applied to the Commission for a CN on February 7, 2024. To aid the Commission in its decision-making, the Minnesota Department of Commerce (Department) must prepare an environmental impact statement (EIS) for the proposed project.

## Project Need

Xcel Energy indicates that additional storage at the PINGP ISFSI is necessary to support operation of the PINGP through 2053/2054. Xcel Energy believes that continued operation of the PINGP through 2053/2054 is a vital part of moving towards a carbon-free portfolio while also ensuring the adequacy, reliability, and efficiency of Minnesota's energy supply. If the Commission does not grant a CN for additional storage, Xcel Energy would cease operating the PINGP in 2033/2034, and the electrical energy produced by the PINGP would need to be supplied or otherwise accounted for by other means.

## Human and Environmental Impacts

This EIS finds that the non-radiological impacts of additional spent fuel storage in the PINGP ISFSI are anticipated to be minimal. The additional storage would occur in a developed, industrial site which avoids and minimizes potential impacts.

The EIS also finds that the radiological impacts of additional spent fuel storage in the PINGP ISFSI are anticipated to be minimal, provided that monitoring and maintenance of the DFS systems continues until such time as the spent fuel can be transported to an off-site facility. The radiation dose to the public with additional spent fuel in the PINGP ISFSI is anticipated to be minimal and indistinguishable from background radiation. Further, additional spent fuel storage in the PINGP ISFSI would not change the performance of the ISFSI during accident conditions. Potential radiological impacts to the public under accident conditions would not be significant and would be within U.S. Nuclear Regulatory Commission (NRC) standards.

## Cumulative Impacts

Cumulative impacts are impacts to the environment that result from the incremental effects of a project in addition to past, present, and reasonably foreseeable future projects regardless of who undertakes these projects. Three projects that are reasonably foreseeable because they are connected to Xcel Energy's request for additional spent fuel storage are discussed in the EIS: (1) continued operation of the PINGP through 2053/2054, (2) use of the PINGP ISFSI to facilitate decommissioning of the PINGP after cessation of operations in 2053/2054, and (3) the potential expansion of the instrumentation building adjacent to the ISFSI.

The EIS finds that potential impacts to the human and natural environment as a result of PINGP operations through 2053/2054 are anticipated to be minimal. Potential non-radiological impacts are related to use of cooling water from the Mississippi River, which are anticipated to be minimal. Potential radiological impacts are related to regulated releases of radioactive effluents from the PINGP; these impacts are also anticipated to be minimal.

Potential impacts resulting from use of the PINGP ISFSI to facilitate decommissioning are anticipated to be minimal, provided that monitoring and maintenance of the ISFSI continues until such time as the spent fuel can be transported to an off-site facility. If monitoring and maintenance do not continue, radiological impacts are anticipated to be significant.

Expansion of the ISFSI instrumentation building by up to 1,200 square feet is not expected to impact human or environmental resources. The building does not produce or manage radioactive material and is on an existing developed, industrial site.

## Alternatives to the PINGP ISFSI

It is possible that the additional spent fuel generated by PINGP operations through 2053/2054 is not stored in DFS systems within the PINGP ISFSI, and instead stored in an auxiliary spent fuel pool at PINGP. The EIS finds that storing additional spent fuel in the existing spent fuel pool is not feasible due to spent fuel pool capacity; storage in a new spent fuel pool is prohibitively expensive and not feasible.

Spent nuclear fuel storage in Yucca Mountain, the proposed federal geologic repository, is not currently feasible as it has been and continues to be politically and socially charged. There are several legal, social, and political challenges to storing spent fuel in consolidated interim storage facilities (CISFs), and these challenges will likely play out over an extended period of time. Spent fuel storage in private CISFs is not currently feasible. There are currently three private CISFs with NRC licenses being developed in the United States – one each in Utah, Texas, and New Mexico. These CISFs are currently being challenged in the judicial system and are not currently a feasible alternative to additional storage of spent fuel in the PINGP ISFSI.

## Alternatives to Continued Operation of the PINGP

The Commission could deny Xcel Energy's request for additional storage of spent fuel in the PINGP ISFSI. If the Commission did so, and absent other alternatives for storing the spent fuel, Xcel Energy would cease operating the PINGP in 2033/2034. If the PINGP ceased operation in 2033/2034, Xcel Energy would need to replace the capacity and energy provided by the PINGP in order to maintain reliable operation of the electric transmission system.

Xcel Energy modeled one scenario for replacing the capacity and energy generated by the PINGP in 2033/2034. The replacement scenario has greater aesthetic and land use impacts than continued operation of the PINGP. Additionally, the replacement scenario will have relatively greater impacts on fauna, specifically birds and bats. Xcel Energy's modeling indicates that the replacement scenario is also more expensive on a social cost basis and has greater carbon emissions than continued operation of the PINGP.

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# 1 Introduction

This draft environmental impact statement (EIS) has been prepared by the Minnesota Department of Commerce (Department) for Xcel Energy's proposed additional storage of spent nuclear fuel in the independent spent fuel storage installation (ISFSI) at the Prairie Island Nuclear Generation Plant (PINGP) in Red Wing, Minnesota.

This EIS evaluates the potential human and environmental impacts of the project and possible mitigation measures. The EIS is not a decision-making document, but rather a guide for decision makers. The EIS is intended to facilitate informed decisions, particularly with respect to the goals of the Minnesota Environmental Policy Act — "to create and maintain conditions under which human beings and nature can exist in productive harmony and fulfill the social, economic, and other requirements of present and future generations of the state's people."[1]

## 1.1 Background

The PINGP electric generating plant in Red Wing, Minnesota is powered by two pressurized water reactors (Unit 1 and Unit 2) that are licensed for a gross output of 584 megawatts (MW) of electricity each. The plant has been in operation since 1973 when Unit 1 was licensed, and Unit 2 was licensed in 1974. Spent nuclear fuel from the plant is stored on site in the PINGP ISFSI.

The plant is currently licensed by the U.S. Nuclear Regulatory Commission (NRC) for operation through 2033/2034. The Minnesota Public Utilities Commission (Commission or PUC) has authorized storage of spent nuclear fuel in the PINGP ISFSI sufficient to allow operation of the PINGP through 2033/2034.

## 1.2 Proposed Project

Xcel Energy is requesting to store additional spent nuclear fuel in the PINGP ISFSI sufficient to extend the operating life of the PINGP by 20 years – from 2033/2034 to 2053/2054.[2] This additional storage requires installation of up to two pads within the current ISFSI to store a projected 34 additional dry fuel storage (DFS) systems that will hold approximately 1,200 spent fuel assemblies. DFS systems would be filled with fuel assemblies welded shut, and then transported and stored on the new pad(s) in the PINGP ISFSI.

[1] Minnesota Statute 116D.02.

[2] Xcel Energy, Certificate of Need Application for Additional Dry Cask Storage at the Prairie Island Nuclear Generating Plant Independent Spent Fuel Storage Installation, February 7, 2024. CN-24-68, eDockets Nos. 20242-203185-01 through -10 and 20242-203189-01 through -10 [hereinafter the "CN Application"].

Xcel Energy has chosen the Orano TN Americas LLC NUHOMS EOS 37PTH DFS system (NUHOMS), 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. The NUHOMS system is covered by a general NRC license as opposed to the site-specific NRC license currently issued for the TN-40/TN-40HT, the PINGP's current DFS technology.[3]

The exact number of DFS systems needed for storage through 2053/2054 (projected at 34 DFS systems holding 1,200 spent fuel assemblies) will be determined by the amount of fuel needed to operate through 2053/2054 and how much fuel is loaded into the PINGP reactor each fuel cycle. Xcel Energy notes that the new concrete storage pad(s) and storage system will be able to accommodate this storage without changing the ISFSI size or security perimeter.[4]

## 1.3 Project Need

Xcel Energy indicates that additional storage at the PINGP ISFSI is necessary to support operation of the PINGP through 2053/2054. Xcel Energy believes that operation of the PINGP through 2053/2054 is a vital approach toward a carbon-free portfolio that ensures the adequacy, reliability, and efficiency of Minnesota's energy supply.[5] If the Commission does not grant a CN for additional storage, and absent other alternatives for storing the spent fuel, Xcel Energy would cease operating the PINGP in 2033/2034, and the electrical energy produced by the PINGP would need to be supplied or otherwise accounted for to maintain reliable operation of the electric transmission system.

## 1.4 State of Minnesota Review Process

Xcel Energy's proposed additional storage of spent nuclear fuel in the PINGP ISFSI requires a certificate of need (CN) from the Commission.[6] Xcel Energy applied to the Commission for a CN on February 7, 2024. In considering Xcel Energy's CN application, the Commission must determine whether the proposed project is needed, or whether some other project would be more appropriate for the state of Minnesota, for example, a project of a different type or size, or a project that is not needed until further into the future.

To help the Commission with its decision-making and to ensure a fair and robust airing of the issues, the state of Minnesota has set out a process for the Commission to follow in making a CN decision. This process requires the Department to prepare an EIS for the project. It also requires public hearings before an administrative law judge. The goal of the EIS is to describe the potential human and environmental impacts of the project ("the facts"); the goal of the

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[3] The Department, Energy Environmental Review and Analysis. *Scoping Environmental Assessment Worksheet*. April 9, 2024. CN-24-68, eDockets No. 20244-205143-01 though -05 [hereinafter the "Scoping EAW"].

[4] Ibid.

[5] CN Application, Executive Summary.

[6] Minnesota Statute 116C. 83, Subd. 2.

hearings is to advocate, question, and debate what the Commission should decide about the project ("what the facts mean"). The entire record developed in this process—the EIS and the report from the administrative law judge, including all public input and testimony—is considered by the Commission when it makes its decision regarding Xcel Energy's CN application.

This EIS has been issued in draft form so that it can be improved through public comment. Based on public comments, the Department will prepare and issue a final EIS.

## 1.5 Organization of EIS

This EIS addresses the issues identified in the Department's scoping decision of July 11, 2024 (Appendix A) and is organized as follows:

| | | |
|---|---|---|
| **Chapter 1** | Introduction | Provides an overview of the proposed project, the state of Minnesota's review process, and this EIS. |
| **Chapter 2** | Regulatory Framework | Describes the regulatory framework associated with the project, including federal and Commission oversight along with environmental review. |
| **Chapter 3** | Proposed Project – Additional Spent Fuel Storage | Describes the proposed project, including the PINGP ISFSI and proposed system for storing spent fuel. |
| **Chapter 4** | Potential Non-Radiological Impacts | Describes potential non-radiological impacts of the project to human and natural resources and possible mitigation measures. |
| **Chapter 5** | Potential Radiological Impacts | Describes potential radiological impacts of the project to human and natural resources and possible mitigation measures. |
| **Chapter 6** | Cumulative Impacts | Describes potential impacts to human and natural resources resulting from operation of the PINGP through 2053/2054 and from using the ISFSI to decommission the PINGP. |

| | | |
|---|---|---|
| **Chapter 7** | Alternatives to the PINGP ISFSI | Describes alternatives to the storage of spent fuel in the PINGP ISFSI. |
| **Chapter 8** | Alternatives to Continued Operation of the PINGP | Describes alternatives to the continued operation of the PINGP. |

## 1.6 Sources of Information

The primary sources of information for this EIS are:

- Xcel Energy's CN application.
- The scoping environmental assessment worksheet (EAW) prepared for Xcel Energy's proposed additional spent fuel storage in the PINGP ISFSI.[7]
- New and additional information from Xcel Energy sent to the Department's Energy Environmental Review and Analysis (EERA) unit in personal email communication regarding its CN application.[8]
- The 2009 PINGP ISFSI Final EIS and the 2022 Supplemental EIS.[9]

All information sources are indicated in chapter footnotes.

[7] Scoping EAW.
[8] Hereinafter "Xcel Energy Additional Information".
[9 pt. 1] Prairie Island Nuclear Generating Plant Independent Spent Fuel Storage Installation Final Environmental Impact Statement, July 2009. CN-08-510, eDockets Nos. 20097-40233-02 through -17; and 20097-40234-02 through -08; and 20097-40235-02 [hereinafter the "2009 PINGP EIS"].
[9 pt. 2] Prairie Island Nuclear Generating Plant Independent Spent Fuel Storage Installation Supplemental Environmental Impact Statement, April 2022. CN-08-510, eDockets No. 20224-185119-01 though -10; and 20224-185120-01 through -03 [hereinafter the "2022 PINGP SEIS"].

# 2 Regulatory Framework

Xcel Energy's proposed additional storage of spent fuel in the PINGP ISFSI requires review by federal and state regulators. The NRC determines whether ongoing and proposed future operation of the PINGP, as well as the storage of spent nuclear fuel in the PINGP ISFSI, can be conducted safely. Xcel Energy must obtain a subsequent license renewal (SLR) from the NRC to continue operation of the PINGP. Additionally, Xcel Energy must notify the NRC of its intention to use an NRC-certified DFS system in the PINGP ISFSI and must document that use of the system is consistent with NRC conditions on its use.

On behalf of the state of Minnesota, the Commission determines as an economic and policy matter whether it is in the public interest to allow additional storage of spent nuclear fuel in the PINGP ISFSI to facilitate PINGP operation through 2053/2054. To store additional spent fuel in the PINGP ISFSI, Xcel Energy must obtain a CN from the Commission.

## 2.1 Federal Regulation

Federal regulations preempt state regulation of engineering, health, and safety standards applicable to nuclear generating plants and spent nuclear fuel storage. The NRC is responsible for regulating the use of radioactive materials from their source, through their uses, to their storage and disposal. The PINGP and ISFSI are considered part of the nuclear fuel cycle and are regulated by the NRC.

### Subsequent License Renewal

The PINGP received an initial 40-year operating license for Unit 1 in 1973 and Unit 2 in 1974.[10] In 2011, the NRC extended the initial operating license for 20 years, allowing operation of the PINGP through 2033/2034.[11] In order to operate beyond 2033/2034, Xcel Energy must request and obtain a SLR from the NRC.

SLRs are available from the NRC solely for terms of 20 years. Thus, if Xcel Energy obtains a SLR for the PINGP, it will allow the PINGP to operate through 2053/2054. At the state level, Xcel Energy is asking the Commission for permission to store additional spent fuel to facilitate operation of the PINGP through 2053/2054.[12]

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[10] CN Application, Chapter 8.3.

[11] Ibid.

[12] CN Application, Executive Summary. Any additional spent fuel storage for operation beyond 2053/2054 would require a CN from the Commission.

Xcel Energy anticipates that it will submit a SLR application to the NRC after 2024.[13] The application must address the technical aspects of plant aging and describe how these aspects will be managed; it must also address potential environmental impacts of plant operations for another 20 years. The NRC will review the application and evaluate potential safety and environmental issues. The NRC review process will last approximately 18 months and include public meetings and opportunities for public comment.

## Use of NRC-Certified Canisters in PINGP ISFSI

Xcel Energy has a general license from the NRC to store spent nuclear fuel in the PINGP ISFSI.[14] The license is not tied to a specific storage technology; it allows for the use of any NRC-certified storage technology as long as the PINGP holds an NRC operating license.[15] Xcel Energy must demonstrate to the NRC that any storage technology used in the PINGP ISFSI can be appropriately deployed, consistent with the conditions and specifications associated with the technology.[16]

Currently, spent nuclear fuel from the PINGP is stored in TN-40/40HT DFS systems in vertical, bolted-lid casks stored on concrete pads in the ISFSI. Each TN-40/40HT DFS system has the capacity to store 40 spent fuel assemblies. As of August 8, 2024, the ISFSI holds 52 DFS systems (2,080 fuel assemblies).

Xcel Energy estimates that approximately 34 additional spent DFS systems will be needed for operations through 2053/2054. The specific vendor and spent fuel storage technology selected by Xcel Energy was the Orano TN Americas LLC NUHOMS EOS 37PTH (NUHOMS).[17] This DFS system uses a canister with a welded closure. The canisters are designed and licensed to store and transport spent fuel.[18] Each DFS canister can hold 37 spent fuel assemblies.

As part of the transition to the new DFS system, Xcel Energy will review its security program, emergency plan, quality assurance program, training program, and radiation protection program, and make any necessary changes to incorporate the canister technology into the PINGP ISFSI.

[13] Scoping EAW.
[14] Ibid.
[15] Ibid.
[16] Nuclear Regulatory Commission. (2023, June). *Spent Fuel Storage Licensing*. https://www.nrc.gov/waste/spent-fuel-storage/licensing.html
[17] Scoping EAW, Section 6.
[18] Ibid.

## 2.2 State Regulation

Storage of spent nuclear fuel in the PINGP ISFSI is regulated by the Commission, whose decisions may be reviewed by the Minnesota Legislature.[19] In order to store additional spent fuel in the PINGP ISFSI, Xcel Energy must obtain a CN from the Commission.[20]

### Certificate of Need

In deciding whether to grant a CN, the Commission must determine whether Xcel Energy's proposed project is needed or if another project would be more appropriate for the state of Minnesota. Minnesota Rules part 7855.0120 provides the criteria that the Commission must use in determining whether to grant a CN:

- The probable direct or indirect result of denial would be an adverse effect upon the future adequacy, reliability, safety, or efficiency of energy supply to the applicant, to the applicant's customers, or to the people of Minnesota and neighboring states;
- A more reasonable and prudent alternative to the proposed facility has not been demonstrated by a preponderance of the evidence on the record by parties or persons other than the applicant;
- It has been demonstrated by a preponderance of the evidence on the record that the consequences of granting the CN for the proposed facility, or a suitable modification thereof, are more favorable to society than the consequences of denying the CN;
- That it has not been demonstrated on the record that the design, construction, operation, or retirement of the proposed facility will fail to comply with those relevant policies, rules, and regulations of other state and federal agencies and local governments.

If the Commission determines that Xcel Energy has met these criteria, the Commission will issue a CN for the project. The Commission could place conditions on the granting of a CN; likewise, it has discretion to approve the project as proposed or with modifications.[21] If the Commission denies the CN, this would indicate that the Commission believes that not building the project (the "no-build alternative" in Chapter 7) is a more reasonable and prudent alternative.

[19] Minnesota Statute 116C.83, Subd. 3.

[20] Minnesota Statute 116C.83, Subd. 2.

[21] For example, as a condition of granting a CN, the Commission could require Xcel Energy to file the results of its competitive bidding process for spent fuel technology with the Commission. See Department Comments Regarding a Change in Spent Fuel Storage Technology at the Prairie Island Nuclear Generating Plant, June 24, 2022, PUC Docket No. E-002/CN-08-510, eDockets No. 20226-186862-01.

## Environmental Review

The Minnesota Environmental Policy Act requires that an environmental impact statement (EIS) be prepared for major governmental actions with the potential to create significant environmental impacts.[22] An EIS is intended to facilitate informed decision-making by entities with regulatory authority over a project. It also assists citizens in providing guidance to decision-makers regarding the project. An EIS describes and analyzes the potential human and environmental impacts of a project and possible mitigation measures, including alternatives to the project. It does not advocate or state a preference for a specific alternative. Instead, it analyzes and compares alternatives so that citizens, agencies, and governments can work from a common set of facts.

The Department is the responsible governmental unit (RGU) for conducting environmental review of spent nuclear fuel storage in an ISFSI.[23] The Department is required to prepare an EIS.[24]

This EIS has been issued in draft form so that it can be improved through public comment. Based on public comments, the Department will prepare and issue a final EIS. The Commission will consider the final EIS and the entire record in deciding on Xcel Energy's CN application.

### *EIS Scoping*

Scoping is the first step in the development of an EIS. Department staff gathered input on the scope of this EIS through public meetings and an associated comment period.

Department staff held a public scoping meeting regarding Xcel Energy's proposed additional storage of spent fuel on April 25, 2024, in Red Wing, Minnesota. Approximately seven people attended this meeting; three people provided public comment.[25] The preceding evening, April 24, 2024, EERA staff held a virtual public meeting. Approximately four people attended this meeting; one person provided public comment.[26] Comments addressed the scope of potential impacts that will be analyzed in the EIS and the possible reprocessing of spent nuclear fuel in the United States.

Following the public scoping meetings, written comments were received from the Minnesota Pollution Control Agency (MPCA), Goodhue County, and two members of the public.[27] The MPCA stated they had no comments on the project at that time. Goodhue County noted its good relationship with Xcel Energy and its effect on the local economy while also asking that the EIS consider the impact of additional tax revenue on socioeconomics due to the project. The

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[22] Minnesota Statute 116D.04.
[23] Minnesota Statute 116C.83, Subd. 6(b).
[24] Ibid.
[25] Public Comments Submitted at EIS Scoping Meeting, eDockets Nos. 20245-206548-01 and 20245-206576-02.
[26] Ibid.
[27] Written Public Comments on EIS Scope, eDockets Nos. 20245-206576-01 and 20245-206662-01.

two members of the public commented on creating a scoping task force, resubmitted comments from a 2009 task force, noted a concern for safety and the lack of permanent storage solutions, and commented on the emergency plan, the impact of climate change over the life of the project, and the PINGP as a safe asset for the community.

The Department issued a scoping decision for the EIS on July 11, 2024 (Appendix A). This EIS has been prepared in accordance with the scoping decision.

### *Public Hearing*

After issuance of the final EIS, public hearings will be held by an administrative law judge (ALJ) from the Office of Administrative Hearings.[28] The hearings will address the need for the project. At the hearing, citizens, agencies, and governmental bodies will have an opportunity to submit comments, present evidence, and ask questions. Citizens can advocate for or against the granting of a CN; they may suggest conditions that they believe are appropriate should the Commission grant a CN. After the hearings, the ALJ will submit a report to the Commission with findings of facts, conclusions of law, and recommendations regarding a CN for the project.

### *Commission Decision*

After considering the entire record, including the final EIS, input received during the public hearings, and the ALJ's report, the Commission will determine whether to grant a CN for the project. The Commission may grant a CN for the project as proposed, grant a CN contingent upon modifications to the project, or deny the CN. The Commission may also place conditions on the granting of a CN. A decision by the Commission regarding Xcel Energy's CN application is anticipated in 2025.

## Integrated Resource Plan

Xcel Energy is required to regularly file an integrated resource plan (IRP) with the Commission. A resource plan details the projected need for electricity in a utility's service territory for a forecasted period of time, and the utility's plans for meeting this projected need.[29] The Commission may approve, reject, or modify a proposed resource plan.

Xcel Energy filed its 2024-2040 Upper Midwest IRP on February 1, 2024.[30] In its plan, Xcel Energy proposed the continued operation of the PINGP through 2053/2054. The Commission has yet to approve Xcel Energy's proposed IRP. Though this approval would indicate that the Commission agrees that continued operation of the PINGP through 2053/2054 is an appropriate part of Xcel Energy's IRP, Xcel Energy will still need to obtain a CN for its proposed additional storage of spent fuel in the PINGP ISFSI.

[28] Office of Administrative Hearings. *First Prehearing Order*. June 3, 2024. eDockets No. 20246-207332-01.

[29] Minnesota Statute 216B.2422; Minnesota Rules 7843.

[30] Xcel Energy. *Initial Filing of 2024-2040 Upper Midwest IRP*. February 1, 2024. Docket RP-24-67, No. 20242-203027-01 through -08 [hereinafter "Xcel Energy's IRP"].

### Casks or Other Containers That Facilitate Transportation of Spent Fuel

In addition to the requirements for a CN and an IRP, the Minnesota Legislature has directed the Commission to ensure that spent nuclear fuel stored in Minnesota is capable of being transported to off-site storage facilities, when such facilities are available. Minnesota Statute 116C.776 provides, in part:

> If the Public Utilities Commission determines that casks or other containers that allow for transportation as well as storage of spent nuclear fuel exist and are economically feasible for storage and transportation of spent nuclear fuel generated by the Prairie Island nuclear power generating plant, the commission shall order their use to replace use of the casks that are only usable for storage, but not transportation.

The casks currently used in the PINGP ISFSI are certified by the NRC for transportation.[31] Additionally, for all future DFS systems used at the PINGP, the PUC has authorized Xcel Energy to use an NRC-approved spent nuclear fuel storage system certified for dual-use as storage and transportation under 10 CFR § 72.212(b).[32] Thus, all DFS systems used in the PINGP ISFSI will allow for potential future transportation of the fuel to off-site storage facilities, should those facilities become available.

## 2.3 Other Permits and Approvals

A building permit from the city of Red Wing may be required for the project.[33] The city will determine if a permit is needed after plans for the project have been finalized.

## 2.4 Issues Outside the Scope of this EIS

In accordance with the scoping decision for this EIS (Appendix A), the following topics are not addressed in this document:

- The appropriateness of NRC regulations for spent nuclear fuel storage technology.
- Potential impacts associated with the nuclear fuel cycle.
- ISFSI sites outside the PINGP plant boundary. The Commission’s authority is limited to the storage of spent nuclear fuel generated by a Minnesota nuclear generation facility and stored on the site of that facility.[34]
- Economic analysis of generation alternatives. Economic analysis in the EIS will be limited to information provided in Xcel Energy’s CN application. Additional economic analysis

[31] CN Application, Chapter 8.

[32] The Commission. *Order Authorizing Fuel Storage Casks*. October 5, 2022. eDockets No. 202210-189557-01.

[33] Scoping EAW, Section 9.

[34] Minnesota Statue 116C.83

will be provided during the Commission's CN proceedings by the Department of Commerce, Energy Regulation and Planning unit.

- The appropriateness of NRC regulations and standards for radiation exposure. The EIS may reference certain standards promulgated by the NRC; however, the EIS will not address the adequacy of these standards.

# 3 The Proposed Project – Additional Spent Nuclear Fuel Storage

To store additional spent nuclear fuel in the PINGP ISFSI, Xcel Energy proposes to install up to two concrete pads within the existing ISFSI. The specific vendor and spent fuel storage technology selected by Xcel Energy is the Orano TN Americas LLC NUHOMS EOS 37PTH (NUHOMS).[35] Each NUHOMS canister can hold 37 spent fuel assemblies. This DFS system is approved under a general license from the NRC for the storage and transport of spent nuclear fuel.[36] Xcel Energy estimates that the spent fuel storage necessary for operation through 2053/2054 will require 34 NUHOMS canisters to be placed on the expanded ISFSI pad(s).

## 3.1 ISFSI

The PINGP is within the city Red Wing, Minnesota. The PINGP site is owned by Xcel Energy and in total consists of approximately 578 acres of land.[37]

The current ISFSI consists of an outdoor lighted area, approximately 720 feet long and 340 feet wide, roughly 5.5 acres in size.[38] The initial ISFSI was constructed with two pads in 1993[39] and expanded to include a third pad in 2021.[40] Within the ISFSI, the DFS systems are currently stored on three reinforced concrete pads. As of August 8, 2024, the ISFSI holds 52 DFS systems (2,080 fuel assemblies).[41] The next dry fuel loading campaign (the action whereby additional casks are placed on the ISFSI) under the current license operation is anticipated in 2025. An equipment storage building and a security building are also within the ISFSI. The tallest structures are approximately 40-foot-tall light poles. Two fences surround the facility with a monitored clear zone between the two fences. A 17-foot-high vegetated earthen berm surrounds the ISFSI. Outside of the earthen berm and to the northeast is an instrumentation building that houses pressure monitoring equipment for the existing DFS systems of the ISFSI.

## 3.2 Installation of up to Two Pads

Xcel Energy proposes to construct up to two new, concrete pads, as needed, to store a projected 34 additional DFS systems (approximately 1,200 spent fuel assemblies) within the current fence line of the ISFSI as illustrated on Figure 1. The exact number of DFS systems will

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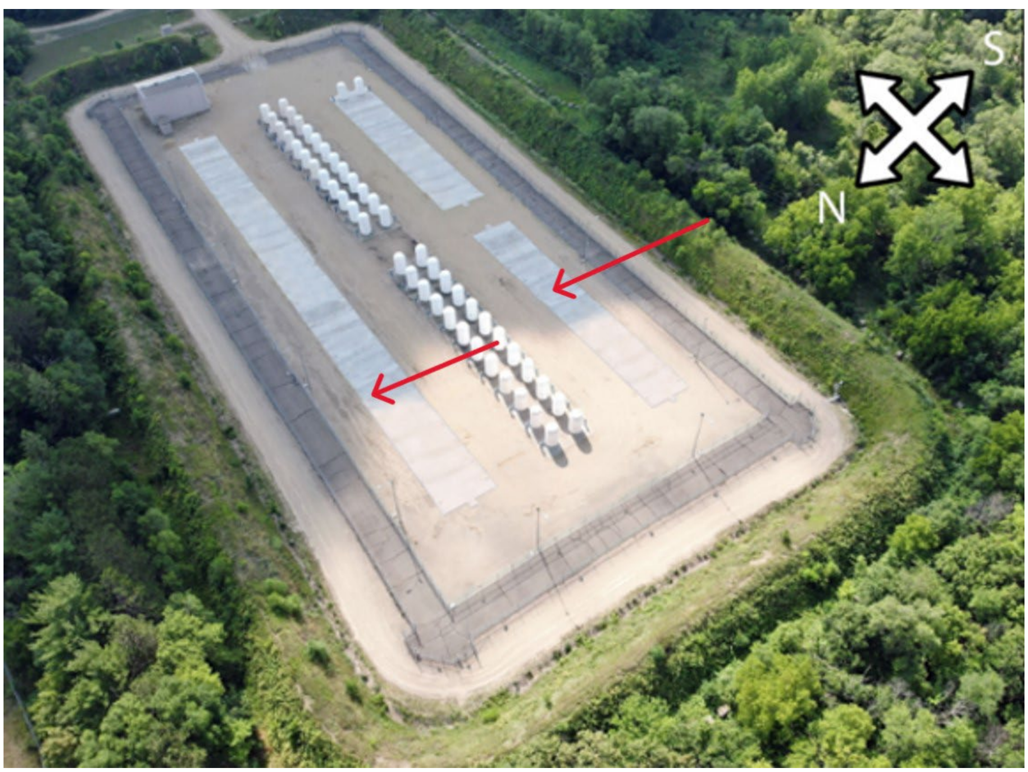
[35] Scoping EAW, Section 6.
[36] Ibid.
[37] Scoping EAW, Section 6b.
[38] Ibid.
[39] Final Environmental Impact Statement – Prairie Island Independent Spent Fuel Installation. April 12, 1991.
[40] 2009 PINGP EIS.
[41] Ibid.

be determined by the specific amount of nuclear fuel required to run an additional 20 years from 2033/2034 to 2053/2054. This is determined by how much fuel is loaded each cycle, inventory management of the spent fuel pool, and the technologies available during future loading campaigns. The potential variation in the number of total DFS systems or the location(s) of the pad(s) within the ISFSI will not result in a modification to the footprint of the ISFSI or the scope of the project as proposed.

To construct the two new pads, temporary ground-disturbing activities within the existing ISFSI security fencing would be required. This would occur on previously disturbed ground, but soil testing would be conducted to verify that conditions are suitable for building the pads. Approximately 5,760 cubic yards of soil and surface material would be excavated in the areas for the pads and in the areas immediately adjacent where concrete approach aprons would be installed. Concrete approach aprons provide access to the pad.

The concrete support pad and approach aprons would then be poured in the excavated area. The concrete will be allowed to cure, then the area surrounding the concrete will be backfilled with engineered fill and compacted. Lastly, gravel surfacing stone would be placed on the area surrounding the pad(s).

**Figure 1: Potential Locations for Future Concrete Pads Within ISFSI**



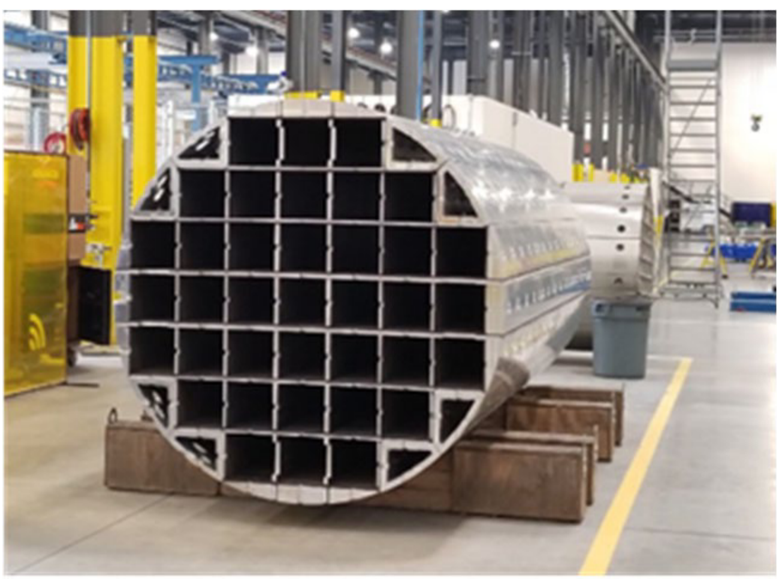
As shown in Figure 1, there are alternatives for the size and location of the project's proposed storage pads.[42] Xcel Energy states that the size and location will depend on the engineering requirements determined by the vendor and short and long-term costs.[43]

## 3.3 Selection and Use of a Spent Fuel Storage Canister System

Spent nuclear fuel is highly radioactive and must be properly handled and stored. All spent fuel storage technology must be certified by the NRC and meet NRC design criteria.[44] Among other criteria, spent fuel technology must: (1) contain the radioactive material so that it is not a danger to persons or the environment, and (2) provide radiation shielding so that radiation does not pose an undue danger to persons nearby (Appendix B).

The NRC has certified several technologies for spent nuclear fuel storage. NRC-certified storage technologies generally take two approaches to containment and shielding: (1) an all-in-one metal cask that provides containment and shielding, or (2) a two-part system consisting of a metal canister that contains the spent fuel and a concrete overpack that provides radiation shielding (canister system).

**Figure 2: Spent Fuel Canister – End View with Basket for Spent Fuel Assemblies**



A dry fuel storage system consisting of a canister and other components provides spent fuel containment, radiation shielding, and transportation. Spent fuel assemblies are stored inside a DFS system canister. The specific vendor and spent fuel storage technology selected by Xcel Energy was the NUHOMS.[45] They are designed to store and transport spent fuel and are approved under a general license from the NRC for storage and transport.[46]

[42] CN Application, Chapter 8.12.1.

[43] Xcel Energy Additional Information.

[44] 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. NRC. (2024, September). https://www.nrc.gov/reading-rm/doc-collections/cfr/part072/full-text.html#part072-0120.

[45] Scoping EAW, Section 6.

[46] Ibid.

The canisters used in this system are large stainless-steel vessels, approximately one-half to one inch thick, that contain spent fuel (Figure 2). Spent fuel assemblies are placed in a canister, and then the canister lid assembly is welded shut. Ancillary devices are used to dry, weld, backfill (with helium) and seal the steel canisters for storage. A transfer cask (a temporary metal overpack) made of steel is used to handle and move the canister from the spent fuel pool to the concrete overpack. The transportation component of the new technology, along with being able to pass on savings to Xcel Energy customers, were main drivers for selecting the NUHOMS technology. The advantages and disadvantages of available technologies for the project are discussed further in Chapter 7.3.

**Figure 3: Placement of Canisters in Horizontal Concrete Overpack**


Sealed canisters are then placed in a reinforced horizontal concrete overpack to protect and shield the spent fuel (Figure 3). The storage module will be made of reinforced concrete and is designed to provide radiological shielding, protection from environmental conditions, structural integrity, and heat removal.[47] The storage module will be fabricated off-site where it is pre-cast before shipment to the ISFSI where it can be placed on the project's concrete storage pad(s).[48]

The DFS systems currently utilized in the PINGP ISFSI are referred to as the TN-40 and TN-40HT DFS systems, which are vertical bolted-lid casks (Figure 4). The TN-40/40HT casks hold 40 spent fuel assemblies. The canisters are stored vertically on three reinforced concrete pads in the PINGP ISFSI.

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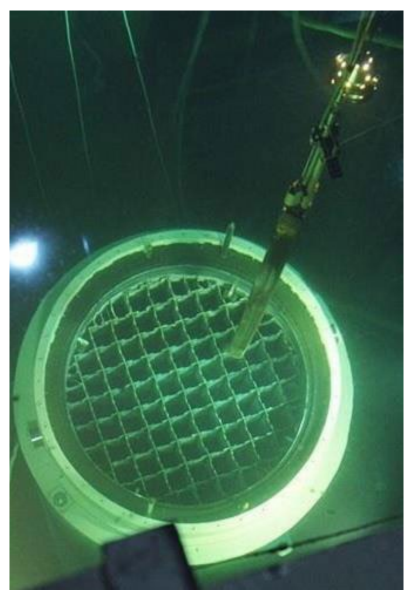
[47] CN Application, Chapter 8.9.2.
[48] CN Application, Chapter 9.1.3.1.

**Figure 4: Current TN-40 and TN-40HT Casks on ISFSI Pad**

## 3.4 Handling Spent Fuel Canisters

When nuclear fuel assemblies are spent after use in the reactor for several fuel cycles, they are first offloaded to the spent fuel pool. Storing the spent fuel in a water-filled pool allows the fuel to cool, both thermally and radioactively. After sufficient cooling time (approximately 10 years) in the spent fuel pool, the used fuel assemblies can be loaded into DFS systems for transport to the ISFSI pad.

**Figure 5: DFS System in Spent Fuel Pool Loading Spent Fuel Assemblies**
*(Credit: Holtec International)*



When fuel is ready to be removed from the spent fuel pool, the DFS system canister is lowered into the pool where the fuel assemblies are loaded into the canister's internal metal fuel basket (Figure 5). It is not possible to lower a concrete overpack into the pool as well; thus, a transfer cask (a temporary metal overpack) is used to maneuver the canister and provide radiation shielding.[49] A canister shield plug is installed underwater before the transfer cask is lifted out of the pool.[50]

[49] CN Application, Chapter 8.9.
[50] CN Application, Chapter 8.10.1.

The canister is then removed from the spent fuel pool and the water is drained from the transfer cask. The canister is decontaminated before a machine welds a top cover plate on the canister.[51] Welding is performed by an automated welding machine. The canister is then vacuum dried and backfilled with helium. More ports and outer cover plates are welded before the transfer cask lid is bolted on. Lastly, the DFS system is moved out of PINGP via a haul path to the ISFSI to be stored on a concrete pad.

To move a loaded canister to its concrete pad, the transfer cask is again used. The transfer cask facilitates movement of the canister and provides shielding until shielding can be provided by the concrete overpack. The concrete overpack provides further radiation shielding to workers and members of the public, and also protect the canisters from external hazards.[52]

The transfer cask is set on a trailer horizontally and driven to the ISFSI. The trailer aligns the canister with an opening in the concrete overpack (Figure 3).[53] The transfer cask is then removed before a hydraulic arm inserts the canister into the concrete overpack. Lastly, the vault is sealed with a door bolted into place. The loading cycle time for each container placed in the ISFSI is expected to take approximately one week based on the typical operating experience reported by Xcel Energy.[54]

## 3.5 Transportation of Spent Nuclear Fuel

The transportation of spent nuclear fuel takes places primarily under the aegis of three federal agencies – the U.S. Department of Transportation (DOT), the NRC, and the U.S. Department of Energy (DOE).

The NRC certifies DFS systems for the transportation of spent nuclear fuel. The NRC approves transportation packages that must meet design criteria related to structural integrity, shielding, and criticality, among others.[55] The NRC also approves the routes that shippers would use to transport spent fuel.[56] To plan for shipments of spent nuclear fuel, DOE has established a national transportation stakeholders forum (NTSF). The NTSF is the primary mechanism by which the DOE communicates with states, tribes, and other federal agencies about the transportation of spent nuclear fuel.[57] The State of Minnesota and the Prairie Island Indian Community (PIIC) participate in the NTSF.[58]

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[51] Ibid.
[52] CN Application, Chapter 8.8.
[53] CN Application, Chapter 8.10.2.
[54] Ibid.
[55] 10 CFR 71.
[56] Ibid.
[57] Going the Distance, Section 1.3.3; PIIC Scoping Comment Letter, October 22, 2021. eDockets No. 202110-179270-02 [hereinafter "PIIC Scoping Comment Letter"].
[58] PIIC Scoping Comment Letter.

No removal of spent fuel from existing casks for repackaging into transportation-ready casks or canisters would be required for the transport of spent fuel from the PINGP ISFSI. The existing TN-40 and TN-40HT casks in the PINGP ISFSI are licensed for transportation. The proposed NUHOMS system canisters are also licensed for transportation.

DOT regulates shipments of all hazardous materials, including spent nuclear fuel.[59] DOT regulations are frequently enforced by states; thus, states have a role to play in ensuring the safe shipment of hazardous materials.[60]

## 3.6 Monitoring and Maintenance of Spent Fuel

Spent fuel canisters and their concrete overpacks require monitoring and periodic maintenance to ensure their safe operation. All ISFSIs must have a radiation monitoring program to verify radiation levels are below regulatory limits and that radiation shielding does not deteriorate over time.[61] These regulatory limits are shown in Table 5 and discussed more in-depth in Chapter 5.2.

Canisters rely on air flow around the canister for cooling and therefore typically require routine monitoring to ensure the airflow is not degraded due to blockage of the inlet or outlet vents. This is accomplished either by routine visual inspection or by monitoring of the outlet air temperature. The system requires no active support systems to ensure performance other than simple pressure and/or temperature monitors that are readily replaceable.[62] Should it be necessary, a welded canister can be transferred to a new storage module.

## 3.7 Project Schedule and Costs

Xcel Energy estimates that installation of up to two concrete pads within the ISFSI and the construction of the concrete overpacks would take up to 12 months.[63] Xcel Energy notes that this construction would occur in the 2027 - 2029 timeframe to support the 2030 loading campaign.[64] The 2030 DFS system loading campaign would place the NUHOMS canisters on the existing ISFSI pad as well as one of the new concrete pads and would take approximately four months to complete. The new NUHOMS systems are planned to be ordered and initial fabrication to begin as early as 2026 to support loading in 2030.[65] Additional loading campaigns are anticipated to occur in 2035, 2040, and 2045.

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[59] Ibid.
[60] Ibid.
[61] 10 CFR 72.104 (exposure limit) and 10 CFR 72.126 (monitoring requirement).
[62] CN Application, Chapter 8.11.
[63] Scoping EAW, Section 6b.
[64] Ibid.
[65] CN Application, Chapter 8.12.1.

Xcel Energy estimates that the total cost of additional storage of spent fuel in the PINGP ISFSI will be $173.8 million (Table 1).[66] These costs will be incurred incrementally over the period of subsequent license renewal.

**Table 1: Estimated Project Costs (2020 dollars)**

| Project Component | Cost ($ millions) |
|---|---|
| Regulatory Processes | 3.5 |
| Engineering, Design, and Construction | 9.4 |
| Canisters, Concrete Overpack, and Fuel Loading | 160.9 |
| **Total** | **173.8** |

[66] CN Application, Chapter 8.12.2.

# 4 Potential Non-Radiological Impacts

Xcel Energy's proposed additional spent fuel storage could impact human or environmental resources near the PINGP. The construction of a concrete storage pad and concrete overpacks could create non-radiological impacts. The handling and storing of spent fuel, as a physical activity, could also create non-radiological impacts.

Because the project will take place within the PINGP site, and in an ISFSI that has been designed for the additional storage of spent fuel, the non-radiological impacts of additional spent fuel storage in the PINGP ISFSI are anticipated to be minimal.

## 4.1 Describing Potential Impacts and Mitigation

This EIS analyzes potential impacts of the project on various resources. Impacts are given context through discussion of their duration, size, intensity, and location. This context is used to determine an overall resource impact level. Impact levels are described using qualitative descriptors. These descriptors are not intended as value judgments, but rather to ensure a common understanding among readers.

- **Minimal** – If a project will not considerably alter the condition or function of a resource, the project impact is considered minimal. Minimal impacts are generally not obvious, but, for some resources and at some locations, may be noticeable to an average observer. Generally, impacts to common resources over a short or long term are considered minimal.
- **Moderate** – If a project will alter the condition or function of an existing resource in a manner that is generally noticeable or predictable for the average observer, the project impact is considered moderate. Moderate impacts may be spread out over a large area, making them difficult to observe, but can be estimated by modeling or related simulation. Moderate impacts may be long term or permanent to common resources but are generally short- to long-term for rare and unique resources.
- **Significant** – If a project will alter the condition or function of an existing resource to the extent that the resource is severely impaired or cannot function, the project impact is considered significant. Significant impacts are typically noticeable or predictable for the average observer. Significant impacts may be spread out over a large area making them difficult to observe but can be estimated by modeling. Significant impacts can be of any duration and may affect common as well as rare and unique resources.

This EIS also discusses opportunities to avoid, minimize, or compensate for potential impacts. These actions are collectively referred to as mitigation. Some impacts can be avoided or minimized; some might be unavoidable but can be minimized; others might be unavoidable and unable to be minimized but can be corrected. The level at which an impacts can be mitigated might change the impact intensity level.

- **Avoid** – Avoiding an impact means that the impact is eliminated altogether by moving or not undertaking parts or all of a project.
- **Minimize** – Minimizing an impact means that the intensity of the impact is limited by reducing the project size or moving a portion of the project from a given location.
- **Mitigate** – Impacts that cannot be avoided or minimized could be mitigated. Impacts can be mitigated by repairing, rehabilitating, or restoring the affected environment, or compensating for it by replacing or providing a substitute resource elsewhere.
- **Correcting** an impact can be used when an impact cannot be avoided or further minimized.

## 4.2 Environmental Setting

The PINGP is bordered by the Vermillion River on the west and by the Mississippi River on the east in Goodhue County, Minnesota. The PINGP site is owned by Xcel Energy and consists of approximately 578 acres.[1] The PINGP ISFSI is about 900 feet southwest of the plant (Figure 6 centroid highlighted in teal).

The PINGP property is on a low island terrace associated with the Mississippi River floodplain that lies within the northwestern portion of the Red Wing city limits. Red Wing is about 28 miles southeast of the Minneapolis-St. Paul metropolitan area with a population of about 16,547 people.[2] Current land use within Red Wing is heavily weighted toward open space, agricultural, and rural residential uses.[3] There are 57 residences within one mile of the PINGP ISFSI, most of whom live in the Lower Island residential area (Figure 6).[4]

The site is industrial and most surfaces are graded and covered with concrete, asphalt, or gravel. The PINGP and the ISFSI occupy a former agricultural field and the predominant land use west of the site is agricultural, while the area to the east of the site is the Mississippi River. Some of the ISFSI area was used for the concrete batch plant and dredge material disposal area during the initial construction of PINGP.[5,6] The Canadian Pacific (CP) Railroad runs northwest

[1] Scoping EAW, Section 6b.
[2] Scoping EAW, Section 22.
[3] City of Red Wing. *Red Wing 2040 Community Plan*. (February 25, 2019). https://www.red-wing.org/846/Red-Wing-2040-Community-Plan
[4] Scoping EAW, Section 10.
[5] NRC. Final Environmental Assessment for the Proposed Renewal of U.S. Nuclear Regulatory Commission License No. SNM-2506 for Prairie Island Independent Spent Fuel Storage Installation. (2015, June). Docket No. 72-0010. https://www.nrc.gov/docs/ML1509/ML15098A026.pdf
[6] NRC. Environmental Assessment for the Proposed Amendment of the of U.S. Nuclear Regulatory Commission License No. SNM-2506 for Prairie Island Independent Spent Fuel Storage Installation. (2020, October). Docket No. 72-0010. https://www.nrc.gov/docs/ML2027/ML20275A342.pdf [hereinafter "2020 PINGP EA"].

towards PINGP from Red Wing along County Road 18 until it approaches the cooling towers and the ISFSI.

The PINGP property is immediately adjacent to the Prairie Island Indian Community (PIIC); the ISFSI is approximately 700 yards from the nearest PIIC residence at the nearest point. The PIIC is a Federally Recognized Indian Tribe organized under the Indian Reorganization Act (25 USC 476). The PIIC is home to tribal members who descend from the Bdewakantunwan (Mdewakanton) Band of Eastern Dakota.[7] As of February 10, 2023, there were 1,100 enrolled members of the PIIC.[8]

Additional facilities within the PIIC and within a 1-mile radius of the site include the Lower Island residential area,[9] the PIIC Land & Environment Office, a wastewater treatment plant and facility, Treasure Island Resort and Casino, the Prairie Island Sports Complex, a church, clinic, community center, education building, elder center, fitness center, pow-wow grounds, public safety building, community garden, tribal court, and tribal government administration building.

**Figure 6: Residences Within One Mile of PINGP ISFSI**


[7] Prairie Island Indian Community. *Media.* (n.d.) https://prairieisland.org/media
[8] Ibid.
[9] The Lower Island residential area consists of 53 Tribal member houses and 4 houses that are not native owned.

## 4.3 Potential Impacts to the Human Environment

While there are residences near the project, most of which are within PIIC, potential non-radiological impacts to the human environment as a result of the project are anticipated to be minimal. The additional spent fuel storage project will occur within the PINGP site, a developed industrial site. No impacts or changes to land use or ownership would occur as part of the project other than the modification of areas within the existing ISFSI fence line.

### Aesthetics

Aesthetics refers to the visual quality of a landscape as perceived by a viewer. Aesthetics are subjective, meaning their relative value depends upon the perception and philosophical or psychological responses unique to individuals. Landscapes which are, for the average person, harmonious in form and use are generally perceived as having greater aesthetic value. Infrastructure which is not harmonious with a landscape or negatively impacts existing features of a landscape could negatively impact the aesthetics of the area.

The proposed additional spent fuel storage within the PINGP ISFSI is harmonious with the industrial nature of the PINGP site. The ISFSI currently contains spent nuclear fuel; the addition of up to two new concrete pads and 34 DFS systems will not significantly change the aesthetics of the site. Additionally, there are few persons who will perceive any change in the PINGP site as a result of the project. The project is entirely within PINGP property and completely obscured from public view from adjacent roads, the Vermillion and Mississippi Rivers, the PIIC, or other residential or recreational users. It is also obscured from view from most PINGP workers. It is surrounded by an earthen berm that is constructed of fill material reinforced with geofabric, except for one gravel road entrance. Thus, aesthetics impacts of the project are anticipated to be minimal.

### Noise

Noise can be defined as any undesired sound.[10] It is measured in units of decibels on a logarithmic scale. The A-weighted scale (dBA) is used to duplicate the sensitivity of the human ear. A three dBA change in sound is barely detectable to average human hearing, whereas a five dBA change is clearly noticeable. Noise perception is dependent on a number of factors including wind speed, wind direction, humidity, and natural and built features between the noise source and the receptor.

Because sounds levels are measured on a logarithmic scale, they are not directly additive. As explained in the MPCA's Guide to Noise Control, "A doubling of sound energy yields an increase of three decibels."[11] For example, if a sound level of 50 dBA is added to another sound level of 50 dBA, the total sound level is 53 dBA, not 100 dBA. This change in sound level (three dBA)

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[10] MPCA. *A Guide to Noise Control in Minnesota*. (2015, November). https://www.pca.state.mn.us/sites/default/files/p-gen6-01.pdf

[11] Ibid.

would be barely detectible. Project noise added to ambient noise values in the area will take this phenomenon into account when measuring potential impacts.

All noises produced by the project must be within state noise standards (Minnesota Rule 7030.0050; Table 2).[12] Noise standards in Minnesota are based on noise area classifications (NAC) that correspond to the location of the listener—referred to as a receptor. NACs are assigned to areas based on the type of land use activity occurring at that location. For example, the most stringent noise standards include residential areas, which are assigned NAC 1.

Noise standards are expressed as a range of permissible dBA over a one-hour period. An $L_{10}$ noise standard may not be exceeded 10 percent of the time, or six minutes per hour, while an $L_{50}$ standard may bit be exceeded 50 percent of the time, or 30 minutes per hour. Standards vary between daytime and nighttime hours. There is no limit to the maximum loudness of a noise.

**Table 2: Minnesota Noise Standards**

| Noise Area Classification | Daytime (7:00 a.m. to 10:00 p.m.) | | Nighttime (10:00 p.m. to 7:00 a.m.) | |
|---|---|---|---|---|
| | $L_{10}$ | $L_{50}$ | $L_{10}$ | $L_{50}$ |
| 1 | 65 | 60 | 55 | 50 |
| 2 | 70 | 65 | 70 | 65 |
| 3 | 80 | 75 | 80 | 75 |

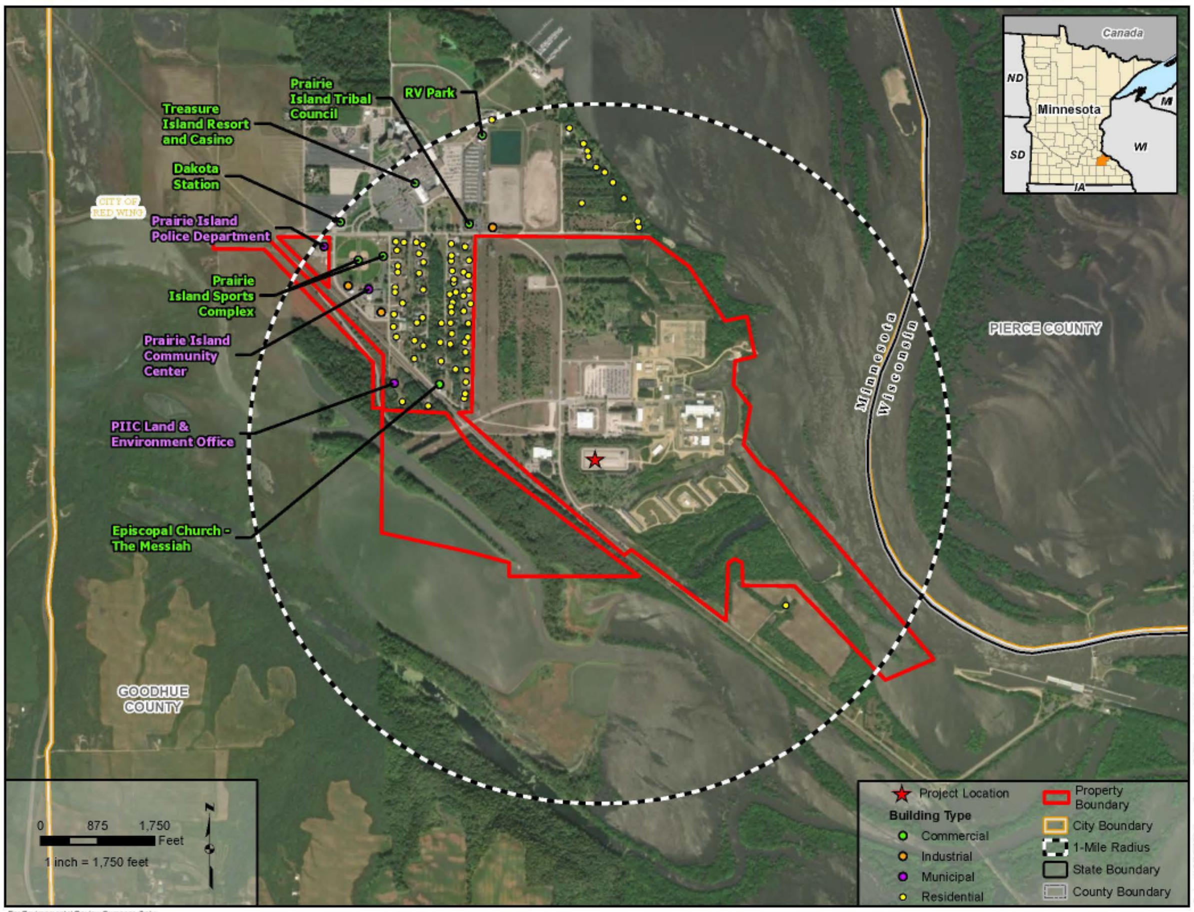
Operation of the project will not add a significant or consistent increase to ambient noise – infrequent use of vehicles for transportation or maintenance would be the only source of new noise. The NRC notes that noise typically associated with the ISFSI is not audible.[13] The earthen berm around the ISFSI also mutes noise generated by the transport vehicle during DFS system transfer.[14]

Potential noise impacts from the project would result from equipment use during construction of the additional pads and concrete overpacks to contain spent fuel canisters in the ISFSI. Xcel Energy anticipates that construction could last up to 12 months.[15] During this time, the project will use a variety of construction equipment including track-excavators, backhoes, cranes, bulldozers, dump trucks, and cement trucks.[16] This equipment produces a range of sound levels, typically from 40 to 55 dBA, assuming one dump truck, one grader, one water truck, and one

[12] Ibid.
[13] 2020 PINGP EA.
[14] Ibid.
[15] Scoping EAW, Section 6.
[16] CN Application, Chapter 12.8.

light truck are operating simultaneously.[17] While maximum noise for this type of equipment can reach up to 85 dBA,[18] equipment will not be operating at full power at all times. Heavy equipment generally runs at full power up to 50 percent of the time.[19] Point source sounds, like construction equipment, decrease six dBA for each doubling of distance;[20] therefore, 85 dBA at 50 feet is perceived as a 61 dBA at 800 feet and 55 dBA at 1,600 feet.

**Figure 7: Sensitive Noise Receptors Within 1 Mile of ISFSI**




There are few sensitive noise receptors near the construction site for the project. Sensitive receptors are defined as homes, schools, churches, or any location where people reside or gather. Existing ambient noise levels at these receptors are due primarily to local vehicle and

[17] Scoping EAW, Section 19 (via the 2009 PINGP EIS).

[18] U.S. Department of Transportation, Federal Highway Administration. *Construction Noise Handbook*. (2006, August). https://www.fhwa.dot.gov/environment/noise/construction_noise/handbook

[19] Ibid.

[20] MPCA. *A Guide to Noise Control in Minnesota*. (2015, November). https://www.pca.state.mn.us/sites/default/files/p-gen6-01.pdf

train traffic, largely associated with the PINGP and the casino.[21] There are about 57 residences within one mile of the site, the nearest being approximately 0.45 miles northwest of the PINGP ISFSI (Figure 6). The nearest resident is also the nearest sensitive receptor as shown in Figure 7.

Even when conservatively considering construction equipment emitting its maximum dBA during construction of the ISFSI, the nearest sensitive receptor would experience less than 55 dBA. This value would be within the noise standards when considering that the equipment will not be running at its maximum power for a continuous 30 minutes. Thus, while some may be temporarily impacted, the additional noise is limited in extent and duration. In sum, noise impacts resulting from the project are anticipated to be minimal.

### Traffic

Access to the PINGP site is controlled by Xcel Energy. Over 800 PINGP employees commute to and from the site each day. Construction activities for the project will slightly increase the number of persons commuting each day. Operation of the project would not cause any increase or change in traffic at the PINGP.

Xcel Energy estimates that about 40 construction workers will be required during the 9-12 month concrete pad construction period between 2027 and 2029, with an average of about 8 workers employed each week and 16 additional commuting trips per day.[22] In addition to workers, the project will result in additional deliveries of materials by truck, which Xcel Energy estimates will add about seven additional trips each day.[23] These additional projected trips (23 per day in total) are less than a three percent increase in daily traffic at the PINGP. Thus, potential traffic impacts resulting from construction of the project are anticipated to be minimal.

### Land Use

The PINGP is within the city limits of Red Wing in an area described as split zoning. Review of the 2040 Community Plan clarifies that the PINGP and the ISFSI are zoned as Industrial. The project is entirely within the PINGP property. The PINGP site, which contains the ISFSI and the project area, is zoned industrial.[24] The project would not require a zoning amendment or conditional use permit. Continued use as an ISFSI is a compatible use in the Industrial zoning district. No impacts to zoning are anticipated.

Land use in and around the ISFSI has remained the same since the facility was constructed. Land use in the area immediately adjacent to the PINGP and the ISFSI is a mixture of commercial, light industrial, residential, municipal, and commercial farming. The PINGP and the

[21] Scoping EAW, Section 19.
[22] Scoping EAW, Section 20.
[23] Ibid.
[24] City of Red Wing. *Red Wing 2040 Community Plan*. (February 25, 2019). https://www.red-wing.org/846/Red-Wing-2040-Community-Plan

ISFSI occupy a former agricultural field and the predominant land use west of the site is agricultural, while the area to the east of the site is the Mississippi River. Within one mile of the ISFSI, recreation areas include one Minnesota Department of Natural Resources (DNR) Wildlife Management Area (Gores Pool #3) and the RJD Memorial Hardwood State Forest. This state forest features six recreational areas, ten campgrounds, and one day-use area.[25] The project would have no impacts on land uses outside of the PINGP site including agriculture, businesses, and recreational activities.

### Public Health and Safety

Access to the PINGP site is controlled by Xcel Energy and restricted by a perimeter fence and other barriers. Thus, non-radiological health and safety impacts to the general public are not anticipated.

Health and safety impacts could occur to workers constructing the project. Additionally, the PINGP is an industrial facility. There are risks to plant personnel typical of an industrial facility, such as falls, burns, or machinery injuries. Xcel Energy implements safety programs to reduce the impact of such risks. Construction of additional ISFSI pad(s) and the placement of additional spent fuel canisters are not anticipated to increase risks or introduce new risks to plant personnel that are not managed by these safety programs.

### Socioeconomics

The PINGP is in Goodhue County, Minnesota, and within the city limits of Red Wing. The primary industries in Goodhue County and Red Wing are educational services, and health care and social assistance, and manufacturing.[26] The PINGP is the third largest employer in the city, following Treasure Island Casino and Red Wing Shoe Company.[27]

Host communities receive personal property tax from power plants in recognition of the extra burdens that plants may place on those communities. Property associated with the PINGP represents approximately 45% of the city of Red Wing's 2023 net tax capacity.[28] Counties and municipal governments in the vicinity of a nuclear power plant also receive tax revenue from sales taxes and fees from the power plant and its employees.[29] Differences in tax revenues are

[25] DNR. *Richard J. Dorer Memorial Hardwood State Forest*. https://www.dnr.state.mn.us/state_forests/forest.html?id=sft00033#homepage

[26] U.S. Census Bureau. *2022 ACS 5-Year Estimates Data Profiles, DP03 Selected Economic Characteristics, Red Wing, Goodhue County, Minnesota*. https://data.census.gov/table/ACSDP5Y2022.DP03?q=selected%20economic&g=160XX00US2753620_050XX00US27049_040XX00US27&moe=false&tid=ACSDP5Y2021.DP03.

[27] City of Red Wing. *Annual Comprehensive Financial Report.* (2022, December). https://www.red-wing.org/DocumentCenter/View/7398/2022-Annual-Comprehensive-Financial-Report-PDF

[28] City of Red Wing. *Where Red Wing's Local Property Tax Revenue Came From: 2023.* (2023). https://www.redwingreportcard.org/taxes

[29] NRC. Generic Environmental Impact Statement for License Renewal of Nuclear Plants. NUREG-1437, Volume 1, Revision 1. (2013, June). https://www.nrc.gov/docs/ML1310/ML13106A241.pdf [hereinafter "NUREG-1437"].

related to variations in State and local taxation laws (which continually change), electricity output, plant size, and plant employment.[30]

The Minnesota Department of Revenue (DOR) conducts assessment of utility property valuation, which drives how PINGP is taxed by the city and county.[31] The data used in the valuation process is drawn from reports submitted to the DOR by the utility companies, in addition to other assessment adjustments.[32] Counties then use that market value to calculate, bill, and collect the taxes.[33] Since the project is an investment in the plant along with the other investments required to support extended operation, these investments could increase PINGP's property tax base in the city and county.[34] Ultimately, the DOR would make the final determination to consider the project in its future valuations.

The amount of tax revenue paid during the license renewal term due to continued operations is not expected to materially change.[35] Tax base changes would likely follow the project's schedule, depending on the timing of investments and their impact on the plant's valuation.[36] The primary impact of license renewal would be the continuation or change in the amount of taxes paid by nuclear power plant owners to local governments and public school systems.[37] Although the most important source of revenue for local communities is property taxes, other sources of revenue include levies of electricity output and direct funding for local educational facilities and programs.[38]

Table 3 outlines demographic comparisons between the State, Goodhue County, and Red Wing. Goodhue County has a lower median income, non-white alone population, and low-income population compared to the State of Minnesota, whereas the city of Red Wing has the lowest median income and the highest low-income population compared to both the State and the County.

[30] Ibid.
[31] Minn. R. 8100.0200.
[32] Ibid.
[33] DOR. *Utility and Pipeline Property Administration.* (December 22, 2023). https://www.revenue.state.mn.us/utility-and-pipeline-property-administration
[34] Xcel Energy Additional Information.
[35] NUREG-1437.
[36] Xcel Energy Additional Information.
[37] NUREG-1437.
[38] Ibid.

**Table 3: Demographic Comparisons for Project Area**[39]

| Location | Median Household Income | Nonwhite Population* | Low Income Population |
|---|---|---|---|
| **Minnesota** | $85,086 | 22.5% | 9.3% ± 0.3% |
| **Goodhue County** | $78,338 | 9.9% | 9.1% ± 1.4% |
| **City of Red Wing** | $65,107 | 14.3% | 12.6% ± 3.2% |

**Nonwhite population was rounded to the nearest percent and includes all persons who do not self-identify as white alone.*

The project is anticipated to have minimal impacts on existing socioeconomics in the project area. The project may introduce minor benefits related to construction expenditures, e.g., short-term housing, foods, supplies. The project is not anticipated to change demographics in the area.

If the Commission authorizes the storage of additional spent fuel in the PINGP ISFSI, thus facilitating operation of the PINGP through 2053/2054, then the city of Red Wing will maintain a relatively high and stable source of tax revenue. While investments into the PINGP's DFS could increase the property tax base, the project is not anticipated to significantly change the value of the PINGP because project phases and costs will be incremental over the extended operating period; thus, tax revenues for the city are not anticipated to change significantly due to the project should the PINGP continue operation through 2053/2054. If the Commission does not authorize the storage of additional spent fuel in the PINGP ISFSI, and absent the ability to ship spent fuel to an off-site facility, Xcel Energy would cease operating the PINGP. A cessation of operations would negatively impact tax revenues for the city of Red Wing.

## Environmental Justice

Environmental justice is the "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."[40] The "fair treatment" goal is not to shift risks among populations, but to ensure that no persons bear a disproportionate share of the negative environmental consequences of a proposed project. To accomplish this, the analysis aims to identify potential disproportionately high and adverse effects, and identify alternatives that may mitigate these impacts.[41]

Populations within the project area were examined to see if they fit the definition of an environmental justice community. These communities may find it difficult to be meaningfully

[39] U.S. Census Bureau: 2023 American Community Survey 1-Year Estimates (Minnesota), 2022 American Community Survey 5-Year Estimates (city of Red Wing and Goodhue County). Race and ethnicity are based on the 2020 Decennial Census.

[40] U.S. EPA. *Final Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analyses.* (1998, April). https://www.epa.gov/sites/default/files/2015-02/documents/ej_guidance_nepa_epa0498.pdf

[41] Ibid.

involved in the State of Minnesota's review of the project or could bear a disproportionate share of the project's impact.

Minnesota Statute 216B.1691, subd. 1 (e) was recently updated to reflect the definition of an environmental justice area. A census tract is considered an environmental justice area if it contains one or more of the following populations:

1) 40 percent or more of the area's total population is nonwhite;
2) 35 percent or more of households in the area have an income that is at or below 200 percent of the federal poverty level;
3) 40 percent or more of the area's residents over the age of five have limited English proficiency; or
4) the area is located within Indian country, as defined in United State Code, title 18, section 1151.

For potential non-radiological impacts, the appropriate extent of the project area is the census tract. The PINGP ISFSI is in census tract 802.02 and the only other census tract within one mile of the ISFSI is Census Tract 9606 in Pierce County, Wisconsin. Census tract 802.02 meets the criteria of an environmental justice area because it includes an area within Indian country, as defined in United State Code, title 18, section 1151.

**Table 4: Environmental Justice Comparisons for Project Area**[42]

| Location | Non-White Alone Population | Low Income Population |
|---|---|---|
| **Census Tract 802.02** | 16.7% | 13.1% ± 7.2% |
| **Goodhue County** | 9.9% | 9.1% ± 1.4% |
| **Minnesota** | 22.5% | 9.6% ± 0.4% |

Table 4 outlines the other criteria that were evaluated for the census tract when determining if it was considered an environmental justice area. While this data demonstrates the environmental justice criteria of the entire census tract in comparison to the County and the State, the defining environmental justice feature of the census tract is the PIIC as the nearest and most historically impacted community by the PINGP. An environmental justice analysis focusing on the PIIC is in Chapter 5 because most of the potential impacts to PIIC are radiological.

[42] U.S. Census Bureau. 2022 American Community Survey 1-Year Estimates.

In 2023, Xcel Energy increased its payment to PIIC from $2.5 million per year to $10 million per year to store spent fuel in the ISFSI for each year the PINGP is in licensed operation.[43] PIIC also receives $50,000 annually for each DFS system stored within the ISFSI, as long as DFS systems continue to be stored onsite.[44] Payments made under this subdivision may be used by PIIC for any purpose benefitting the PIIC. If the Commission authorizes the storage of additional spent fuel in the PINGP ISFSI, the PIIC will maintain the additional $7.5 million each year that PINGP is in licensed operation. During decommissioning, this amount will decrease back to $2.5 million per year. PIIC will continue to receive $50,000 annually for each container of spent fuel that is at PINGP, whether or not the plant is in licensed operation. If the Commission does not authorize the storage of additional spent fuel in the PINGP ISFSI, annual payments to PIIC received through Statute would decrease and negatively impact PIIC socioeconomically.

Non-radiological impacts to PIIC are anticipated to be minimal; therefore, non-radiological environmental justice impacts are anticipated to be minimal.

## Archaeological and Historic Resources

To evaluate the cultural resources in the area, Xcel Energy conducted a site file search from the State Historic Preservation Office (SHPO) for the PINGP and a surrounding five mile-radius. The results were cross-checked with the Office of the State Archaeologist online database. As discussed in depth in the Scoping EAW, while there are several properties that were included in the search, there are no National Register of Historic Places (NRHP) sites[45] within the project site or a one-mile radius.

Additionally, there are no archaeological sites within the project boundary, and no NRHP sites within a one-mile radius. SHPO stated that the likelihood of intact archaeological sites at the ISFSI is low and that additional archaeological survey is not warranted. Xcel Energy conducted an archaeological survey of the area that would be disturbed by the project, which did not identify any cultural resources (Appendix C). Thus, impacts to archaeological and historic resources is expected to be minimal.

Northern States Power Company, Xcel Energy’s predecessor, and PIIC have a settlement agreement which includes a commitment to protect significant historical, archaeological, and cultural resources that may currently exist on the PINGP site. As discussed in the Scoping EAW, this includes procedures and practices for review, notification, and consultation with PIIC prior to all ground-disturbing activities at PINGP.[46] The previously disturbed nature of the site and the

[43] Senate File 2847. Xcel Energy Testimony. (2023, March). https://assets.senate.mn/committees/2023-2024/3122_Committee_on_Energy_Utilities_Environment_and_Climate/SF%202847%20Testimony%20(3-28-29).pdf

[44] Codified in Statute 216B.1645, Subd. 4 (b).

[45] The United States official list of sites, buildings, structures, districts, and objects deemed worthy of preservation for their historical significance or "great artistic value". See the National Historic Preservation Act of 1966.

[46] NRC. *Prairie Island Independent Spent Fuel Storage Installation, ISFSI Site-specific License Amendment Request, Environmental Report Supplement*. May 8, 2019.

lack of historic/archaeological properties has been confirmed by multiple surveys in coordination with Xcel Energy, SHPO, and the PIIC.

## 4.4 Potential Impacts to the Natural Environment

Xcel Energy's proposed additional spent fuel storage project will occur within the PINGP site, a developed industrial site. There are relatively few natural resources within the site. Thus, potential impacts to the natural environment as a result of the project are anticipated to be minimal.

### Water Resources

The Mississippi River, Vermillion River, and Sturgeon Lake are adjacent to PINGP. The Mississippi River is designated as a State Water Trail.[47] 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 PWIs.[48,49] There are no surface waters or wetlands within the project boundary. The nearest public water is "U.S. Lock and Dam #3 Pool" 0.3 miles east from the ISFSI, which controls the flow and level of the Mississippi River in the vicinity of PINGP and Sturgeon Lake. 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.

The project is not near trout streams/lakes, wildlife lakes, migratory waterfowl feeding/resting lakes, or outstanding resource value waters.[50] The project would require no water resources for construction nor maintenance of the additional DFS systems. Groundwater generally flows beneath the PINGP site to the Mississippi River. The ISFSI site is on an island terrace within the Mississippi River floodplain. The groundwater table near PINGP is generally within 5 to 20 feet of the ground surface and slopes to the southwest.[51] The local groundwater table responds quickly to changes in river elevation.[52]

#### *Stormwater*

There are no surface water discharges from the ISFSI other than stormwater runoff that is permitted under the existing PINGP Industrial Stormwater NPDES/SDS permit (MN0004006). Because the project will not result in any new impervious surface or modifications to the quality or quantity of stormwater runoff, additional impacts to impaired waters are not expected. During construction it is estimated that most stormwater would drain into the surrounding

[47] Scoping EAW, Section 12.
[48] U.S. Nuclear Regulatory Commission. *Prairie Island Independent Spent Fuel Storage Installation, ISFSI Site-specific License Amendment Request, Environmental Report Supplement*. (May 8, 2019).
[49] DNR. *Mississippi State Water Trail.* (2023). https://www.dnr.state.mn.us/watertrails/mississippiriver/index.html
[50] Scoping EAW, Section 12.
[51] Ibid.
[52] 2009 PINGP EIS.

soils, which are highly permeable. Prior to starting work, Xcel Energy will implement erosion control measures that will consist of best management practices (BMPs) such as silt fences and straw bales to minimize any surface drainage off the site. Coverage under the MPCA's construction stormwater permitting program will not be required as the disturbed area will be less than one acre (approximately 0.6 acres).

Once additional storage within the ISFSI is constructed, 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 earthen berm surrounding the ISFSI. In sum, impacts to water resources within and near the PINGP site are anticipated to be minimal.

### Flora and Fauna

The PINGP site is an industrial site with impervious surfaces (buildings, concrete, gravel). There is no habitat within the site for flora or fauna. Birds and raptors may fly over the site and may use the site for nesting (see discussion, below). No impacts to these species are anticipated as a result of the project. No impacts to flora and fauna are anticipated.

### Geology and Soils

Information regarding the geology of the area has not changed significantly since the analysis last presented in the 2009 PINGP EIS. The depth to bedrock beneath the PINGP site is approximately 100 feet. The area within the ISFSI not currently used for storage pads is covered with compacted aggregate.

Excavation for the project would be limited to removal of sub-grade materials that were previously disturbed and/or placed as part of original ISFSI. As the excavations would be limited to removing no more than the top 6 feet of material and are not anticipated to extend beyond unconsolidated, previously disturbed materials, impacts to subsurface geology are not expected per results of the soil testing conducted in April 2024.[53]

Soil excavation would total about 5,760 cubic yards on 0.6 acres. As detailed in the Scoping EAW, Xcel Energy has conducted a series of ISFSI soil tests and borings from 2014 to 2024. Xcel Energy completed soil analyses within the ISFSI in April 2024 to characterize the subsurface materials.[54] No soil corrections or stabilizations are needed for the project, thus, impacts to soils are expected to be minimal.

[53] Xcel Energy is waiting for the final report from Braun Intertec that verifies these results. The report has been reviewed and accepted with permissible results, thus will be acceptable and available for publication of the final EIS.

[54] Ibid.

## Rare and Unique Natural Resources

There is no habitat for flora or fauna within the PINGP site, which is surrounded by the Vermillion and Mississippi Rivers, the CP Railroad, the PIIC and its residents, and agricultural land uses. The landscape somewhat supports rare and unique natural resources, mostly those that utilize the rivers.[55] The PINGP site does not contain any sites of biodiversity significance or native plant communities, the nearest is west of East County Road 18.

A query of the Natural Heritage Information System (NHIS) database returned 16 threatened or endangered species (14 mussels, 1 fish, and 1 turtle) within 1 mile of the project area.[56] In addition, records for eight special concern species (2 fish, 1 plant, 3 mussels, 1 bird, and 1 mammal) are also within 1 mile of the project area.[57] Threatened species include the Blanding's turtle, butterfly mussel, fawnsfoot, monkeyface, mucket, paddlefish, spike, and wartyback, all of which heavily rely on the major nearby rivers. Endangered species include the Ebonyshell, Elephant-ear, Higgins Eye, Pistolgrip, Rock Pocketbook, Sheepnose, Washboard, and Yellow Sandshell, all of which also heavily rely on the major nearby rivers.

Peregrine falcons, which are state threatened, nest in a nest box installed and maintained by Xcel Energy on the PINGP reactor building.[58] The DNR stated that as long as the project footprint doesn't change, it is unlikely that the construction activities would affect these birds.

There are two rare federal species near the PINGP site: northern long-eared bats and the Higgins eye pearlymussel.[59] According to Information for Planning and Consultation (IPaC), there are no critical habitats at this location. According to USFWS IPaC submission, a "no effect" determination for the northern long eared bat, Higgins eye, monarch butterfly, tricolored bat, and whopping crane was made, meaning that the project should not have any positive or negative effects to these species or their designated critical habitat.[60]

No impacts to rare and unique resources are anticipated as a result of the project. Construction activities could increase noise levels that antagonize nearby species; however, most are accustomed to the noise and activities associated with the plant and are expected to be close to or within either the Vermillion or Mississippi Rivers.

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[55] Scoping EAW, Section 14b (State-Listed Species).
[56] Ibid.
[57] Ibid.
[58] Scoping EAW, Appendix B-10.
[59] Scoping EAW, Section 14b (State-Listed Species).
[60] Scoping EAW, Appendix B-7.

## Greenhouse Gases and Climate Change

Minnesota's climate is getting warmer and wetter due to anthropogenic greenhouse gas (GHG) emissions.[61] GHG are gaseous emissions that trap heat in the atmosphere and contribute to climate change. These emissions occur from natural processes and human activities. The most common GHGs emitted from human activities include carbon dioxide, methane, and nitrous oxide.

Minnesota's average temperature increased by 3.0 degrees Fahrenheit (F) between 1895 and 2020, and the state's annual rainfall has increased by 3.4 inches over that same period. The 10 warmest and wettest years have all occurred since 1998. In addition to more annual precipitation, the number of extreme storms has also been increasing and is likely to continue on this trend for the foreseeable future.[62]

### *Impacts of the Project on Climate Change*

Construction activities will result in short-term increases in GHG emissions because of the combustion of fossil fuels in construction equipment and vehicles. Construction will require the use of heavy equipment (e.g., excavators, bulldozers, trucks). This equipment will emit GHGs over the approximately 9 to 12 months it will take to construct the project. Total GHG emissions for construction activities are estimated to be about 305 tons of carbon dioxide equivalent ($CO_2e$).[63] GHG emissions for construction of the project are less than those of other energy facility projects recently permitted by the Commission. Total emissions for the state of Minnesota in 2020 were approximately 137 million tons.[64] GHG emissions for project construction are anticipated to be an insignificant amount relative to the state's overall annual transportation emissions. Potential impacts due to construction GHG emissions are anticipated to be minimal.

Operation of an expanded ISFSI is anticipated to have minimal GHG emissions. There are no emissions associated with the operation of additional spent fuel canisters or their concrete overpacks. There would be emissions from the vehicles used to transport spent fuel canisters from the PINGP spent fuel pool to the ISFSI. These emissions are anticipated to be substantially less than those for construction of the project.

On whole, construction and operation of the project is anticipated to have a minimal impact on climate change.

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[61] Minnesota Department of Natural Resources. *Climate Change and Minnesota*. https://www.dnr.state.mn.us/climate/climate_change_info/index.html.

[62] DNR. *Climate Trends*. https://www.dnr.state.mn.us/climate/climate_change_info/climate-trends.html

[63] Scoping EAW, Section 18.

[64] Minnesota Pollution Control Agency. *Greenhouse Gas Emissions Data*. https://www.pca.state.mn.us/air/greenhouse-gas-emissions-data.

### *Impacts of Climate Change on the Project*

The project is not expected to interact with climate trends in any material way. Specifically, NRC approves spent fuel DFS systems, such as the NUHOMS system, by evaluating each design for resistance to accident conditions such as floods, earthquakes, tornado missiles,[65] and temperature extremes. These conditions include events that are Design Events III and IV as defined by the American National Standards Institute/American Nuclear Society (ANSI/ANS) 57.9. Extreme conditions from the ANSI/ANS are based on historical data.

The NRC issues a Certificate of Compliance for a DFS system design to a vendor if the review of the design finds it technically adequate. Licensees are required to perform evaluations of their site to demonstrate that the site is adequate for storing spent fuel in the DFS system. These evaluations must show that the cask Certificate of Compliance conditions can be met.[66]

The NUHOMS system has been approved under a general license from the NRC. All DFS technology certified by the NRC are designed to withstand ambient temperature extreme highs (125 degrees F) and lows (-40 degrees F) based on historical data. As such, even with the projected annual average temperature rises associated with climate change, the designed temperature tolerances of the DFS far exceed local climatological predictions at the ISFSI.

A maximum flooding study was performed for the ISFSI and submitted to the NRC.[67] The probable maximum flood level calculated to occur at the ISFSI is 706.7 amsl and considered water velocity of 6.2 feet per second, including wave run-up. The ISFSI has been sited and designed so that the lowest point of potential water entry into the DFS is above the level of the probable maximum flood. In addition, river levels at PINGP are evenly controlled by the U.S. Army Corps of Engineers (USACE) Lock and Dam 3 near the PINGP's setting on the Mississippi River.[68] The project would not change the surface elevation of the existing ISFSI footprint.

Heavier rainfall events could also impact stormwater management. Section 15.11 of the Stormwater Pollution Prevention Plan (SWPPP) describes the stormwater drainage system at the ISFSI. The ISFSI is surrounded, except for an opening to allow travel in and out of the ISFSI, by a large earthen berm. The project will not produce any new impervious area, which will result in no change in the quantity or quality of stormwater. No design changes are needed to account for potential impacts from climate change.

In sum, climate change is not anticipated to impact non-radiological functioning of additional spent fuel storage in the PINGP ISFSI.

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[65] A tornado missile is a missile that's generated by a tornado and can cause damage to buildings and equipment.
[66] NRC. *Spent Fuel Storage Licensing*. https://www.nrc.gov/waste/spent-fuel-storage/licensing.html
[67] ADAMS Public Documents | NRC.gov; see NRC ascension no. ML16090A254 (PINGP).
[68] 2020 PINGP EA.

## 4.5 Cumulative Potential Effects

Cumulative potential effects are effects on the environment that result from other projects near the PINGP site that might reasonably be expected to affect the same environmental resources. There are projects planned near the PINGP site; however, because the PINGP site is a controlled industrial site, and none of the projects overlap geographically with the ISFSI, cumulative potential effects are anticipated to be minimal.

The PIIC has established the Net Zero Project with a goal of achieving net zero carbon emissions within the community and gaining energy resiliency and sovereignty within the next few years.[69,70] PIIC intends to reach its net zero carbon emissions goals through a combination of energy efficiency measures, renewable energy generation, and electrification projects at both the commercial and residential levels. The Net Zero project has developed solar photovoltaic and geothermal energy projects, and commercial and residential energy efficiency projects are underway.[71] Much of the work to finish the Net Zero project elements would likely be complete by the time the ISFSI project construction begins.

The city of Red Wing maintains a list of active and proposed projects on its website.[72] Projects include an improvement plan for the He Mni Can — Barn Bluff landmark and park, a bicycle and pedestrian plan, surface water management projects, and various park and conservation development projects. He Mni Can – Barn Bluff is about six miles southeast of PINGP. Additional plans adopted by the city of Red Wing include Bicycle and Pedestrian Master Plans, as well as Management Plans for Barn Bluff Habitat, Billings-Tomfohr Conservation Area, Memorial Park, and Upper Harbor Conservation Area. Each of these areas are between three and six miles southeast of the PINGP.

The city of Red Wing also lists several road projects underway or planned, some of which such as a new Sturgeon Lake Road bridge over the CP Railway, are near the PINGP.[73] Construction is scheduled in 2024 and 2025, and could overlap with construction of the ISFSI – however, cumulative impacts that could be expected to coincide are not expected to be significant, such as increased construction traffic and subsequent noise or GHG emissions.

Although Goodhue County also has plans underway that may coincide with the project, these are not near the PINGP.[74] Projects evaluated include the Hastings to Red Wing Trail Master

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[69] PIIC. *Righting an Environmental Injustice*. (2023). https://prairieisland.org/who-we-are/our-land/net-zero

[70] Sahan Journal. *Prairie Island Indian Community Nuclear Concern Powers Net Zero Carbon Emissions Plan*. (August 5, 2022). https://sahanjournal.com/climate-environment/prairie-island-indian-community-nuclear-concern-powers-new-emissions-plan/

[71] Sahan Journal. *In the Shadow of a Nuclear Power Plant, Prairie Island Celebrates Steps Toward a Green Future*. (October 2, 2023). https://sahanjournal.com/climate-environment/prairie-island-indian-community-celebrates-green-future/

[72] City of Red Wing. *Current Planning Projects*. (2023). http://www.red-wing.org/352/Current-Planning-Projects

[73] City of Red Wing. *Construction Projects*. https://www.red-wing.org/160/Construction-Projects

[74] Goodhue County. *Public Works Projects*. https://goodhuecountymn.gov/public_works/projects/

Plan[75] and road construction projects.[76] The project nearest to PINGP was a resealing of County Road 18 that has already been completed in June 2024.

Review of the USACE St. Paul District's projects website indicates that the USACE has various improvements and maintenance activities planned for Mississippi River Locks and Dams 2 through 10.[77] The timing of any planned improvements for Lock and Dam No. 3 near PINGP is not known currently.

The Minnesota Department of Transportation (MNDOT), District 6, Southeast Minnesota Regional Information planning website provides information about planning studies and potential future projects throughout southeastern Minnesota.[78] The Southeast Minnesota Area Transportation Partnership provides a list of planned projects during the 2024 to 2027 timeframe, but they all would be completed at least a year before construction within the ISFSI is anticipated to begin. The nearest potential projects are the CP Railway and Lock and Dam No. 3 within the District 6 Freight Plan, which still lack conceptual design and a firm timeline.

In sum, there are a number of projects planned near the PINGP site; however, none of these projects will impact resources within the PINGP site. With respect to resources and potential impacts outside of the PINGP site (e.g., traffic, noise, GHG emissions), these incremental impacts are anticipated to be minimal. There is some uncertainty in this characterization. Of the projects discussed here, the city of Red Wing's development plans likely have the greatest potential to impact traffic, noise, and GHG emissions near the PINGP site. However, on whole, cumulative potential effects are anticipated to be minimal.

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[75] Goodhue County. *Hastings to Red Wing Trail Master Plan*. https://goodhuecountymn.gov/files/public_works/parks_trails/hastings_to_red_wing_trail_master_plan_94607.pdf

[76] Goodhue County. *Public Works Road Construction, Interactive Map*. https://experience.arcgis.com/experience/022bf3a83bcf44e0b5636078d70e0020

[77] USACE, St. Paul District Website. *District Projects Home*. (n.d.) https://www.mvp.usace.army.mil/About/District-Projects/Mississippi-River-Basin/

[78] MNDOT. *Southeast Minnesota Regional Information, MnDOT District 6, Planning and Public Involvement*. (2023). http://www.dot.state.mn.us/d6/planningandinvolvement.html.

# 5 Potential Radiological Impacts

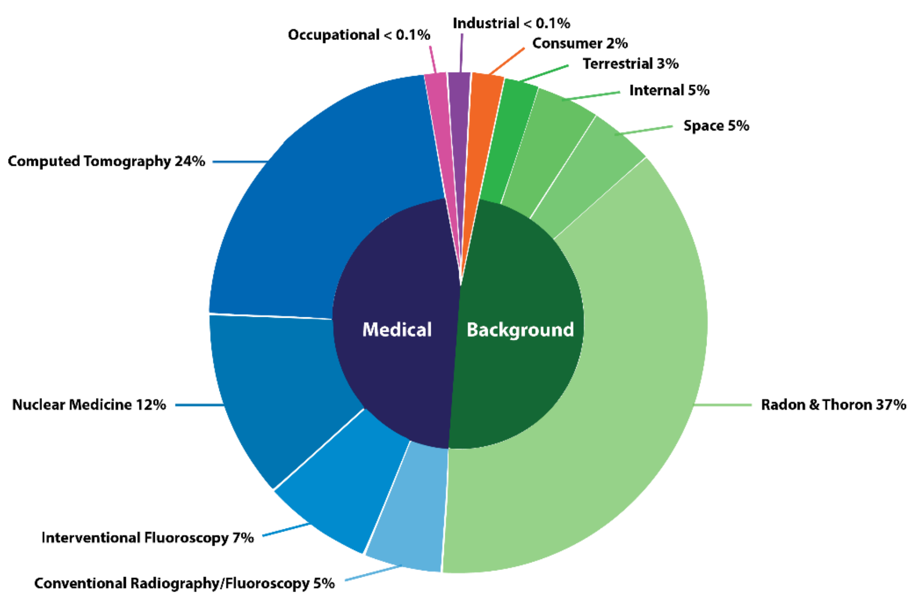
Xcel Energy's proposed additional spent fuel storage could impact the health of persons near the PINGP and its ISFSI through exposure to radiation. Radiation can cause direct and long-term health impacts. Spent nuclear fuel is highly radioactive. Thus, spent nuclear fuel must be properly handled and stored to avoid radiological health impacts.

Potential radiological impacts to the public and to workers at the PINGP are anticipated to be minimal. Additional spent fuel storage in the PINGP ISFSI will incrementally increase radiation levels within the ISFSI; however, these levels will have minimal impact on the general public and PINGP workers.

## 5.1 Radiation and Health Effects

All inhabitants of the planet are regularly exposed to radiation from natural and man-made sources. The average American receives approximately 620 millirem (mrem) of radiation each year.[1] Approximately half of this average annual radiation dose comes from natural sources, e.g., gases produced by radioactive decay (green categories in Figure 8). The other half comes primarily from medical procedures (blue categories in Figure 8). Doses due to occupational and industrial exposures make up less than 0.2 percent of average annual radiation doses.

**Figure 8: Sources of Radiation Exposure**[2]




[1] U.S. Environmental Protection Agency. *Radiation Sources and Doses*. https://www.epa.gov/radiation/radiation-sources-and-doses

[2] National Council on Radiation Protection and Measurements. *Report No. 160*.

Radiological health effects result from the deposition of radiation energy within the human body. This energy causes cellular damage, which may or may not be able to be repaired by normal cellular repair mechanisms. If cellular damage does occur, health effects may also occur. The primary low-dose health effect of concern is cancer.

If the dose is long-term, low-level radiation, the health risk is substantially low because there is a greater likelihood of repairing the damage.[3] There is still a risk of long-term effects such as cataracts or cancer, however, that may appear years or even decades later. Effects of this type will not always occur, but their likelihood is proportional to the radiation dose and the risk is higher for children and adolescents.[4]

According to the World Health Organization, "Based on the available evidence and the limitations identified in the scientific robustness of the studies that were reviewed, it was concluded that there was no convincing evidence of an association between exposure to depleted uranium and clinical outcomes, including any type of cancer and congenital malformations."[5] The NRC has noted that, "Dry cask storage has proven to be a safe technology over the 30 years it has been used. Since the first casks were loaded in 1986, dry storage has released no radiation that affected the public or contaminated the environment… Tests on spent fuel and cask components after years in dry storage confirm that the systems continue to provide safe storage."[6]

To ensure continued safe dry storage of spent fuel, the NRC is further studying how the fuel and storage systems perform over time.[7] For welded, canister-based systems like the project, the thick steel-reinforced concrete vault that surrounds an inner canister provides shielding for both neutron and gamma radiation.[8] Shielding in bolted cask systems comes from their thick steel shells that may have several inches of lead gamma shielding inside. These systems have a neutron shield on the outside consisting of low-density plastic material, typically mixed with boron to absorb neutrons.[9]

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[3] World Health Organization. *Ionizing radiation and health effects*. (July 27, 2023). https://www.who.int/news-room/fact-sheets/detail/ionizing-radiation-and-health-effects

[4] Ibid.

[5] United Nations Scientific Committee on the Effects of Atomic Radiation 2018 Report via World Health Organization. *Radiation and health, Depleted Uranium*. (May 18, 2018.) https://www.who.int/teams/environment-climate-change-and-health/radiation-and-health/environmental-exposure/depleted-uranium

[6] U.S. NRC. *Safety of Spent Fuel Storage*. (2017). https://www.nrc.gov/docs/ML1710/ML17108A306.pdf

[7] Ibid.

[8] Ibid.

[9] Ibid.

The best estimate of the relationship between radiation doses and incidences of cancer is provided by the National Academy of Sciences' BEIR VII Report.[10] This report recommends that estimates of additional cancers due to long-term, low-level radiation doses be calculated using a risk coefficient of 1 E-06 (i.e., 1 in a million) incident cancers per person-mrem received.[11] Some examples of this risk coefficient in use may be helpful:

- If 100 persons receive a dose of 10 mrem in a year, the risk of additional cancers in this group of 100 persons due to the radiation dose is 1 in 1,000 (100 persons * 10 mrem * 1 E-06 additional cancers per person-mrem).

- If 1,000 persons receive a dose of 10 mrem per year for 50 years, the risk of additional cancers in this group of persons due to the radiation dose is 0.5 (1,000 persons * 10 mrem per year * 50 years * 1 E-06 additional cancers per person-mrem). That is, we would expect 0.5 additional cancers in this group over 50 years than would otherwise occur due to the radiation dose.

Thus, additional incidences of cancer due to low-level radiation exposure can be mitigated by: (1) reducing the radiation dose received, and (2) limiting the number of persons that receive a dose.

Per the National Council on Radiation Protection and Measurements (NCRP), "health effects other than cancer such as cardiovascular disease and cataracts are emerging as potentially important concerns."[12] NCRP recommendations are the basis for radiation protection programs in the United States as a Congressionally chartered body that seeks information, guidance and recommendations on radiation protection and measurements which represent the consensus of leading scientific thinking.[13] NCRP also reported that there is evidence that effects to the lens of the eye can be observed at lower levels than previously estimated, but that the current level of knowledge is not enough to determine a threshold.[14] Ultimately, the NCRP stated that the annual dose to a member of the public from a continuous source should not exceed 1 millisievert (mSv),[15] or 100 mrem.[16]

A National Academy of Sciences' review of previous studies of cancer risks provided no significant evidence of a positive association between distance from nuclear plants and cancer

[10] National Academy of Sciences. *Beir VII: Health Risks from Exposure to Low Levels of Ionizing Radiation*. https://www.nap.edu/resource/11340/beir_vii_final.pdf.
[11] Ibid.
[12] National Council on Radiation Protection and Measurements. Report No. 180. (2018).
[13] Public Law 88-376. 88th Congress, H. R. 10437. July 14, 1964.
[14] National Council on Radiation Protection and Measurements. Report No. 180. (2018).
[15] Ibid.
[16] See details for Radiation Unit Conversion on the EPA's radiation website: https://www.epa.gov/radiation/radiation-terms-and-units.

risk.[17] Of this body of studies, only one found a correlation with leukemia from the Federal Office of Radiation Protection in Germany.[18] Ultimately, the study has been criticized strongly by other researchers.[19] An international Committee on Medical Aspects of Radiation in the Environment has undertaken further investigation since 1985 with 14 reports published to date in at least 11 countries including the United States.[20] Current joint efforts from France and Germany are focusing on developing studies that would improve understanding of the positive associations between childhood leukemia and distance from nuclear power plants by improving current knowledge on the etiology of the disease.[21]

Radiation effects related to cardiovascular disease and the central nervous system remain areas that require more investigation, however, there is evidence that cardiovascular disease may be a factor at lower exposures than previously thought.[22] The NRC concluded that that evidence is not sufficient to develop an approach in the overall system of radiation protection.[23] Epidemiologic studies have not shown an association with dementia, Alzheimer's disease, Parkinson's disease, or motor neuron disease for low level radiation.[24]

Other recent studies continue to research the effects of radiation from nuclear power plants, such as assessments related to the Three Mile Island incident (see Chapter 6.1).[25] However, these studies have largely concluded that additional analysis and interpretation is needed to establish any potential significance.[26] Although physical dosimetry and modeling of atmospheric dispersion indicates exposures of the nearby population to the Three Mile Island plant have no discernable impacts to health, contrary evidence that doesn't use the conventional expression for radiological measurement[27] argues that further research is needed to reevaluate this impact.[28]

[17] The National Academies Press. *Analysis of Cancer Risks in Populations Near Nuclear Facilities: Phase I (Section 1.2).* (2012.) https://nap.nationalacademies.org/catalog/13388/analysis-of-cancer-risks-in-populations-near-nuclear-facilities-phase

[18] Ibid. (Kaatsch et al., 2008; Spix et al., 2008).

[19] Ibid. (Committee on Medical Aspects of Radiation in the Environment, 2011; Kinlen, 2011).

[20] Ibid.

[21] Ibid.

[22] National Council on Radiation Protection and Measurements. *Report No. 180*. (2018).

[23] Ibid.

[24] Ibid.

[25] ISEE Conference of the International Society of Environmental Epidemiology, Volume 2024, Issue 1. Results of a Biodosimetric re-assessment of Three Mile Island (TMI) exposures using whole genome directional genomic hybridization (dGH). Doug Brugge, Aaron Datesman, Christopher J Tompkins, Megan Rouillard, Erin M Cross, and Susan M Bailey. (25 August 2024). https://doi.org/10.1289/isee.2024.0631

[26] Ibid.

[27] There are studies that argue that the conventional expression for the energy imparted to tissue does not consider the temporal character of energy deposition and therefore cannot account properly for the nature of the chemical damage to tissue resulting from exposure to an internally incorporated beta-emitting radionuclide.

[28] Datesman, AM. Radiobiological shot noise explains Three Mile Island biodosimetry indicating nearly 1,000 mSv exposures. Sci Rep. 2020 Jul 2;10(1):10933. doi: 10.1038/s41598-020-67826-5. PMID: 32616922; PMCID: PMC7331574.

## 5.2 Radiation Monitoring

Radiation monitoring is conducted at the PINGP and the ISFSI by Xcel Energy, the Minnesota Department of Health (MDH), and the Wisconsin Department of Health Services (WDHS).[29] NRC regulations strictly limit the amount of radiation that can be released by a nuclear facility, such as the PINGP.

Xcel Energy's monitoring program has been developed in accordance with the NRC as it is required by NRC regulations. As an NRC licensee, Xcel Energy must control, monitor, evaluate, and report all radiological effluents discharged into the environment.[30] Xcel Energy must operate the PINGP such that radiation doses to members of the public and to workers are within NRC standards (Table 5).[31]

Xcel Energy ensures that radiation doses are within NRC regulations through environmental sampling and monitoring on and around the PINGP site (Figure 9). Xcel Energy samples air, surface water, drinking water, and groundwater.[32] It samples ingestion sources like agricultural products from nearby farms and downstream shoreline sediment.[33] It uses thermoluminescent dosimeters (TLDs) to monitor direct radiation on site and around the plant.[34]

[29] 2009 Prairie Island EIS, Chapter 1, Section 4.13.

[30] NRC. *Radioactive Effluent and Monitoring Reports for Prairie Island 1 & 2*. https://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/prai1-2.html

[31] In addition to the radiation dose standards noted in Table 7, the NRC has promulgated standards for other dose scenarios, e.g., workers with planned special exposures (10 CFR 20) and workers during accident conditions (EPA-400-R-92-001).

[32] NRC. 2023 Annual Radiological Environmental Operating Report, Prairie Island Nuclear Generating Plant, Section 3.2. https://www.nrc.gov/docs/ML2413/ML24130A236.pdf

[33] Ibid.

[34] Ibid.

**Table 5: Radiation Dose Limits – NRC Standards**

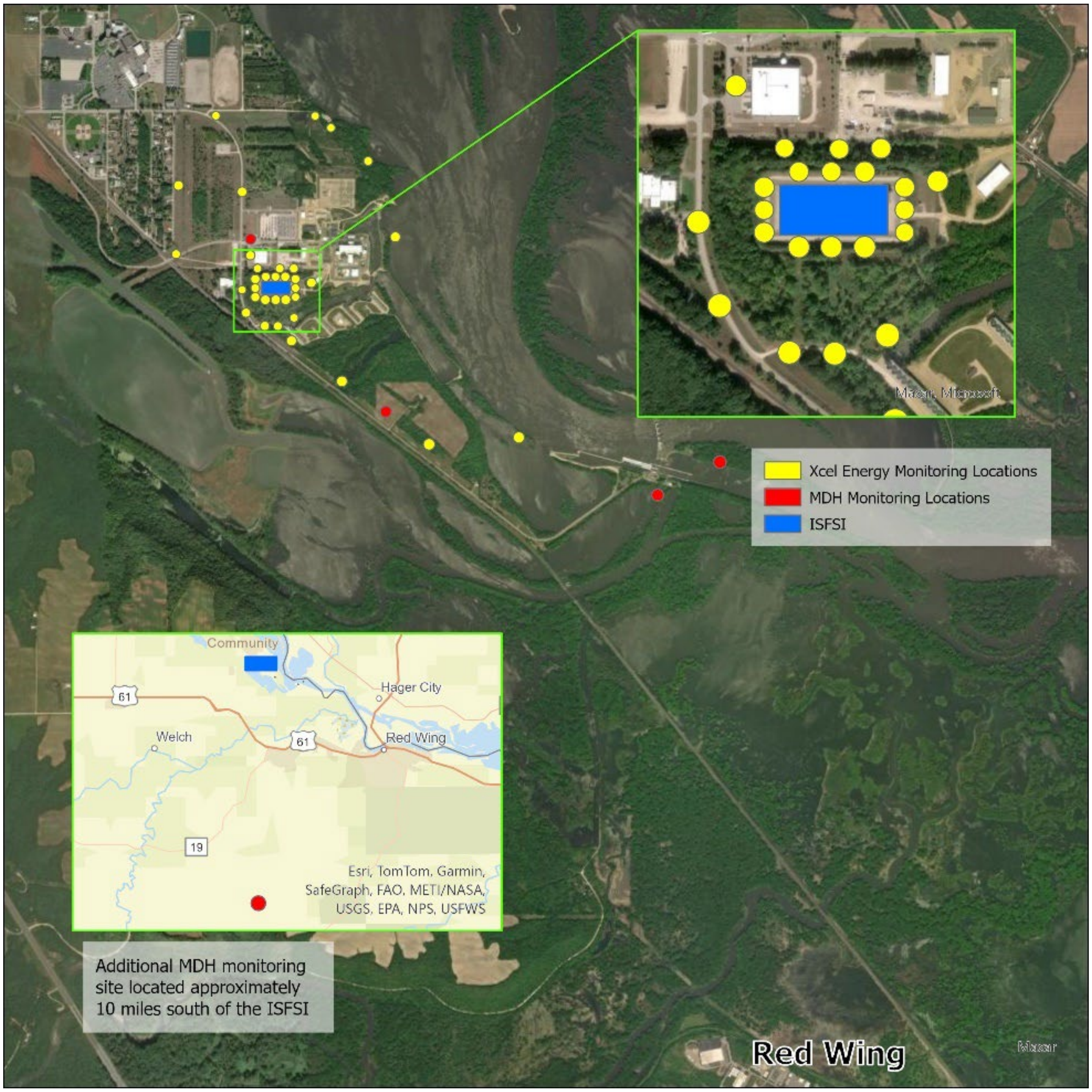
| Federal Radiation Dose Standards – Applicability | Radiation Dose Limit (mrem/year) | Regulation |
|---|---|---|
| General Public; licensed operations | 100 | 10 CFR 20 |
| General Public; uranium fuel cycle operations | 25 – whole body<br>75 – thyroid<br>25 – any other organ | 40 CFR 190 |
| General Public; normal ISFSI operations | 25 – whole body<br>75 – thyroid<br>25 – any other organ | 10 CFR 72 |
| General Public; ISFSI design basis accident conditions | 5,000 | 10 CFR 72 |
| Workers; occupational exposure | 5,000 | 10 CFR 20 |

Environmental monitoring by the MDH includes air, surface water, and milk sampling (Figure 9).[35] Ambient radiation dose levels are monitored using optically stimulated luminescence dosimeters (OSLDs).[36] Near the PINGP is the only place in Minnesota where MDH collects well water samples for radiation monitoring. MDH also monitors for radiation with continuous measurements within the PINGP ISFSI.[37]

Separately, MDH monitors and reports levels of gamma radiation with OSLDs beyond PINGP boundaries to estimate doses to the public.[38] The PINGP air sampler is near Lock and Dam No. 3, downwind from the plant based on predominant wind directions.[39] Air sampling determines the level of radioactive contamination that could be exposed to the public through inhalation.[40] WDHS conducts air, water, soil, and other sampling in Wisconsin, just east of the PINGP.[41] WDHS also uses TLDs to monitor background radiation.

[35] Minnesota Department of Health. *Environmental Monitoring*. https://www.health.state.mn.us/communities/environment/radiation/monitor/index.html
[36] Minnesota Department of Health. *Environmental Monitoring Report, 2022 Data*. (January 9, 2024). https://www.health.state.mn.us/communities/environment/radiation/docs/monitor/2020envirorpt.pdf
[37] Ibid., see Image 2: Prairie Island Environmental Sampling Sites.
[38] Ibid., see Image 4: Prairie Island OSLD Locations.
[39] Ibid.
[40] Ibid.
[41] 2009 PINGP EIS.

**Figure 9: Environmental Radiation Monitoring Locations**




## 5.3 Potential Radiological Impacts to the Public

The NRC has extensively reviewed research on the potential for radiological impacts to the public from nuclear power plants. The NRC continues to cite a study by the National Cancer Institute that concluded that there was no increased risk of death from cancer for people living in counties adjacent to U.S. nuclear facilities.[42] In addition, a NRC 2023 Regulatory Information

[42] Nuclear Regulatory Commission Library. *Backgrounder on Biological Effects of Radiation*. (June 19, 2024). https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/bio-effects-radiation.html

Conference presented long-term studies of a million workers whose radiation doses were closely monitored.[43] These studies indicate the current system of radiation protection adequately protects the health and safety of workers and the general public.[44]

Radiation doses to the general public from PINGP ISFSI operations result from skyshine radiation.[45] Skyshine radiation is gamma and neutron radiation that travels upward from the spent fuel canisters, through their concrete overpacks, and is reflected off the atmosphere back to the ground.

The annual dose from PINGP ISFSI skyshine radiation to the nearest resident to the (0.45 miles), calculated in 2022, was estimated to be 0.9 mrem per year.[46] This is based on empirical data from the Radioactive Effluent Release Report (RERR) monitoring program.[47] This 0.9 mrem per year dosage is within NCRP recommendations as well as NRC standards and is indistinguishable from background radiation (Table 5). The dose from skyshine radiation decreases with distance from the ISFSI. Members of the public at a distance greater than 0.45 miles would receive less than 0.9 mrem per year.

Separately, Xcel Energy conducted a dose study for potential radiological impact of the project.[48] The conservative calculation in the dose study assumed the 1) DFS locations within the ISFSI relative to the distance from the nearest resident, 2) the allowable radioactivity of the spent fuel in the DFS systems per design and regulatory limits, 3) 44 new technology DFS systems in the ISFSI to facilitate operations through 2053/2054,[49] and 4) the 50 TN40/40HT DFS systems stored in the ISFSI at the time of the report plus 5 additional TN40HTs.[50] Conservative dose rate and distance scaling factors were applied to bound potential dose based on cask design and distance to the nearest resident. The conservative results were approximately 22 mrem, however, based on empirical data from RERRs, Xcel Energy anticipates approximately 0.9 mrem.[51]

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[43] NRC, Regulatory Information Conference, 2023. *Human Health Radiation Risk Assessment in the Nuclear Power and Industrial Radiographer Worker Cohorts.* https://www.nrc.gov/public-involve/conference-symposia/ric/past/2023/docs/abstracts/sessionabstract-19.html

[44] Ibid.

[45] There are no gaseous or liquid effluents from the spent fuel canisters under normal operation conditions; thus, there are no radiation doses associated with exposure to, of ingestion of, radioactive materials.

[46] 2022 PINGP Radioactive Effluent Release Report. Scoping EAW, Section 21.c.i. The closest residence is approximately 724 meters northwest of the PINGP ISFSI. Historic reports are available on the NRC's website at: https://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/prai1-2.html

[47] Ibid.

[48] Sargent & Lundy. 2023. Report SL-018015, Dose Study to Support ISFSI Certificate of Need.

[49] 34 new technology DFS systems from the project plus 10 new technology DFS systems that will be present from the existing operating license.

[50] Sargent & Lundy. 2023. Report SL-018015, Dose Study to Support ISFSI Certificate of Need.
At the time of the analysis, the NUHOMS technology had not been selected so a conservative, bounding analysis was performed to consider various cask technology.

[51] Ibid.

Monitoring programs corroborate the ISFSI dose estimate and its near-background level. Xcel Energy monitoring indicates that radiation dose levels near the PINGP, as measured by TLDs in the area, are indistinguishable from background radiation levels.[52] Monitoring by the MDH also indicates that radiation dose levels are indistinguishable from background radiation levels.[53]

Health impacts to the general public resulting from ISFSI skyshine radiation are anticipated to be minimal. The primary health concern is cancer. Cancer incidences due to skyshine radiation are anticipated to be minimal because the estimated radiation dose is near background radiation levels. There are 57 residences within one mile of the PINGP.[54] Assuming that these residences represent 228 persons (four people in each residence),[55] and that these persons receive 0.9 mrem per year continuously for 70 years, it is estimated that an additional 0.00144 persons among this group of residents would be diagnosed with cancer.[56] By comparison, it is estimated from the same sample size and timeframe that 70 residents would be diagnosed with cancer from all causes of cancer.[57]

It is possible that, over time, more residents will live near the PINGP ISFSI. Any growth may lead to more persons being impacted by skyshine radiation, at least for part of the day. Even with an increase in the number of persons that could be impacted by skyshine radiation, potential health impacts are anticipated to be minimal. Assuming that the population of Red Wing increases by 50 percent by 2053/2054, and that these additional 8,400 persons reside near the PINGP ISFSI such that they receive the same annual dose as the nearest residence (0.9 mrem per year) for 70 years, it is estimated that an additional 0.0529 persons, among these 8,400 persons, would be diagnosed with cancer.[58] By comparison, it is estimated that 2,590 of these 8,400 residents would be diagnosed with cancer during this time period from all causes of cancer.[59]

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[52] NRC. 2023 Annual Radiological Environmental Operating Report, Prairie Island Nuclear Generating Plant. https://www.nrc.gov/docs/ML2413/ML24130A236.pdf

[53] Minnesota Department of Health. *Environmental Monitoring Report, 2022 Data*. (January 9, 2024). https://www.health.state.mn.us/communities/environment/radiation/docs/monitor/2020envirorpt.pdf.

[54] See Chapter 4.2.

[55] Per the Minnesota Department of Employment and Economic Development's *Minnesota Cost of Living Study, Annual Report to the Legislature, 2023:* "The average family size in Minnesota is 3.1 persons and the average household size, for family and nonfamily households combined, is 2.5 persons." https://www.lrl.mn.gov/docs/2023/mandated/230445.pdf

[56] (228 persons) X (0.9 mrem/year) X (70 years) X (1 E-06 cancer incidences/person-mrem) = 0.00144 cancer incidences, or 144 cancer incidences per 100,000 persons. This estimate is conservative in that residents are not anticipated to be at home, outside, 24 hours a day, for 70 years.

[57] The cancer incidence rate in the United States for all cancers is 440.5 incidences per 100,000 persons per year; see National Cancer Institute. *Cancer Statistics.* https://www.cancer.gov/about-cancer/understanding/statistics. (228 persons) X (0.004405 incidences/person-year) X (70 years) = 70 cancer incidences.

[58] (8,400 persons) X (0.9 mrem/year) X (70 years) X (1 E-06 cancer incidences/person-mrem) = 0.0529 cancer incidences.

[59] (8,400) X (0.004405 incidences/person-year) X (70 years) = 2,590 cancer incidences.

The above discussion assumes that monitoring and maintenance of the spent fuel canisters continues until such time as the spent fuel can be transported to an off-site facility. Monitoring and maintenance ensure the integrity of the spent fuel canisters such that radiation doses to the general public are solely the result of skyshine radiation. If monitoring and maintenance do not continue, radiological impacts are anticipated to be significant (see Chapter 6.2).

The above discussion also assumes the use of a canister system with a horizontal concrete overpack as the technology for the PINGP ISFSI. This was the selected technology for the project. As all NRC-certified canister systems must meet the same design criteria, including criteria for radiation shielding, the above characterizations of potential health impacts to the general public would hold true for any NRC-certified canister system selected by Xcel Energy for use in the PINGP ISFSI.

## Off-Normal Conditions

All NRC-certified spent fuel technologies must meet the same design criteria. These criteria include protection against natural phenomena, e.g., earthquake, tornado, flood, and man-made phenomena, e.g., fire or explosion.[60] Accordingly, when these technologies are appropriately deployed in an ISFSI, potential radiological impacts to the general public during off-normal conditions are anticipated to be minimal and within NRC standards.

Canister storage systems use steel canisters that are welded shut. These welds are inspected and must meet applicable quality standards. They are considered leak tight. Thus, for there to be a radiological release during off-normal operating conditions, the phenomenon would need to cause either the canister itself to fail or the welds sealing the canister to fail. The discussion here references the final safety analysis report (FSAR) for the proposed project technology (the NUHOMS EOS-37PTH) for both Revision 0 and the most recent, Revision 5.[61]

### *Earthquake*

The NUHOMS EOS-37PTH proposed for the project is designed to withstand a design basis earthquake.[62] The NUHOMS EOS-37PTH was evaluated based on the NRC's Regulatory Guide 1.60 for seismic response spectra such as vertical and horizontal directional accelerations that would be amplified during an earthquake.[63] The results of the analysis show the NUHOMS EOS-37PTH would not be compromised as a result of an earthquake as the seismic stresses imposed

[60] 10 CFR 72. https://www.nrc.gov/reading-rm/doc-collections/cfr/part072/full-text.html#part072-0120

[61pt1] NRC. *NUHMOS EOS System Updated Final Safety Analysis Report for the NUHOMS EOS System, Revision 5 (Public Version)* [hereinafter "NUHOMS FSAR"]. (2023, July). https://www.nrc.gov/docs/ML2319/ML23198A297.pdf

[61pt2] NRC. *NUHMOS EOS System Final Safety Analysis Report for the NUHOMS EOS System, Revision 0 (Public Version)* [hereinafter "NUHOMS FSAR"]. (2023, July). https://www.nrc.gov/docs/ML1724/ML17249A014.pdf

[62] Ibid.

[63] Ibid.

on the system are well below the stress limits.[64] Accordingly, there would be no radiological impacts to the public.

### *Tornado*

Stability and stress analyses are performed to determine the response of the NUHOMS EOS-37PTH to massive missile impact, tornado wind pressure loads, and pressure or suction forces created by drag due to a tornado.[65] The most severe tornado generated wind and missile loads analyzed are specified by the NRC Regulatory Guide 1.76, with wind speeds up to 360 mph. The analysis calculates the sliding and overturning stability response of the NUHOMS EOS-37PTH due to wind and massive impact loads. Analysis of the NUHOMS EOS-37PTH indicates that the canisters would not be compromised as a result of a tornado.[66]

An additional hazard considered in this scenario is the impact of an object which is picked up in the tornado. Such an object, impelled by the wind, would act as a missile against the concrete overpack and canister. Analysis indicates that such missiles would not compromise the spent fuel canisters.[67] Thus, no radiological impacts are anticipated.

### *Flood*

The NUHOMS EOS-37PTH is designed to withstand flood conditions, including external hydrostatic pressure. The design basis flood is a flood with pressures equivalent to a 50 foot head of water and with a maximum water flow velocity of 15 feet per second.[68] Analysis of the NUHOMS EOS-37PTH indicates that the canisters would not be compromised as a result of a flood or the pressures created by a flood.[69]

The ISFSI is within a Federal Emergency Management Agency (FEMA)-designated 500-year floodplain with 100-year floodplains directly adjacent to the east of the PINGP property (i.e., the Mississippi River, a designated FEMA floodway), south, and on the opposite side of the CP Railroad.[70] River levels at PINGP are evenly controlled by the USACE Lock and Dam 3 near the PINGP's setting on the Mississippi River.[71]

The PINGP ISFSI elevation is 694.5 feet above mean sea level (amsl). The normal water level of the Mississippi River is 674.5 feet amsl.[72] The probable maximum flood level calculated to occur at the ISFSI is 706.7 feet amsl, including wave run-up.[73] The ISFSI has been sited and designed so

[64] Ibid.
[65] NRC. *Regulatory Guide 1.76, Revision 1 [2-8]*. https://www.nrc.gov/docs/ML0703/ML070360253.pdf
[66] NUHOMS FSAR.
[67] Ibid.
[68] Ibid.
[69] Ibid.
[70] Scoping EAW, Section 10 aiii.
[71] 2020 PINGP EA.
[72] Ibid.
[73] Scoping EAW, Section 7b.

that the lowest point of potential water entry is above the level of the probable maximum flood. A study of the potential impacts on the ISFSI due to a probable maximum flood is included as Appendix F in the Prairie Island Updated Safety Analysis Report.[74] No flooding of the ISFSI that could cause radiological impacts are anticipated.

### *Fire or Explosion*

Current spent fuel casks are stored on concrete pads away from combustible material. The only source of fuel which could cause a fire in the PINGP ISFSI is the fuel tank of the cask transport vehicle, which is only inside the ISFSI when transporting a cask to the pads.[75] Thus, the analysis calculates the maximum fuel cladding and seal temperatures to demonstrate containment integrity of the cask.

Xcel Energy evaluated the thermal response of the existing TN-40HT casks onsite in the Safety Analysis Report for the ISFSI (Appendix D). The analysis for the TN-40HT for fire and explosion is expected to be similar for the project's proposed NUHOMS canister technology because the parameters of the bounding hypothetical fire would not change. The hypothetical fire is based on a diesel fuel fire with a 200-gallon fuel tank that engulfs around the cask (Appendix D, A3.3.2.2.1.2). It was concluded that the cask will maintain its integrity during and after this hypothetical fire accident. The maximum fuel capacity allowed inside the ISFSI at any time is 200 gallons to ensure the site remains within the bounds of this analysis.[76] Thus, there would be no radiological impacts to the public.

### *Transfer Cask Mishandled*

Spent fuel canisters require handling to load them and to transport them to a concrete overpack on an ISFSI pad. It is possible that a canister could be mishandled during this process. The NUHOMS FSAR examines the possibility of dropping a transfer cask enroute to the ISFSI pad.[77] The probability for a load drop is minimized by an overhead handling system designed to comply with the guidelines of NUREG-0554. The NUHOMS EOS-37PTH is transferred to the ISFSI in a horizontal configuration. Therefore, the only drop accident evaluated during storage or transfer operations is a side drop or a corner drop. This evaluation demonstrates structural integrity during transfer and plant handling.

The scenario assumes a 65-inch drop height from the transfer trailer.[78] The analysis finds that the spent fuel canister would not be compromised by a transfer cask drop.[79]

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[74] NRC. *ADAMS Public Documents.* NRC ascension no. ML16090A254 (PINGP).
[75] Xcel Energy Additional Information.
[76] Xcel Energy Additional Information.
[77] NUHOMS FSAR.
[78] Ibid.
[79] Ibid.

### *Terrorism*

The radiological risks resulting from a terrorist attack on the PINGP ISFSI are covered, to a great degree, by the risk analyses for natural and man-made phenomena. There are few forces that could be brought to bear on the canisters and their concrete overpacks by terrorists greater than those already examined, such as a tornado, explosion, or mishandled transfer cask. It is possible that armaments could be used to attack the ISFSI, creating damage or a fire. An airplane could be commandeered to attack the ISFSI. These risks are difficult to assess and include substantial uncertainties. However, the risks and potential radiological impacts are likely similar to those from the natural and man-made phenomena discussed herein.

Following the events of September 11, 2001, the NRC developed and required security enhancements for all ISFSIs. The NRC also initiated a classified review of the capability of nuclear facilities to survive a terrorist attack, including commercial aircraft attacks, vehicle bomb assaults, and ground assaults. This review indicated that the likelihood of a radioactive release with significant radiological impacts was very low. Nonetheless, the NRC has provided revised guidance to all licensees regarding security requirements against terrorism.[80] Xcel Energy has implemented security enhancements at the PINGP in accordance with NRC guidance and regulations.

## Accident Conditions

Radiological impacts to the public from the PINGP ISFSI during normal and off-normal conditions are anticipated to be minimal. Analysis indicates that spent fuel canisters would not be compromised by natural or man-made phenomena. Thus, impacts to the public would be limited to skyshine radiation (discussed above). Nonetheless, it is possible that a canister could be compromised by some unknown means resulting in a release of radioactive materials.

DFS systems are required to be designed to normal, off-normal, and accident conditions as defined by the NRC. Any DFS system used at the PINGP ISFSI will be designed and tested to meet the "leak tight" criteria of ANSI N14.5-1997.[81] The NRC has analyzed the potential impacts associated with a hypothetical release from spent fuel in an ISFSI.[82] The analysis assumes removal of the lids from the lid of a DFS system cask containing 24 damaged spent fuel assemblies with the subsequent release of radioactive gases including Krypton (Kr-85) and Iodine (I-129). It is assumed that the fuel had been removed from the reactor core five years earlier and that 10 percent of the Kr-85 and 1 percent of the I-129 are released. The maximum estimated dose to an off-site public member from this release was 3 mrem to a person 100 meters from the ISFSI; persons at a greater distance would receive a smaller dose. A dose of 3

[80] NRC. *Backgrounder on Nuclear Security*. (2019, May). https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/security-enhancements.html

[81] NUREG-1567, Standard Review Plan for Spent Fuel Dry Storage Facilities, Section 9.4.2.1. March 2000.

[82] U.S. NRC. *NUREG-1140. A Regulatory Analysis on Emergency Preparedness for Fuel Cycle and Other Radioactive Material Licensees*. https://www.nrc.gov/docs/ML0620/ML062020791.pdf

mrem is within NRC standards and indistinguishable from background radiation. The impacts of such a dose would be minimal.

As a nuclear power plant licensee, Xcel Energy is required to have an emergency response plan for the PINGP.[83] Site-specific letters of agreement are maintained by PINGP with organizations having an emergency response role such as the State of Wisconsin; Goodhue, Dakota, and Pierce County Emergency Management; Sacred Heart and Regions Hospital the city of Red Wing; and the Mayo Clinic Health System in Red Wing.[84] These off-site medical facilities would serve for injuries related to an emergency or emergency response. The listed counties' sheriff offices would also provide law enforcement services to the PINGP, including any services necessary during an emergency. If there were accident conditions at the PINGP, emergency responders would address the situation in an attempt to control any radiological release and to minimize radiological impacts to the public.

Emergency response planning must include strategies to mitigate potential radiological impacts due to inhalation of radioactive particles – typically, a 10-mile emergency planning zone.[85] Plans must also account for possible ingestion of radioactive materials – typically, a 50-mile emergency planning zone.[86] Xcel Energy, in coordination with state and county emergency management personnel, updates and distributes site related emergency planning information annually to residents living within the plume-exposure pathway emergency planning zone.[87]

Assistance will be provided, as necessary, by federal, state, tribal and county agencies that are mandated by charter, regulation, or law to protect public health and safety.[88] State, tribal and county organizations have developed radiological emergency plans and procedures in an integrated manner with Xcel Energy.[89]

## Spent Fuel Transportation Safety

Analysis, testing, and experience with shipping spent fuel indicate that the impacts of transporting spent nuclear fuel are anticipated to be minimal. In 2006, the National Research Council issued a report on the transportation of spent nuclear fuel in the United States.[90] The report concluded that there were no fundamental technical barriers to the safe transport of spent nuclear fuel and high-level radioactive waste in the United States.[91]

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[83] See current PINGP Emergency Plans under eDockets No. 20246-207711-01.
[84] Ibid.
[85] U. S. NRC. *Emergency Planning Zones*. https://www.nrc.gov/about-nrc/emerg-preparedness/about-emerg-preparedness/planning-zones.html
[86] Ibid.
[87] See current PINGP Emergency Plans under eDockets No. 20246-207711-01.
[88] Ibid.
[89] Ibid.
[90] Transportation Research Board and National Research Council. Going the Distance?: The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States. (2006). https://doi.org/10.17226/11538
[91] Ibid. Section S.1.

The report did find that there are social and institutional challenges to shipping spent nuclear fuel. Further, the report noted that there is a risk of malevolent actions (e.g., terrorism) that could impact safe transport. The report examined analysis and testing results from a variety of sources, including national and international experience with shipping spent nuclear fuel. The report noted that there have been no recorded instances of any releases of radioactive material exceeding regulatory limits from any transport package in Western Europe, Japan, or the United States.[92] There are, however, well-documented instances of exposures to radioactivity from inadequate decontamination of the external surfaces of transport packages after they are loaded with spent fuel. However, these releases have been small, and there are no documented instances in which exposures to workers or the public exceeded regulatory limits.[93]

A 2016 report prepared for DOE reached similar conclusions regarding experience with transporting spent nuclear fuel. The report concluded that there have been few transportation accidents worldwide in the history of transporting spent nuclear fuel and none have had significant radiological consequences.[94] The report echoed the National Research Council stating that instances of radioactive contamination on casks and the vehicles that carry them have occurred more frequently than transportation accidents.[95]

Thus, to date, experience with transporting spent nuclear fuel worldwide indicates that the primary risk is radiation exposure due to contamination remaining on the *outside* of a cask or canister that has been loaded for transportation. This is not to say that contamination on the outside of a transportation package is the primary concern with respect to transporting spent fuel. The primary concern remains the possibility of an accident that releases radioactive materials that are *inside* a transportation package.

Lastly, the NRC's most recent risk analysis for spent fuel transportation (NUREG-2125) concluded that radiation doses to the public and workers from routine transportation of spent nuclear fuel are less that background radiation levels. Additionally, NUREG-2125 concluded that if there was an accident during shipment, there is a less than a one-in-one billion chance that radioactive materials would be released.[96]

The NUREG analysis found that an accident which released radioactive material from a transportation package would result in a dose to the public of 218 person-rem.[97] This dose

[92] Ibid. Section 3.1.1.
[93] Ibid.
[94] DOE, Nuclear Fuels Storage and Transportation Planning Project. *A Historical Review of the Safe Transport of Spent Nuclear Fuel*. (2016, August). https://www.energy.gov/ne/articles/historical-review-safe-transport-spent-nuclear-fuel
[95] Ibid.
[96] NUREG-2125, Spent Fuel Transportation Risk Assessment, Public Summary and Chapter 6. (2014, January). https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr2125/index.html
[97] Ibid.

would result in an additional 0.22 incidences of cancer among persons near the accident. The analysis indicates that the greater public health risk is an accident resulting in a fire that compromises the lead shielding in a transportation package.[98] Although the project does not include a transportation package, the selected DFS system technology uses steel shielding, not lead shielding. In sum, the analysis concluded that potential radiological impacts of spent fuel transportation are small.

## 5.4 Potential Radiological Impacts to Workers

Workers at the PINGP, particularly workers who load spent fuel and handle spent fuel storage canisters, are exposed to greater radiation risks than the general public. Shielding, proper procedures, and training are used to avoid and mitigate these risks. NRC regulations require that radiation doses to workers are as low as reasonably achievable. The NRC's occupational radiation dose limit is 5,000 mrem per year (Table 5).

The NRC requires the monitoring and reporting of worker radiation doses from all NRC-licensed facilities in the United States subject to reporting requirements in 10 CFR 20.2206. This reporting is summarized annually in a report (NUREG-0713).[99] The latest version of the report (Volume 43) includes worker radiation doses through 2021.[100]

There are about 1,500 workers at the PINGP, and about 1,000 of those receive measurable exposure, though this number varies over time.[101] This variability is due to, among other factors, the cyclical nature of removing spent fuel from the PINGP reactor and the loading of new fuel. The dose also varies depending on the type of work occurring during the outage, such as a during a steam generator replacement which would result in extra dosage. Though the number of workers receiving a measurable dose varies from year to year, the average annual dose is fairly constant. During the 2019-2021 timeframe, the average PINGP worker receiving a measurable dose was exposed to 70 mrem annually, whereas no worker had an annual dose over 1,000 mrem.[102] This dose is within NRC standards (occupational exposure is 5,000 mrem per 10 CFR 20; see Table 5), and impacts from this dose are anticipated to be minimal. The average annual dose per worker at the PINGP from 2019-2021 was 0.07 rem;[103] no average annual dose per worker has exceeded 0.1 since 2012.[104] If workers at the PINGP received the average station dose from 2019-2021 (30.31 person-rem)[105] over a 40-year tenure at the PINGP,

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[98] Ibid.

[99] U.S. NRC. *NUREG-0713, Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities.* (March 07, 2024). https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0713/index.html

[100] U.S. NRC. NUREG-0713, Volume 43. Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities 2021. (February 2024). https://www.nrc.gov/docs/ML2406/ML24060A017.pdf

[101] Ibid.

[102] Ibid. Average over 2019-2021 timeframe in Table B-1.

[103] Ibid. Table 4-6.

[104] Ibid. Appendix .

[105] Ibid. The collective dose per site (person-rem) for 2019, 2020, and 2021 were 24.593, 20.018, and 46.326 respectively.

it is estimated that an additional 1.2 persons, among all PINGP workers, would be diagnosed with cancer.[106]

Data from the PINGP and other U.S. nuclear plants indicates that radiation doses to workers does not vary significantly with the type of canister system used (Table 6). Data in Table 6 shows that the radiation dose to workers is more dependent on the type of fuel being loaded (pressurized water reactor vs. boiling water reactor) rather than the canister technology.

**Table 6: Worker Radiation Exposure for Different Canister Technologies**[107]

| Type of Cask / Canister | Type of Fuel | Average Cumulative Worker Exposure During Fuel Loading (person-mrem) |
|---|---|---|
| Canister – Vertical Overpack[1] | PWR[4] | 220 |
| Canister – Horizontal Overpack[2] | PWR | 160 |
| Cask – Horizontal Overpack[3] | BWR[5] | 608 |

[1] Holtec data from 15 canisters.
[2] TN Americas data from four canisters.
[3] Monticello nuclear generating plant cask loading data.
[4] Pressurized water reactor.
[5] Boiling water reactor.

## Accident Conditions

All NRC-certified spent fuel canisters must meet the same requirements for performance during accident conditions. Thus, the radiation risks associated with the spent fuel, should an accident occur, would be protective of the same standards.

As discussed above (Chapter 5.3), no radiological impacts to the public are anticipated during off-normal operation of the PINGP ISFSI. There could be impacts to workers related to off-normal operations, e.g., additional monitoring and maintenance should an earthquake or tornado occur. Any additional radiation doses associated with this type of maintenance are difficult to estimate. Doses would be managed by Xcel Energy to remain within NRC standards.

Similarly, doses to workers should a hypothetical release occur at the ISFSI due to an accident are difficult to estimate. If we assume a hypothetical release similar to that analyzed in NUREG-1140 (discussed above), workers responding to the release would receive doses from Krypton and Iodine gas as well doses from the canisters themselves (direct gamma and neutron radiation). If we assume that 100 workers and/or emergency responders receive the maximum occupational radiation dose of 5,000 mrem during the accidental release, then this would result

[106] (30.31 person-rem/year) X (1000 mrem/rem) X (40 years) X (1 E-06 cancer incidences/person-mrem) = 1.2 cancer incidences.
[107] 2022 PINGP SEIS, Chapter 5.

in an additional 0.5 cancer incidences among this group of 100 persons.[108] In responding to an accident, individual worker doses could vary significantly. Doses would be monitored and managed using time, distance, and shielding.

## 5.5 Potential Radiological Impacts to the Natural Environment

Radiation doses to flora and fauna from ISFSI operations are typically not estimated or monitored, except as these doses are indicative of potential impacts to humans (e.g., monitoring agricultural crops because they will be eaten by humans). Radiation exposure for flora and fauna is most likely similar to that of the general public, i.e., indistinguishable from background radiation, and thus there is no significant radiological impact. However, this assumption would not hold for two cases: (1) flora that is very near the ISFSI, and (2) fauna that lives in, moves through, or otherwise utilizes the ISFSI site or nearby habitat.

Radiation impacts to tall nearby flora, e.g., trees along the Mississippi River, are anticipated to be minimal but unavoidable. Radiation impacts to nearby fauna are mitigated by the fact that there is no potential habitat for fauna within the ISFSI or within the PINGP site generally. Birds may land near the ISFSI or fly through the ISFSI, but likely would not make a nest within the ISFSI. ISFSI operating procedures preclude use of the ISFSI by nesting animals. Accordingly, radiation impacts to fauna are anticipated to be minimal.

## 5.6 Climate Change

As discussed in Chapter 4.4, greenhouse gas emissions resulting from human activities are making Minnesota's climate warmer and wetter. In addition, the frequency of extreme storms, storms with extreme rainfall and high winds, is increasing. These changes in the climate could adversely impact the resilience of spent fuel canisters under accident conditions.

The NRC has taken climate change into account in its regulation and review of spent fuel storage systems.[109] The primary risks that are exacerbated by climate change are high winds and flooding.[110] The NRC indicates that current regulations are appropriate for a warmer, wetter, and more energetic climate.[111] Further, the NRC notes that any additional regulatory action that may be needed with respect to climate change can be taken in a timely manner to ensure the safe operation of spent fuel storage systems.

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[108] (100 persons) X (5,000 mrem) X (1 E-06 cancer incidences/person-mrem) = 0.5 cancer incidences.

[109] NRC. *NUREG-2157, Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel: Volume 2 (Section 4.18)*. https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr2157/v1/index.html [hereinafter "NUREG-2157"].

[110] Ibid.

[111] Ibid.

## 5.7 Environmental Justice

The analysis in Chapter 4.3 discussed environmental justice with respect to potential non-radiological impacts, however, it offered a holistic view of the issue that should be applied in conjunction with this section of the EIS. That analysis used the census tract which contains the PINGP for purposes of identifying environmental justice populations as described in Minnesota Statute 216B.1691, subd. 1 (e). This is appropriate because potential non-radiological impacts are limited in their extent; almost all impacts would occur within the census tract. This is not the case for potential radiological impacts. Radiological impacts, particularly impacts from accidents conditions at the ISFSI, could extend for several miles.[112]

The 2011 Environmental Report for the PINGP's NRC license extension used a study area with a 50-mile radius from the PINGP, rather than the census tract which contains the PINGP, for its environmental justice analysis.[113] NRC stated that the 50-mile radius could reasonably be expected to contain potential environmental impact sites, and includes census tracts in both Minnesota and Wisconsin. Of the 2,197 census tracts in the radius, 562 were identified as environmental justice areas based on minority populations and 89 based on low-income for a total of 651.[114] Of these tracts, 630 were in Hennepin and Ramsey counties.

The report concluded that the populations identified through its analysis as having potential environmental justice concerns are concentrated in an urban center with a high population density approximately 30 miles northwest of the PINGP site (the Minneapolis-St. Paul metropolitan area).[115]

Based on the report's analysis, environmental justice impacts related to potential radiological impacts are anticipated to be minimal. There are census tracts in the study area with minority and low-income populations; however, these tracts make up 26 percent of the census tracts in the study area. Though the number of persons in a census tract varies, the percentage of census tracts with minority and low-income populations is a fair estimate of the population percentages themselves. That is, based on the report's analysis, approximately 26 percent of the population in the study area are minority or low-income. These percentages are not greater than the percentages for the State of Minnesota as a whole at 32 percent (see Table 4).

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[112] See Chapter 5.3, noting that emergency response planning required by the NRC includes 10 mile and 50 mile emergency planning zones.

[113] NRC. *Application for Renewal Operating Licenses, Appendix E: Environmental Report*. (2011, June). https://www.nrc.gov/reactors/operating/licensing/renewal/applications/prairie-island.html [hereinafter the "2011 Environmental Report"].

[114] NRC. *2011 Environmental Report, Table 2.5-2*. https://www.nrc.gov/reactors/operating/licensing/renewal/applications/prarie-island/pi-lra-appendix-e-sect1-2.pdf

[115] 2011 Environmental Report.

In sum, minority and low-income populations in the metropolitan area are not anticipated to bear a disproportionate share of any negative radiological consequences of Xcel Energy's proposed additional spent fuel storage. Environmental justice impacts are anticipated to be minimal.

## Prairie Island Indian Community

As stated by PIIC President Johnny Johnson in 2023 during a hearing of the House's Climate and Energy Finance and Policy Committee, "To this day, we are the closest — and I repeat, the closest — community to a nuclear power plant and spent nuclear waste in the country…"[116] As such, members of the community receive slightly higher radiation doses (skyshine radiation) than communities at a greater distance. These doses create a small incremental risk that the PIIC bears differentially from other communities.

The PIIC was not involved with the decisions to site or license the PINGP, which began operations in 1973. PIIC opposed the legislature's authorization for Xcel Energy to store its waste in casks on PINGP and stated, "the federal government failed to protect the tribe."[117] The 1994 legislation authorizing on-site dry cask storage contained a provision that designated the tribe as a "third party beneficiary" to enforce the contract agreement between the State and Xcel Energy's predecessor (Northern States Power Company).[118] It was not until 2003 that the PIIC was able to settle and resolves its rights under the 1994 agreement which led to annual compensation to the PIIC ($2.5 million per year, which went unchanged until 2023 when it was increased to $10 million per year).

Although bearing disproportionate risk, the PIIC was not being compensated by the PINGP at the same rate of increase as other communities such as the city of Red Wing until 2023. PIIC leaders asked the Minnesota Legislature to adopt a plan more in line with the tax revenue that nearby local governments receive. Xcel Energy filed testimony supporting the new public policy, recognizing the disproportionate risk PIIC bears from continued operation of PINGP, including the extra burden of PIIC members' health and safety.[119]

Potential impacts to PIIC members include radiological impacts from PINGP operation and the uncertainty and risk of a potential incident occurring at the PINGP. Xcel Energy's proposed change in storage technology would not significantly change the likelihood of an accident at the PINGP or its ISFSI. The PIIC is the closest community to the PINGP should an accident which

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[116] MinnPost, 2023. *Xcel Energy Agrees to Pay Prairie Island $7.5 Million More a Year to Store Spent Nuclear Waste*. https://www.minnpost.com/greater-minnesota/2023/03/xcel-energy-agrees-to-pay-prairie-island-7-5-million-more-a-year-to-store-spent-nuclear-waste/#:~:text=Under%20a%20deal%20announced%20Tuesday,governments%20like%20Red%20Wing%20get

[117] Ibid.

[118] Senate File 2847. Xcel Energy Testimony. (2023, March). https://assets.senate.mn/committees/2023-2024/3122_Committee_on_Energy_Utilities_Environment_and_Climate/SF%202847%20Testimony%20(3-28-29).pdf

[119] Ibid.

released radiation occur at the PINGP or its ISFSI. A potential incident could be a caused by a nuclear emergency, radiological waste storage (such as the project), among others. The likelihood of such an accident is small. Nonetheless, there is a low-level of continuing uncertainty regarding an accident. This uncertainty is borne by many Minnesota and Wisconsin communities but is most directly felt by those communities closest to the PINGP; these communities would most likely be impacted should an accident occur. This project in and of itself is not expected to significantly increase or exacerbate these impacts.

Because PIIC is the closest community to PINGP, PIIC members will receive slightly higher radiological exposure levels and doses than communities at a greater distance as a result of the project. Doses will be within federal regulatory limits but will create an incremental risk that the PIIC bears disproportionately from other communities. Although there are no other cumulative contributors to radiological exposure in the impact area, the radiological impacts experienced by the PIIC related to this project alone would not be mitigated until the DFS systems can be removed from the ISFSI and transported off-site to a federally licensed storage facility. Discontinuing operations alone at PINGP would not eliminate environmental justice concerns related to the ISFSI.

Additionally, although the probabilities associated with an incident occurring at PINGP are projected to be very low, PIIC nonetheless bears the disproportional impact of burdening this uncertainty, whom would likely be most directly impacted should an incident occur. The 2022 PINGP SEIS for PINGP noted that it is fair to consider this uncertainty a cumulative socio-psychological impact from the operation of PINGP.[120] The PIIC affirmed these impacts of the PINGP in 2015:

> The presence of the PINGP and ISFSI has had a negative effect on the PIIC, its people and lands … many tribal members do not want to raise their families so close to such a facility. Prairie Island is the ancestral homeland of the Mdewakankton Dakota, a land of traditional and cultural significance, and portions of Prairie Island are held in Trust by the United States government and designated as a reservation for the common benefit of all tribal members. This land was to allow the PIIC to continue to maintain its traditions and culture in perpetuity. Prairie Island itself is integral to tribal traditions and culture. Because of the ISFSI and the spent nuclear fuel, the Tribal Council has been looking for land elsewhere, away from the PINGP and ISFSI, to meet the housing and other needs of tribal members. If tribal members cannot live on Prairie Island or refuse to reside on Prairie Island, the tribe's culture may not survive.[121]

PIIC has been impacted historically by the PINGP and this project would continue to have an impact on this environmental justice community. Xcel Energy continues to engage PIIC on the

[120] 2022 PINGP SEIS.
[121] 2015 Federal EA for PINGP ISFSI, Chapter 4.1.

project,[122] and other land use activities that occur on the PINGP property and the ISFSI per Xcel Energy's Cultural Resource Management Plan (CRMP). Xcel Energy states that they continue to meet on a recurring basis to discuss PINGP with PIIC. The CRMP was the outcome of a 2009 commitment to protect significant historical, archaeological, and cultural resources that may currently exist on the PINGP site.[123] The CRMP also details procedures that apply to this project and will require Xcel Energy to consider site review prior to construction. In April 2024, Xcel Energy conducted a survey to the area north of the original two pads in the ISFSI in coordination with PIIC.[124] No cultural resources were identified during the survey.

In sum, if the project occurred at the PINGP ISFSI, environmental justice concerns would remain generally the same for the PIIC. Concerns would neither increase with the change, nor would they be allayed by a change.

[122] Scoping EAW, Appendix B.

[123] Northern States Power Company. 2011. *Prairie Island Independent Spent Fuel Storage Installation Application for Renewed ISFSI Site-Specific License, Environmental Report Supplement*.

[124] Xcel Energy is waiting for the final report from Braun Intertec that verifies these results. The report has been reviewed and accepted with permissible results, thus will be acceptable and available for publication of the final EIS. The survey conducted a cultural and geotechnical (soil) survey simultaneously.

# 6 Cumulative Impacts

Cumulative impacts are impacts to the environment that result from the incremental effects of a project in addition to past, present, and reasonably foreseeable future projects regardless of who undertakes these projects. Three projects that are reasonably foreseeable because they are connected to Xcel Energy's request for additional spent fuel storage are discussed here:

- Continued operation of the PINGP through 2053/2054;
- Use of the PINGP ISFSI to facilitate decommissioning of the PINGP after cessation of operations in 2053/2054; and
- Potential expansion of the instrumentation building on the northeast side of the ISFSI.

Potential impacts to the human and natural environment as a result of PINGP operations through 2053/2054 are anticipated to be minimal. Potential impacts resulting from use of the PINGP ISFSI to facilitate decommissioning are also anticipated to be minimal, provided that monitoring and maintenance of the ISFSI continues until such time as the spent fuel can be transported to an off-site facility. If monitoring and maintenance do not continue, radiological impacts are anticipated to be significant. Lastly, the minimal footprint for the expansion of the instrumentation building is not expected to impact human or environmental resources.

## 6.1 Continued Operation of the PINGP Through 2053/2054

Overall, this discussion is framed around the fact that there are no planned changes at PINGP between 2033 and 2054 that are expected to lead to materially different impacts. Potential impacts to the human and natural environment as a result of PINGP operations through 2053/2054 are anticipated to be minimal. Non-radiological impacts are related primarily to the use of river water for cooling. These impacts are anticipated to be minimal. Radiological impacts are related to regulated releases of radioactive liquids and gases as well as direct radiation. These impacts are also anticipated to be minimal.

### Potential Non-Radiological Impacts

The PINGP is powered by two pressurized water reactors (Unit 1 and Unit 2) that are licensed for a gross output of 584 MW each. Heat generated by the reactor is used to create steam which drives a turbine and electric generator. Water from the Mississippi River, in combination with cooling towers, is used in a circulating water system to cool condensers and reject heat.[1]

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[1] 2011 Environmental Report, Chapter 3.

The PINGP site consists of several buildings including the reactor building and turbine building, which house the reactor and turbine-generator systems, respectively. The site includes gas vents for regulated releases of gases after processing by interconnected equipment trains.[2] Electricity generated at the plant is distributed to the electrical grid through a substation with two switchyards that disseminate power to five transmission lines along three transmission corridors.[3]

### *Impacts to the Human Environment*

Continued operation of the PINGP through 2053/2054 will introduce no new, non-radiological impacts to the human environment. The PINGP site is a developed, industrial site. No changes to the PINGP or associated facilities, other than regular maintenance and repair activities, are anticipated.

Continued operation of the PINGP will not change aesthetics in the area, create new noise impacts, or add to any existing traffic impacts.[4] Continued operation of the PINGP is consistent with existing and planned land uses.[5] Continued operation of the PINGP will not introduce new, non-radiological health or safety concerns.

As discussed in Chapter 4.3, the PINGP is an economic resource in the area. PINGP property taxes provide a relatively high and stable source of tax revenue for the city of Red Wing. Continued operation of the PINGP would have a positive socioeconomic impact on the city of Red Wing and local economies.

### *Impacts to the Natural Environment*

Potential non-radiological impacts to the natural environment are related to the use Mississippi River water for heat rejection from the PINGP in closed-cycle cooling systems. Water from the river is withdrawn through an intake structure, circulated through the PINGP condenser and through cooling towers, and is then discharged back into the river.[6]

Impacts to fish can occur if they are injured or killed by screens and other filtering systems when water is withdrawn from the Mississippi River.[7] Fish can also be impacted by heat shock if the water discharged back into the river is at too high a temperature.[8] The PINGP cooling water intake system is designed to minimize impacts to fish populations.[9] Analysis based on several years of sampling and monitoring fish communities in the Mississippi River indicates that

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[2] Ibid.
[3] Ibid. Section 3.1.6.2.
[4] Scoping EAW, Section 21.c.i.
[5] Ibid.
[6] 2011 Environmental Report, Section 3.1.3. The circulating water system can be operated in a variety of modes depending on river levels and cooling requirements.
[7] 2011 Environmental Report, Section 3.
[8] Ibid.
[9] Ibid.

impacts to fish communities in the river as a result of PINGP operations are minimal.[10] Sampling upstream and downstream of the plant show similar, stable populations of fish species.[11]

Xcel Energy is required by Section 316(b) of the Clean Water Act to use the best technology available to minimize adverse impacts related to its circulating water system at the PINGP.[12] Further, the PINGP has a national pollutant discharge elimination system (NPDES) permit from the MPCA that addresses potential impacts to fish communities in the Mississippi River (e.g., by limiting discharge water temperatures).[13] In sum, potential impacts to fish communities as a result of continued operation of the PINGP are anticipated to be minimal.

Fish and other species that rely on the Mississippi River could also be impacted by continued PINGP operations if evaporative losses of water due to the PINGP's circulating water system substantially reduced the flow of the river. However, this is not the case. The PINGP has a water appropriation permit from the DNR that limits water withdrawals from the Mississippi River.[14] The rate of consumptive use of water at PINGP is small compared to average monthly discharges at Lock and Dam 3.[15] Under normal circumstances, consumptive use of water at PINGP (evaporative losses from cooling towers) represent a small reduction in Mississippi River flow and an imperceptible (0.1 inch) reduction in stream level.[16] Thus, impacts to fish and riparian species are anticipated to be minimal.

No impacts to terrestrial species are anticipated as a result of continued operation of the PINGP through 2053/2054.[17] The PINGP site is a developed, industrial site with little to no habitat. Impacts to rare and unique natural resources are also not anticipated (see Chapter 4.4).

### *Impacts of the Project on Climate Change*

The PINGP generates minimal greenhouse gases. Electric energy is generated at the PINGP from the heat produced by a controlled nuclear reaction; thus, the PINGP has no carbon emissions.[18] The conclusion that the PINGP generates minimal greenhouse gases is true considering both direct and lifecycle emissions.[19] Analysis by the National Renewable Energy Laboratory indicates that electricity generated by nuclear power has lifecycle greenhouse gas impacts similar to solar farms and wind farms.[20]

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[10] 2011 Environmental Report, Section 4.3.
[11] Ibid.
[12] Ibid.
[13] Ibid.
[14] 2011 Environmental Report, Chapter 3.1.3.1.
[15] 2011 Environmental Report, Chapter 4.2.2.
[16] 2011 Environmental Report, Chapter 4.2.1.
[17] 2011 Environmental Report, Chapter 4.6.
[18] The PINGP does have carbon emissions associated with equipment used to maintain the PINGP, e.g., trucks, lifts. However, as noted in the text, these emissions are minimal.
[19] National Renewable Energy Laboratory. *Life Cycle Greenhouse Gas Emissions from Electricity Generation: Update*. (2021). https://www.nrel.gov/docs/fy21osti/80580.pdf
[20] Ibid.

As continued operation of the PINGP would result in minimal greenhouse gas emissions, adverse climate impacts are not anticipated. Greenhouse gas emissions of alternatives to continued operation of the PINGP are discussed in Chapter 8.

### *Impacts of Climate Change on the Project*

Minnesota's climate is getting wetter and warmer due to anthropogenic GHG emissions. These two trends may impact the ability of the PINGP to reject heat to the Mississippi River. If Minnesota's climate is wetter such that flow in the Mississippi River is stable or increases over time, no impacts to heat rejection are anticipated. If the climate is warmer such that the river flow decreases over time, the flow could reach a level that limits heat rejection and operation of the plant.

Historical river flow data shows the flow of the Mississippi River at the PINGP as fairly stable, mostly due to the evenly controlled series of USACE locks and dams.[21] Lock and Dam Number 3 controls the flow and level of the Mississippi River in the vicinity of PINGP and Sturgeon Lake. Typically, discharge from Lock and Dam 3 tends to be at its peak in the spring and summer. This stability argues that potential climate change impacts on operation of the PINGP will be minimal. However, it is possible that climate change creates greater variability with respect to precipitation and droughts that will be difficult for locks and dams to manage.[22] Thus, it is possible that future flows may be limited by drought to an extent that impacts PINGP operations.

Lastly, it is possible that climate change could result in the Mississippi River at the PINGP having an increased flow and increased temperature. This scenario would not impact heat rejection unless the water temperature increased to such an extent that heat could not effectively be rejected.[23] Though this is a possibility, it is not likely as the PINGP could use cooling towers to lower the temperature of cooling water.

On whole, climate change impacts on PINGP operations, particularly heat rejection, are anticipated to be minimal; however, there is uncertainty in this characterization due to the potential variability in Minnesota's future climate.

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[21] Scoping EAW, Section 7a.

[22] The Center for Climate and Energy Solutions. *Drought and Climate Change*. https://www.c2es.org/content/drought-and-climate-change; DNR. *Climate Trends*. https://www.dnr.state.mn.us/climate/climate_change_info/climate-trends.html

[23] Bloomberg. *France to Curb Nuclear Output as Europe's Energy Crisis Worsens*. (August 3, 2022). https://www.bloomberg.com/news/articles/2022-08-03/edf-to-curb-nuclear-output-as-french-energy-crisis-worsens

## Potential Radiological Impacts

As discussed in Chapter 5.3, existing radiation levels near the PINGP (including the PINGP and its ISFSI) are indistinguishable from background radiation levels. The same is true for the project's projected dose of radiation and its potential impact on residents in the area. Cumulatively, the existing radiation at the PINGP, the project's radiation, and other existing sources of radiation in homes, such as radon, could theoretically create a cumulative radiation impact. As discussed in Chapter 5.1, the annual dose to a member of the public from a continuous source should not exceed 100 mrem. Because the 2023 RERR for PINGP reveals that the radiation dose from the PINGP is approximately 1.1 mrem/year, it is unreasonable to assume this dosage in conjunction with the added dosage from the project would interact with other sources of background radiation in residences to a degree that would cause a measurable impact.

Potential radiological impacts from operation of the PINGP are related to regulated releases of radioactive effluents from direct radiation. The discussion here focuses on potential impacts from radioactive effluents.

The nuclear chain reaction within the PINGP reactor produces neutron radiation which can activate other materials (i.e., gases, liquids, and solids) within the reactor system. Activation means that these materials absorb neutrons and become unstable; thus, they are induced to become radioactive themselves. Xcel Energy is required by the NRC to monitor and manage all radioactive wastes generated by the PINGP. The radioactive wastes must be collected and treated, and any releases to the environment must be within NRC regulations.[24] To accomplish this collection and treatment, there are separate gas, liquid, and solid radioactive waste systems at the PINGP.[25]

Radioactive gases generated at the PINGP are collected in a waste processing system to allow for radioactive decay of short-lived radioisotopes.[26] Radioactive materials in gaseous effluents are reduced before discharge. Prior to discharge the gases are sampled and analyzed to record gas activity and discharged to the auxiliary building vent at a controlled rate. The NRC notes that similar small quantities of radioactive gaseous effluents are expected from PINGP and are not expected to change significantly during the period of extended operation.[27]

The blowdown used to control steam generator chemistry is released to the circulating water canal after radiation monitoring results demonstrate design objectives of 10 CFR 50 have been met. The liquid discharge point also has an effluent monitor and is upstream of the circulating water canal discharge structure in the Mississippi River to minimize the potential for the tritium

[24] Scoping EAW, Section 21.c.i.
[25] Ibid.
[26] Ibid.
[27] Ibid.

to enter the local ground water.[28] Radioactive effluent release reports are prepared each year, where the NRC notes that variations in the amount of radioactive effluents from year to year can be expected in normal ventilation system effluents at a nuclear power plant.[29]

Solid radioactive wastes are generated at the PINGP through the course of normal operation, including contaminated paper, plastic, wood, metals, spent resins, spent reactor control blades, ion chambers, clothing, rags, and filters.[30] Wastes are stored in shielded storage to allow for radioactive decay. Solid wastes are then shipped to an off-site radioactive waste management facility.[31]

### ***Potential Exposure Pathways and Impacts to the Public***

Members of the public could receive a radiation dose from the PINGP's radioactive effluents by ingesting radionuclides or by inhalation of radionuclides in the air.[32] Radionuclides could be ingested by drinking water or by eating foods upon which radionuclides have been deposited. Potential doses from ingesting or inhaling radionuclides are estimated based on sampling near the PINGP and are calculated using an NRC-required dose calculation manual.[33] To demonstrate that doses are within NRC standards, Xcel Energy must file an annual radioactive effluent release report and an annual radiological environmental operating report with the NRC.[34]

Estimated radiation doses to the general public from radioactive effluents from the PINGP are minimal. For example, in 2023, for a postulated most-exposed member of the public, annual estimated doses are less than 1.1 mrem, indistinguishable from background radiation, and within NRC standards (Table 7).[35] Further, estimated radiation doses from PINGP effluents do not vary significantly over time.[36] Xcel Energy's 2023 environmental operation report shows that doses due to gaseous and liquid effluents are essentially stable over the 2001 – 2023 time period.[37]

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[28] Ibid.

[29] Historic reports are available on the NRC's website: https://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/prai1-2.html.

[30] Scoping EAW, Section 21.c.i. and Xcel Energy Additional Information.

[31] Ibid.

[32] NRC. 2023 Annual Radioactive Effluent Release Report, Prairie Island Nuclear Generating Plant. https://www.nrc.gov/docs/ML2413/ML24130A239.pdf [hereinafter "2023 RERR"].

[33] Ibid.

[34] NRC. *Radioactive Effluent and Environmental Reports for Prairie Island 1 & 2*. https://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/prai1-2.html

[35] 2023 RERR.

[36] NRC. 2023 Annual Radiological Operating Report, Prairie Island Nuclear Generating Plant. https://www.nrc.gov/docs/ML2413/ML24130A236.pdf

[37] Ibid.

**Table 7: Estimated Dose to Most-Exposed Individual Due to PINGP Effluents, 2023**[38]

| Organ | Estimated Dose (mrem) | Dose Limit (mrem) |
|---|---|---|
| Whole Body | 1.09 | 25 |
| Thyroid | 1.09 | 75 |
| Maximum Any Organ | 1.09 | 25 |

Monitoring and sampling by the MDH confirm that estimated radiation doses from PINGP operations are minimal and within NRC standards.[39] Thus, potential radiological impacts of continued operation of the PINGP through 2053/2054 are anticipated to be minimal.

### *Potential Impact to Workers*

Potential radiological impacts to workers at the PINGP are discussed in Chapter 5.4 where potential impacts are anticipated to be minimal and do not vary significantly over time. Thus, potential radiological impacts to PINGP workers as a result of continued operation of the PINGP through 2053/2054 are anticipated to be minimal.

### *Off-Normal and Accident Conditions*

Assuming that monitoring and maintenance continue as currently performed at the PINGP, radiological impacts from any off-normal or accident conditions at the PINGP which might occur during an additional 20 years of operation (through 2053/2054) are anticipated to be within NRC standards and are not anticipated to be significant.

A probabilistic risk assessment (PRA) was conducted for potential off-normal and accident scenarios at the PINGP.[40] The PRA examined potential off-normal and accident scenarios and estimated their frequency of occurrence and potential associated radiological impacts. Impacts to the general public would generally not occur unless there was a radiological release from the reactor containment building or associated facilities.

The PRA estimated accident scenarios involving core damage would occur once every 82,644 reactor-years.[41] This release would lead to a radiological dose of about 2,000 person-rem, similar to dose from the 1979 accident at the Three Mile Island nuclear plant (discussed

[38] 2023 RERR, Enclosure 1, p. 2. Summation of 40 CFR 190 Dose Limits.

[39] MDH. *Environmental Monitoring*. https://www.health.state.mn.us/communities/environment/radiation/monitor/index.html.

[40] 2009 Prairie Island EIS, Chapter 5.4 and Prairie Island Nuclear Generating Plant Certificate of Need Application, Appendix J, Environmental Report, Section 4.17, Attachment F. May 16, 2008.

[41] Ibid.

below).[42] This dose would result in an estimated 2.0 additional incidences of cancer in the local population.

The NRC has also evaluated potential accidents at reactor sites in the United States in a generic EIS (NUREG-1437).[43] The EIS uses regression analysis to estimate the radiological impacts of potential accidents, which estimates the collective dose to the public from a severe accident at the PINGP to be 730 person-rem. This dose would result in an additional 0.73 incidences of cancer in the local population.

The most serious accident to occur at a commercial U.S. nuclear plant is the accident at the Three Mile Island plant in 1979.[44] Due to a loss of coolant, the reactor core at the plant suffered a partial meltdown. The estimated collective dose to the general public from the accident was approximately 2,000 person-rem.[45] This dose was within NRC standards and was indistinguishable from background radiation.[46]

Based on the PRA conducted for the PINGP, the NRC's generic EIS accident evaluation, and the accident at Three Mile Island, radiological impacts from any off-normal or accident conditions at the PINGP which might occur during an additional 20 years of operation are anticipated to be within NRC standards and are not anticipated to be significant.

### ***Fukushima Daiichi Accident***

On March 11, 2011, an earthquake off the coast of Japan created a tsunami which disabled cooling systems for three reactors at the Fukushima Daiichi nuclear plant.[47] The plant lost all direct and backup electrical power sources and was not able to maintain reactor cooling systems. Thus, the reactors suffered partial meltdowns. The reactors were boiling water reactors whereas the PINGP utilizes pressurized water reactors.

In response to the Fukushima Daiichi accident, in March 2012 the NRC requested information from reactor operators in the United States and subsequently issued a series of orders directing changes at reactor sites. These changes included new capabilities to ensure reactor cooling during a loss of power, to ensure reactor containment buildings can be vented during accidents, and to monitor spent fuel pool water levels.[48]

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[42] NRC. *Fact Sheet on the Three Mile Island Accident*. http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html.

[43] NUREG-1437.

[44] NRC. *Backgrounder on the Three Mile Accident*. https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/3mile-isle.html

[45] Ibid.

[46] Ibid. The NRC estimates that approximately two million persons received a dose of one millirem.

[47] World Nuclear Association. *Fukushima Daiichi Accident*. https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-daiichi-accident.aspx

[48] NRC. *Backgrounder on NRC Response to Lessons Learned from Fukushima*. https://www.nrc.gov/reading-rm/doc-collections/fact-sheets/japan-events.html

## 6.2 Use of the PINGP ISFSI to Facilitate Decommissioning

If the NRC authorizes operation of the PINGP through 2053/2054, it is possible that the plant would cease operations at the end of that period and undergo decommissioning.[49] Spent nuclear fuel would, in a step-wise process, be removed from the reactor, cooled in the spent fuel pool, and then moved to the PINGP ISFSI.[50] To accommodate the spent fuel associated with decommissioning, the PINGP ISFSI would need to be expanded or a second ISFSI constructed on the PINGP site. Xcel Energy estimates the number of DFS systems that would need to be stored upon decommissioning PINGP in 2053/2054 would be approximately 126 DFS systems,[51] 27 of which would be solely required for decommissioning.[52]

Alternatives to the storage of spent nuclear fuel in the PINGP ISFSI are discussed in Chapter 7. As is noted in Chapter 7, there is substantial uncertainty as to when an off-site storage facility will be available to accept spent nuclear fuel from the PINGP. Because of this uncertainty, the analysis here assumes the temporary, long-term storage of spent fuel in the PINGP ISFSI for up to 200 years. This assumption is strictly for analysis purposes and is used to bound the uncertainty associated with the eventual availability of an off-site storage facility.

Potential impacts resulting from use of the PINGP ISFSI to facilitate decommissioning are anticipated to be minimal, provided that monitoring and maintenance of the ISFSI continues until such time as the spent fuel can be transported to an off-site facility. If monitoring and maintenance do not continue, then radiological impacts are anticipated to be significant.

### Potential Non-Radiological Impacts

To accommodate the spent fuel associated with decommissioning, the PINGP ISFSI would need to be expanded or an additional ISFSI constructed on the PINGP site. Xcel Energy notes that based on current and projected fuel inventory through 2053/2054, they do not anticipate needing to expand the existing fence line of the ISFSI to support dry fuel storage through the decommissioning period.[53] Xcel Energy would assess their current inventories and determine at the time of decommissioning whether expansion of the ISFSI footprint is likely, which would lead to an engineering study that would evaluate whether to expand the existing ISFSI or construct a second ISFSI. No matter the scenario, a new CN from the Commission will be

[49] Alternately, Xcel Energy could request the Commission to authorize operation of the PINGP through a later date, e.g., 2074.

[50] Minnesota law requires that spent fuel from the PINGP be stored on the PINGP site unless and until it can be transported to an off-site storage facility; see Minnesota Statute 116C.83, Subd. 4.

[51] 65 DFS systems (2033/2034) + 34 DFS systems (2053/2054) + 27 DFS systems (decommissioning) = 126 DFS systems. Note, these values are approximate given that a different DFS technology and, therefore, capacity DFS system, could be in use at the time of decommissioning.

[52] Scoping EAW, Section 21.b.ii. Xcel Energy would need to obtain a certificate of need from the Commission to store these additional canisters.

[53] Xcel Energy Additional Information.

required should Xcel Energy need on-site dry fuel storage beyond that required for operation through 2053/2054.

A possible expanded or additional ISFSI could likely be accommodated within the existing ISFSI fence line, even after construction of the project (Figure 1). There are currently three pads in use at the ISFSI, up to two proposed for the project, and space for an additional pad in the future (Figure 1).

The construction process would be similar regardless of the location selected to store the decommissioning canisters. After geo-technical and engineering analysis, the ISFSI site would be appropriately graded and filled. A heavy haul road would be constructed, and concrete pad(s) would be poured. Electrical power would be extended to the site as necessary and tied into the PINGP's security monitoring system.

The potential non-radiological human and environmental impacts associated with using an additional pad within the existing ISFSI for decommissioning are anticipated to be minimal. As discussed in Chapter 4, the PINGP site is a developed, industrial site. Use of the site to store additional spent fuel canisters associated with decommissioning would not impact human or environmental resources. Minimal impacts related to aesthetics, noise, traffic, and land use are anticipated. Minimal impacts to flora, fauna, and rare natural resources are anticipated.

### Potential Radiological Impacts

Assuming that regular monitoring and maintenance continue as currently performed at the ISFSI, radiological impacts from operation of the PINGP ISFSI for up to 200 years are anticipated to be minimal and within NRC standards. Spent fuel canisters are passive systems that emit no radioactive effluents; thus, radiation exposure would occur solely through skyshine radiation (see Chapter 5.3).

The estimated maximum annual radiation dose (based on a conservative dose rate analysis) to the nearest residence with 99 spent fuel canisters in the PINGP ISFSI is 22.1 mrem.[54] This dose is both below the federal limit and indistinguishable from background radiation and within NRC standards.[55] This maximum is also a conservative, theoretical value; empirical data from previous RERRs at PINGP indicate this dose rate will be closer to 1 mrem/year.[56]

[54] Scoping EAW, Section 21.c.ii. This dose estimate assumes all 99 canisters are placed within an expanded PINGP ISFSI. These findings would still be representative of present conditions and those under decommissioning with up to 126 DFS systems, in that radioactive decay from the other DFS systems will have decreased exposure rates.

[55] Average background radiation levels are 310 mrem/year and an additional annual dose rate of 310 mrem/year comes from man-made sources of radiation including medical, commercial and industrial sources. See NRC. *Doses In Our Daily Lives*. https://www.nrc.gov/about-nrc/radiation/around-us/doses-daily-lives.html

[56] 2022 PINGP RERR (0.9 mrem/year) and 2023 PINGP RERR (1.1 mrem/year).

There are 57 residences within one mile of the PINGP ISFSI. If we assume that these residences represent 228 persons (four people in each residence), and that these persons receive 22.1 mrem per year, continuously for 200 years, it is estimated that one additional person among this group of residents would be diagnosed with cancer.[57] By comparison, it is estimated from the same sample size and timeframe that 201 residents would be diagnosed with cancer from all causes of cancer.[58]

Assuming that the population of Red Wing increases by 200 percent, and that these additional 33,400 persons reside near the PINGP ISFSI such that they receive the same maximum annual dose as the nearest residence (22.1 mrem per year) for 200 years, it is estimated that an additional 148 persons, among these 33,400 persons, would be diagnosed with cancer over these 200 years.[59] This estimate is conservative in that 100 percent of residents are unlikely to reside near the ISFSI, are not anticipated to be at home, outside, 24 hours a day, for 200 years, and because historic data shows values much closer to 1 mrem/year rather than 22.1.[60]

Radiological impacts to PINGP workers during and after decommissioning are anticipated to be minimal. Canisters would no longer need to be loaded and placed on the ISFSI pad, which would decrease exposure to workers. Canisters would still need to be monitored and maintained until moved to an off-site storage facility; thus, this radiation exposure component would remain. It is assumed that plant staffing levels would drop with decommissioning. Thus, the collective plant worker dose would greatly decrease.

### *NRC Analysis of Continued ISFSI Storage*

The NRC has analyzed the potential impacts of continued storage of spent nuclear fuel at ISFSIs in the United States in a generic EIS (NUREG-2157).[61] Because the timing of repository availability is uncertain, the generic EIS analyzed three potential lengths of spent fuel storage in an ISFSI: (1) 60 years, (2) 160 years, and (3) indefinite storage.[62] Analysis in the EIS was based on a number of assumptions, including:[63]

- Spent fuel canisters would be replaced every 100 years.

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[57] (228 persons) X (22.1 mrem/year) X (200 years) X (1 E-06 cancer incidences/person-mrem) = 1.01 cancer incidences.

[58] The cancer incidence rate in the United States for all cancers is 440.5 incidences per 100,000 persons per year; see National Cancer Institute. *Cancer Statistics*. https://www.cancer.gov/about-cancer/understanding/statistics (228 persons) X (0.004405 incidences/person-year) X (200 years) = 200.9 cancer incidences.

[59] (33,400 persons) X (22.1 mrem/year) X (200 years) X (1 E-06 cancer incidences/person-mrem) = 147.6 cancer incidences. The annual collective dose (person-mrem per year) received by the public and the associated cancer risks will vary over a 200-year timeframe based on the number of residents receiving a dose and their proximity to the ISFSI. Dose rates will decrease with distance from the ISFSI and with time (due to radioactive decay of the spent fuel).

[60] 2022 PINGP RERR (0.9 mrem/year) and 2023 PINGP RERR (1.1 mrem/year).

[61] NUREG-2157.

[62] Ibid.

[63] Ibid. Executive Summary, p. xxxi.

- To facilitate this replacement, a dry transfer system (DTS) would be constructed at each ISFSI to repackage spent fuel.
- ISFSI and DTS facilities would be replaced every 100 years.
- Institutional controls would remain in place for all analysis timeframes.
- All spent fuel would be moved from spent fuel pools to dry storage by the end of the short-term storage timeframe (60 years).

Analysis in the generic EIS indicated that most all potential human and environmental impacts of continued storage of spent nuclear fuel would be small.[64] Though the NRC analyzed a scenario in the EIS reflecting indefinite storage in an ISFSI, the NRC believes that the most likely scenario for spent fuel storage is the availability of a federal, geologic repository within 60 years of a reactor's licensed lifetime.[65] The generic EIS noted that the NRC believes that, although the prediction of a particular date when a geologic repository will become available is uncertain, the timeframe needed to develop a repository is approximately 25 to 35 years and that a repository is likely to become available by the end of 60 years.[66]

### *Monitoring, Maintenance and Institutional Control*

Both the analysis in this EIS and that of NRC indicate that the potential radiological impacts of continued storage of spent nuclear fuel in the PINGP ISFSI will be minimal if monitoring and maintenance of the ISFSI continue over time. For this to occur, an entity responsible for the monitoring and maintenance must continue to function over time. Additionally, the social and political infrastructure that supports the PINGP ISFSI must continue to function. This continuation of social, political, and economic functioning is commonly known as institutional control.

Analysis in the EIS prepared for Yucca Mountain, the proposed federal, geologic repository for spent fuel, examined the storage of spent fuel in ISFSIs with and without institutional control.[67] In its evaluation of a no-action alternative, the EIS assumes that Yucca Mountain does not enter operation, and that commercial spent nuclear fuel is stored in ISFSIs at existing plant locations for 10,000 years. The EIS examines two scenarios – one in which institutional control exists for all 10,000 years (Scenario 1), and one in which institutional control ends after 100 years (Scenario 2). The analysis makes some simplifying assumptions including the replacement of ISFSIs every 100 years.

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[64] Ibid. Table ES-3. NUREG-2157 defines "small" impacts as, "environmental effects [that] are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource."

[65] Ibid. Section ES.12.

[66] Ibid. Section B.2.2.

[67] U.S. DOE. EIS-0250 Final Environmental Impact Statement: Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada. (2002, October). https://www.energy.gov/nepa/downloads/eis-0250-final-environmental-impact-statement

In Scenario 1, because institutional control exists for 10,000 years, ISFSIs function as designed and estimated doses to the general public are relatively low (≤ 1 mrem/year) and within NRC standards.[68]

In Scenario 2, institutional control ends after 100 years and this cessation leads to degradation of ISFSIs, their failure, and the eventual release of radionuclides into the environment. For facilities located in the Upper Midwest, the EIS estimates that precipitation will infiltrate the ISFSIs' concrete storage structures 70 years after the end of institutional control, leading to degradation of spent fuel canisters (by corrosion) and an initial release of radionuclides 1,000 years after the end of institutional control.[69] Radionuclides would be released to the air, soil, and surface waters causing chronic exposures and adverse health impacts. The EIS estimates approximately 3,700 additional cancer fatalities over the 10,000 year period, and projects that fatalities would peak about 3,400 years after the end of institutional control due to releases to the Mississippi River and its tributaries.[70] Individuals living near degraded ISFSIs are projected to suffer severe health impacts due to direct radiation and/or internal doses due to ingestion.

Analysis in the Yucca Mountain EIS makes clear that without monitoring and maintenance of ISFSIs and institutional control that supports this monitoring and maintenance, radiological impacts will be significantly adverse. A supplemental Yucca Mountain EIS released by the DOE in 2022 reaches similar conclusions.[71] If monitoring and maintenance do not continue at the PINGP ISFSI for the duration of spent fuel storage in the PINGP ISFSI then radiological impacts are anticipated to be significant.

### *Funding for Long-Term Storage*

Funding mechanisms for the storage of spent nuclear fuel have been established at the federal and state level.

At the federal level, the Nuclear Waste Policy Act (NWPA) established a nuclear waste fund to pay for the development of a geologic repository for spent nuclear fuel. In accordance with the NWPA, nuclear reactor operators entered contracts with the U.S. DOE for the removal and disposal of spent fuel.[72] DOE was to begin disposing of spent fuel by January 31, 1998.[73] DOE did not meet this deadline; subsequently, reactor operators filed lawsuits to recover costs for storing spent nuclear fuel.[74]

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[68] Ibid. See Chapter 7, Environmental Impacts of the No-Action Alternative, Table 7-6, Table 7-11.
[69] Ibid.
[70] Ibid.
[71] U.S. DOE. EIS-0250-S1: Final Supplemental Environmental Impact Statement: Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada. (2008, June). https://www.energy.gov/sites/default/files/EIS-0250-S1-FEIS-Summary-2008.pdf
[72] Civilian Nuclear Waste Disposal. *Congressional Research Service*. (September 17, 2021). https://sgp.fas.org/crs/misc/RL33461.pdf [hereinafter "Civilian Nuclear Waste Disposal"].
[73] Ibid.
[74] Ibid.

Xcel Energy has successfully sued DOE for costs associated with the continued storage of the PINGP's spent nuclear fuel.[75] As storage at the PINGP ISFSI is ongoing, likewise the recovery of cost has been ongoing. On July 12, 2024, Xcel Energy reported its fourteenth DOE settlement payment for spent fuel storage costs.[76] The Commission directs how payments received by Xcel Energy are used – e.g., payments can be invested, used to defray decommissioning costs, or returned to ratepayers.

At the state level, a nuclear decommissioning trust fund (NDT) has been established to cover the costs of decommissioning the PINGP and PINGP ISFSI.[77] The fund covers, among other expenses, the operation of the ISFSI after plant shutdown until all fuel is removed from the site and the removal of all ISFSI structures.[78] The NDT is funded through rates charged to Xcel Energy customers.[79] To the extent the NDT is used for storage of spent nuclear fuel in the ISFSI, DOE settlement payments may also be used to fund the NDT (or offset expenses).[80] The Commission reviews the NDT every three years; the NRC reviews the NDT every two years.[81]

Xcel Energy submitted its most recent NDT review to the Commission on December 1, 2020.[82] In its review, Xcel Energy notes that the two primary factors driving decommissioning costs are (1) when decommissioning activities take place (in the near term versus putting the plant into "safe storage" for years and then conducting decommissioning activities) and (2) how long spent fuel is stored in the ISFSI after shutdown of the plant.[83]

Though federal and state efforts to ensure funding for the safe, long-term storage of spent nuclear fuel are substantial, there are indirect funding requirements that are difficult to quantify and ensure. Safe, long-term storage of spent nuclear fuel requires institutional control that facilitates the monitoring and maintenance of spent fuel storage facilities. This institutional control assumes not only solvent and effective entities responsible for maintaining proper functioning of storage facilities (e.g., an ISFSI), but also solvent and effective socio-political institutions that provide a stable societal framework for these storage facilities. To paraphrase the 2022 PINGP SEIS, for there to be institutional control of the PINGP ISFSI, the city of Red Wing, Goodhue County, the State of Minnesota, and the United States of America all have to

[75] Xcel Energy Additional Information.
[76] Xcel Energy. *DOE Fourteenth Settlement Payment*. (July 12, 2024). PUC Docket No. M-21-815, eDockets No. 20247-208544-01.
[77] 2022 PINGP SEIS, Section 7.3.
[78] Ibid.
[79] Ibid.
[80] Ibid.
[81] Ibid.
[82] Xcel Energy. *Petition 2022-2024 Triennial Nuclear Plant Decommissioning Study & Assumptions*. (December 1, 2020). PUC Docket No. M-20-855, eDockets No. 202012-168696-01.
[83] Ibid.

exist as functioning political entities.[84] Whether this functioning can be assured over the time that spent nuclear fuel will be stored in the PINGP ISFSI is an ongoing concern.

### *Off-Normal and Accident Conditions*

Assuming that regular monitoring and maintenance continue at the PINGP ISFSI, radiological impacts from off-normal and accident conditions at the ISFSI which might occur over 200 years are anticipated to be within NRC standards and minimal. The addition of 27 spent fuel canisters for decommissioning and the storage of the canisters for up to 200 years does not introduce any new phenomena, natural or man-made, that could compromise the canisters (see Chapter 5.3). The NRC is incorporating climate change risks into its regulation and certification of spent fuel storage systems (see Chapter 5.6).

As noted above, the ability of the PINGP ISFSI to provide safe storage of spent nuclear fuel depends largely on institutional control that facilitates on-going monitoring and maintenance of the ISFSI. Without this control, with monitoring and maintenance, off-normal and accident conditions at the PINGP ISFSI would lead to significant radiological impacts.

## 6.3 Potential Instrumentation Building Expansion

There is a potential need to modify or expand the existing 10-foot by 10-foot instrumentation building, which currently houses pressure monitoring equipment for the existing DFS systems, to accommodate the use of equipment needed to monitor the project's additional DFS systems. It is unclear how this building may be modified at this time, but with the addition of new DFS systems and the associated pressure monitoring and potential temperature monitoring systems, it is anticipated the building could expand by up to 1,200 square feet, adjacent to the current building (Figure 10). Xcel Energy assumes that the height of the building expansion would be approximately 12 feet, which is the same as the existing structure.

This site is well within the PINGP property boundary outside the earthen berm of the ISFSI (Figure 10). There is no flora or fauna habitat present as the building is currently in cleared areas with no vegetation. Construction will be short term and localized. Construction noise would likely be in the range of 40-55 dBA when equipment is operating.[85]

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[84] 2022 PINGP SEIS, Chapter 7.
[85] Scoping EAW.

**Figure 10: Current Instrumentation Building Near the ISFSI**

Expansion of the instrumentation building may result in generation of non-radiological solid waste such as normal construction debris. Xcel Energy has processes in place to address management of waste produced by construction and operation activities at PINGP. Any spills or releases would be managed in accordance with the PINGP Spill Prevention, Control, and Countermeasure Plan and with state and federal spill response and reporting regulations.

A Phase I archaeological investigation of the instrumentation building expansion area was conducted in 2014.[86] The survey found no archaeological properties, no evidence of paleosols, and concluded that no additional archaeological investigations were warranted within the studied area.

As described in the Scoping EAW, the potential non-radiological human and environmental impacts associated with expanding the instrumentation building are anticipated to be minimal. Expansion of the instrumentation building would not result in radiological impacts as this feature does not produce or manage radioactive material. The PINGP site and ISFSI are on a developed, industrial site. The expansion of up to 1,200 square feet to an existing building already near the ISFSI is not expected to impact human or environmental resources. Minimal impacts related to aesthetics, noise, traffic, land use, geology, soils, water resources, wastes, historic properties, air quality, flora, fauna, and rare natural resources are anticipated.

[86] 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. (2014, December).

# 7 Alternatives to the PINGP ISFSI

Xcel Energy is requesting that the Commission approve additional storage of spent nuclear fuel in the PINGP ISFSI to facilitate operation of the PINGP through 2053/2054. It is possible that the Commission will deny this request (a "no action" alternative); in this case, Xcel Energy would cease operating the PINGP in 2033/2034. It is also possible that the spent fuel could be stored in a facility other than the PINGP ISFSI. These alternatives are discussed further in this chapter.

## 7.1 No Action Alternative

In a no action alternative, the Commission would deny Xcel Energy's request for additional storage of spent fuel in the PINGP ISFSI. The Commission would not issue a CN for expansion of the ISFSI. Absent other alternatives for storing the spent fuel, Xcel Energy would cease operating the PINGP in 2033/2034. Xcel Energy would need to request Commission approval for additional storage of spent fuel in the PINGP ISFSI to facilitate decommissioning of the PINGP. Spent fuel would be removed from the PINGP reactor, stored in the spent fuel pool, and eventually stored in an ISFSI on the PINGP site.

If the PINGP ceased operation in 2033/2034, Xcel Energy would need to replace the capacity and energy provided by the PINGP to maintain reliable operation of the electric transmission system. One possible replacement scenario and its potential impacts are discussed in Chapter 8.

### Human and Environmental Impacts

Xcel Energy estimates that it will require 27 additional spent fuel canisters to decommission the PINGP in 2033/2034.[1] Thus, there would be a total of 126 canisters in the PINGP ISFSI.[2] The PINGP ISFSI would likely need to be expanded to hold these canisters or a second ISFSI constructed. The storage facility is laid out so that the storage pads could be extended to the north and south to accommodate an additional 130 DFS systems without having to change the security perimeter (Figure 1).[3] This extra space could be used to store fuel to decommission PINGP as this capacity exceeds the current project proposal which requests space for 34 DFS systems.

The human and environmental impacts of decommissioning the PINGP in 2033/2034 would be similar to those if the PINGP were decommissioned in 2053/2054. These impacts are discussed in Chapter 6.2 and are anticipated to be minimal. As the PINGP site is a developed, industrial

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[1] Xcel Energy Additional Information.

[2] 65 DFS systems (2033/2034) + 34 DFS systems (2053/2054) + 27 DFS systems (decommissioning) = 126 DFS systems. Note, these values are approximate given that a different DFS technology and, therefore, capacity DFS system, could be in use at the time of decommissioning.

[3] Scoping EAW, Section 21.b.ii.

site, non-radiological impacts will be minimal. Even with this conservative estimation, as discussed in Chapter 6.2, this dose is indistinguishable from background radiation and within NRC standards. Health impacts associated with this dose rate are anticipated to be minimal.

Beyond impacts at the PINGP site, there may be impacts associated with the replacement of the capacity and energy provided by the PINGP – impacts that would occur if the PINGP ceased operation in 2033/2034. For example, if the energy produced by the PINGP were replaced by energy produced with fossil fuels, there would be potential greenhouse gas and climate change impacts. These potential impacts are discussed in Chapter 8.

## 7.2 Additional Spent Fuel Pool Storage

Instead of storing spent fuel in an ISFSI, the fuel could be stored in a storage pool, similar to the existing storage pool at the PINGP. Additional space for spent fuel to facilitate operation through 2053/2054 could be created by consolidating fuel in the existing pool or by building an additional pool at the PINGP. These spent fuel pool options are not feasible and have radiological impacts that are significantly greater than additional spent fuel storage in an ISFSI.

### Consolidating Spent Fuel

Spent fuel in the existing PINGP spent fuel pool could theoretically be consolidated through two means: (1) fuel rod consolidation, a process which involves disassembling spent fuel assemblies and repackaging the assemblies into a smaller volume, or (2) re-racking, a process in which fuel assemblies are left intact and are placed in higher density storage racks.[4] Both processes are directed to using less space to store spent fuel in the pool, which would free up space for additional spent fuel.

#### *Consolidation*

Industry experience with fuel rod consolidation has shown that it is not a feasible strategy for creating additional space in a spent fuel pool.[5] The predicted space-savings in a pool have not been realized through known attempts. Fuel rod consolidation would require development of a site-specific solution if implemented, which could be very complex.[6] Additionally, radiation doses to workers were higher than predicted due to labor-intensive spent fuel handling.[7] Lastly, consolidation would generate a significant amount of radioactive debris.[8]

#### *Re-Racking*

Re-racking spent fuel assemblies by moving them from lower-density to higher-density racks is a possible strategy for creating additional space within the spent fuel pool. However, Xcel

[4] CN Application, Chapter 9.1.2.
[5] Ibid.
[6] Ibid.
[7] Ibid.
[8] Ibid.

Energy estimates that re-racking in the PINGP spent fuel pool would result in additional storage of spent fuel to support up to 13 years of additional PINGP operation.[9] Thus, re-racking could not support operation of the PINGP through 2053/2054 and is not a feasible option.

### Adding a Spent Fuel Pool

An additional spent fuel pool could be constructed at the PINGP similar to the existing spent fuel pool. The pool would be licensed and regulated by the NRC. Unlike an ISFSI, a spent fuel pool uses an active cooling system by filtering and circulating water within the pool. Pool components would include storage racks, cooling and filtration systems, a crane, fuel assembly handling tools, a building ventilation system, radiation monitoring equipment, and a cask decontamination area.[10]

Though an additional spent fuel pool is a possible strategy for storing spent fuel, Xcel Energy's timing estimate indicates that constructing a new pool would take significantly more time than the project (five years)[11] rather than up to 12 months (see Chapter 3.6). A spent fuel pool is also expected to be more expensive than the project at about $174 million (see Chapter 3.6) whereas in 1991 dollars a pool was estimated to cost $82 million,[12] or $157 million in 2020 dollars.[13] This estimate for a spent fuel pool is underestimated as it does not include costs for plant personnel labor or purchasing hardware such as the transfer casks. Additionally, since the spent fuel pool would not be connected, spent fuel would have to be moved several more times compared to the other alternatives, which increases cost and risk to plant personnel. Lastly, the spent fuel would still have to be moved to dry fuel storage eventually, a cost that would equate to a similar magnitude as the proposed project. Thus, these costs make an additional spent fuel pool prohibitively expensive and infeasible.

Beyond costs, and depending on the how spent fuel is managed in the spent fuel pools, radiation doses to workers would likely be higher for an actively managed pool system than for a passive ISFSI system.[14] Radiation exposure to workers could triple if spent fuel was first placed in the current PINGP pool, then moved to the second new pool, and lastly placed in the DFS system to transport it to the ISFSI.

## 7.3 Alternative Spent Fuel Storage Technologies

The NRC certifies two basic types of spent fuel storage technology: casks and canisters (see Chapter 3.3). The PINGP is currently using TN-40 and TN-40HT DFS systems, which utilize cask

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[9] CN Application, Chapter 9.1.2.2.
[10] CN Application, Chapter 9.1.2.3.
[11] Ibid.
[12] Includes $50,000/year over 20 years for operation costs.
[13] 2020 dollars were used for proper comparison to the project's cost estimate in Table 1 of this EIS. Bureau of Labor Statistics. *Inflation Calculator*. https://data.bls.gov/cgi-bin/cpicalc.pl
[14] CN Application, Chapter 9.1.2.3.

technology with bolted lids. The project has elected to use the Orano TN Americas LLC NUHOMS EOS 37PTH DFS system, which uses canister technology with welded closures. Of the storage system technologies that utilize canisters, there are two variations for how the fuel is stored and transported: horizontal and vertical. The project's technology utilizes the horizontal variation for storage and transportation (see Chapter 3.4).

### Cask and Canister Systems

Advantages of a cask system include relatively less handling of spent fuel compared to a canister system and relatively lower radiation doses for workers.[15] Casks are bolted shut and thus do not require welding. Casks are all-in-one metal vessels; unlike canister systems, they do not require a transfer cask. Because cask systems require relatively less spent fuel handling, worker radiation doses are relatively lower for cask systems.

Disadvantages of a cask system include cost, the necessity to manage a pressure monitoring system, and potential obstacles in moving casks to an off-site storage facility.[16] Casks are large metal vessels that require specialized equipment to fabricate and handle. Because there are only a few facilities that can manufacture casks and because of the amount of steel involved, casks are about twice as expensive as canisters.[17] Over time, canister systems have been adopted by the nuclear industry as the predominant method for storing spent nuclear fuel.[18] As a result, advances in canister systems can be shared among ISFSI operators. These advances are not available to cask systems. Thus, cask systems are not supported by spent fuel industry innovations or advances.

Lastly, interim storage facilities being developed in the United States (discussed below) are predicated on the storage of spent fuel canisters, not casks.[19] The NRC license applications for these facilities are based on storing spent fuel canisters. In order to store casks, facilities would need to amend their NRC licenses. Any amendments would take additional time and push any casks awaiting transport and storage back in the queue. In contrast, spent fuel canisters could be transported and stored once the facilities are operational.

### Horizontal and Vertical Systems

The advantages and disadvantages of horizontal and vertical storage system are largely similar. Currently, the only horizontal system available is the technology chosen for the project. Both the vertical and horizontal systems never need to be re-opened once welded closed, avoiding exposure and maintenance costs. This however results in requiring both welding and weld inspections for both systems, which increases storage preparation time and worker exposure to radiation. Workers are also exposed to increased radiation doses with both systems because

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[15] CN Application, Chapter 9.1.3.3.
[16] Ibid.
[17] 2022 PINGP SEIS, Chapter 3.6. eDockets No. 20224-185119-01.
[18] Ibid.
[19] 2022 PINGP SEIS, Chapter 1.3 and 3.6.

the canisters have to be transferred between casks, storage modules, and transported to overpacks. Both systems also require a temperature monitoring system or vent blockage inspection. Ultimately, the horizontal system has more advantages, including direct canister transfer from transfer cask to storage to shipping that doesn't require a crane.

## 7.4 Alternatives to On-Site Storage

Spent fuel storage at nuclear plants is considered temporary, with the ultimate goal being permanent disposal. At this time, there is no facility available for permanent disposal of high-level waste. As discussed below, a few consolidated interim storage facilities have been proposed to the NRC in the U.S. These facilities, if constructed, would store spent fuel from nuclear plants until a permanent disposal facility is available.

There are four away-from-reactor storage possibilities considered for PINGP for the spent nuclear fuel, i.e. considerations other than utilizing the ISFSI. These include recycling spent nuclear fuel, contracting with an existing interim storage facility off-site, contracting with a future interim storage facility off-site, and the potential availability of a permanent repository at Yucca Mountain.

### Recycling Spent Nuclear Fuel

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.[20] "Recycling" is the process of using reprocessed fuels to create new fuels for commercial power use, or potentially for advanced reactor use.[21] 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, as its potential energy remains in the fuel even after five years of operation in a reactor.[22,23] However, there has been limited progress made by private companies pursuing investment in reprocessing initiatives.

The United States does not currently recycle spent nuclear fuel but other countries do, such as the hydro-recycling process in place in France. The U.S. Office of Nuclear Energy reports that there are some advanced reactor designs in development that could consume or run on spent nuclear fuel in the future.[24]

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[20] CN Application, Chapter 9.1.1.1.
[21] Ibid.
[22] Ibid.
[23] U.S. DOE, Office of Nuclear Energy. *5 Fast Facts about Spent Nuclear Fuel*. (2022). https://www.energy.gov/ne/articles/5-fast-facts-about-spent-nuclear-fuel
[24] U.S. DOE, Office of Nuclear Energy. *3 Advanced Reactor Systems to Watch by 2030*. (2021). https://www.energy.gov/ne/articles/3-advanced-reactor-systems-watch-2030

The U.S. DOE pursues research and development in spent nuclear fuel recycling that assures economic commercial viability.[25] Most recently, in 2022, the DOE granted money for a nuclear fuel recycling project to an energy company named Oklo. Oklo submitted a licensing project plan to the NRC in January 2023, a process which can take up to five years. Oklo has received a site use permit from the DOE with plans to use recovered fuel in its first reactor.[26] Any viable nuclear fuel recycling option in the United States is currently dependent on the completion of Oklo's project. There is no certainty this project will go forward, and no other projects are currently being considered; thus, spent fuel recycling is not currently a viable alternative.[27]

## Federal Repository – Yucca Mountain

The NWPA, first enacted in 1982 and subsequently amended, governs efforts in the United States to manage spent nuclear fuel.[28] The NWPA:

- Requires DOE to establish a permanent geologic repository at Yucca Mountain, Nevada, for the storage of spent nuclear fuel.
- Allows DOE to construct a monitored retrievable storage (MRS) facility if DOE recommends to the President that a permanent repository can be constructed; further, construction of the MRS facility cannot begin until Yucca Mountain has received a construction permit.
- Establishes a nuclear waste fund to pay for development of a geologic repository.[29]

The Yucca Mountain site has been the only location under consideration by the DOE for construction of a permanent underground national repository for high-level radioactive waste.[30] DOE completed an EIS for the Yucca Mountain repository in 2002. DOE submitted a license application for the Yucca Mountain repository to the NRC in 2008. In 2010, the Obama administration determined that the Yucca Mountain repository should not be opened and discontinued funding for the repository.[31] Subsequent administrations have (1) proposed funding for the repository but not received funding from Congress and (2) not requested funding for the repository.[32] Licensing and development of the permanent underground repository has been suspended since federal fiscal year 2010.[33] Thus, the Yucca Mountain repository remains lodged in the NRC licensing process without funding to move forward.

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[25] CN Application, Chapter 9.1.1.1.
[26] Generation IV International forum. *2023 Annual Report*. https://www.gen-4.org/resources/annual-reports/2023-gif-annual-report
[27] CN Application, Chapter 9.1.1.1.
[28] Civilian Nuclear Waste Disposal.
[29] Ibid.
[30] Ibid.
[31] Ibid.
[32] Ibid.
[33] Ibid.

At the same time that the Obama administration foreclosed the Yucca Mountain repository, it established a Blue Ribbon Commission (BRC) to recommend new spent fuel management strategies.[34] The BRC recommended that the NWPA be amended to adopt a consent-based approach to the siting of a geologic repository.[35] The bill would not have affected the existing Yucca Mountain licensing process.[36] Additionally, the BRC recommended that the NWPA be amended to allow for multiple MRS facilities whose development could proceed independent of a repository.[37]

Since the BRC report, several bills have been introduced in Congress that address consent-based siting for MRS facilities and for a geologic repository. To date, none of these bills has been passed out of Congress or enacted into law.[38] The DOE is currently in the planning and capacity building stage of its consent-based siting process and is not looking for volunteer host communities in this phase.[39] The next phase would initiate early screening of communities interested in being a volunteer site.[40] Nonetheless, DOE reaffirmed the Federal government's commitment to the ultimate disposal of spent fuel and predicted that a repository would be available by 2048 (see Chapter 6.2).[41]

Thus, Yucca Mountain remains a possible off-site storage facility for the PINGP's spent fuel, albeit at some time in the future. Yucca Mountain is not currently a feasible alternative to additional storage of spent fuel in the PINGP ISFSI.

### Interim Off-Site Storage Facilities

Although a portion of the growing inventory of spent nuclear fuel in the United States might be suitable for reprocessing and reuse in nuclear reactors, permanent disposal will be the management solution for most of this material.[42] The U.S. DOE states that, "Deep, underground, geologic disposal that provides isolation and containment is the scientifically preferred approach for permanent disposal of highly radioactive materials, such as spent nuclear fuel, without placing a burden on future generations."[43]

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[34] Ibid.
[35] Blue Ribbon Commission on America's Nuclear Future. (2012, January). https://www.energy.gov/sites/prod/files/2013/04/f0/brc_finalreport_jan2012.pdf
[36] Civilian Nuclear Waste Disposal.
[37] Blue Ribbon Commission on America's Nuclear Future. (2012, January). https://www.energy.gov/sites/prod/files/2013/04/f0/brc_finalreport_jan2012.pdf
[38] Civilian Nuclear Waste Disposal.
[39] U.S. DOE. *Consent-Based Siting for Consolidated Interim Storage*. (August 9, 2024). https://eedgis.pnnl.gov/portal/apps/storymaps/stories/34462804fe664a5980e93fc4b6026f42
[40] Ibid.
[41] NUREG-2157, Volume 1, Section 1.1.
[42] U.S. DOE. *Consent-Based Siting for Consolidated Interim Storage*. (August 9, 2024). https://eedgis.pnnl.gov/portal/apps/storymaps/stories/34462804fe664a5980e93fc4b6026f42
[43] Ibid.

It is unclear whether private consolidated interim storage facilities (CISFs) are compatible with the NWPA. The NWPA permits DOE to construct a monitored retrievable storage facility if Yucca Mountain has received a construction permit. It is unclear if DOE may contract with a private developer for the interim storage of spent fuel absent a Yucca Mountain construction permit.[44] In 2019, then DOE secretary Rick Perry indicated that current law prevents DOE from contracting for interim storage of spent fuel at a private facility.[45] Legislation authorizing DOE to enter into contracts with private CISFs was introduced in Congress several times in the 2015-2021 timeframe; however, none of the bills was enacted into law.[46]

### *Existing Off-Site Storage*

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.[47] Xcel Energy shipped 1,058 spent fuel assemblies from the Monticello Nuclear Generating Plant to the General Electric 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.[48]

### *Future Off-Site Storage*

As a federal repository remains undeveloped and spent nuclear fuel continues to accumulate at reactor sites throughout the United States, three companies have proposed privately developed and operated CISFs.

Private Fuel Storage, LLC (PFS) has pursued building a CISF on the West Central Utah reservation of the Skull Valley Band of Goshute Indians since 1997.[49] After a series of court cases, the NRC issued a license for the interim storage facility in 2006; to date, this license remains in place without successful judicial or legislative challenges.[50] However, the PFS project remains unconstructed and would require the U.S. Department of the Interior's approval of the land lease, 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.[51] None of these conditions are currently in place.

Private centralized interim spent fuel storage has received more attention in the past five years with the NRC licensing approvals of the Interim Storage Partners LLC (ISP) and Holtec

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[44] Holtec International. *HI-STORE CISF*. https://www.nrc.gov/waste/spent-fuel-storage/cis/holtec-international.html
[45] Ibid.
[46] Ibid.
[47] CN Application, Chapter 9.1.1.2.
[48] Ibid.
[49] CN Application, Chapter 9.1.1.3.1.
[50] Ibid.
[51] Ibid.

International (Holtec) facilities.[52] To date, neither the ISP CISF nor the Holtec CISF has accepted spent nuclear fuel for storage, and it is unclear when or whether they might commence construction or accept such fuel.

ISP has proposed a CISF in Andrews County, Texas.[53] The CISF would be built in eight phases with each phase holding 5,000 metric tons of spent fuel, for a total of 40,000 metric tons.[54] The NRC issued a license for the first phase of the facility on September 13, 2021.[55] The ISP project is currently subject to judicial objections with a pending petition for rehearing for which no decision has been made to date.[56] Additionally, the state of Texas has enacted a law banning new storage sites for spent nuclear fuel within the state.[57]

Holtec has proposed a CISF in Lea County, New Mexico.[58] The CISF would, ultimately, hold up to 173,600 metric tons of spent fuel in 10,000 spent fuel canisters.[59] Holtec's initial application to the NRC requested a license for 8,680 metric tons of spent nuclear fuel stored in Holtec spent fuel canisters.[60] The NRC issued a license to Holtec on May 9, 2023, authorizing the company to receive, possess, transfer and store 8,860 metric tons of commercial spent nuclear fuel for 40 years.[61] The state of New Mexico has filed a lawsuit to block the licensing of the Holtec CISF in March of 2023.[62] Additionally, separate appeals are consolidated at the D.C. Court of Appeals and the court is slated to hear argument on March 5, 2025.[63]

CISFs are a possible off-site storage facility for some of the PINGP's spent fuel. As noted above (Chapter 7.3), these facilities are designed to store spent fuel canisters. The PINGP currently uses storage casks (TN-40 and TN-40HT) and has proposed the NUHOMS canister system for the additional spent fuel required for PINGP operation through 2053/2054. However, because there are several legal and political challenges to storing spent fuel in CISFs, and these challenges will likely play out over an extended period of time, CISFs are not currently a feasible alternative to additional storage of spent fuel in the PINGP ISFSI.

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[52] CN Application, Chapter 9.1.1.3.

[53] The CISF would be located next to two existing low-level radioactive waste storage facilities. Civilian Nuclear Waste Disposal; Interim Storage Partners. https://www.nrc.gov/waste/spent-fuel-storage/cis/waste-control-specialist.html

[54] Civilian Nuclear Waste Disposal.

[55] Ibid.

[56] CN Application, Chapter 9.1.1.3.2.

[57] NRC. Holtec International. *HI-STORE CISF*. https://www.nrc.gov/waste/spent-fuel-storage/cis/holtec-international.html

[58] Civilian Nuclear Waste Disposal.

[59] Civilian Nuclear Waste Disposal.

[60] NRC. Holtec International. *HI-STORE CISF*. https://www.nrc.gov/waste/spent-fuel-storage/cis/holtec-international.html

[61] CN Application, Chapter 9.1.1.3.3.

[62] NRC. Holtec International. *HI-STORE CISF*. https://www.nrc.gov/waste/spent-fuel-storage/cis/holtec-international.html

[63] Ibid.

# 8 Alternatives to Continued Operation of the PINGP

In a no action alternative, the Commission would deny Xcel Energy's request for additional storage of spent fuel in the PINGP ISFSI. Absent other alternatives for storing spent fuel, Xcel Energy would cease operating the PINGP in 2033/2034. If the PINGP ceased operation in 2033/2034, Xcel Energy would need to replace the capacity and energy provided by the PINGP in order to maintain reliable operation of the electric transmission system.

Xcel Energy has modeled one scenario (the "replacement scenario") for replacing generation from the PINGP in 2033/2034.[1] The replacement scenario assumed some gas-fired combustion turbine generation capacity would be required to replace lost nuclear generation. Minnesota's 100 percent carbon free by 2050 sensitivity was also run for the replacement scenario, restricting carbon emitting generation sources by 2050.[2]

The replacement scenario has greater aesthetic and land use impacts than continued operation of the PINGP. Additionally, the replacement scenario will have relatively greater impacts on fauna, specifically birds and bats. Xcel Energy's modeling indicates that the replacement scenario is more expensive on a social cost basis and has greater carbon emissions than continued operation of the PINGP.[3]

The replacement scenario modeled by Xcel Energy is the only scenario discussed in this EIS (Appendix A). Other replacement scenarios are possible.

## 8.1 Capacity and Energy

The PINGP provides both capacity and energy to the electrical system in Minnesota. Capacity is a measure of the maximum amount of electricity that a generator can produce.[4] For power plants, capacity is usually expressed in MWs. Thus, when the PINGP is noted as a 1,100 MW generating plant, it means that the plant can produce 1,100 MWs when running at its maximum output.[5]

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[1] CN Application, Chapter 9.3.

[2] Senate File 4 for the 93rd State of Minnesota Legislature. Revisor number: 23-01474.
See The Department. *Governor Walz Signs Bill Moving Minnesota to 100 Percent Clean Energy by 2040*. (February 7, 2023). https://mn.gov/commerce/news/?id=17-563384

[3] CN Application, Chapter 9.3.

[4] U.S. DOE. *What is Generation Capacity?* https://www.energy.gov/ne/articles/what-generation-capacity#

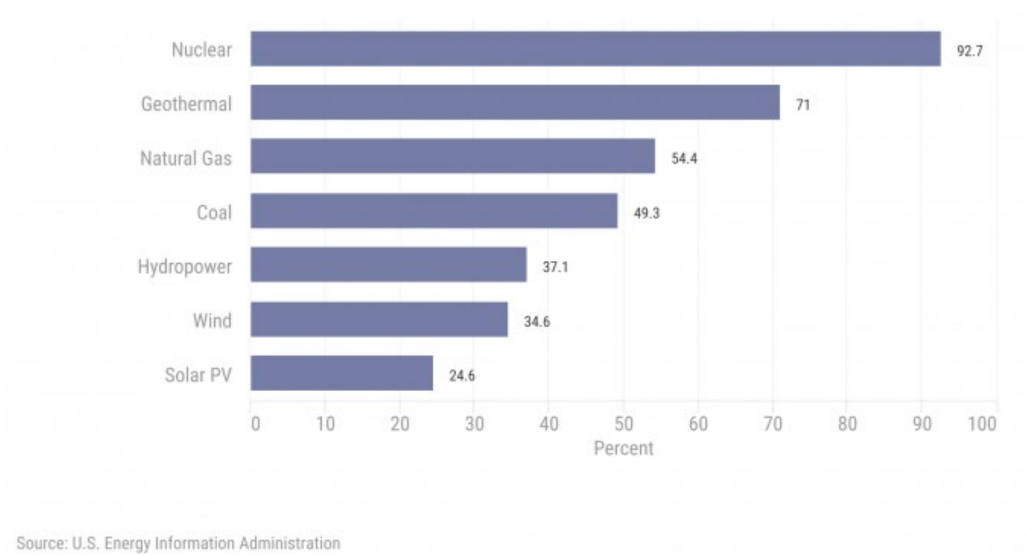
[5] Note that while the Scoping EAW reported that both pressurized water reactors are licensed for a gross output of 584 MWs a piece, 550 MWs is the value used when discussing the average nominal output of each unit. See CN Application, Executive Summary, Section I.

Energy is a measure of the amount of electricity that a generator can produce over time. For power plants, energy is usually expressed in megawatt-hours (MWh). Energy considers that a generating plant may not be operating at its maximum output all of the time. The output of the plant may vary over time. For example, a solar generating plant produces electricity only when the sun is shining.

The PINGP provides a substantial portion of the electric capacity and energy generated in Minnesota. For both categories of total capacity available and energy output, it is the second largest generating plant in the state.[6] In 2022, Minnesota electric utilities produced 42,147,963 MWh of energy; the PINGP produced 9,150,932 MWh, or about 22 percent of the energy produced in Minnesota.[7]

Nuclear power plants need to be refueled every 18 to 24 months. Thus, nuclear plants can be online, generating electricity for relatively long stretches of time.[8] This means that nuclear plants have a relatively high capacity factor, i.e. they are operating at their generating capacity almost all the time.[9] In 2021, nuclear plants in the U.S. were online and operating at capacity 92.7 percent of the time (Figure 11).

**Figure 11: Capacity Factors by Energy Source, 2021**[10]




[6] U.S. Energy Information Administration. *Minnesota Electricity Profile 2022*. https://www.eia.gov/electricity/state/minnesota/

[7] Ibid.

[8] The PINGP recently completed a run of 670 consecutive days of operation, see CN Application, Chapter 1.2.

[9] U.S. DOE. *U.S. Capacity Factor by Energy Source – 2021. What is Generation Capacity?* https://www.energy.gov/ne/articles/what-generation-capacity#

[10] Ibid.

## 8.2 PINGP Replacement Scenario

Xcel Energy has modeled one scenario for replacing the capacity and energy provided by the PINGP if plant life is not extended beyond 2033/2034 (the "replacement scenario"). This model optimized a portfolio of new resources to address what the system needs would be. This includes the model's basis on the 100 percent carbon free by 2050 sensitivity, which restricts carbon emitting generation by 2050 to replace the capacity and energy provided by the PINGP. The model then selects replacement resources with a goal of minimizing costs and optimizes the results without generation from market purchases or sales.

Within the established parameters of the model, the replacement scenario uses the following generation resources to support system needs: adds natural gas-fired combustion turbines (4,488 MW), wind turbines (11,200 MW), solar farms (3,858 MW), and standalone storage (2,220 MW) as shown in Table 8 below.[11]

If PINGP would cease operation in 2033/2034, firm dispatchable capacity would be needed starting in 2027 to meet load serving needs. If the PINGP operation were to be extended as proposed by the project, this would offset the need for significant alternative resource additions for the system as the grid transitions away from carbon-based generation to meet the 100 percent carbon free by 2050 goal.

### Potential Impacts to the Human Environment

The replacement scenario places new generation facilities on the landscape – combustion turbines, wind turbines, solar farms, and standalone battery storage. These facilities, even with proper siting, will have impacts on the human environment. The facilities will have aesthetic impacts; such impacts are likely limited for combustion turbines, battery storage, and solar farms – combustion turbines and battery storage due to their compactness and solar farms because of their relatively low height. However, wind turbines can be seen from a distance and impact the aesthetics of entire viewsheds. In comparison, continued operation of the PINGP would create no new aesthetic impacts.

The replacement scenario facilities will generate noise. With proper siting, noise levels will be within state noise standards. However, compared with continued operation of the PINGP, the replacement scenario will introduce new noise sources on the landscape.

The replacement scenario facilities will impact land use and agriculture. Wind farms require about 0.3 acres of land per MW; solar farms require 7 to 10 acres per MW.[12] Thus, compared with continued operation of the PINGP, the replacement scenario will impact about 3,360 additional acres of land for wind turbines and 27,006 acres of land for solar panels. A

[11] CN Application, Chapter 9.3, Figure 9-1.

[12] The Department. *Environmental Report for Buffalo Ridge Wind Project*. (June 2020). eDockets No. 20206-164214-01 [hereinafter "Buffalo Ridge Environmental Report"].

combustion turbine facility would add approximately an additional 10 acres per 200 MW, or 224 acres for the replacement scenario.[13] Battery storage facilities could add approximately an additional four acres per 95 MW, or 93 acres for the replacement scenario.[14] The land used for wind turbines and solar panels could, at a future date, be returned to agricultural or other use. The land for combustion turbines would be relatively more difficult to remediate and repurpose.

Xcel Energy's modeling indicates that the reliability of the electricity supplied in the replacement scenario would be less than continued operation of the PINGP, largely because of the inherent risk associated with transmission system stability, especially in extreme weather.[15] Nuclear provides a level of stability and predictability that other generation resources cannot match. Nuclear units have flexible operation capabilities that can respond to market conditions that renewables resources cannot consistently do as their performance is subject to atmospheric conditions. It should be noted, however, that even with the relatively low-capacity factors of wind and solar farms (see Figure 11), electrical energy from combustion turbines bolsters the reliability of the replacement scenario. Overall, the replacement scenario still decreases the diversity of generation on the system, which makes it less resilient.

Compared with continued operation of the PINGP, the replacement scenario is relatively more expensive on a social cost basis (i.e., when accounting for the costs of emissions, particularly carbon emissions) as shown in Table 8.

**Table 8: Replacement Scenario Compared to Continued Operation of PINGP over 2033/2034 – 2053/2054 Timeframe**

| Characteristic | Replacement Scenario (Remove PINGP in 2033/2034) | Continued Operation of PINGP (over 2033/2034 – 2053/2054) |
|---|---|---|
| **Resources selected to replace PINGP capacity and energy** | • Combustion turbines (4,488 MW)<br>• Wind turbines (11,200 MW)<br>• Solar farms (3,858 MW)<br>• Standalone storage (2,220 MW) | • Combustion turbines (4,488 MW)<br>• Wind turbines (8,800 MW)<br>• Solar farms (3,174 MW)<br>• Standalone storage (1,440 MW) |
| **Additional land use (acres)** | 29,584[α] | 25,144[β] |

[13] Acreage extrapolated from the Environmental Assessment Worksheet for the Cambridge Station Unit 2 Combustion Turbine Ultra-Low Sulfur Diesel Fuel Conversion Project. (July 2023). Docket GS-22-122, eDockets No. 20237-197372-01.
[14] Acreage extrapolated from the *Environmental Assessment for the Lake Wilson Solar Energy Center Project*. (October 2023). Docket No. GS-21-792, eDockets No. 202310-199721-02.
[15] CN Application, Chapter 9.3.

| | | |
|---|---|---|
| **Additional present value social cost (PVSC $ million)** | 34,888 | 31,242 |
| **Additional bird and bat fatalities** | 33,600 (birds per year)*<br>112,000 (bats per year)+ | 26,400 (birds per year)*<br>88,000 (bats per year)+ |
| **Additional carbon emissions (short tons)** | 10,547,336 | 1,660,994 |

*[α] 3,360 wind; 27,006 solar; 225 combustion turbines; 93 battery storage*
*[β] 2,640 wind; 22,218 solar; 225 combustion turbines; 61 battery storage*
**based on 3 birds per MW, as discussed below under "Potential Impacts to the Natural Environment"*
*+based on 10 bats per MW, as discussed below under "Potential Impacts to the Natural Environment"*

## Potential Impacts to the Natural Environment

The replacement scenario facilities will have a greater impact on flora and fauna than continued operation of the PINGP. These facilities will impact additional acres of land (discussed above); though most of this land will likely be agricultural, some acres of non-agricultural flora would likely be impacted, e.g., woody vegetation, trees.

The replacement scenario will impact relatively more birds and bats due the increased use of wind turbines. Bird fatalities for wind turbines range from 3 to 6 fatalities per MW per year; bat fatalities range from 1 to 20 fatalities per MW per year.[16] The replacement scenario includes 11,200 MW of wind turbines resulting in approximately 33,600 bird fatalities and 112,000 bat fatalities per year (Table 8). It is uncertain whether these fatalities will have population level effects.[17] The fatalities would decrease with continued operation of the PINGP (Table 8).

The replacement scenario would have relatively more greenhouse gas ($CO_2$) emissions than continued operation of the PINGP (Table 8). Xcel Energy estimates the replacement scenario would result in the emission of approximately 8.9 million additional tons of carbon over a 2033/2034-2053/2054 timeframe compared to continued operation of the PINGP (Table 8). These additional carbon emissions are primarily associated with the scenario's combustion turbines.

[16] Buffalo Ridge Environmental Report.
[17] Bird fatalities due to wind turbines are relatively minimal compared with other anthropogenic risks, e.g., cats kept as pets, buildings, vehicles; see, Sierra Club. *Wind Turbines and Birds and Bats*. https://www.sierraclub.org/michigan/wind-turbines-and-birds-and-bats.
However, see U.S. Geological Service. *Bird Mortality at Renewable Energy Facilities have Population Level Effects*. https://www.usgs.gov/news/science-snippet/bird-mortality-renewable-energy-facilities-have-population-level-effects#.

Total emissions for the state of Minnesota in 2020 were approximately 137 million tons of $CO_2$-e.[18] Electrical generation was responsible for about 19 percent of this total (26.2 million tons $CO_2$-e).[19] The additional greenhouse gases associated with the replacement scenario would exacerbate climate change impacts. These impacts include drought, storms and flooding, impacts to public health, and impacts to agriculture and ecosystem functions.[20]

## Associated Infrastructure Impacts

Beyond the impacts discussed above, the replacement scenario facilities would also have associated infrastructure impacts – i.e., impacts related to the interconnection of the facilities with the electric transmission grid. The PINGP is already connected to the grid; it does not need additional transmission lines to commute the power generated at the plant. Both scenarios require more wind, solar, and storage facilities and will need additional transmission line infrastructure to connect those facilities to the grid. Even with proper siting, the replacement scenario would require more transmission lines compared to the continued operation of the PINGP.

It is difficult to estimate the extent of potential transmission line impacts associated with the replacement scenario facilities. Transmission lines have aesthetic impacts; they are visible at a distance. Transmission lines can impact existing and planned land uses. Transmission lines can also impact birds through electrocution and collision. Transmission line impacts are anticipated to be relatively less than those of the replacement scenario facilities themselves; however, the impacts could be similar in magnitude, depending on the length of the transmission lines required.

[18] Minnesota Pollution Control Agency. *Greenhouse Gas Emissions Data*. https://public.tableau.com/app/profile/mpca.data.services/viz/GHGemissioninventory/GHGsummarystory

[19] Ibid.

[20] Intergovernmental Panel on Climate Change. *Climate Change 2022*. https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf