Xcel Energy®

Prairie Island Nuclear Generating Plant
1717 Wakonade Drive East
Welch, MN 55089

November 19, 2014

L-PI-14-114
10 CFR 72.56

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Director, Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety and Safeguards
Washington, DC 20555-0001

Prairie Island Independent Spent Fuel Storage Installation
Docket No. 72-10
Materials License No. SNM-2506

Prairie Island Independent Spent Fuel Storage Installation – Response to Request For Additional Information Regarding License Amendment Request to Revise Cavity Pressurization Requirements for TN-40 and TN-40HT Spent Fuel Storage Casks (TAC No. L24929)

References:

1. Letter from K. Davison (NSPM) to Document Control Desk (NRC), "Prairie Island Independent Spent Fuel Storage Installation – License Amendment Request to Revise Cavity Pressurization Requirements for TN-40 and TN-40HT Spent Fuel Storage Casks," L-PI-11-031, dated May 23, 2014 (ADAMS Accession No. ML14143A202).

2. Letter from C. Allen (NRC) to J.E. Lynch (NSPM), "Request for Additional Information Related to the Proposed Amendment to Special Nuclear Materials License No. 2506," dated October 30, 2014 (ADAMS Accession No. ML14304A528).

Pursuant to 10 CFR 72.56, Northern States Power Company, a Minnesota corporation doing business as Xcel Energy (hereafter "NSPM"), submitted a letter dated May 23, 2014 (Reference 1) that requested approval from the Nuclear Regulatory Commission (NRC) of an amendment to the materials license for the Prairie Island Independent Spent Fuel Storage Installation (ISFSI). This license amendment request (LAR) proposed to revise the cask cavity pressurization requirements and their technical bases for the Prairie Island ISFSI spent fuel storage casks.

NMSS26

In a letter dated October 30, 2014 (Reference 2), the NRC requested additional information to support the staff's review of the subject LAR, and a clarifying telephone conference was held on October 30, 2014. This letter provides NSPM's response to this request for additional information (RAI).

Enclosure 1 to this letter contains the oath or affirmation statement required pursuant to 10 CFR 72.16(b).

Enclosure 2 to this letter provides NSPM's response to the subject RAI. NSPM submits this supplemental information in accordance with 10 CFR 72.56.

NSPM has determined that the information provided in this RAI response does not affect the conclusion in Reference 1 that the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(11) and, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared. In addition, pursuant to 10 CFR 51.60(b)(2), no environmental report need be prepared and no changes are required to the Prairie Island ISFSI Environmental Report.

If there are any questions or if additional information is needed, please contact Gene Eckholt at 651-267-1742.

Summary of Commitments

This letter contains no new commitments and no revisions to existing commitments.

Scott Sharp
Director, Site Operations, Prairie Island Nuclear Generating Plant
Northern States Power Company - Minnesota

Enclosures (2)

cc: Administrator, Region III, USNRC
SFST Project Manager, Prairie Island ISFSI, USNRC (8 copies with Enclosures)
NRR Project Manager, Prairie Island Nuclear Generating Plant, USNRC (letter only)
Resident Inspector, Prairie Island Nuclear Generating Plant, USNRC
State of Minnesota (letter only)

ENCLOSURE 1

Oath or Affirmation Pursuant to 10 CFR 72.16

1 Page Follows

UNITED STATES NUCLEAR REGULATORY COMMISSION

NORTHERN STATES POWER COMPANY - MINNESOTA

PRAIRIE ISLAND INDEPENDENT SPENT FUEL STORAGE INSTALLATION
DOCKET NO. 72-10

REQUEST FOR AMENDMENT TO
MATERIALS LICENSE No. SNM-2506

SUPPLEMENT TO LICENSE AMENDMENT REQUEST
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION REGARDING
PROPOSED REVISION TO CAVITY PRESSURIZATION REQUIREMENTS
FOR TN-40 AND TN-40HT SPENT FUEL STORAGE CASKS

The Northern States Power Company, a Minnesota corporation, d/b/a Xcel Energy (hereafter "NSPM") provides additional information that supports a license amendment request to revise cavity pressurization requirements for TN-40 and TN-40HT spent fuel storage casks.

NORTHERN STATES POWER COMPANY - MINNESOTA

By Scott Sharp
Scott Sharp
Director, Site Operations
Prairie Island Nuclear Generating Plant
Northern States Power Company - Minnesota

State of Minnesota

County of Hennepin

On this 19 day of November, 2014 before me a notary public acting in said County, personally appeared Scott Sharp, Director, Site Operations, Prairie Island Nuclear Generating Plant, and being first duly sworn acknowledged that he is authorized to execute this document on behalf of NSPM, that he knows the contents thereof, and that to the best of his knowledge, information, and belief the statements made in it are true.

Joanne Marie McNabb

JOANNE MARIE MCNABB
NOTARY PUBLIC
MINNESOTA
My Commission Expires Jan. 31, 2019

ENCLOSURE 2

Response to Request for Additional Information

Regarding License Amendment Request to Revise Cavity Pressurization Requirements for TN-40 and TN-40HT Spent Fuel Storage Casks

Introduction

This enclosure provides supplemental information from the Northern States Power Company, a Minnesota corporation (hereafter "NSPM") doing business as Xcel Energy, in support of a License Amendment Request (LAR) for the Prairie Island Independent Spent Fuel Storage Installation (ISFSI). The subject LAR was submitted May 23, 2014 (Reference 1, ADAMS Accession Number ML14143A202) and requested approval of a revision to the cavity pressurization requirements for TN-40 and TN-40HT spent fuel storage casks which are used at the Prairie Island ISFSI.

In a letter dated October 30, 3014 (Reference 2, ADAMS Accession Number ML14304A528), the Nuclear Regulatory Commission (NRC) provided a Request for Additional Information (RAI) regarding the subject LAR, and this RAI was discussed with the NRC staff during a telephone conference on October 30, 2014. The RAI question is quoted below in italics and is followed by the NSPM response in normal font.

Reference documents are identified at the end of this Enclosure.

RAI-1

Justify that positive internal pressurization is no longer required to prevent in-leakage of air.

The FSAR states the following:

> *A positive cask cavity pressure is described in the SAR as a barrier "to prevent inleakage of air" (Section 3.2.5.3.3/A3.2.5.3.3) and as a "precaution against the inleakage of air" (Section 3.3.1 /A3.3.1). However, in-leakage is prevented by the welded containment vessel and double 0-ring seals on all mechanical connections. The seal interspace is pressurized and monitored with a low pressure alarm for each cask, as explained in the Containment Integrity discussion later in this Evaluation.*

A thorough and detailed justification of the confinement integrity including base material, welds, and seal regions was provided to the staff as justification for elimination of the internal pressure requirement. That justification however

appears to be unchanged from the original licensing basis, and as such, does not explain the necessity of the original requirement for internal pressurization to prevent against air in-leakage. If the confinement integrity, which limited the escape of pressurized helium to an unacceptable level was sufficient in the original licensing basis, it is unclear how air-inleakage could physically occur, regardless of pressurization within the canister at the values under consideration. It appears that the feature of pressurization was initially coupled with the overall confinement integrity and therefore cannot merely be discarded without a more thorough explanation of its purpose and relative importance to overall confinement than what was originally provided in the amendment request.

This information is needed to ensure compliance with 10 CFR 72.120(d) and 72.122(h)(1).

NSPM Response

To provide a more thorough explanation of the purpose of positive cask pressure and its relative importance to confinement integrity, NSPM has reviewed the original ISFSI licensing correspondence, discussed this requirement with representatives of the cask designer (Transnuclear, now AREVA TN), and reviewed other industry reports about cask designs. Although NSPM has not identified specific documented explanation beyond that provided in Reference 1, there is evidence, some of which is anecdotal, which suggests that this requirement was a carryover from earlier transport cask applications that did not include seal interspace pressurization and monitoring features.

Historical Perspective

In the 1980s, a number of spent fuel transport casks were in operation, including the TN-8, TN-9, and TN-13/2 casks which operated with an inert cover gas, slightly subatmospheric cavity pressure, and double elastomeric O-ring seals. The subatmospheric pressure protected against release of radioactive material from the cask in the unlikely event of seal leakage. The seal interspace on these transport casks included a connection for seal leak testing, but there was no interspace pressurization system. After concerns were raised regarding oxidation of fuel and cladding materials during storage and transport, operating procedures were changed to provide a positive cavity pressure as a barrier against air in-leakage in the event of a seal leak.

Casks designed for spent fuel storage at ISFSIs evolved from earlier cask designs, including the transport casks described above. Elastomeric seals were replaced with double metallic seals with a longer expected lifetime, and an interspace monitoring system was included. For the TN-40 cask, the design included a pressurized seal interspace with pressure monitoring and alarms, and also included a positive cavity pressure requirement that is consistent with the changes in operating procedures for transport casks discussed above.

The License Application correspondence for the TN-40 casks illustrates early thinking regarding positive cavity pressure and seal interspace pressurization and monitoring systems. The key licensing basis documents for this review are the original proposed Technical Specifications and Safety Analysis Report (SAR) that were submitted with the ISFSI License Application in 1990 (Reference 3). A copy of these proposed Technical Specifications is included in Attachment 1 to this enclosure. The Technical Specifications that were actually issued with the initial license are included in Attachment 2 to this enclosure.

1990 License Application

In the original SAR submitted in Reference 3, Section 3.3, "Safety Protection Systems," describes that containment integrity is maintained by the welded steel vessel and a lid closure system with double high performance metallic face seals. The lid closure system is described as the only pathway for cavity gas to escape. A pressurized and monitored seal interspace guarded against a release of cavity gas to the environment or in-leakage of air to the cavity, and a positive cavity pressure was identified as a precaution against in-leakage of air, which might be harmful to the fuel. This was the original source for the positive pressure requirement for the TN-40 casks.

The original proposed Technical Specifications, Revision A, submitted in Reference 3 (see Attachment 1) included the following:

- Limiting Condition (LC) 3.1, "Cask Internal Helium Pressure," identified the helium backfill pressure requirement and this was verified prior to moving the cask to the storage pad in Surveillance Requirement (SR) 4.6, "Cask Internal Helium Pressure." The Bases for LC 3.1 state that "The thermal and pressure analyses performed for the cask assumes the use of a cover gas. Compliance with Limiting Condition 3.1 will confirm that each cask is functionally capable of ensuring long-term maintenance of fuel clad integrity as required for safe operation." It is noted that the Bases for the cavity pressure LC do not refer to the confinement integrity function.
- LC 3.2, "Cask Leakage," identified the leakage limit applicable to the cask seals, and this was verified prior to moving the cask to the storage pad in SR 4.7, "Cask Leakage." The Bases for LCO 3.2 state that "Compliance with Limiting Condition 3.2 will confirm that each cask is functionally capable of ensuring cask integrity as required for safe operation."

It is noteworthy that these proposed Technical Specifications did not include requirements to establish a pressurized seal interspace or to periodically check the monitoring system. This is consistent with the philosophy stated in Reference 3, Chapter 13, Proposed License Conditions, which stated that "The ISFSI is a totally passive system which requires no monitoring instrumentation and a minimum of operating controls."

The interspace pressurization and monitoring system was designed to provide positive pressure in the seal interspace for 20 years, without reliance on periodic checks. The

initial pressure of the overpressurization system was established so that the interspace pressure would remain greater than the cask cavity pressure for 20 years, assuming design leakage through both inner and outer seals and taking into account a reduction in cavity pressure due to cooling.

Based on the above, the original License Application philosophy was that the lid closure seals were the only pathway considered for leakage, and that confinement integrity was ensured by Technical Specification requirements to limit seal leakage. A pressurized and monitored seal interspace was provided but was not required by the Technical Specifications. Also, although the Technical Specifications required the cask to be backfilled to a specified positive pressure, the basis for this requirement was to protect fuel cladding integrity, not to ensure confinement integrity. In the event of seal leakage, a positive pressure in the cask cavity would provide some protection against in-leakage of air if the interspace pressurization system was lost, although the duration of this protection would be dependent upon the size of the leak; in any event, a positive cavity pressure would not provide long term protection since pressures would eventually equalize on both sides of the leak.

Subsequent Revisions to Technical Specifications

The ISFSI Technical Specifications have been revised a number of times since the original proposed Revision A, and specifications have been added to ensure that the pressurized seal interspace is maintained. In 1993, the Technical Specifications that were issued as Attachment A to the ISFSI materials license included Specification 3/4.7, "Pressure Monitoring" (see Attachment 2). This specification required daily checks of the interspace pressure monitoring alarms, and the Basis stated that this was to ensure that the helium atmosphere in the cask is maintained. However, no specific interspace pressure was required and there were no Action times for restoration if seal leakage was identified.

Currently, the Prairie Island ISFSI Technical Specifications include Limiting Condition for Operation (LCO) 3.1.5, "Cask Interseal Pressure," which requires cask interseal pressure to be maintained at least 30 psig, which is greater than the cask cavity and the outside atmosphere. This ensures that any seal leakage would involve the flow of clean helium from the cask overpressure system either into the cask cavity from inner seal leakage, or outside into the environment from outer seal leakage. Also, Completion Times are specified to ensure that if the interseal pressure is less than 30 psig, actions are taken to restore pressure within 7 days and, if pressure is not restored, the cask is returned to the spent fuel pool within 30 days.

Summary

Based on the above, a review of the SAR and Technical Specification document history indicates the following:

- Confinement integrity is relied upon to ensure a helium atmosphere in the cask cavity.
- The lid closure system is the only leak path for cavity gas to escape or for outside air to leak in; two design features are provided to prevent leakage, including a

double seal system and a pressurized and monitored interspace that ensures any seal leakage will be clean helium either into the cask through the inner seal or outside through the outer seal.

- In the original License Application, the seal interspace pressurization and monitoring system was described in the SAR, but it was not required to be maintained under the proposed Technical Specification controls.
- In the original License Application, a positive cavity pressure was described as a precaution against in-leakage of air. The original SAR and proposed Technical Specifications described that casks are backfilled with helium to a specified positive pressure to maintain fuel clad integrity, and a positive cavity pressure was consistent with operating procedures previously established for transport casks that did not have pressurized seal interspaces.
- Currently, the pressurized seal interspace is required to be maintained and monitored by Technical Specification requirements which include actions and completion times to be met in the event of a failure in the lid closure system.

Cask pressurization does not provide the protection against air in-leakage that is provided by a pressurized and monitored seal interspace, as is required by the current Technical Specifications. Based on controls provided in the current Technical Specifications, and on the justification provided above and in Reference 1, NSPM considers that cavity pressurization should not be coupled to confinement integrity and there is no need for the precaution of maintaining positive pressure in the cask cavity to preclude air in-leakage.

References

1. NSPM Letter, K. Davison to NRC Document Control Desk, "Prairie Island Independent Spent Fuel Storage Installation – License Amendment Request to Revise Cavity Pressurization Requirements for TN-40 and TN-40HT Spent Fuel Storage Casks," L-PI-11-031, dated May 23, 2014 (ADAMS Accession No. ML14143A202).

2. Letter from C. Allen (NRC) to J.E. Lynch (NSPM), "Request for Additional Information Related to the Proposed Amendment to Special Nuclear Materials License No. 2506," dated October 30, 2014 (ADAMS Accession No. ML14304A528).

3. Northern States Power (NSP) letter, T.M. Parker to R.E. Cunningham (NRC), "Prairie Island Independent Spent Fuel Storage Installation, Docket No. 72-10, Application for a License to Construct and Operate a Dry Cask Independent Spent Fuel Storage Installation, dated August 31, 1990.

Attachment 1

Prairie Island
Independent Spent Fuel Storage Installation

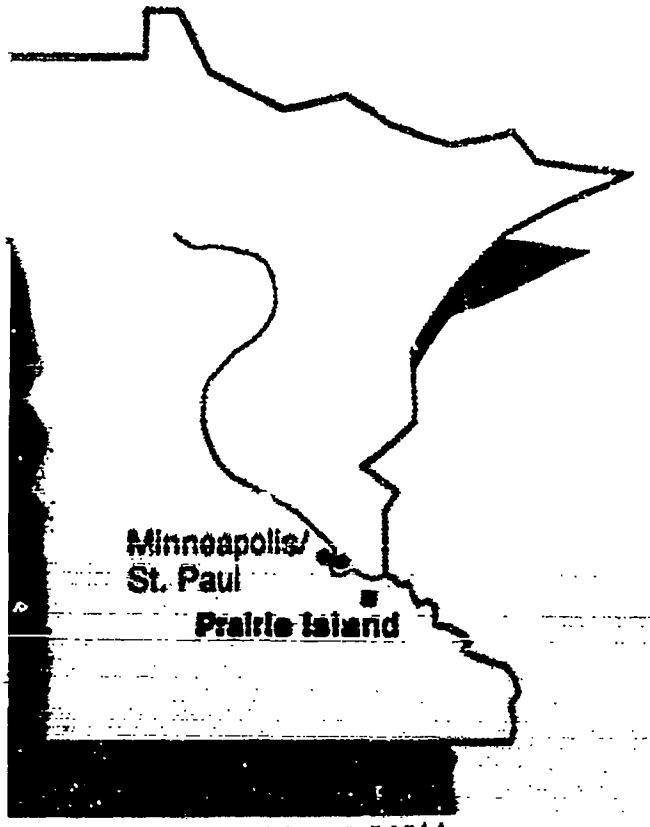
Technical Specifications
Revision A 8/90

Included with Northern States Power Company's
Application for License to Construct and Operate a Dry Cask
Independent Spent Fuel Storage Installation, dated August 31, 1990,
as attachment titled
"Technical Specifications and Safety Analysis Report"

19 pages follow

Prairie Island Independent Spent Fuel Storage Installation

Technical Specifications and Safety Analysis Report



Docket Number: 72-10

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NORTHERN STATES POWER COMPANY

PRAIRIE ISLAND
INDEPENDENT SPENT FUEL STORAGE INSTALLATION

TECHNICAL SPECIFICATIONS
MATERIALS LICENSE SNM-xxxx

TABLE OF CONTENTS

TS SECTION

TS BASES SECTION

1.0 INTRODUCTION

These Technical Specifications govern the safety of the receipt, possession and storage of irradiated nuclear fuel at the Prairie Island Independent Spent Fuel Storage Installation (ISFSI) and the transfer of such irradiated nuclear fuel to and from the Prairie Island Nuclear Generating Plant and the ISFSI.

1.1 DEFINITIONS

The following definitions apply for the purpose of these Technical Specifications.

1. Administrative Controls: Provisions relating to organization and management procedures, recordkeeping, review and audit, and reporting necessary to assure that the operations involved in the storage of spent fuel at the ISFSI are performed in a safe manner.

2. Design Features: Features of the facility associated with the basic design such as materials of construction, geometric arrangements, dimensions, etc., which, if altered or modified, could have a significant effect on safety.

3. Functional and Operating Limits: Limits on fuel handling and storage conditions necessary to protect the integrity of the stored fuel, to protect employees against occupational exposures, and to guard against the uncontrolled release of radioactive materials.

4. Fuel Assembly: The unit of nuclear fuel in the form that is charged or discharged from the core of a light-water reactor (LWR). Normally, will consist of a rectangular arrangement of fuel rods held together by end fittings, spacers, and tie rods.

5. Limiting Conditions: The lowest functional capabilities or performance levels of equipment required for safe operation of the facility.

6. Surveillance Requirements: Surveillance requirements include: (i) inspection, test and calibration activities to ensure that the necessary integrity of required systems, components, and the spent fuel in storage is maintained; (ii) confirmation that operation of the installation is within the required functional and operating limits; and (iii) a confirmation that the limiting conditions required for safe storage are met.

7. Tonne (Te): One metric ton, equivalent to 1000 kg or 2204.6 lb. Fuel quantity is expressed in terms of the heavy metal content of the fuel measured in metric tons and written TeU.

B. Loading Operations: Loading Operations include all cask preparation steps prior to cask transport from the fuel building area.

1.2 PREOPERATIONAL LICENSE CONDITIONS

The license issued under Part 72 shall not allow the first cask to be loaded with spent nuclear fuel until such time as the following preoperational license conditions are satisfied:

1. A training exercise (Dry Run) of all cask loading and handling activities shall be held which shall include but not be limited to:

   a. Moving cask in and out of spent fuel pool area.

   b. Loading fuel assembly (using dummy assembly).

   c. Cask drying, sealing, and cover gas backfilling operations.

   d. Moving cask to and placing it on the storage pad.

   e. Returning the cask to the Auxiliary Building.

   f. Unloading the cask.

   g. Decontaminating the cask.

   All cask handling during training shall be performed according to written procedures.

2. The Prairie Island Nuclear Generating Plant Emergency Plan has been reviewed and modified as required to include the ISFSI.

3. A training module has been developed for the Prairie Island Nuclear Generating Plant Training Program establishing an ISFSI Training Program which includes the following:

   a. Cask Designs (overview)

   b. ISFSI Facility Design (overview)

   c. ISFSI Safety Analysis (overview)

   d. Fuel loading and cask handling procedures and abnormal procedures

   e. ISFSI License (overview).

4. The Prairie Island Nuclear Generating Plant Radiation Protection Procedures have been reviewed and modified as required to include the ISFSI.

5. The Prairie Island Nuclear Generating Plant Administrative Procedures has been reviewed and modified as required to include the ISFSI.

6. A procedure has been developed for the documentation of the characterizations performed to select spent fuel to be stored in the casks.

7. Written operating and abnormal/emergency procedures have been prepared.

1.3 GENERAL LICENSE CONDITIONS

1.3.1 Quality Assurance

Activities at the Prairie Island ISFSI shall be conducted in accordance with the requirements of Northern States Power Company's Operational Quality Assurance Plan and 10 CFR Part 72, Subpart G.

1.3.2 Fuel and Cask Handling Activities

Fuel and cask movement and handling activities which are to be performed in the Prairie Island Nuclear Generating Plant Auxiliary Building will be governed by the requirements of the Prairie Island Nuclear Generating Plant Facility Operating Licenses DPR-42 and DPR-60 and associated Technical Specifications.

1.3.3 Administrative Controls

The ISFSI is located on the Prairie Island Nuclear Generating Plant site and will be managed and operated by the Plant staff. The administrative controls shall be in accordance with the requirements of the Station Facility Operating Licenses DPR-42 and DPR-60 and associated Technical Specifications.

2.0 FUNCTIONAL AND OPERATING LIMITS

2.1 FUEL

The spent nuclear fuel to be received and stored at the ISFSI shall meet the following requirements:

1. Only fuel irradiated at the Prairie Island Nuclear Generating Plant Unit Nos. 1 and 2 may be used.

2. Maximum initial enrichment shall not exceed 3.85 weight percent U-235.

3. Maximum assembly average burnup shall not exceed 45,000 megawatt-days per metric ton uranium.

4. Fuel shall have cooled a minimum of 10 years after reactor discharge prior to storage in the ISFSI.

5. Fuel shall be intact unconsolidated fuel. Partial fuel assemblies, that is, fuel assemblies from which fuel pins are missing must not be stored unless dummy fuel pins are used to displace an amount of water equal to that displaced by the original pins.

6. Fuel assemblies known or suspected to have structural defects sufficiently severe as to adversely affect fuel handling shall not be loaded into a cask for storage, unless canned.

2.2 CASK

The spent fuel storage casks used at the Prairie Island ISFSI shall meet the following requirements:

1. Cask surface temperature shall be less than 250°F.

2. The cask surface dose rate shall be less than 125 mR/hr.

3. Removable surface contamination levels on the cask shall be less than 1000 dis/min/100cm^2 from beta and gamma emitting sources and 20 dis/min/100cm^2 from alpha emitting sources.

4. Maximum lifting height of a cask by a non-redundant lifting device shall be less than 18 inches.

3.0 LIMITING CONDITIONS

3.1 CASK INTERNAL HELIUM PRESSURE

The cask shall be backfilled with a helium cover gas to a pressure of 20 ± 1 psia (5.3 psig ± 1 psig) at 77°F.

3.2 CASK LEAKAGE

The cask leakage shall be less than 10^{-6} atm/cc-sec.

4.0 SURVEILLANCE REQUIREMENTS

Requirements for surveillance of fuel parameters, cask loading, cask temperature, cask surface dose rate, cask contamination, cask internal helium pressure, cask leakage, safety status and ISFSI area dose rate are described in this section. These requirements are summarized in Table 4-1 from details contained in Sections 4.1 through 4.9. Specific time intervals between surveillances may be adjusted plus or minus 25 percent to accommodate normal test schedules.

TABLE 4-1

SURVEILLANCE REQUIREMENTS SUMMARY

Section	Quantity or Item	Period
4.1	Fuel Parameters	P
4.2	Cask Loading	C
4.3	Cask Temperature	S
4.4	Cask Surface Dose Rate	L
4.5	Cask Contamination	L
4.6	Cask Internal Helium Pressure	L
4.7	Cask Leakage	L
4.8	Safety Status Surveillance	Q
4.9	ISFSI Area Dose Rate	Q

P - Prior to cask loading
C - Prior to cask closure following loading
S - A minimum of 24 hours after cask loading and prior to moving cask to storage pad
L - Prior to moving the cask to the storage pad
Q - Quarterly

4.1 FUEL PARAMETERS

Prior to cask loading, the fuel selected to be loaded shall have been reviewed to ensure that it is within the cask-specific functional and operating limit stated in Section 2.1. This information shall be documented for each assembly to be loaded into the cask.

4.2 CASK LOADING

Prior to cask closure, the actual core loading will be verified to be correct.

4.3 CASK TEMPERATURE

A minimum of 24 hours after cask loading and prior to moving the cask to the storage pad, the surface temperature of the cask shall be measured to ensure that it is within the functional and operating limit specified in Section 2.2.

4.4 CASK SURFACE DOSE RATE

Prior to moving a loaded cask to the storage pad, gamma and neutron measurements shall be taken on the outside surface of the cask surface. These dose rates shall be less than the functional and operating limit specified in Section 2...

4.5 CASK CONTAMINATION

Prior to moving cask to the storage pad, the cask removable surface contamination levels shall be measured to ensure they are less than the functional and operating limit specified in Section 2.2.

4.6 CASK INTERNAL HELIUM PRESSURE

Prior to moving the cask to the storage pad, the helium pressure shall be measured to ensure it is within limiting conditions set forth in Section 3.1.

4.7 CASK LEAKAGE

Prior to moving the cask to the storage pad, the cask seal shall be tested using a helium leak detector to ensure that the seal leak tightness is within the limiting conditions specified in Section 3.2.

4.8 SAFETY STATUS SURVEILLANCE

A visual surveillance of the ISFSI shall be performed on a quarterly basis to determine that no significant damage or deterioration of the exterior of the emplaced casks has occurred. Surveillance shall also include observation to determine that no significant accumulation of debris on cask surfaces has occurred.

4.9 ISFSI AREA DOSE RATE

TLDs located on the ISFSI site fence shall be read quarterly.

5.0 DESIGN FEATURES

5.1 SITE

The ISFSI is located on the Prairie Island Nuclear Generating Plant site, as described in Section 2.1 of the Prairie Island ISFSI Safety Analysis Report (SAR).

5.2 CASK DESIGN

The casks used in the ISFSI are described in the Prairie Island ISFSI SAR.

5.3 STORAGE PAD

The ISFSI cask storage pads will be constructed of reinforced concrete, with nominal dimensions of 36 ft. x 216 ft. x 3 ft. thick. The top of the concrete pad is at elevation 697.0 ft. msl, minimum, in order to ensure that non-borated water could not get into the cask in the event of the maximum hypothetical flood.

5.4 TOTAL STORAGE CAPACITY

The total storage capacity of the ISFSI is limited to 715.29 TeU.

BASES FOR

SECTION 2.0

FUNCTIONAL AND OPERATING LIMITS

NOTE

The Bases contained in succeeding pages summarize the reasons for the Specifications in Section 2.0.

2.0 FUNCTIONAL AND OPERATING LIMITS

2.1 FUEL

Bases

The design criteria and subsequent safety analyses of the ISFSI and storage casks assumed certain characteristics and limitations for the fuels that are to be received and stored. Specification 2.1 assures that these bases remain valid by defining the source of the spent fuel, and limits on maximum initial enrichment, irradiation history, and minimum post irradiation cooling time. The objective of these limits is to protect the integrity of the spent fuel by ensuring that the thermal and criticality analyses are valid for fuel stored at the ISFSI.

2.2 CASK

Bases

The design criteria and subsequent safety analysis of the Transnuclear TN-40 cask assumed certain characteristics and operating limits for the use of the casks. Specification 2.2 assures that those design criteria are not exceeded.

Confirmation that the cask surface temperature is within the prescribed limit will ensure that the cladding temperature of the fuel assemblies is less than the maximum design basis temperature of 340°C. This will protect the integrity of the spent fuel stored in the ISFSI by ensuring that the thermal analyses are valid for the fuel stored in the ISFSI.

Confirmation that cask surface dose and surface contamination levels are below prescribed limits will protect employees against occupational exposures by ensuring compliance with occupational dose limits and ALARA principles.

Confirmation that cask lifting heights are within the prescribed limit will protect the cask integrity and guard against uncontrolled release of radioactive material by ensuring the thermal, criticality, and radiological analyses remain valid following an accidental cask drop.

BASES FOR

SECTION 3.0

LIMITING CONDITIONS

NOTE

The Bases contained in succeeding pages summarize the reasons for the Specifications in Section 3.0.

3.0 LIMITING CONDITIONS

3.1 CASK INTERNAL HELIUM PRESSURE

Bases

The thermal and pressure analyses performed for the cask assumes the use of a cover gas. Compliance with Limiting Condition 3.1 will confirm that each cask is functionally capable of ensuring long-term maintenance of fuel clad integrity as required for safe operation.

3.2 CASK LEAKAGE

Bases

Compliance with Limiting Condition 3.2 will confirm that each cask is functionally capable of ensuring cask integrity as required for safe operation.

BASES FOR

SECTION 4.0

SURVEILLANCE REQUIREMENTS

NOTE

The Bases contained in succeeding pages summarize the reasons for the Specifications in Section 4.0.

4.0 SURVEILLANCE REQUIREMENTS

Bases

Surveillance requirements will confirm that the ISFSI is initially capable of operating within referenced functional and operating limits and limiting conditions and that cask integrity is subsequently maintained.

DOCUMENT CONTROL

PRAIRIE ISLAND INDEPENDENT SPENT FUEL STORAGE INSTALLATION
TECHNICAL SPECIFICATIONS

PAGE	REVISION
Document Control Tab	A
TS-A	A
TS-B	A
Technical Specifications Tab	A
Technical Specifications	A
TS-i	A
TS.1-1	A
TS.1-2	A
TS.1-3	A
TS.2-1	A
TS.3-1	A
TS.4-1	A
TS.4-2	A
TS.5-1	A
Title Page 2.0	A
B2-1	A
Title Page 3.0	A
B3-1	A
Title Page 4.0	A
B4-1	A

DOCUMENT CONTROL

PRAIRIE ISLAND INDEPENDENT SPENT FUEL STORAGE INSTALLATION
RECORD OF TECHNICAL SPECIFICATION CHANGES AND LICENSE AMENDMENTS

NSP Revision (REV) No.	Date of Issue	License Amendment No.	Remarks
A	8/90	-	Proposed Appendix A Technical Specifications included in August 1990 License Application

Attachment 2

Appendix A to Materials License SNM-2506

Technical Specifications

Initial Issue – October 1993

26 pages follow

PRAIRIE ISLAND

INDEPENDENT SPENT FUEL STORAGE INSTALLATION

APPENDIX "A"
TO
MATERIALS LICENSE SNM-2506

TECHNICAL SPECIFICATIONS

ISSUED BY THE UNITED STATES NUCLEAR REGULATORY COMMISSION

CONTENTS

INTRODUCTION

These Technical Specifications govern the safety of the receipt, possession, and storage of irradiated nuclear fuel at the Prairie Island Independent Spent Fuel Storage Installation and the transfer of such irradiated nuclear fuel to and from Units 1 and 2 of the Prairie Island Nuclear Generating Plant and the Prairie Island Independent Spent Fuel Storage Installation. The protection of the environment during the activities described above is also governed under these technical specifications. The loading of spent fuel into the TN-40 cask at the Prairie Island Nuclear Generating Plant Auxiliary Building is governed by the existing Prairie Island 10 CFR Part 50 operating licenses (DPR-42 and -60), technical specifications, and new specific procedures.

SECTION 1.0

DEFINITIONS

1.0 DEFINITIONS

The following definitions apply for the purpose of these Technical Specifications:

a. ADMINISTRATIVE CONTROLS: Provisions relating to organization operating, emergency, and management procedures; recordkeeping, review, and audit; and reporting necessary to ensure that the operations involved in the movement, transfer, and storage of spent fuel at the Prairie Island ISFSI are performed in a safe manner.

b. DESIGN FEATURES: Features of the facility associated with the basic design, such as materials of construction, geometric arrangements, dimensions, etc., which, if altered or modified, could have a significant effect on safety.

c. FUEL ASSEMBLY: The unit of nuclear fuel in the form that is charged or discharged from the core of a light-water reactor (LWR). Normally, will consist of a rectangular arrangement of fuel and non-fuel held together by end fittings, spacers, and guide tubes.

d. FUNCTIONAL AND OPERATING LIMITS: Limits on fuel handling and storage conditions necessary to protect the integrity of the stored fuel, to protect employees against occupational exposures, and to guard against the uncontrolled release of radioactive materials.

e. LIMITING CONDITIONS: The minimum or maximum functional capabilities or performance levels of equipment required for safe operation of the facility.

f. LOADING OPERATIONS: Loading Operations include all cask preparation steps before cask transport from the auxiliary building area.

g. SURVEILLANCE INTERVAL: A surveillance interval is the interval between a surveillance check, test, or calibration. Unless specifically stated otherwise, the specific frequency for each surveillance requirement is met if the surveillance is performed within 1.25 times the interval specified in the frequency, as measured from the previous performance.

For frequencies specified as "once," the above interval extension does not apply.

If a required action requires performance of a surveillance, or its completion time requires periodic performance of "once per ...," the above frequency extension applies to the repetitive portion, not to the initial portion of the completion time.

h. SURVEILLANCE REQUIREMENTS: Surveillance requirements include: (i) inspection, test, and calibration activities to ensure that the necessary integrity of required systems, components, and the spent fuel in storage is maintained; (ii) confirmation that operation of the installation is within the required functional and operating limits; and (iii) a confirmation that the limiting conditions required for safe storage are met.

SECTION 2.0

FUNCTIONAL AND OPERATING LIMITS

2.1 CASK VACUUM PRESSURE DURING DRYING

SPECIFICATION: The cask cavity vacuum pressure during drying shall not exceed 10 mbar after stepped evacuation. The vacuum pressure shall be maintained for not less than 30 minutes.

APPLICABILITY: Applicable to all casks.

ACTION: If the required vacuum cannot be obtained.

1. Check and repair vacuum drying system as necessary.

2. Check and repair the cask seals as necessary.

If the specification is still not met, remove fuel from the cask.

BASIS: A stable vacuum pressure of less than 10 mbar indicates that all liquid water has evaporated in the cask cavity, and that the resulting inventory of oxidizing gases in the cask is less than 0.25 percent of the volume.

2.2 CASK HELIUM BACKFILL PRESSURE

SPECIFICATION: The cask cavity shall be backfilled with helium. The backfill pressure shall be 20 psia (1.4 bar) ± 1 psia (70 mbar).

APPLICABILITY: Applicable to all casks.

ACTION: If the required pressure cannot be obtained:

1. Check and repair the cask seals as necessary.

2. If the backfill pressure exceeds the criterion, release a sufficient quantity of helium to lower the cask cavity pressure.

If the specification is still not met, remove fuel from the cask.

BASIS: The thermal analysis performed for the cask assumes the use of helium as a cover gas. Also, the use of an inert gas (helium) ensures long-term maintenance of fuel clad integrity.

The value of 20 psia (1.4 bar) was selected to ensure that the pressure within the cask remains within the pressure design limits.

2.3 MAXIMUM CASK LIFTING HEIGHT

SPECIFICATION: The cask lifting height with a non-single-failure-proof lifting device shall not exceed 46 cm (18 in.).

APPLICABILITY: This specification applies to handling of a loaded cask outside the auxiliary building.

ACTION: In the event of a cask drop from a height greater than 18 inches (45 cm), with fuel in the cask, the fuel shall be returned to the spent fuel pool and visually inspected. If the spent fuel meets the requirements for storage in the ISFSI, the fuel may be subsequently transferred to the ISFSI. The cask shall be removed from service and evaluated for further use or disposed of, as may be appropriate.

BASIS: The drop analyses performed for cask drop incidents, for a cask loaded with spent fuel, confirm that drops up to 18 inches (45 cm) can be sustained without unacceptable damage to the cask. This limiting condition ensures that the handling height limits will not be exceeded at the storage pad nor in transit to and from the spent fuel pool. Design of the cask is to ASME B&PV Code Section III, Division 1, Subsection NB for Class 1 components, Service Level D requirements.

SECTION 3/4.0

LIMITING CONDITIONS / SURVEILLANCE REQUIREMENTS

3/4.1 FUEL TO BE STORED AT ISFSI

LIMITING CONDITION FOR OPERATION

3.1.1 The spent nuclear fuel to be received and stored in the TN-40 cask at the Prairie Island ISFSI shall meet the following requirements:

(1) Only fuel irradiated at the Prairie Island Nuclear Generating Plant Unit Nos. 1 and 2 may be used.

(2) Maximum initial enrichment shall not exceed 3.85 weight percent U-235.

(3) Maximum assembly average burnup shall not exceed 45,000 megawatt-days per metric ton uranium.

(4) Fuel shall have cooled a minimum of 10 years after reactor discharge, before storage in the ISFSI.

(5) Fuel shall be intact unconsolidated fuel. Partial fuel assemblies, that is, fuel assemblies from which fuel pins are missing must not be loaded unless dummy fuel pins are used to displace an amount of water equal to that displaced by the original pins.

(6) Fuel assemblies known or suspected to have structural defects or gross cladding failures (other than pinhole leaks) sufficiently severe to adversely affect fuel handling and transfer capability shall not be loaded into the cask for storage.

APPLICABILITY: This specification is applicable to all spent fuel to be loaded and stored in the TN-40 cask at the Prairie Island ISFSI.

ACTION: If the requirements of the above specification are not met, do not load the fuel assembly into the TN-40 cask.

SURVEILLANCE REQUIREMENTS:

4.1.1 Each fuel assembly to be loaded shall have the above specifications independently verified and documented.

4.1.2 Before inserting a spent fuel assembly into a cask and again before closing the cask, the identity of each fuel assembly shall be independently verified and documented.

BASIS: The design criteria and subsequent safety analyses of the Prairie Island ISFSI and storage casks assumed certain characteristics and limitations for the fuel that is to be stored. Specification 3/4.1 ensures that the

integrity of the fuel is protected by defining characteristics such as: the source of the spent fuel, maximum initial enrichment, irradiation history, and minimum post-irradiation cooling time.

This specification was derived to ensure that the peak fuel rod temperatures, cask surface contact dose rates, reactivity, and fuel mass are below the design values.

3/4.2 DISSOLVED BORON CONCENTRATION

LIMITING CONDITION FOR OPERATION

3.2.1 The cask cavity shall be moderated only by water with a boron concentration greater than or equal to 1800 ppm.

APPLICABILITY: Applicable to all loading and unloading of casks.

ACTION:

1. With the measured boron concentration less than the specification before the beginning of cask loading and unloading operations, suspend all activities involving cask loading and unloading.

2. With the measured boron concentration less than the specification during cask loading and unloading operations, suspend all loading and unloading operations until the boron concentration is increased to 1800 ppm or greater.

SURVEILLANCE REQUIREMENTS

4.2.1.1 Within 4 hours before insertion of the first spent fuel assembly into a cask, verify and document that the dissolved boron concentration in water in the spent fuel pool and introduced into the cask cavity satisfies the limits specified above, in accordance with the requirements of the Prairie Island Nuclear Generating Station Operating Licenses (DPR-42 and -60).

4.2.1.2 Within 4 hours before flooding the cask cavity for unloading the fuel assemblies, verify and document that the dissolved boron concentration in water in the spent fuel pool and the water to be introduced into the cask cavity satisfies the limits specified above, in accordance with the requirements of the Prairie Island Nuclear Generating Station Operating Licenses (DPR-42 and -60). If the water introduced into the cask cavity is not from the spent fuel pool, then the dissolved boron concentration shall be independently determined by chemical analysis (two samples analyzed by two different individuals). All boron concentration measurements shall be documented.

BASIS: This specification ensures that k_{eff} is less than 0.95, and therefore, the spent fuel is subcritical during fuel loading and unloading.

3/4.3 MAXIMUM HELIUM LEAK RATE

LIMITING CONDITION FOR OPERATION

3.3.1 The standard helium leak rate for all closure seals shall not exceed 10^{-5}atm-cc/s.

APPLICABILITY: Applicable to all casks.

ACTION: With the requirements of the above specifications not satisfied, the seals shall be repaired or replaced in accordance with approved procedures and re-examined in accordance with these specifications.

SURVEILLANCE REQUIREMENT:

4.3.1 During cask loading operations, the cask seals shall be tested in accordance with ANSI N 14.5, to ensure that the seal leakage is less than or equal to 10^{-5}atm-cc/s.

BASIS: The safety analysis of the cask is based on the seals being tight to maintain a leak rate less than 10^{-5}atm-cc/s. Seal tightness at this leak rate will ensure the helium atmosphere in the storage cask is maintained for the licensed period.

3/4.4 MAXIMUM CASK REMOVABLE SURFACE CONTAMINATION

LIMITING CONDITION FOR OPERATION

3.4.1 Removable contamination on the cask exterior surfaces shall be less than 1,000 dpm/100 cm^2 (0.2 Bq/cm^2) from beta and gamma sources, and 20 dpm/100 cm^2 (0.003 Bq/cm^2) from alpha sources.

APPLICABILITY: Applicable to all casks.

ACTION: If the limit is exceeded, the cask external surfaces shall be decontaminated to meet the specification before movement to the ISFSI.

SURVEILLANCE REQUIREMENT:

4.4.1 Contamination surveys shall be taken on the accessible cask exterior surfaces. The contamination surveys for removable surface contamination shall be conducted after fuel loading and before moving the loaded cask to the ISFSI site.

BASIS: Compliance with this limit ensures that the offsite dose limits in 10 CFR Part 20, 10 CFR Part 50 - Appendix I, 10 CFR Part 72, and 40 CFR 190 are met.

3/4.5 MAXIMUM CASK SURFACE TEMPERATURE

LIMITING CONDITION FOR OPERATION

3.5.1. The equilibrium cask surface temperature shall not exceed 250° F (121°C).

APPLICABILITY: This temperature limit applies to all casks stored at the ISFSI.

ACTION: If a cask surface temperature greater than 250° F (121°C) is observed for any cask, then this indicates that the cask is not performing as intended, or that fuel assemblies not meeting Specification 2.1 have been loaded into the cask. If after verification, fuel assemblies meeting Specification 2.1 have been loaded into the cask and the cask surface temperature is greater than 250° F (121°C), then the cask shall be unloaded. A written report shall be submitted to the Nuclear Regulatory Commission Region III Office, with a copy to the Director, Office of Nuclear Material Safety and Safeguards, within 30 days of this incident.

SURVEILLANCE REQUIREMENT:

4.5.1. Cask surface temperatures shall be measured and recorded at least 24 hours after completing cask loading and before moving the cask to the ISFSI.

BASIS: This is to ensure that the fuel clad will be at a temperature such that it will be protected against degradation that leads to gross rupture.

3/4.6 DOSE RATES

LIMITING CONDITION FOR OPERATIONS

3.6.1 The contact dose rate (neutron + gamma) on the surface of the cask shall not exceed 200 mrem/hr (2.0 mSv/hr) or the equivalent dose rate at 2 yards (2 meters).

APPLICABILITY: This specification is applicable to the accessible top and side surfaces of a loaded cask.

ACTION: If the measured dose rate exceeds the limit, correct fuel loading shall be verified. If correct fuel is loaded, specific analysis must demonstrate compliance with 10 CFR Part 20, and 10 CFR Part 72 radiation protection requirements, or appropriate action must be taken to comply with acceptable limits. If acceptable limits cannot be achieved, the cask shall not be placed in service at the ISFSI.

SURVEILLANCE REQUIREMENTS:

4.6.1 Cask surface gamma and neutron dose rates shall be measured before moving a cask to the ISFSI. Measurements shall be taken near the accessible top and side surfaces.

4.6.2 Two (2) thermoluminescent dosimeters (TLDs) shall be placed on the fence at each side of the ISFSI site (8 total) and read quarterly to determine ISFSI radiation levels.

BASIS: The basis for this specification is the shielding analysis presented in Appendix 7A of the ISFSI Safety Analysis Report (SAR). The dose rates stated in this specification were selected to maintain as-low-as-is-reasonably-achievable exposure to the general public and to onsite personnel inspecting the casks. Compliance with the cask surface dose rates (as described in ISFSI SAR Table 7A-4) will ensure compliance with the ISFSI site radiation protection requirements (as described in ISFSI SAR Tables 7A-5 and 7A-7, and ISFSI SAR Figure 7A-6).

3/4.7 PRESSURE MONITORING

LIMITING CONDITION FOR OPERATIONS

3.7.1 The alarm board that monitors cask pressure shall be checked daily and tested annually to ensure that the helium atmosphere in the casks is maintained.

APPLICABILITY: Applicable to all casks.

ACTION: If monitoring of pressure between the cask double seals indicates loss of pressure and seal leakage, return the cask to the auxiliary building and repair or replace the seals, as necessary, to return the cask to proper operation.

SURVEILLANCE REQUIREMENTS:

4.7.1 The alarm board, to which pressure monitoring devices are connected, shall be checked daily.

4.7.2 The alarm board shall be tested annually, to ensure proper functioning.

BASIS: Pressure between the cask seals must be maintained to ensure that the helium atmosphere in the cask is maintained. Periodic testing of the alarm board ensures proper functioning of the pressure monitoring and alarm system, to provide timely corrective action.

3/4.8 SAFETY STATUS SURVEILLANCE

LIMITING CONDITION FOR OPERATIONS

3.8.1 The cask shall be free of damage or debris, to maintain proper functioning of the cask.

APPLICABILITY: Applicable to all casks.

ACTION: If significant damage, deterioration, or debris accumulation occurs to the cask surfaces such that the safety functions of the cask are impaired, take appropriate corrective action to return the cask to proper operation.

SURVEILLANCE REQUIREMENT:

4.8.1 A visual surveillance of all casks at the ISFSI shall be conducted, on a quarterly basis, to determine that no significant damage nor deterioration of the exterior of the casks has occurred and that no significant accumulation of debris on cask surfaces has occurred.

BASIS: These surveillance requirements shall ensure cask maintenance.

Table 3/4-1 TN-40 CASK OPERATING LIMITS

	Operating Limit
Maximum Lifting Height with a Non-Redundant Lifting Device	18 inches (45 cm)
Maximum Cask Surface Temperature	250°F (121°C)
Maximum Surface Dose Rate (or equivalent at 2 meters)	200 mrem/hr
Maximum Removable Surface Contamination	
- Beta and Gamma	1000 dpm/100 cm^2
- Alpha	20 dpm/100 cm^2
Maximum Helium Leak Rate	10^{-5} atm-cc/s
Initial Helium Pressure (Cask Cavity)	20 ± 1 psia (1.4 bar ± 70 mbar)
Pressure During Cask Drying Test (held for 30 min.)	≤ 10 mbar
Boron Concentration in Pool & Cask	≥ 1800 ppm
Storage Capacity	≤ 40 assemblies
Fuel Assembly Characteristics	
- Initial Enrichment, U-235	≤ 3.85 wt. %
- Average Burnup	≤ 45,000 MWD/MTU
- Time after Irradiation	≥ 10 Years

Table 3/4-2 SURVEILLANCE REQUIREMENTS SUMMARY

Specification	Quantity or Item	Period
3/4.1	Fuel to be Stored at ISFSI	P, C
3/4.2	Dissolved Boron Concentration	P
3/4.3	Maximum Helium Leak Rate	L
3/4.4	Maximum Removable Surface Contamination	L
3/4.5	Maximum Cask Surface Temperature	S
3/4.6	Dose Rates	
	Cask surface or equivalent at 2 yards (2 meters)	L
	At the Fence	Q
3/4.7	Pressure Monitoring	D, A
3/4.8	Safety Status Surveillance	Q

Legend
P - Prior to cask loading.
C - Prior to cask closure following loading.
S - At least 24 hours after cask loading and prior to moving cask to storage pad.
L - Prior to moving cask to the storage pad.
Q - Quarterly -- at least once per 92 days.
A - Annually -- at least once per 366 days.
D - Daily.

Note: Specified time periods or frequencies may be adjusted by 25 percent to accommodate normal test schedules (see Section 1.0 Definitions, g. "Surveillance Interval.")

SECTION 5.0

DESIGN FEATURES

5.0 DESIGN FEATURES

The Prairie Island ISFSI design approval was based on use of the TN-40 storage cask and review of specific design drawings, some of which have been deemed appropriate for inclusion in the Prairie Island ISFSI Safety Evaluation Report (SER). Drawings listed in Section 1.2 of the Prairie Island ISFSI SER have been reviewed and approved by NRC. These drawings may be revised under the provisions of 10 CFR 72.48, as appropriate.

SECTION 6.0

ADMINISTRATIVE CONTROLS

6.0 ADMINISTRATIVE CONTROLS

6.1 GENERAL

The Prairie Island ISFSI is located on the Prairie Island Nuclear Generating Plant site and will be managed and operated by the Northern States Power Company staff. The administrative controls shall be in accordance with the requirements of the Prairie Island Nuclear Generating Plant Facility Operating Licenses (DPR-42, and -60) and associated Technical Specifications, as appropriate.

6.2 ENVIRONMENTAL MONITORING PROGRAM

The licensee shall include the Prairie Island ISFSI in the environmental monitoring program for the Prairie Island Nuclear Generating Plant. An environmental monitoring program is required pursuant to 10 CFR 72.44(d)(2). The licensee shall include the ISFSI in the environmental monitoring report for the Prairie Island Nuclear Generating Plant, and a copy shall be sent to the Director, Office of Nuclear Material Safety and Safeguards.

6.3 ANNUAL ENVIRONMENTAL REPORT

An annual report, as required by 10 CFR 50.36a(a)(2), which is the Prairie Island Nuclear Generating Plant Annual Radioactive Effluent Release Report, shall include the Prairie Island ISFSI and shall be submitted to the NRC Region III, Office, with a copy to the Director, Office of Nuclear Material Safety and Safeguards, within 60 days after January 1 of each year. This report should specify the quantity of each of the principal radionuclides released to the environment in liquid and in gaseous effluents during the previous year of operation and such other information as may be required by the Commission to estimate maximum potential radiation dose commitment to the public resulting from effluent release. The report under this specification is also required pursuant to 10 CFR 72.44(d)(3).