Enclosure 3, Attachment 6 Contains Proprietary Information

ENCLOSURE 3

Evaluation of the Proposed Changes

License Amendment Request (LAR) to Modify TN-40 Cask Design (Designated as TN-40-HT)

1. SUMMARY DESCRIPTION
2. DETAILED DESCRIPTION
   2.1 Proposed Changes
   2.2 Background
3. TECHNICAL EVALUATION
4. REGULATORY SAFETY ANALYSIS
   4.1 Applicable Regulatory Requirements/Criteria
   4.2 Conclusions
5. REFERENCES

ATTACHMENTS:

1. Revised Technical Specifications Pages
2. Technical Specifications Bases Pages (For information only)
3. Current Technical Specifications to Revised Technical Specifications Cross Reference Matrix
4. ISFSI SAR Pages (Markup, for information only)
5. ISFSI SAR Pages (Retyped, for information only)
6. ISFSI SAR Addendum A Pages

1. SUMMARY DESCRIPTION

Pursuant to 10 CFR 72.56, the Nuclear Management Company, LLC (NMC) hereby requests an amendment to the Special Nuclear Materials (SNM) license No. SNM-2506 and Technical Specifications for the Prairie Island Independent Spent Fuel Storage Installation (PI ISFSI), to modify the TN-40 cask for storage of high enrichment and high burnup fuel and to reformat the Technical Specifications. The modified cask is designated as the TN-40HT cask.

2. DETAILED DESCRIPTION

2.1 Proposed Changes

The changes requested in this LAR include the design of the TN-40HT dry cask system (as described in Attachment 6, which will become ISFSI Safety Analysis Report (SAR) Addendum A), the associated changes to the PI ISFSI Technical Specifications (as shown in Attachments 1, and 3), and the reformatting of the Technical Specifications (as shown in Attachment 1).

Attachment 4 to this enclosure is provided for information only. It shows the current SAR pages that will be changed as a result of the addition of Addendum A to the SAR and the operation of the ISFSI with TN-40HT casks. The changes include the addition of a paragraph to Section 1.1 noting that the analyses and evaluations associated with the design of the TN-40HT system are contained in Addendum A of the Safety Analysis Report. In addition, the onsite and offsite dose analyses contained in Section 7 and Appendix 7A are not representative of the ISFSI containing a mixture of TN-40 and TN-40HT casks. However the corresponding information in Addendum Section A7 and Appendix A7A conservatively bounds ISFSI operations with a mixture of TN-40 and TN-40HT cask designs. Therefore the onsite and offsite dose information contained in Section 7 and Appendix 7A will be replaced with statements referring the reader to Addendum Section A7 and Appendix A7A. The information that is being added to the ISFSI pages is shown in dash border boxes, e.g., xxxxxx, while information being deleted is shown in crossed out boxes, e.g., ~~xxxxxx~~ or a strikethrough. Attachment 5 to this enclosure shows the retyped ISFSI page changes.

Attachment 2 to this enclosure is provided for information only. It includes Technical Specifications Bases pages associated with the proposed revised Technical Specifications. The Technical Specifications Bases proposed in Attachment 2 are formatted consistent with the Prairie Island Nuclear Generating Plant (PINGP) Technical Specifications Bases.

2.2 Background

The current PI ISFSI Technical Specifications limit the fuel that may be stored in a TN-40 cask to fuel that had an initial enrichment of ≤ 3.85 wt% U-235 and a burnup of ≤ 45,000 MWd/MTU. However, since 1990 the PINGP has been operating with fuel that has had an initial enrichment of > 3.85 wt% U-235 and has burned the fuel to burnup values greater than the 45,000 MWd/MTU limit.

To accommodate dry storage of fuel with higher initial enrichment and the increase in decay heat associated with the increase in burnup, the TN-40 cask design has been modified. The modifications include an improved heat transfer basket design that relies upon slotted aluminum and neutron poison plates, thicker stainless steel fuel compartment walls, stainless steel support bars between the fuel compartment walls, and an increase in the neutron poison loading. The construction and materials of the modified basket are very similar to the previously approved basket design in 10 CFR Part 72.214, Certificate Number: 1027, "TN-68 dry cask", Reference 1. To maintain the loaded cask weight within the Auxiliary Building Crane capacity rating, the increase in weight due to the basket modifications was offset by reducing the thickness of the radial gamma shield, bottom gamma shield, and lid outer plate. To reduce the neutron dose associated with the increase in burnup, the thickness of the radial neutron shield was increased.

The changes being made to the TN-40 cask design are such that the TN-40HT cask will use the existing equipment for lifting, loading, and transporting the cask.

To improve plant operator usage of the Technical Specifications, this amendment request reformats the Technical Specifications to the format adopted for the PINGP Technical Specifications.

With the TN-40HT cask design and the Technical Specifications proposed in this LAR, the PI ISFSI will continue to operate safely and the health and welfare of the public is protected.

3. TECHNICAL EVALUATION

PINGP is a two unit plant located on the right bank of the Mississippi River approximately 6 miles northwest of the city of Red Wing, Minnesota. The facility is owned by Northern States Power Company (NSP) and operated by NMC. Each unit at PINGP employs a two-loop pressurized water reactor designed and supplied by Westinghouse Electric Corporation. The initial PINGP application for a Construction Permit and Operating License was submitted to the Atomic Energy Commission (AEC) in April 1967. The Final Safety Analysis Report (FSAR) was submitted for application of an Operating License in January 1971. Unit 1 began commercial operation in December 1973 and Unit 2 began commercial operation in December 1974.

The PI ISFSI is located on the PINGP site and is operated under a site specific license. The licensing basis for the TN-40 dry cask system design is an integral part of the site specific license.

TN-40HT Dry Cask Description

The TN-40HT cask is very similar in design to the TN-40 cask. The major difference is that the TN-40HT cask is designed to store higher enrichment and higher burnup fuel. In order to accomplish this, the heat transfer capability of the basket design was enhanced. Additionally, to accommodate the enhanced basket, some minor changes were made to the cask body. The TN-40HT cask employs a slightly thinner lid, shield shell and cask bottom shield. However, the radial neutron shield thickness is increased to offset the higher neutron source of the high burnup fuel.

The TN-40HT cask accommodates up to 40, 14x14 Pressurized Water Reactor fuel assemblies with or without fuel inserts. It consists of the following components:

- A basket assembly which locates and supports the fuel assemblies, transfers heat to the cask body wall, and provides neutron absorption to satisfy nuclear criticality requirements.
- A containment vessel including a bolted closure lid and seals which provides radioactive material confinement and a cavity with an inert gas atmosphere.
- Gamma shielding surrounding the containment vessel.
- Radial neutron shielding surrounding the shield shell which provides additional radiation shielding. This neutron shielding is enclosed in an outer steel shell.
- A top neutron shield which is attached to the outer surface of the cask lid and provides additional neutron shielding.
- An overpressure system which monitors and maintains the pressure between the cask closure seals and provides a positive pressure differential across the inner seals so that any inner seal leak will result in inleakage to the cask cavity.
- A protective cover which provides weather protection for the closure lid, top neutron shield and overpressure system.
- Sets of upper and lower trunnions which provide the means for lifting and rotating the cask.

The maximum allowable initial enrichment of the fuel to be stored in a TN-40HT cask is 5.0 wt% U-235. The maximum bundle average burnup, maximum decay heat, and minimum cooling time are 60,000 MWd/MTU, 0.80 kW/assembly, and 12 years, respectively. The cask is designed for a maximum heat load of 32 kW.

TN-40HT Design Information

The details of the TN-40HT design and analyses are summarized in Attachment 6, which will become Addendum A of the PI ISFSI SAR. Addendum A follows the organizational format of the PI ISFSI SAR to the maximum extent practical. For example, Section 3.3.2.2.1 of the SAR contains the discussion of thermal models used to analyze the TN-40 cask design, and Section A3.3.2.2.1 of Addendum A contains the discussion of the thermal models used to analyze the TN-40HT cask design. This approach segregates the TN-40HT design basis information from the TN-40 information, and will aid site personnel that are familiar with the PI ISFSI SAR format in finding TN-40HT design information.

For those sections in the PI ISFSI SAR that are independent of cask design or that are also applicable to the TN-40HT cask, a statement indicating such is placed in the corresponding section in Addendum A. For example, the description of the PI ISFSI site contained in Section 2.1.2 of the SAR is independent of the cask design stored within the ISFSI. Thus Addendum Section A2.1.2 states "The information in Section 2.1.2 is independent of cask design." This enables the section numbering within Addendum A to remain consistent with that in the body of the SAR.

Following the same organizational format for Addendum A as used in the body of the SAR also provides a means to ensure that all current licensing basis considerations described in the SAR are addressed for the TN-40HT cask design.

Proposed Technical Specifications Changes

This LAR proposes to revise the PI ISFSI Technical Specifications to incorporate operating restrictions associated with the TN-40HT dry cask system, e.g., fuel enrichment and burnup limits. In addition, the proposed changes include changing the format of the Technical Specifications to be consistent with the current format adopted for the PINGP Technical Specifications. As part of the reformatting effort, NUREG-1745 (Reference 2) was reviewed, and where practical, the NUREG was incorporated.

Where the current licensing basis requirements can safely be applied to operation of a TN-40HT dry cask system, the proposed Technical Specifications do not change the technical requirements. However, where operation of the TN-40HT system requires a more restrictive requirement and the more restrictive requirement will not unduly affect operations of a TN-40 cask system, the proposed Technical Specifications are written such that the more restrictive requirement will apply to both the TN-40 and the TN-40HT dry cask systems. For those few circumstances where it is not possible to have a single requirement that is appropriate for both a TN-40 and TN-40HT system, the proposed Technical Specifications are written such that the requirement for each cask design system is clear.

The LAR also proposes to completely reformat the Technical Specifications to improve plant operator usage by adopting industry Technical Specification format standards. These reformatted Technical Specifications will facilitate continued safe cask and storage facility operations through clarity of requirements and conformance with the format and rules of usage of the PINGP Technical Specifications.

The proposed revised Technical Specifications are shown in Attachment 1 to this enclosure. For each current Technical Specification Limiting Condition for Operation (LCO), Action, and Surveillance Requirement, Attachment 3 to this enclosure provides a cross reference to the corresponding proposed revised Technical Specification LCO, Action, or Surveillance Requirement.

Technical Basis for Change

The technical basis for the proposed changes associated with the TN-40HT cask design is contained in Attachment 6 which will become SAR Addendum A. The information in Attachment 6 shows that the TN-40HT dry cask system meets the applicable requirements set forth in 10 CFR Part 72.

The technical basis for reformatting the current Technical Specifications are provided in Attachment 3.

Conclusions

This license amendment request proposes to modify the TN-40 cask design designated as TN-40HT, revise the Technical Specifications as required to ensure the safe operation of the modified system, and reformat the Technical Specifications. Attachment 6 shows that the TN-40HT dry cask system meets the applicable requirements set forth in 10 CFR Part 72 for safe operation of a dry cask system under a site specific license. The proposed Technical Specifications contain the necessary requirements to ensure that the TN-40HT system will be operated safely and consistent with the design analyzed in Attachment 6. The reformatting of the current Technical Specifications maintains or increases the level of safety.

Operation of the PI ISFSI with the TN-40HT dry cask system and the revised Technical Specifications will continue to protect the health and safety of the public.

4. REGULATORY SAFETY ANALYSIS

4.1 Applicable Regulatory Requirements/Criteria

Title 10 Code of Federal Regulations (CFR) 72.44, "License Conditions"

Title 10 CFR 72.44 states, "(c) Each license issued under this part must include technical specifications. Technical specifications must include requirements in the following categories . . . ". This regulation requires Technical Specifications to include: 1) functional and operating limits and monitoring instruments and limiting control settings; 2) limiting conditions; 3) surveillance requirements; 4) design features; and 5) administrative controls. Currently the Prairie Island Independent Spent Fuel Storage Installation has Technical Specifications which were issued by the Nuclear Regulatory Commission and comply with these regulatory requirements. This license amendment request proposes changes to the TN-40 cask design which involves changes to the Technical Specifications. Since this amendment requires Technical Specification changes, this amendment request further proposes to completely reformat the Technical Specifications to improve plant operator usage by adopting industry Technical Specification format standards. These reformatted Technical Specifications will facilitate continued safe cask and storage facility operations through clarity of requirements and conformance with the format and rules of usage of the Prairie Island Nuclear Generating Plant Technical Specifications.

Thus with the changes proposed in this license amendment request, the requirements of Title 10 CFR 72.44 continue to be met.

10 CFR Part 72, Subpart F--General Design Criteria

Subpart F of 10 CFR 72 provides general criteria for storage of high level nuclear wastes of which some apply to independent spent fuel storage facilities. The Prairie Island Independent Spent Fuel Storage Installation comprises storage of dry spent fuel casks within a licensed storage facility. Since this license amendment request proposes to modify only the cask design, criteria applicable to the facility are not affected by this amendment. Also, the cask modifications and this amendment do not change the loading and handling operations described in Section 5 of the Prairie Island Independent Spent Fuel Storage Installation Safety Analysis Report. Table 1 below lists the sections of Part 72 which contain general criteria and identifies if the section is affected by the changes proposed in this amendment request. For those sections which are affected, more detailed discussion is provided below.

Table 1
Criteria Sections Affected by the TN-40 Design Modifications

Regulation	Title	Affected by this Amendment
72.120	General consideration	No
72.122	Overall requirements	Yes
72.124	Criteria for nuclear criticality safety	Yes
72.126	Criteria for radiological protection	Yes
72.128	Criteria for spent fuel, high-level radioactive waste, and other radioactive waste storage and handling	Yes
72.130	Criteria for decommissioning	No

72.122 Overall requirements

This Section defines criteria applicable to dry spent fuel storage casks with respect to quality standards, protection against environmental conditions and natural phenomena, fires and explosions, confinement barriers and systems, instrumentation and controls, and retrievability. Quality standards have been, or will be, applied to the design, fabrication and testing of the new casks. The modified cask has been designed to meet the applicable criteria for protection against environmental conditions and natural phenomena, fires and explosions, and confinement barriers and systems. The modified casks will be equipped with appropriate instrumentation and controls which meet the applicable criteria. The casks are designed to accommodate the removal of the spent fuel and thus the criterion for retrievability is met.

72.124 Criteria for nuclear criticality safety

The modified cask has been design to prevent criticality in accordance with the applicable criteria in this Section.

72.126 Criteria for radiological protection

The modified cask has been design to control radiation exposure through the use of shielding in accordance with the applicable criteria in this Section.

72.128 Criteria for spent fuel, high-level radioactive waste, and other radioactive waste storage and handling

The modified cask has been design to ensure adequate safety under normal and accident conditions in accordance with the applicable criteria in this Section.

Thus with the changes proposed in this license amendment request, the requirements of Title 10 CFR Part 72, Subsection F continue to be met.

4.2 Conclusions

In conclusion, based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

5. REFERENCES

1. 10 CFR Part 72.214
   Certificate Number: 1027.
   Initial Certificate Effective Date: May 30, 2000
   Amendment Number 1 Effective Date: October 30, 2007
   SAR Submitted by: Transnuclear, Inc.
   SAR Title: Final Safety Analysis Report for the TN-68 Dry Storage Cask.
   Docket Number: 72-1027.
   Certificate Expiration Date: May 28, 2020.
   Model Number: TN-68.

2. NUREG-1745 "Standard Format and Content for Technical Specifications for 10 CFR Part 72 Casks Certificates of Compliance", Published June 2001.

ENCLOSURE 3

ATTACHMENT 1

PI ISFSI TECHNICAL SPECIFICATIONS

54 Pages Follow

1.0 USE AND APPLICATION

1.1 Definitions

----------NOTE----------
The defined terms of this section appear in capitalized type and are applicable throughout these Technical Specifications and Bases.

Term	Definition
ACTIONS	ACTIONS shall be that part of a Specification that prescribes Required Actions to be taken under designated Conditions within specified Completion Times.
CHANNEL OPERATIONAL TEST (COT)	A COT shall be the injection of a simulated or actual signal into the channel as close to the sensor output as practicable to verify the operability of required alarm functions. The COT shall include adjustments, as necessary, of the required alarm setpoint so that the setpoint is within the required range and accuracy.
LOADING OPERATIONS	LOADING OPERATIONS include all licensed activities on a cask while it is being loaded with fuel assemblies. LOADING OPERATIONS begin when the first fuel assembly is placed in the cask and end when the cask is supported by the transporter.
STORAGE OPERATIONS	STORAGE OPERATIONS include all licensed activities that are performed at the Independent Spent Fuel Storage Installation (ISFSI) while a cask containing one or more spent fuel assemblies is sitting on a storage pad within the ISFSI.
TRANSPORT OPERATIONS	TRANSPORT OPERATIONS include all licensed activities performed on a cask loaded with one or more spent fuel assemblies when it is being moved to or from the ISFSI. TRANSPORT OPERATIONS begin when the cask is first suspended from the transporter and end when the cask is at its destination and no longer supported by the transporter.

1.1 Definitions (continued)

UNDAMAGED FUEL ASSEMBLIES

In TN-40 casks, UNDAMAGED FUEL ASSEMBLIES are spent nuclear fuel assemblies with:

a. no visible deformation of the fuel rods other than rod bow;

b. no fuel rods are missing, unless dummy rods are used to displace an amount of water equal to or greater than that displaced by the original fuel rod(s);

c. no missing, displaced, or damaged structural components such that radiological or criticality safety is adversely affected (e.g., significantly changed rod pitch);

d. no missing, displaced, or damaged structural components such that the assembly cannot be handled by normal means;

e. no known or suspected cladding defects greater than pinhole leaks or hairline cracks; and

f. no debris such as loose fuel pellets or rod segments.

In TN-40HT casks, UNDAMAGED FUEL ASSEMBLIES are spent nuclear fuel assemblies with:

a. no visible deformation of the fuel rods other than the uniform rod bowing that occurs in the reactor. This refers to bowing that does not significantly open up the lattice spacing;

b. no fuel rods are missing, unless dummy rods are used to displace an amount of water equal to or greater than that displaced by the original fuel rod(s);

c. no missing, displaced, or damaged structural components such that radiological or criticality safety is adversely affected (e.g., significantly changed rod pitch);

1.1 Definitions

UNDAMAGED FUEL ASSEMBLIES (continued)	d.	no missing, displaced, or damaged structural components such that the assembly cannot be handled by normal means;
	e.	no cladding breaches; and
	f.	no debris such as loose fuel pellets or rod segments.
UNLOADING OPERATIONS	UNLOADING OPERATIONS include all licensed activities on a cask while fuel assemblies are being unloaded. UNLOADING OPERATIONS begin when the cask is no longer supported by the transporter and end when the last fuel assembly is removed from the cask.	

1.0 USE AND APPLICATION

1.2 Logical Connectors

PURPOSE

The purpose of this section is to explain the meaning of logical connectors.

Logical connectors are used in Technical Specifications (TS) to discriminate between, and yet connect, discrete Conditions, Required Actions, Completion Times, Surveillances, and Frequencies. The only logical connectors that appear in TS are AND and OR. The physical arrangement of these connectors constitutes logical conventions with specific meanings.

BACKGROUND

Several levels of logic may be used to state Required Actions. These levels are identified by the placement (or nesting) of the logical connectors and by the number assigned to each Required Action. The first level of logic is identified by the first digit of the number assigned to a Required Action and the placement of the logical connector in the first level of nesting (i.e., left justified with the number of the Required Action). The successive levels of logic are identified by additional digits of the Required Action number and by successive indentations of the logical connectors.

When logical connectors are used to state a Condition, Completion Time, Surveillance, or Frequency, only the first level of logic is used, and the logical connector is left justified with the statement of the Condition, Completion Time, Surveillance, or Frequency.

1.2 Logical Connectors (continued)

EXAMPLES The following examples illustrate the use of logical connectors.

EXAMPLE 1.2-1

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met.	A.1 Verify . . . AND A.2 Restore . . .	

In this example the logical connector AND is used to indicate that when in Condition A, both Required Actions A.1 and A.2 must be completed.

1.2 Logical Connectors

EXAMPLES (continued)

EXAMPLE 1.2-2

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met.	A.1 Stop . . . OR A.2.1 Verify . . . AND A.2.2.1 Reduce . . . OR A.2.2.2 Perform . . . OR A.3 Remove . . .	

This example represents a more complicated use of logical connectors. Required Actions A.1, A.2, and A.3 are alternative choices, only one of which must be performed as indicated by the use of the logical connector OR and the left justified placement. Any one of these three Actions may be chosen. If A.2 is chosen, then both A.2.1 and A.2.2 must be performed as indicated by the logical connector AND. Required Action A.2.2 is met by performing A.2.2.1 or A.2.2.2. The indented position of the logical connector OR indicates that A.2.2.1 and A.2.2.2 are alternative choices, only one of which must be performed.

1.0 USE AND APPLICATION

1.3 Completion Times

PURPOSE	The purpose of this section is to establish the Completion Time convention and to provide guidance for its use.
BACKGROUND	Limiting Conditions for Operation (LCOs) specify minimum requirements for ensuring safe operation of the cask. The ACTIONS associated with an LCO state Conditions that typically describe the ways in which the requirements of the LCO can fail to be met. Specified with each stated Condition are Required Action(s) and Completion Time(s).
DESCRIPTION	The Completion Time is the amount of time allowed for completing a Required Action. It is referenced to the time of discovery of a situation (e.g., inoperable equipment or variable not within limits) that requires entering an ACTIONS Condition unless otherwise specified, providing the cask is in a specified condition stated in the Applicability of the LCO. Required Actions must be completed prior to the expiration of the specified Completion Time. An ACTIONS Condition remains in effect and the Required Actions apply until the Condition no longer exists or the cask is not within the LCO Applicability. Once a Condition has been entered, subsequent subsystems, components, or variables expressed in the Condition, discovered to be not within limits, will <u>not</u> result in separate entry into the Conditions unless specifically stated. The Required Actions of the Condition continue to apply to each additional failure, with Completion Times based on initial entry into the Condition.

1.3 Completion Times (continued)

EXAMPLES

The following examples illustrate the use of Completion Times with different types of Conditions and changing Conditions.

EXAMPLE 1.3-1

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required Action and associated Completion Time not met.	B.1 Perform Required Action B.1.	12 hours
	AND	
	B.2 Perform Required Action B.2.	36 hours

Condition B has two Required Actions. Each Required Action has its own separate Completion Time. Each Completion Time is referenced to the time that Condition B is entered.

The Required Actions of Condition B are to complete Required Action B.1 within 12 hours AND to complete Required Action B.2 within 36 hours. A total of 12 hours is allowed for completing Required Action B.1 and a total of 36 hours (not 48 hours) is allowed for completing Required Action B.2 from the time that Condition B was entered. If Required Action B.1 is completed within 6 hours, the time allowed for completing Required Action B.2 is the next 30 hours because the total time allowed for completing Required Action B.2 is 36 hours.

1.3 Completion Times

EXAMPLES (continued)

EXAMPLE 1.3-2

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One system not within limit.	A.1 Restore system to within limit.	7 days
B. Required Action and associated Completion Time not met.	B.1 Perform Action B.1. AND B.2 Perform Action B.2.	12 hours 36 hours

When a system is determined to not meet the LCO, Condition A is entered. If the system is not restored to within the LCO limit within 7 days, Condition B is also entered and the Completion Time clocks for Required Actions B.1 and B.2 start. If the system is restored after Condition B is entered, Condition A and B are exited, and therefore, the Required Actions of Condition B may be terminated.

EXAMPLE 1.3-3

Example 1.3-3 is not applicable to the ISFSI.

EXAMPLE 1.3-4

Example 1.3-4 is not applicable to the ISFSI.

1.3 Completion Times

EXAMPLES (continued)

EXAMPLE 1.3-5

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each cask.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met.	A.1 Perform Action A.1.	4 hours
B. Required Action and associated Completion Time not met.	B.1 Perform Action B.1. AND B.2 Perform Action B.2.	12 hours 36 hours

The Note above the ACTIONS Table is a method of modifying how the Completion Time is tracked. If this method of modifying how the Completion Time is tracked was applicable only to a specific Condition, the Note would appear in that Condition rather than at the top of the ACTIONS Table.

The Note allows Condition A to be entered separately for each cask, and Completion Times tracked on a per cask basis. When a cask does not meet the LCO, Condition A is entered and its Completion Time starts. If subsequent casks are determined not to meet the LCO, Condition A is entered for each cask and separate Completion Times start and are tracked for each cask.

1.3 Completion Times

EXAMPLES (continued)	EXAMPLE 1.3-6 Example 1.3-6 is not applicable to the ISFSI. EXAMPLE 1.3-7 Example 1.3-7 is not applicable to the ISFSI
IMMEDIATE COMPLETION TIME	When "Immediately" is used as a Completion Time, the Required Action should be pursued without delay and in a controlled manner.

1.0 USE AND APPLICATION

1.4 Frequency

PURPOSE

The purpose of this section is to define the proper use and application of Frequency requirements.

DESCRIPTION

Each Surveillance Requirement (SR) has a specified Frequency in which the Surveillance must be met in order to meet the associated Limiting Condition for Operation (LCO). An understanding of the correct application of the specified Frequency is necessary for compliance with the SR.

The "specified Frequency" is referred to throughout this section and each of the Specifications of Section 3.0, Surveillance Requirement (SR) Applicability. The "specified Frequency" consists of the requirements of the Frequency column of each SR as well as certain Notes in the Surveillance column that modifies performance requirements.

Sometimes special situations dictate when the requirements of a Surveillance are to be met. They are "otherwise stated" conditions allowed by SR 3.0.1. They may be stated as clarifying Notes in the Surveillance, as part of the Surveillance, or both.

Situations where a Surveillance could be required (i.e., its Frequency could expire), but where it is not possible or not desired that it be performed until sometime after the associated LCO is within its Applicability, represent potential SR 3.0.4 conflicts. To avoid these conflicts, the SR (i.e., the Surveillance or the Frequency) is stated such that it is only "required" when it can be and should be performed. With an SR satisfied, SR 3.0.4 imposes no restriction.

The use of "met" or "performed" in these instances conveys specific meanings. A Surveillance is "met" only when the acceptance criteria are satisfied. Known failure of the requirements of a Surveillance,

1.4 Frequency

DESCRIPTION (continued)

even without a Surveillance specifically being "performed," constitutes a Surveillance not "met." "Performance" refers only to the requirement to specifically determine the ability to meet the acceptance criteria

Some Surveillances contain notes that modify the frequency of performance or the conditions during which the acceptance criteria must be satisfied. For these Surveillances, the Applicability-entry restrictions of SR 3.0.4 may not apply. Such a Surveillance is not required to be performed prior to entering the specified condition in the Applicability of the associated LCO if any of the following three conditions are satisfied.

a. The Surveillance is not required to be met in the specified condition to be entered; or

b. The Surveillance is required to be met in the specified condition to be entered, but has been performed within the specified Frequency (i.e., it is current) and is known not to be failed; or

c. The Surveillance is required to be met, but not performed, in the specified condition to be entered, and is known not to be failed.

Examples 1.4-3 and 1.4-6 discuss these special situations.

1.4 Frequency (continued)

EXAMPLES

The following examples illustrate the various ways that Frequencies are specified.

EXAMPLE 1.4-1

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Verify pressure within limit.	12 hours

Example 1.4-1 contains the type of SR most often encountered in the Technical Specifications (TS). The Frequency specifies an interval (12 hours) during which the associated Surveillance must be performed at least one time. Performance of the Surveillance initiates the subsequent interval. Although the Frequency is stated as 12 hours, an extension of the time interval to 1.25 times the stated Frequency is allowed by SR 3.0.2 for operational flexibility. The measurement of this interval continues at all times, even when the SR is not required to be met per SR 3.0.1 (such as when the equipment is determined to not meet the LCO, a variable is outside specified limits, or the facility is outside the Applicability of the LCO). If the interval specified by SR 3.0.2 is exceeded while the facility is in a condition specified in the Applicability of the LCO, and the performance of the Surveillance is not otherwise modified (refer to Example 1.4-3), then SR 3.0.3 becomes applicable.

If the interval as specified by SR 3.0.2 is exceeded while the facility is not in a condition specified in the Applicability of the LCO for which performance of the SR is required, the Surveillance must be performed within the Frequency requirements of SR 3.0.2 prior to entry into the specified condition. Failure to do so would result in a violation of SR 3.0.4.

1.4 Frequency

EXAMPLES (continued)

EXAMPLE 1.4-2

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Verify flow is within limits.	Once within 12 hours prior to starting activity AND 24 hours thereafter

Example 1.4-2 has two Frequencies. The first is a one time performance Frequency, and the second is of the type shown in Example 1.4-1. The logical connector "AND" indicates that both Frequency requirements must be met. Each time the example activity is to be performed, the Surveillance must be performed within 12 hours prior to starting the activity.

The use of "once" indicates a single performance will satisfy the specified Frequency (assuming no other Frequencies are connected by "AND"). This type of Frequency does not qualify for the 25% extension allowed by SR 3.0.2.

"Thereafter" indicates future performances must be established per SR 3.0.2, but only after a specified condition is first met (i.e., the "once" performance in this example). If the specified activity is canceled or not performed, the measurement of both intervals stops. New intervals start upon preparing to restart the specified activity.

1.4 Frequency

EXAMPLES (continued)

EXAMPLE 1.4-3

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
----------NOTE---------- Not required to be performed until 24 hours after first completion of SR 3.1.5.2. ---------- Verify cask interseal helium pressure $\geq$ 30 psig.	24 hours

The interval continues, whether or not SR 3.1.5.2 has been performed.

As the Note modifies the required performance of the Surveillance, it is construed to be part of the "specified Frequency." Should the 24 hour interval be exceeded prior to the completion of SR 3.1.5.2, this Note allows 24 hours after SR 3.1.5.2 to perform the Surveillance. The Surveillance is still considered to be performed within the "specified Frequency." Therefore, if the Surveillance were not performed within the 24 hour (plus the extension allowed by SR 3.0.2) interval, but SR 3.1.5.2 has not been completed, it would not constitute a failure of the SR or failure to meet the LCO. Also, no violation of SR 3.0.4 occurs when entering STORAGE OPERATIONS (the assumed Applicability of the associated LCO), even with the 24 hour Frequency not met.

Once SR 3.1.5.2 has been completed, 24 hours would be allowed for completing the Surveillance. If the Surveillance were not performed within this 24 hour interval, there would then be a failure to perform a Surveillance within the specified Frequency, and the provisions of SR 3.0.3 would apply.

1.4 Frequency

EXAMPLES (continued)

EXAMPLE 1.4-4

Example 1.4-4 is not applicable to the ISFSI.

EXAMPLE 1.4-5

Example 1.4-5 is not applicable to the ISFSI.

EXAMPLE 1.4-6

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
----------NOTE---------- Not required to be met prior to the specified Frequency. ---------- Verify the cask helium leak rate is $\leq$ 1.0 E-5 atm-cc/sec.	Once prior to TRANSPORT OPERATIONS

Example 1.4-6 specifies that the requirements of this Surveillance do not have to be met until required by the specified Frequency i.e., TRANSPORT OPERATIONS (the assumed Applicability of the associated LCO is LOADING OPERATIONS). The interval measurement for the Frequency of this Surveillance continues at all times, as described in Example 1.4-1. However, the Note constitutes an "otherwise stated" exception to the Applicability of this Surveillance. Therefore, until required by the specified Frequency, there is neither failure of the SR nor failure to meet the LCO per SR 3.0.1. Therefore, no violation of SR 3.0.4 occurs when entering the Applicability of the associated LCO, e.g., entering LOADING OPERATIONS.

2.0 FUNCTIONAL AND OPERATING LIMITS

2.1 Fuel Characteristics for Fuel Stored in a TN-40 or TN-40HT Cask

a. Fuel shall be unconsolidated UNDAMAGED FUEL ASSEMBLIES;

b. Fuel shall be irradiated at the Prairie Island Nuclear Generating Plant Units 1 or 2;

c. Fuel shall be limited to fuel types:

   i. Westinghouse 14X14 Standard,
   ii. Exxon 14X14 Standard (includes high burnup standard),
   iii. Exxon 14X14 TOPROD, and
   iv. Westinghouse 14X14 OFA (including VANTAGE+);

d. Fuel may include burnable poison rod assemblies (BPRAs) provided:

   i. the BPRA has cooled for ≥ 18 years,
   ii. the cask average cumulative burnup of the fuel assembly(s) where the BPRA(s) resided during reactor operation shall be ≤ 30,000 MWd/MTU;

e. Fuel may include thimble plug devices (TPDs) provided:

   i. the TPD has cooled for a minimum of 16 years,
   ii. the cask average cumulative burnup of the fuel assembly(s) where the TPD(s) resided during reactor operation shall be ≤ 125,000 MWd/MTU;

f. The combined weight of a fuel assembly and any BPRA or TPD shall be < 1330 lbs;

g. The combined weight of all fuel assemblies, BPRAs, and TPDs stored in a single cask shall be < 52,000 lbs; and

h. The number of assemblies stored shall be ≤ 40.

2.0 FUNCTIONAL AND OPERATING LIMITS (continued)

2.2 Additional Fuel Characteristics for Fuel Stored in a TN-40 Cask

a. The initial enrichment shall be ≤ 3.85 weight percent U-235;

b. The assembly average burnup shall be ≤ 45,000 MWd/MTU;

c. The cooling time prior to loading shall be ≥10 years; and

d. The maximum combined heat load of an assembly and any associated BPRA or TPD shall be < 675 Watts.

2.3 Additional Fuel Characteristics for Fuel Stored in a TN-40HT Cask

a. The initial enrichment shall be ≤ 5.0 weight percent U-235;

b. The assembly average burnup shall be:

Initial percent U-235 (%)	Assembly Average Burnup (MWd/MTU)
Enrichment < 3.4	≤ 44,000
3.4 ≤ Enrichment ≤ 5.0	≤ 60,000

c. The cooling time prior to loading shall ≥ 12 years;

d. The combined heat load of an assembly and any associated BPRA or TPD shall be ≤ 800 Watts. The following formula shall be used to determine the heat load of an assembly:

2.0 FUNCTIONAL AND OPERATING LIMITS

2.3 Additional Fuel Characteristics for Fuel Stored in a TN-40HT Cask (continued)

$$\text{Heat load} = F * e^{\left(-0.309*\left(1-\frac{12}{C}\right)*\left(\frac{C}{B}\right)^{0.431}*\left(\frac{E}{B}\right)^{-0.374}\right)}$$

Where :

$$F = 18.76 + (11.27 * B) + (6.506 * E) + (0.163 * B^2) + (-1.826 * B * E) + (6.617 * E^2)$$

B is the assembly average burnup in GWd/MTU

E is initial enrichment in wt. % U-235

C is cooling time in years

2.4 Functional and Operating Limits Violations

If any Functional and Operating Limit of 2.1, 2.2, or 2.3 is violated, the following actions shall be completed.

2.4.1 The affected fuel assemblies shall be removed from the cask;

2.4.2 Within 24 hours, notify the NRC Operations Center; and

2.4.3 Within 30 days, submit a special report which describes the cause of the violation and the actions taken to restore compliance and prevent recurrence.

3.0 LIMITING CONDITION FOR OPERATION (LCO) APPLICABILITY

LCO 3.0.1 LCOs shall be met during specified conditions in the Applicability, except as provided in LCO 3.0.2.

LCO 3.0.2 Upon discovery of a failure to meet an LCO, the Required Actions of the associated Conditions shall be met, except as provided in LCO 3.0.5.

If the LCO is met or is no longer applicable prior to expiration of the specified Completion Time(s), completion of the Required Action(s) is not required unless otherwise stated.

LCO 3.0.3 When an LCO is not met and the associated ACTIONS are not met, or an associated ACTION is not provided, within 4 hours actions shall be initiated to:

a. implement appropriate compensatory actions as needed;

b. verify that the cask is not in an unanalyzed condition or that a required safety function is not compromised; and

c. within 24 hours, obtain Shift Manager approval of the compensatory actions and plan for exiting LCO 3.0.3.

Where corrective measures are completed that permit operation in accordance with the LCO or ACTIONS, completion of the actions required by LCO 3.0.3 is not required.

3.0 LCO APPLICABILITY (continued)

LCO 3.0.4 When an LCO is not met, entry into a specified condition in the Applicability shall only be made:

a. when the associated ACTIONS to be entered permit continued operation in the specified condition in the Applicability for an unlimited period of time;

b. after performance of a risk assessment addressing inoperable systems and components, consideration of the results, determination of the acceptability of entering the specified condition in the Applicability, and establishment of risk management actions, if appropriate; exceptions to this Specification are stated in the individual Specifications, or

c. when an allowance is stated in the individual value, parameter, or other Specification.

This Specification shall not prevent changes in specified conditions in the Applicability that are required to comply with ACTIONS or that are related to the unloading of a cask.

LCO 3.0.5 Equipment removed from service or not in service in compliance with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate it meets the LCO or that other equipment meets the LCO. This is an exception to LCO 3.0.2 for the system returned to service under administrative control to perform the testing required to demonstrate that the LCO is met.

3.0 LCO APPLICABILITY (continued)

LCO 3.0.6	Not applicable to the ISFSI.
LCO 3.0.7	Not applicable to the ISFSI.
LCO 3.0.8	Not applicable to the ISFSI.
LCO 3.0.9	Not applicable to the ISFSI.

3.0 SURVEILLANCE REQUIREMENT (SR) APPLICABILITY

SR 3.0.1

SRs shall be met during the specified conditions in the Applicability for individual LCOs, unless otherwise stated in the SR. Failure to meet a Surveillance, whether such failure is experienced during the performance of the Surveillance or between performances of the Surveillance, shall be failure to meet the LCO. Failure to perform a Surveillance within the specified Frequency shall be failure to meet the LCO except as provided in SR 3.0.3. Surveillances do not have to be performed on inoperable equipment or variables outside specified limits.

SR 3.0.2

The specified Frequency for each SR is met if the Surveillance is performed within 1.25 times the interval specified in the Frequency, as measured from the previous performance or as measured from the time a specified condition of the Frequency is met.

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

If a Completion Time requires periodic performance on a "once per . . ." basis, the above Frequency extension applies to each performance after the initial performance.

Exceptions to this Specification are stated in the individual Specifications.

3.0 SR APPLICABILITY (continued)

SR 3.0.3

If it is discovered that a Surveillance was not performed within its specified Frequency, then compliance with the requirement to declare the LCO not met may be delayed, from the time of discovery, up to 24 hours or up to the limit of the specified Frequency, whichever is greater. This delay period is permitted to allow performance of the Surveillance. A risk evaluation shall be performed for any Surveillance delayed greater than 24 hours and the risk impact shall be managed.

If the Surveillance is not performed within the delay period, the LCO must immediately be declared not met, and the applicable Condition(s) must be entered.

When the Surveillance is performed within the delay period and the Surveillance is not met, the LCO must immediately be declared not met, and the applicable Condition(s) must be entered.

SR 3.0.4

Entry into a specified condition in the Applicability of an LCO shall only be made when the LCO's Surveillances have been met within their specified Frequency, except as provided by SR 3.0.3. When an LCO is not met due to Surveillances not having been met, entry into a specified condition in the Applicability shall only be made in accordance with LCO 3.0.4.

This provision shall not prevent entry into specified conditions in the Applicability that are required to comply with ACTIONS or that are related to the unloading of a cask.

3.1 CASK INTEGRITY

3.1.1 Cask Cavity Vacuum Drying

LCO 3.1.1 The cask cavity vacuum drying pressure shall be below the limit.

APPLICABILITY: LOADING OPERATIONS.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each cask.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Cask cavity vacuum drying pressure limit not met.	A.1 Return cask to pool and reflood.	7 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.1.1	----------NOTE---------- Not required to be met prior to the specified Frequency. ---------- Verify that the equilibrium cask cavity vacuum drying pressure is brought to ≤ 10 mbar absolute for ≥ 30 minutes after isolation from the vacuum drying system.	Once prior to helium backfill (SR 3.1.2.2)

3.1 CASK INTEGRITY

3.1.2 Cask Helium Backfill Pressure

LCO 3.1.2 The cask cavity shall be backfilled with helium to within the limits.

APPLICABILITY: LOADING OPERATIONS.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each cask.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Cask initial helium backfill pressure limit not met.	----------NOTE---------- Action A.1 applies until a gas other than helium is introduced into the cask for subsequent operations or the helium is removed for the performance of SR 3.1.1.1. ----------	
	A.1 Initiate action to establish a helium environment in the cask.	Immediately
	AND	
	A.2 Establish cask cavity backfill pressure within limits.	Prior to leak testing (SR 3.1.3.1)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required Action A.1 and associated Completion Time not met.	B.1 Return cask to pool and reflood.	7 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.2.1	----------NOTE---------- Not required to be met prior to the specified Frequency. ---------- Verify that a helium environment has been established in the cask cavity.	Once within 34 hours after commencing cask draining
SR 3.1.2.2	----------NOTE---------- Not required to be met prior to the specified Frequency. ---------- Verify that the cask cavity helium pressure is $\geq$ 1345 mbar absolute and $\leq$ 1445 mbar absolute.	Once prior leak testing (SR 3.1.3.1)

3.1 CASK INTEGRITY

3.1.3 Cask Helium Leak Rate

LCO 3.1.3 The combined helium leak rate for all seals shall be less than the limit.

APPLICABILITY: LOADING OPERATIONS.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each cask.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Cask helium leak rate not met.	A.1 Establish cask helium leak rate within limit.	7 days
B. Required Action A.1 and associated Completion Time not met.	B.1 Return cask to spent fuel pool and reflood.	30 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.3.1	----------NOTE---------- Not required to be met prior to the specified Frequency. ---------- Verify the cask helium leak rate is $\leq$ 1.0 E-5 atm-cc/sec.	Once prior to TRANSPORT OPERATIONS

3.1 CASK INTEGRITY

3.1.4 Cask Safety Status

LCO 3.1.4 The cask exterior surfaces shall be free of damage, deterioration, and debris.

APPLICABILITY: STORAGE OPERATIONS.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each cask.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Significant damage, deterioration, or debris accumulation to cask surface.	A.1 Take appropriate action to return cask to proper operation.	30 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.4.1	Visually verify that there is no significant damage or deterioration of cask exterior surfaces.	92 days
SR 3.1.4.2	Visually verify that there is no significant accumulation of debris on cask exterior surfaces.	92 days

3.1 CASK INTEGRITY

3.1.5 Cask Interseal Pressure

LCO 3.1.5 Cask interseal pressure shall be maintained at a pressure greater than the limit.

APPLICABILITY: STORAGE OPERATIONS.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each cask.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Cask interseal pressure below limit.	A.1 Reestablish cask interseal pressure above limit.	7 days
B. Required Action A.1 and associated Completion Time not met.	B.1 Return cask to spent fuel pool and reflood.	30 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.5.1	----------NOTE---------- Not required to be performed until 24 hours after first completion of SR 3.1.5.2. ---------- Verify cask interseal helium pressure ≥ 30 psig.	24 hours
SR 3.1.5.2	----------NOTE---------- Not required to be met prior to the specified Frequency. ---------- Perform a CHANNEL OPERATIONAL TEST (COT) to verify proper functioning of pressure switch / transducer on cask overpressure system.	Once within 7 days of commencing STORAGE OPERATIONS AND Every 12 months thereafter

3.1 CASK INTEGRITY

3.1.6 Cask Maximum Surface Temperature

LCO 3.1.6 The cask surface temperature shall be less than the limit.

APPLICABILITY: LOADING OPERATIONS.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each cask.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Cask surface temperature above limit.	A.1 Return cask to spent fuel pool and remove all fuel assemblies from the cask.	7 days
	AND	
	A.2 Submit report to NRC Region III office with a copy to Director, Office of Nuclear Material Safety and Safeguards.	30 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.6.1	----------NOTE---------- Not required to be performed prior to the specified Frequency. ---------- Verify outer surface temperature is $\leq$ 250°F.	Once at least 24 hours after commencing cask draining AND Prior to TRANSPORT OPERATIONS

3.2 CASK RADIATION PROTECTION

3.2.1 Cask Surface Contamination

LCO 3.2.1 Removable contamination on the cask exterior surface shall be less than the limits.

APPLICABILITY: LOADING OPERATIONS.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each cask.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Removable contamination on the cask exterior surface exceed a limit.	A.1 Decontaminate cask surfaces to below required levels.	Prior to TRANSPORT OPERATIONS

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.2.1.1	----------NOTE---------- Not required to be met prior to the specified Frequency. ---------- Verify that the removable contamination on the exterior surface of the cask are: a. < 1000 dpm / 100 cm^2 (0.2 Bq / cm^2) from beta and gamma sources; and b. < 20 dpm / 100 cm^2 (0.003 Bq / cm^2) from alpha sources.	Once prior to TRANSPORT OPERATIONS

3.2 CASK RADIATION PROTECTION

3.2.2 Cask Dose Rates

LCO 3.2.2 Dose rates on the cask exterior surfaces shall be less than the limits.

APPLICABILITY: LOADING OPERATIONS.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each cask.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Dose rates on the cask exterior surface exceed a limit.	A.1 Perform specific analysis demonstrating compliance with 10 CFR Part 20, and 10 CFR Part 72 radiation protection requirements.	Prior to TRANSPORT OPERATIONS

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.2.2.1	----------NOTE---------- Not required to be performed prior to the specified Frequency. ---------- Verify that dose rates on the exterior surface of the cask are: a. $\leq$ 45 mrem/hr gamma and $\leq$ 10 mrem/hr neutron at center of top protective cover; b. $\leq$ 80 mrem/hr gamma and $\leq$ 190 mrem/hr neutron between cask flange and side neutron shield; c. $\leq$ 40 mrem/hr gamma and $\leq$ 35 mrem/hr neutron at mid-height of side neutron shield; and d. $\leq$ 85 mrem/hr gamma and $\leq$ 930 mrem/hr neutron between cask bottom and side neutron shield.	Once prior to TRANSPORT OPERATIONS

3.3 CASK CRITICALITY CONTROL

3.3.1 Dissolved Boron Concentration

LCO 3.3.1 The dissolved boron concentration of the water in the spent fuel pool and the water added to the cavity of a cask shall be greater than the limit.

APPLICABILITY: LOADING OPERATIONS and UNLOADING OPERATIONS.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each cask.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Dissolved boron concentration limit not met.	A.1 Initiate actions to suspend loading of fuel assemblies into cask.	Immediately
	AND	
	A.2 Remove all fuel assemblies from cask.	24 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.1.1	Verify dissolved boron concentration limit in spent fuel pool water and water to be added to the cask cavity is ≥ 2450 ppm.	Once within 4 hours prior to LOADING OPERATIONS
SR 3.3.1.2	----------NOTE---------- Not required to be met prior to the specified Frequency. ----------	
	Verify dissolved boron concentration limit in spent fuel pool water and water to be added to the cask cavity is ≥ 2450 ppm.	Once within 4 hours prior to flooding cask for UNLOADING OPERATIONS

3.4 CASK FUEL LOADING CONTROL

3.4.1 Fuel Stored in a cask

LCO 3.4.1 Fuel stored in a cask shall meet the functional and operating limits specified in Specification 2.1 through 2.3.

APPLICABILITY: LOADING OPERATIONS.

ACTIONS

----------NOTE----------
Separate Condition entry is allowed for each cask.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Requirements of LCO not met.	A.1 Initiate action to remove the affected fuel assembly(s) from the cask.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.1.1	----------NOTE---------- Not required to be performed prior to the specified Frequency. ---------- Verify by administrative means that each fuel assembly and fuel assembly insert (BPRA or TPD) satisfies the requirements in Specification 2.1 through 2.3.	Once prior to inserting into cask
SR 3.4.1.2	----------NOTE---------- Not required to be performed prior to the specified Frequency. ---------- Verify the identity of each fuel assembly and fuel assembly insert (BPRA or TPD).	Once prior to inserting into cask <u>AND</u> Once prior to closure of cask

4.0 DESIGN FEATURES

4.1 Design Drawings

The Prairie Island ISFSI design approval was based on use of the TN-40 and TN-40HT storage casks 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.

4.2 Maximum Cask Lifting Height

The casks have been evaluated for drops up to 18 inches. All lifts of a loaded cask greater than 18 inches must be performed with a single-failure-proof system.

4.3 Neutron Poison Loading in the TN-40HT Casks

The minimum areal boron-10 density of the neutron poison plates shall meet that specified in Table 4.3-1. This will ensure that the poison loading is consistent with that assumed in the criticality analysis.

4.4 Codes and Standards for the TN-40HT Casks

The American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section III, 2004 Edition including the 2006 Addenda (the Code), is the governing code for the TN-40HT cask, except that the material properties from later editions of Section II Part D may be used for design. The TN-40HT cask containment boundary is designed, fabricated and inspected in accordance with Subsection NB of the ASME Code to the maximum practical extent. Exceptions to the Code are listed in Table 4.4-1.

The TN-40HT basket is designed, fabricated and inspected in accordance with Subsection NG of the ASME Code to the maximum practical extent. Exceptions to the Code are listed in Table 4.4-1.

The ASME Code requirements apply only to safety related items.

4.0 DESIGN FEATURES

4.4 Codes and Standards for the TN-40HT Casks (continued)

Proposed alternatives to the Code, including exceptions allowed by Table 4.4-1 may be used when authorized by the Director of the Office of Nuclear Material Safety and Safeguards or Designee. Requests for exceptions shall demonstrate that:

1. The proposed alternatives would provide an acceptable level of quality and safety; or

2. Compliance with the specified requirements of the Code would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Requests for exceptions in accordance with this section shall be submitted in accordance with 10 CFR 72.4

TABLE 4.3-1
MINIMUM B10 AREAL CONTENT FOR TN-40HT FIXED POISON PLATES

Minimum Areal B10 Content for Boral® (mg/cm^2)	Minimum Areal B10 Content for B-Al[(a)] (mg/cm^2)
45.0	37.5

(a) B-Al = Metal Matrix Composites and Borated Aluminum Alloys.

TABLE 4.4-1
TN-40HT ASME CODE EXCEPTIONS
(Page 1 of 4)

Component	Reference ASME Code/Section	Code Requirement	Alternatives, Justification & Compensatory Measures
TN-40HT Cask, Basket	NB/NF/ NG-1100 NB/NF/ NG-2130 NB/NF/ NG-4121	Stamping and preparation of reports by the Certificate Holder, Use of ASME Certificate Holders	The TN-40HT cask is not stamped, nor is there a code design specification or stress report generated. A design criteria document is generated in accordance with Transnuclear's (TN) Quality Assurance (QA) Program and the design and analysis is performed under TN's QA Program. The cask may also be fabricated by other than N-stamp holders and materials may be supplied by other than ASME Certificate holders.
TN-40HT Cask, Basket	NCA	All	Not compliant with NCA. TN Quality Assurance requirements, which are based on 10 CFR72 Subpart G, are used in lieu of NCA-4000. Fabrication oversight is performed by TN personnel in lieu of an Authorized Nuclear Inspector.
Pressure Test of the Containment Boundary	NB-6000	Hydrostatic testing	The containment vessel is hydrostatically tested in accordance with the requirements of the ASME B&PV Code, Section III, Articles NB-6200 with the exception that some of the containment vessel may be installed in the shield shell during testing. The containment vessel is supported by the shield shell during all design and accident events.
Weld of Bottom Inner Plate to the Containment Shell	NB-5231	Full penetration corner welded joints require the fusion zone and the parent metal beneath the attachment surface to be UT'd after welding	The joint may be welded after the containment shell is shrink-fit into the shield shell. The geometry of the joint does not allow for UT inspection. In this case, the joint will be examined by RT and either PT or MT methods in accordance with ASME subsection NB requirements. If the containment shell is welded complete before shrink fitting, UT examination per NB-5231 will be performed.

TABLE 4.4-1
TN-40HT ASME CODE EXCEPTIONS
(Page 2 of 4)

Component	Reference ASME Code/Section	Code Requirement	Alternatives, Justification & Compensatory Measures
Containment Shell Rolling Qualification	NB-4213	The rolling process used to form the inner vessel should be qualified to determine that the required impact properties of NB-2300 are met after straining by taking test specimens from three different heats	If the plates are made from less than three heats, each heat will be tested to verify the impact properties.
Welds of the Bottom Shield to Shield Shell and Shield Shell to Shell Flange	NB-4243 and NB-5230	Category C weld joints in vessels and similar weld joints in other components shall be full penetration joints. These welds shall be examined by UT or RT and either PT or MT	Certain welds are partial penetration welds. As an alternative to the NDE requirements of NB-5230, for Category C welds, all of these closure welds are multi-layer welds that are progressive PT examined.
Containment Vessel	NB-7000	Vessels are required to have overpressure protection	No overpressure protection is provided. Function of containment vessel is to contain radioactive contents under normal and accident conditions. The containment vessel is designed to withstand maximum internal pressure considering 100% fuel rod failure and maximum accident temperatures.
Containment Vessel, Basket	NB-8000 NG-8000	Requirements for nameplates, stamping and reports per NCA-8000	The TN-40HT cask is to be marked and identified in accordance with 10 CFR 72 requirements. Code stamping is not required. QA data package to be in accordance with TN approved QA program.

TABLE 4.4-1
TN-40HT ASME CODE EXCEPTIONS
(Page 3 of 4)

Component	Reference ASME Code/Section	Code Requirement	Alternatives, Justification & Compensatory Measures
Weld of Shield Plate to Lid Outer Plate	NB-4335 NB-4620	Impact testing of weld and heat affected zone of lid to shield plate Post weld heat treatment	The lid shield plate is not in the component support path, and has no pressure-retaining function; it is a non-structural attachment, and NB jurisdiction does not apply to the plate or weld. The weld must conform to NB-4430.
Gamma Shielding and Trunnion	NB-1132 NF-1132	Attachments in the component support load path and not performing a pressure retaining function shall conform to Subsection NF	The gamma shield shell and trunnions are not fabricated completely in accordance with Subsection NF. The shield shell's primary function is not structural. The weld of the bottom shield plate to the shield shell is subject to multilevel PT or MT to prevent complete loss of the bottom shielding in an accident. Other shield shell weld (shield shell to the shell flange) failures would not lead to loss of shielding. The trunnions and trunnion welds are designed to load factors much higher than those of subsection NF, the trunnion weld is subject to root and final PT or MT, and the trunnions are tested to 1.5 times design load.
Basket Neutron Poison Material	NG-2000	Use of ASME Materials	The basket neutron poison material is not considered in the structural analysis of the basket. The material provides criticality control and adds a heat transfer path. The poison material is not a Code material.

TABLE 4.4-1
TN-40HT ASME CODE EXCEPTIONS
(Page 4 of 4)

Component	Reference ASME Code/Section	Code Requirement	Alternatives, Justification & Compensatory Measures
Basket	NG-3352	Table NG 3352-1 lists the permissible welded joints	The fusion welds between the stainless steel insert plates and the stainless fuel compartment tube are not included in Table NG-3352-1. The required minimum tested capacity of the welded connection (at each side of the tube) shall be 35 kips (at room temperature). The capacity shall be demonstrated by qualification and production testing. ASME Code Section IX does not provide tests for qualification of these types of welds. Therefore, these welds are qualified using Section IX to the degree applicable together with the testing described here. The welds will be visually inspected to confirm that they are located over the insert plates, in lieu of the visual acceptance criteria of NG-5260 which are not appropriate for this type of weld. A joint efficiency (quality) factor of 1.0 is utilized for the fuel compartment longitudinal seam welds. Table NG-3352-1 permits a joint efficiency (quality) factor of 0.5 to be used for full penetration weld examined by ASME Section V visual examination (VT). For the TN-40HT basket, the compartment seam weld is thin (0.188" thick) and the weld will be made in one pass. Both surfaces of weld (inside and outside) will be fully examined by VT and therefore a factor of 2 x 0.5=1.0 will be used in the analysis. This is justified as both surfaces of the single weld pass/layer will be fully examined, and the stainless steel material that comprises the fuel compartment tubes is very ductile.

5.0 ADMINISTRATIVE CONTROLS

5.1 General

The Prairie Island ISFSI is located on the Prairie Island Nuclear Generating Plant site and will be managed and operated by Nuclear Management Company, LLC, 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.

5.2 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). This program shall include the quarterly determination of ISFSI radiation levels from two (2) thermoluminescent dosimeters on the fence at each side of the ISFSI (8 total).

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

5.3 Annual Environmental Report

An annual report, as required by 10 CFR 72.44(d)(3), 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.

5.0 ADMINISTRATIVE CONTROLS (continued)

5.4 Technical Specification Bases Control Program

This program provides a means for processing changes to the Bases of these Technical Specifications.

a. Changes to the Bases of these Technical Specifications shall be made under appropriate administrative controls and reviews;

b. Licensees may make changes to Bases without prior NRC approval provided the changes do not require either of the following;

   1. a change in the Technical Specifications incorporated in the license, or

   2. a change to the ISFSI SAR or Bases that requires NRC approval pursuant to 10 CFR 72.48;

c. The Bases Control Program shall contain provisions to ensure that the Bases are maintained consistent with the ISFSI SAR; and

d. Changes to the Bases implemented without prior NRC approval shall be provided to the NRC on a frequency consistent with the ISFSI SAR updates.

ENCLOSURE 3

ATTACHMENT 2

PI ISFSI TECHNICAL SPECIFICATIONS BASES

49 Pages Follow

B 2.0 FUNCTIONAL AND OPERATING LIMITS

BASES

BACKGROUND

To protect the integrity of the fuel cladding and ultimately the public from radioactive materials in effluents and direct radiation levels associated with cask operation, the TN-40 and TN-40HT storage cask design requires certain criteria and limits to be placed on the spent fuel parameters for the fuel to be stored in a cask. These criteria and parameter limits include fuel type, initial enrichment, maximum burnup, minimum cooling time, and fuel assembly physical condition (i.e., unconsolidated UNDAMAGED FUEL ASSEMBLIES). To limit the associated radiological dose terms from other devices to be stored in casks, i.e., burnable poison rod assemblies (BPRA's) and thimble plug devices (TPD's), similar limitations are placed on BPRA's and TPD's. These criteria and the associated limits are placed on the respective input assumptions used in the thermal, structural, criticality, shielding, and confinement analyses performed for the TN-40 and TN-40HT casks.

APPLICABLE SAFETY ANALYSIS

The applicable safety analyses, as described in the SAR, are the thermal, structural, criticality, shielding, and confinement. The associated Technical Specification criteria and limits are applied to the input assumptions for the specific fuel parameters within these analyses. Within these SAR analyses fuel is considered "Design Bases Fuel" which bounds all specific fuel types to be considered for the TN-40 or TN-40HT. Therefore, the respective SAR analyses do not describe the maximum uranium content for each fuel type. The fuel geometry is determined by the fuel type designation (i.e. 14x14 std, 14x14 TOPROD, 14x14 OFA, etc.).

BASES (continued)

FUNCTIONAL AND OPERATING LIMITS VIOLATIONS

The Functional and Operational Limits are established to protect the integrity of the fuel clad barrier and the public from radioactive materials in effluents and direct radiation levels associated with cask operation. Therefore, all limit violations result in the following ACTIONS.

If Functional and Operating Limit 2.1, 2.2, or 2.3 is violated, the limitations on the fuel assemblies in the cask have not been met. ACTIONS must be taken to place the affected fuel assemblies in a safe condition. This safe condition may be established by returning the affected fuel assemblies to the spent fuel pool.

Any violation of a Functional and Operating Limit is to be reported to the NRC Operations Center within 24 hours and a written report of the violation must be accomplished within 30 days.

B 3.0 LIMITING CONDITION FOR OPERATION (LCO) APPLICABILITY

BASES

LCOs	LCO 3.0.1, 3.0.2, 3.0.3, 3.0.4, and 3.0.5 establish the general requirements applicable to all Specifications and apply at all times, unless otherwise stated.
LCO 3.0.1	LCO 3.0.1 establishes the Applicability statement within each individual Specification as the requirement for when the LCO is required to be met (i.e., when the cask is in the specified conditions of the Applicability statement of each Specification).
LCO 3.0.2	LCO 3.0.2 establishes that upon discovery of a failure to meet an LCO, the associated ACTIONS are required to be met. The Completion Time of each Required Action for an ACTIONS Condition is applicable from the point in time that an ACTIONS Condition is entered. The Required Actions establish those remedial measures that must be taken within specified Completion Times when the requirements of an LCO are not met. This Specification establishes that: a. completion of the Required Actions within the specified Completion Times constitutes compliance with a Specification; and b. completion of the Required Actions is not required when an LCO is met within the specified Completion Time, unless otherwise specified. There are two basic types of Required Actions. The first type of Required Action specifies a time limit in which the LCO must be met. This time limit is the Completion Time to restore a system or component or to restore variables to within specified limits. If this

BASES

LCO 3.0.2 (continued)

type of Required Action is not completed within the specified Completion Time, the cask may have to be placed in the spent fuel pool and unloaded. (Whether stated as a Required Action or not, correction of the entered Condition is an action that may always be considered upon entering ACTIONS.) The second type of Required Action specifies the remedial measures that permit continued operation that is not further restricted by the Completion Time. In this case, compliance with the Required Actions provides an acceptable level of safety for continued operation.

Completing the Required Actions is not required when an LCO is met or is no longer applicable, unless otherwise stated in the individual Specification.

The Completion Times of the Required Actions are also applicable when a system or component is removed from service intentionally. The reasons for intentionally relying on the ACTIONS include, but are not limited to, performance of Surveillances, preventive maintenance, corrective maintenance, or investigation of operational problems. Entering ACTIONS for these reasons must be done in a manner that does not compromise safety. Intentional entry into ACTIONS is not to be made for operational convenience.

Individual Specifications may specify a time limit for performing a Surveillance Requirement (SR) when equipment is removed from service or bypassed for testing. In this case, the Completion Times of the Required Actions are applicable when this time limit expires, if the equipment remains removed from service or bypassed.

When a change in specified condition is required to comply with Required Actions, the cask may enter a specified condition in which another Specification becomes applicable. In this case, the Completion Times of the associated Required Actions would apply from the point in time that the new Specification becomes applicable and the ACTIONS Condition(s) are entered.

BASES (continued)

LCO 3.0.3

LCO 3.0.3 establishes that upon discovery of a failure to meet an LCO and that associated ACTIONS required cannot be met or an associated ACTION to resolve the condition is not provided, the Required Actions of this LCO establish those additional remedial measures that must be taken. These remedial measures provide for the implementation of appropriate compensatory actions to resolve the condition, verification that the cask is not in an unanalyzed condition, verification that required safety functions have not been compromised, and involvement of Plant Operations Management Staff has been included.

LCO 3.0.4

LCO 3.0.4 establishes limitations on changes in specified conditions in the Applicability when an LCO is not met. It allows placing the cask in a specified condition stated in that Applicability (e.g., Applicability desired to be entered) when:

a. conditions are such that the requirements of the LCO would not be met in the Applicability desired to be entered; and

b. continued noncompliance with the LCO requirements, if the Applicability were entered, would result in the cask being required to exit the Applicability desired to be entered to comply with the Required Actions.

Compliance with Required Actions that permit continued operation of the cask for an unlimited period of time in a specified condition provides an acceptable level of safety for continued operation. Therefore, in such cases, entry into a specified condition in the Applicability may be made in accordance with the provisions of the Required Actions. The provisions of this Specification are not to be interpreted as endorsing the failure to exercise the good practice of restoring equipment or variables to within specified limits before entering an associated specified condition in the Applicability.

BASES

LCO 3.0.4 (continued)

The provisions of LCO 3.0.4 are not to prevent changes in specified conditions in the Applicability that are required to comply with ACTIONS. In addition, the provisions of LCO 3.0.4 are not to prevent changes in specified conditions in the Applicability that are related to the unloading of a cask.

Exceptions to LCO 3.0.4 are stated in the individual Specifications. Exceptions may apply to all the ACTIONS or to a specific Required Action of a Specification.

Surveillances do not have to be performed on the associated equipment out of service (or on variables outside the specified limits), as permitted by SR 3.0.1. Therefore, changing specified conditions while in an ACTIONS Condition, either in compliance with LCO 3.0.4 or where an exception to LCO 3.0.4 is stated, is not a violation of SR 3.0.1 or SR 3.0.4 for those Surveillances that do not have to be performed due to the associated out of service equipment.

LCO 3.0.5

LCO 3.0.5 establishes the allowance for restoring equipment to service under administrative controls when it has been removed from service or not in service in compliance with ACTIONS. The sole purpose of this Specification is to provide an exception to LCO 3.0.2 (e.g., to not comply with the applicable Required Action(s)) to allow the performance of required testing to demonstrate:

a. the equipment being returned to service meets the LCO; or

b. other equipment meets the applicable LCOs.

The administrative controls ensure the time the equipment is returned to service in conflict with the requirements of the ACTIONS is limited to the time absolutely necessary to perform the allowed required testing. This Specification does not provide time to perform any other preventive or corrective maintenance.

BASES (continued)

LCO 3.0.6	This specification is not applicable to the ISFSI. The placeholder is retained for consistency with the Prairie Island Nuclear Generating Plant Technical Specifications.
LCO 3.0.7	This specification is not applicable to the ISFSI. The placeholder is retained for consistency with the Prairie Island Nuclear Generating Plant Technical Specifications.
LCO 3.0.8	This specification is not applicable to the ISFSI. The placeholder is retained for consistency with the Prairie Island Nuclear Generating Plant Technical Specifications.
LCO 3.0.9	This specification is not applicable to the ISFSI. The placeholder is retained for consistency with the Prairie Island Nuclear Generating Plant Technical Specifications.

B 3.0 SURVEILLANCE REQUIREMENT (SR) APPLICABILITY

BASES

SRs

SR 3.0.1 through SR 3.0.4 establishes the general requirements applicable to all Specifications and apply at all times, unless otherwise stated.

SR 3.0.1

SR 3.0.1 establishes the requirement that SRs must be met during the specified conditions in the Applicability for which the requirements of the LCO apply, unless otherwise specified in the individual SRs. This Specification is to ensure that Surveillances are performed to verify systems and components, and that variables are within specified limits. Failure to meet a Surveillance within the specified Frequency, in accordance with SR 3.0.2, constitutes a failure to meet an LCO. Surveillances may be performed by means of any series of sequential, overlapping, or total steps provided the entire Surveillance is performed within the specified Frequency. Additionally, the definitions related to instrument testing (e.g., CHANNEL OPERATION TEST) specify that these tests are performed by means of any series of sequential, overlapping, or total steps.

Systems and components are assumed to meet the LCO when the associated SRs have been met. Nothing in this Specification, however, is to be construed as implying that systems or components meet the associated LCO when:

a. the systems or components are known to not meet the LCO, although still meeting the SRs; or

b. the requirements of the Surveillance(s) are known to be not met between required Surveillance performances.

BASES

SR 3.0.1 (continued)

Surveillances do not have to be performed when the cask is in a specified condition for which the requirements of the associated LCO are not applicable, unless otherwise specified. Surveillances, including Surveillances invoked by Required Actions, do not have to be performed on equipment that has been determined to not meet the LCO because the ACTIONS define the remedial measures that apply. Surveillances have to be met and performed in accordance with SR 3.0.2 prior to returning equipment to service.

Upon completion of maintenance, appropriate post maintenance testing is required to declare equipment within its LCO. This includes ensuring applicable Surveillances are not failed and their most recent performance is in accordance with SR 3.0.2. Post maintenance testing may not be possible in the current specified conditions in the Applicability due to the necessary cask parameters not having been established. In these situations, the equipment may be considered to meet the LCO provided testing has been satisfactorily completed to the extent possible and the equipment is not otherwise believed to be incapable of performing its function. This will allow operation to proceed to a specified condition where other necessary post maintenance tests can be completed.

SR 3.0.2

SR 3.0.2 establishes the requirements for meeting the specified Frequency for Surveillances and any Required Action with a Completion Time that requires the periodic performance of the Required Action on a "once per..." interval.

SR 3.0.2 permits a 25% extension of the interval specified in the Frequency. This extension facilitates Surveillance scheduling and considers plant operating conditions that may not be suitable for conducting the Surveillance (e.g., transient conditions or other ongoing Surveillance or maintenance activities).

BASES

SR 3.0.2 (continued)

The 25% extension does not significantly degrade the reliability that results from performing the Surveillance at its specified Frequency. This is based on the recognition that the most probable result of any particular Surveillance being performed is the verification of conformance with the SRs. The exceptions to SR 3.0.2 are those Surveillances for which the 25% extension of the interval specified in the Frequency does not apply. These exceptions are stated in the individual Specifications. The requirements of regulations take precedence over the TS. Therefore, when a test interval is specified in the regulations, the test interval cannot be extended by the TS, and the SR includes a Note in the Frequency stating, "SR 3.0.2 is not applicable".

As stated in SR 3.0.2, the 25% extension also does not apply to the initial portion of a periodic Completion Time that requires performance on a "once per..." basis. The 25% extension applies to each performance after the initial performance. The initial performance of the Required Action, whether it is a particular Surveillance or some other remedial action, is considered a single action with a single Completion Time. One reason for not allowing the 25% extension to this Completion Time is that such an action usually verifies that no loss of function has occurred by checking the status of redundant or diverse components or accomplishes the function of the equipment in an alternative manner.

The provisions of SR 3.0.2 are not intended to be used repeatedly merely as an operational convenience to extend Surveillance intervals or periodic Completion Time intervals beyond those specified.

BASES (continued)

SR 3.0.3

SR 3.0.3 establishes the flexibility to defer declaring affected equipment as not meeting the LCO or an affected variable outside the specified limits when a surveillance has not been completed within the specified Frequency. A delay period of up to 24 hours or up to the limit of the specified Frequency, whichever is greater, applies from the point in time that it is discovered that the Surveillance has not been performed in accordance with SR 3.0.2, and not at the time that the specified Frequency was not met. This delay period provides adequate time to complete Surveillances that have been missed. This delay period permits the completion of a surveillance before complying with Required Actions or other remedial measures that might preclude completion of the Surveillance.

The basis for this delay period includes consideration of facility conditions, adequate planning, availability of personnel, the time required to perform the Surveillance, the safety significance of the delay in completing the required Surveillance, and the recognition that the most probable result of any particular Surveillance being performed is the verification of conformance with the requirements.

When a surveillance with a Frequency based not on time intervals, but upon specified facility conditions or operational situations, is discovered not to have been performed when specified, SR 3.0.3 allows the full delay period of 24 hours to perform the Surveillance.

SR 3.0.3 also provides a time limit for completion of Surveillances that become applicable as a consequence of changes in the specified conditions in the Applicability imposed by Required Actions.

Failure to comply with specified Frequencies for SRs is expected to be an infrequent occurrence. Use of the delay period established by SR 3.0.3 is a flexibility which is not intended to be used as an operational convenience to extend Surveillance intervals.

BASES

SR 3.0.3 (continued)

If a surveillance is not completed within the allowed delay period, then the equipment is considered not in service or the variable is considered outside the specified limits and the Completion Times of the Required Actions for the applicable LCO Conditions begin immediately upon expiration of the delay period. If a surveillance is failed within the delay period, then the equipment is not in service, or the variable is outside the specified limits and the Completion Times of the Required Actions for the applicable LCO Conditions begin immediately upon the failure of the Surveillance.

Completion of the Surveillance within the delay period allowed by this Specification, or within the Completion Time of the ACTIONS, restores compliance with SR 3.0.1.

SR 3.0.4

SR 3.0.4 establishes the requirement that all applicable SRs must be met before entry into a specified condition in the Applicability.

This Specification ensures that system and component requirements and variable limits are met before entry in the Applicability for which these systems and components ensure safe operation of the facility.

The provisions of this Specification are not to be interpreted as endorsing the failure to exercise the good practice of restoring systems or components to an appropriate status before entering an associated specified condition in the Applicability. However, in certain circumstances, failing to meet an SR will not result in SR 3.0.4 restricting a change in specified condition. When a system, subsystem, division, component, device, or variable is outside its specified limits, the associated SR(s) are not required to be performed, per SR 3.0.1, which states that Surveillances do not have to be performed on such equipment. When equipment does not

BASES

SR 3.0.4 (continued)

meet the LCO, SR 3.0.4 does not apply to the associated SR(s) since the requirement for the SR(s) to be performed is removed. Therefore, failing to perform the Surveillance(s) within the specified Frequency does not result in an SR 3.0.4 restriction to changing specified conditions of the Applicability. However, since the LCO is not met in this instance, LCO 3.0.4 will govern any restrictions that may (or may not) apply to specified condition changes.

The provisions of SR 3.0.4 are not to prevent changes in specified conditions in the Applicability that is required to comply with ACTIONS. In addition, the provisions of SR 3.0.4 are not to prevent changes in specified conditions in the Applicability that are related to the unloading of a cask. The precise requirements for performance of SRs are specified such that exceptions to SR 3.0.4 are not necessary. The specific time frames and conditions necessary for meeting the SRs are specified in the Frequency, in the Surveillance, or both. This allows performance of Surveillances when the prerequisite condition(s) specified in a Surveillance procedure require entry into the specified condition in the Applicability of the associated LCO prior to the performance or completion of a surveillance. A Surveillance that could not be performed until after entering the LCO Applicability would have its Frequency specified such that it is not "due" until the specific conditions needed are met. Alternatively, the Surveillance may be stated in the form of a Note as not required (to be met or performed) until a particular event, condition, or time has been reached. Further discussion of the specific formats of SR annotation is found in Section 1.4, Frequency.

B 3.1 CASK INTEGRITY

B 3.1.1 Cask Cavity Vacuum Drying

BASES

BACKGROUND

A cask is placed in the spent fuel pool and loaded with fuel assemblies meeting the requirements of the Functional and Operating Limits. A lid is then placed on the cask. Subsequent operations involve lifting the cask above the fuel pool level, removing water from the cask fuel cavity, and then moving the cask to the decontamination area. After the cask lid is secured, vacuum drying of the cask cavity is performed and the cask cavity is backfilled with helium. During normal storage conditions, the cask is backfilled with helium, which is a better heat conductor than air, which results in lower temperatures for stored fuel and the basket.

Cavity vacuum drying is utilized to remove residual water/moisture from the fuel cavity after the cask has been drained of water. Any water which was not drained from the cask cavity evaporates from fuel or basket surfaces due to the vacuum. This is aided by the temperature increase due to the heat generation of the fuel.

APPLICABLE SAFETY ANALYSIS

The confinement of radioactive material during the storage of spent fuel in a cask is ensured by the use of multiple confinement barriers and systems. The barriers relied upon are the uranium dioxide fuel pellet matrix, the metallic fuel cladding tubes in which the fuel pellets are contained, and the cask in which the fuel assemblies are stored. Long-term integrity of the fuel cladding depends on storage in an inert atmosphere. This protective environment is accomplished by removing water from the cask cavity and backfilling the cavity with an inert gas.

BASES (continued)

LCO

A vacuum drying pressure of less than the limit indicates that all liquid water has evaporated and has been removed from the cask cavity. Removing water from the cask cavity helps to ensure the long term minimization of fuel clad corrosion.

APPLICABILITY

Cavity vacuum drying is performed during LOADING OPERATIONS before the cask is transported to the ISFSI storage pad. Therefore, the vacuum requirements do not apply after the cask is backfilled with helium prior to TRANSPORT OPERATIONS and STORAGE OPERATIONS.

ACTIONS

The ACTIONS Table is modified by a Note indicating that a separate Condition entry is allowed for each cask. This Note is acceptable because the internal environment of one cask is independent of the internal environment of subsequent casks or adjacent casks. The Required Actions for each Condition provide appropriate compensatory actions for each cask not meeting the LCO. Subsequent casks that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

A.1

If the cask cavity drying pressure limit cannot be achieved the cask is to be placed back into the spent fuel pool within 7 days. Seven days is sufficient time to reflood the cask. Once placed in the spent fuel pool, the fuel is provided with adequate decay heat removal to maintain the loaded fuel within limits.

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.1.1.1

This Surveillance is modified by a Note. The Note clarifies that meeting the Surveillance is not required, and thus there is not a failure to meet the LCO per SR 3.0.1 and SR 3.0.4 does not apply, prior to the specified Frequency.

Cask cavity dryness is demonstrated by evacuating the cask cavity to a high vacuum and verifying that the vacuum is held over a specified time period. A maintained high vacuum for the specified time period is an indication that no further evaporation is occurring and the cask cavity is dry. During the dryness demonstration period, the vacuum evacuation pump is to be isolated from the cask cavity. This is accomplished by closing the isolation valve and shutting down of vacuum pump or other system line-ups established to ensure a leaking evacuation pump isolation valve could not be inappropriately maintaining the vacuum in the cask.

The dryness demonstration must be performed successfully on each cask prior to placing the cask in storage. The dryness demonstration must be performed prior to completing the final helium backfill required by SR 3.1.2.2.

REFERENCES None.

B 3.1 CASK INTEGRITY

B 3.1.2 Cask Helium Backfill Pressure

BASES

BACKGROUND

A cask is placed in the spent fuel pool and loaded with fuel assemblies meeting the requirements of the Functional and Operating Limits. A lid is then placed on the cask. Subsequent operations involve lifting the cask above the fuel pool level, removing water from the cask fuel cavity, and then moving the cask to the decontamination area. After the cask lid is secured, vacuum drying of the cask cavity is performed and the cask cavity is backfilled with helium. For normal storage conditions, the cask is backfilled with helium, which is a better heat conductor than air, which results in lower temperatures for stored fuel and the basket.

Backfilling the cask cavity with helium promotes heat transfer from the fuel and the inert atmosphere protects the fuel cladding. Providing a helium pressure greater than atmospheric pressure ensures that there will be no in-leakage of air over the life of the cask.

APPLICABLE SAFETY ANALYSIS

The confinement of radioactive material during the storage of spent fuel in a cask is ensured by the use of multiple confinement barriers and systems. The barriers relied upon are the uranium dioxide fuel pellet matrix, the metallic fuel cladding tubes in which the fuel pellets are contained, and the cask in which the fuel assemblies are stored. Long-term integrity of the fuel cladding depends on storage in an inert atmosphere. This is accomplished by removing water from the cask cavity and backfilling the cavity with an inert gas. The failure of storage cask confinement capability is considered in the accident analysis (References 1 and 2).

BASES

APPLICABLE SAFETY ANALYSIS (continued)

The thermal analyses of the cask are performed assuming that helium is in the cask. But during the period from draining of the cask until evacuation of the air and its replacement by helium, heat conduction out of the fuel occurs through air, which has a lower conductivity than helium. A thermal analysis for TN-40HT casks has shown that under these conditions, the maximum fuel cladding temperature will remain below the limit of 752°F for at least 34 hours (Reference 3).

Establishment of even a low pressure helium environment satisfies the helium properties described in design basis thermal analyses because thermal conductivity of gases is not pressure dependent until a very high vacuum is attained.

The heat-up analysis for the TN-40 casks does not contain a time limit on when helium must be introduced into the cask to maintain acceptable fuel cladding temperature. However, the time derived for the TN-40HT casks, .i.e. the Frequency established for SR 3.1.2.1, is conservatively applied to TN-40 casks.

LCO

Backfilling the cask cavity with helium ensures that the heat transfer, is in accordance with cask design functions.

Backfilling the cask cavity with helium at a pressure exceeding atmospheric pressure will ensure that there will be no air in-leakage into the cavity which could damage the fuel cladding over the licensed storage period. An initial helium pressure limit is specified to ensure that the pressure within the cask remains within the design pressure limits over the life of the cask (Reference 3). The helium pressure is the as left value immediately after helium fill is completed in preparation for long term storage.

BASES (continued)

APPLICABILITY

Helium backfill is performed during LOADING OPERATIONS prior to transporting the cask to the ISFSI storage pad.

ACTIONS

The ACTIONS Table is modified by a Note indicating that a separate Condition entry is allowed for each cask. This Note is acceptable because the internal environment of one cask is independent of the internal environment of subsequent casks or adjacent casks. The Required Actions for each Condition provide appropriate compensatory actions for each cask not meeting the LCO. Subsequent casks that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

A.1

Required Action A.1 is modified by a Note which allows exiting this Required Action to vent the helium cask environment to perform subsequent actions that may be necessary to ready the cask for storage.

The thermal analyses of the cask are performed assuming that helium is in the cask. If the helium back fill pressure is not met, then actions must be initiated immediately to establish a helium environment.

A.2

If the helium backfill pressure cannot be obtained, actions must be taken to meet the LCO. Once the helium atmosphere is established by Required Action A.1, there is enough conduction to maintain the loaded fuel within its temperature limits and to prevent thermal expansion from damaging the basket. Therefore, no time limit is required for this action, other than completion prior to helium leak testing.

BASES

ACTIONS (continued)

B.1

If a helium cask environment cannot be achieved and maintained, fuel clad temperatures may increase beyond the analyzed condition. Therefore, the cask will be required to be placed back into the spent fuel pool within 7 days and re-flooded. This time is sufficient time to return the cask to the spent fuel pool and re-flood the cask cavity. Once placed in the spent fuel pool, the fuel is provided adequate decay heat removal to maintain the loaded fuel within limits.

SURVEILLANCE REQUIREMENTS

SR 3.1.2.1

This Surveillance is modified by a Note. The Note clarifies that meeting the Surveillance is not required, and thus there is not a failure to meet the LCO per SR 3.0.1 and SR 3.0.4 does not apply, prior to the specified Frequency.

Establishment of even a low pressure helium environment satisfies the helium properties described in design basis thermal analyses because thermal conductivity of gases is not pressure dependent until a high vacuum is attained. Thereby, design basis heat removal requirements will be satisfied provided some helium as been introduced to, and maintained in, the cask cavity within the 34 hour vacuum drying time frame analyzed in Reference 3.

SR 3.1.2.2

This Surveillance is modified by a Note. The Note clarifies that meeting the Surveillance is not required, and thus there is not a failure to meet the LCO per SR 3.0.1 and SR 3.0.4 does not apply, prior to the specified Frequency.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.2.2 (continued)

The long-term integrity of the stored fuel is dependent on storage in a dry, inert environment and maintenance of adequate heat transfer mechanisms. Filling the cask cavity with helium at the initial pressure specified will ensure that there will be no air in-leakage, which could potentially damage the fuel cladding, and that the cask cavity internal pressure will remain within limits for the life of the cask.

Backfilling with helium at a specified pressure must be performed successfully on each cask prior to performance of leak testing activities and TRANSPORT and STORAGE OPERATIONS.

REFERENCES

1. SAR Section 8.2.
2. SAR Section A8.2.
3. SAR Section A3.3.

B 3.1 CASK INTEGRITY

B 3.1.3 Cask Helium Leak Rate

BASES

BACKGROUND

A cask is placed in the spent fuel pool and loaded with fuel assemblies meeting the requirements of the Functional and Operational Limits. A lid is then placed on the cask. Subsequent operations involve removing water from the cask fuel cavity and moving the cask to the decontamination area. After the cask lid is secured, vacuum drying of the cask cavity is performed, and the cavity is backfilled with helium.

During normal storage conditions, the cask is backfilled with helium, which is a better heat conductor than air, and the inert atmosphere protects the fuel cladding. Prior to moving the cask to the storage pad, the helium leak rate is determined to ensure that the fuel is confined.

APPLICABLE SAFETY ANALYSIS

The confinement of radioactive material during the storage of spent fuel in a cask is ensured by the use of multiple confinement barriers and systems. The barriers relied upon are the uranium dioxide fuel pellet matrix, the metallic fuel cladding tubes in which the fuel pellets are contained, and the cask in which the fuel assemblies are stored. Long-term integrity of the fuel cladding depends on storage in an inert atmosphere. This is accomplished by removing water from the cask cavity and backfilling the cavity with an inert gas. In addition, the thermal analyses of the cask STORAGE OPERATIONS assume that the cask cavity is filled with helium.

BASES (continued)

LCO

Verifying that the cask cavity is sealed by measuring the helium leak rate will ensure that the assumptions in the normal, off-normal, and accident radiological evaluations are maintained. The safety analyses are based on an air leakage rate of 1.0 E-5 atm-cc/sec (Reference 1). Thus specifying a helium leak rate limit at the same value is conservative.

APPLICABILITY

The cask seal integrity verification, by measuring helium leak rate, is performed during LOADING OPERATIONS prior to TRANSPORT OPERATIONS and STORAGE OPERATIONS.

ACTIONS

The ACTIONS Table is modified by a Note indicating that a separate Condition entry is allowed for each cask. This Note is acceptable because the internal environment of one cask is independent of the internal environment of subsequent casks or adjacent casks. The Required Actions for each Condition provide appropriate compensatory actions for each cask not meeting the LCO. Subsequent casks that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

A.1

If the helium leak rate limit is not met ACTIONS must be taken to meet the LCO. The 7 day Completion Time of Required Action A.1 provides ample time to investigate the source of the leak and reestablish the cask helium leak rate within limit.

BASES

ACTIONS (continued)

B.1

The 30 day Completion Time of Required Action B.1 is based on engineering judgment that any credible seal leak within the 30 day period would not result in a significant loss of helium inventory that would affect the heat removal capability of the cask. In the event of a significant leak, the cask environment would not be reduced to less than one atmosphere of helium because there is no mechanism to exchange the helium in the cask with external air. Based on engineering judgment, this 30 day Completion Time is sufficient to disconnect the test equipment, vent the cask, and return it to the spent fuel pool. Once placed in the spent fuel pool, the fuel is provided adequate decay heat removal to maintain the loaded fuel within limits.

SURVEILLANCE REQUIREMENTS

SR 3.1.3.1

This Surveillance is modified by a Note. The Note clarifies that meeting the Surveillance is not required, and thus there is not a failure to meet the LCO per SR 3.0.1 and SR 3.0.4 does not apply, prior to the specified Frequency.

A primary design consideration of the cask is that it adequately contain radioactive material and retain an inert environment. The specified helium leak rate for this Surveillance demonstrates that an adequate confinement barrier has been established and that the cask is within design assumptions. The determination of the leak rate shall be done in accordance with ANSI N14.5 (Reference 2).

Measuring the helium leak rate must be performed successfully on each cask prior to placing it in storage. Once the helium atmosphere is established by SR 3.1.2.1, there is enough conduction to maintain

BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.3.1 (continued)

the loaded fuel within its temperature limits, and to prevent thermal expansion from damaging the basket. Therefore, no time limit is required for this Surveillance, other than completion prior to Transport Operations.

REFERENCES

1. SAR Section A8.2.

2. American National Standards Institute, "National Standard for Leakage Tests on Packages for Shipment of Radioactive Materials", ANSI N14.5-1977, New York, Oct. 1987.

B 3.1 CASK INTEGRITY

B 3.1.4 Cask Safety Status

BASES

BACKGROUND	The design intent of a dry storage cask is for the temporary confinement and shielding of irradiated nuclear fuel assemblies during cask placement on a concrete storage pad outside of the plant power block. The cask is designed and constructed within specific design requirements and parameters, as well as provided with associated design features that result in acceptable heat transfer rates away from the irradiated fuel assemblies through the exterior surfaces of the cask and into the environment. During STORAGE OPERATIONS the cask needs to be maintained free from damage and accumulation of debris so as not to compromise the confinement, shielding, and heat transfer design function of the cask.
APPLICABLE SAFETY ANALYSIS	The cask packaging is designed to passively reject decay heat under normal conditions of storage and hypothetical accidents while maintaining appropriate packaging temperatures and pressures within specified design limits. The applicable safety analysis is the heat transfer analysis and thermal model as well as the shielding and confinement analyses presented in the SAR (References 1 and 2).
LCO	Verifying that the cask is free from damage and accumulation of debris will ensure heat transfer, shielding, and confinement are in accordance with the cask design functions.
APPLICABILITY	This LCO is applicable during STORAGE OPERATIONS to ensure each cask is free from damage and accumulation of debris.

BASES (continued)

ACTIONS

The ACTIONS Table is modified by a Note indicating that a separate Condition entry is allowed for each cask. This Note is acceptable because the exterior surface of one cask is independent of the exterior surface of subsequent casks or adjacent casks. The Required Actions for each Condition provide appropriate compensatory actions for each cask not meeting the LCO. Subsequent casks that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

A.1

Required Action A.1 is in place to ensure that casks are maintained and that design heat transfer characteristics are not compromised by damage or accumulation of debris during cask storage.

SURVEILLANCE REQUIREMENTS

SR 3.1.4.1

A primary design consideration of the cask is that it can adequately contain radioactive material and sufficiently transfer heat from the cask surfaces to the environment. This Surveillance is to visually ensure that a cask does not exhibit damage or deterioration during storage that could compromise the design function of the cask. A Surveillance Frequency of 92 days is sufficient to observe and ensure the implementation of necessary actions to resolve any unsatisfactory conditions.

SR 3.1.4.2

A primary design consideration of the cask is that it can adequately contain radioactive material and sufficiently transfer heat from the

BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.4.2 (continued)

cask surfaces to the environment. This Surveillance is to visually ensure that a cask does not exhibit accumulation of debris during storage that could compromise the design function of the cask. A Surveillance Frequency of 92 days is sufficient to observe and ensure the implementation of necessary actions to resolve any unsatisfactory conditions.

REFERENCES.

1. SAR Section 3.3.
2. SAR Section A3.3.

B 3.1 CASK INTEGRITY

B 3.1.5 Cask Interseal Pressure

BASES

BACKGROUND

A cask is loaded, dried, and sealed prior to being transported to the ISFSI and placed on a storage pad. The cask is designed with redundant seals to contain the radioactive material. In addition, 10 CFR 72.122(h)(4) states that the casks must have the capability to be continuously monitored such that the licensee will be able to determine when corrective action needs to be taken to maintain safe storage conditions. The monitoring systems provide:

a. the capability to monitor interseal pressure that will indicate if cask seal integrity is compromised; and

b. local alarms to indicate that potential seal degradation has occurred.

It is necessary to verify cask seal integrity at regular intervals to ensure the cask's interseal containment boundary is being maintained and to verify there is no seal leakage to the environment.

APPLICABLE SAFETY ANALYSIS

The confinement of radioactive material during the storage of spent fuel in a cask is ensured by the use of multiple confinement barriers and systems. The barriers relied upon are the uranium dioxide fuel pellet matrix, the metallic fuel cladding tubes in which the fuel pellets are contained, and the cask in which the fuel assemblies are stored. Long-term integrity of the fuel cladding depends on storage in an inert atmosphere. This is accomplished by removing water from the cask cavity and backfilling the cavity with an inert gas. The failure of storage cask confinement capability is considered in

BASES

APPLICABLE SAFETY ANALYSIS (continued)	the accident analysis (References 1 and 2). In addition, the thermal analyses of the cask STORAGE OPERATIONS assume that the cask cavity is filled with helium.
LCO	Verifying cask interseal pressure ensures that the assumptions relating to radioactive releases in the accident analyses and radiological evaluations are maintained. Seal integrity is verified by monitoring interseal pressure indication and associated alarms.
APPLICABILITY	Cask interseal pressure verification is performed regularly during STORAGE OPERATIONS to confirm that the cask confinement barriers have not been compromised. During LOADING OPERATIONS, the seal integrity is verified prior to moving the cask to the ISFSI storage pads. Verification during TRANSPORT OPERATIONS is not possible as the cask is being moved. However, TRANSPORT OPERATIONS are brief, follow the verification performed during LOADING OPERATIONS, and, therefore, do not represent a significant lapse in seal integrity monitoring.
ACTIONS	The ACTIONS Table is modified by a Note indicating that a separate Condition entry is allowed for each cask. This Note is acceptable because the sealing function of one cask is independent of the sealing function of subsequent casks or adjacent casks. The Required Actions for each Condition provide appropriate compensatory actions for each cask not meeting the LCO. Subsequent casks that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

BASES

ACTIONS (continued)

A.1

If the cask interseal pressure is below the limit, an appropriate assessment and evaluation is to be performed to determine the cause of the low pressure condition. The 7-day period is sufficient time to perform an assessment of the condition and make necessary repairs to the overpressure system and reestablish a pressure above the limit. Reestablishing the pressure above the limit prevents leakage of radioactive material from the cask cavity.

B.1

If it is determined that there is a leakage path in the cask seals or overpressure system, a repair is to be performed in a timely manner. If the interseal pressure has been reestablished to 30 psig or above, no leakage of radioactive material from the cask cavity can occur. The 30-day Completion Time of Required Action B.1 provides ample time to implement necessary repairs or for the return of the cask to the spent fuel pool and to be re-flooded. Once placed in the spent fuel pool, the fuel is provided adequate decay heat removal to maintain the loaded fuel within limits.

SURVEILLANCE REQUIREMENTS

SR 3.1.5.1

This Surveillance is modified by a Note. This Note clarifies that performing the Surveillance is not required, and thus SR 3.0.4 does not apply, until 24 hours after first completion of SR 3.1.5.2. This Note is necessary to allow entry into STORAGE OPERATIONS and subsequent installation of the necessary monitoring equipment on the ISFSI pad to allow for performing the Surveillance during the STORAGE OPERATIONS.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.5.1 (continued)

During STORAGE OPERATIONS the cask overpressure tank pressure is routinely monitored by associated system instrumentation. Every 24 hours the pressure is to be verified to be above the 30 psig pressure minimum limit. The 24 hours is an appropriate time-frame during STORAGE OPERATIONS to alert operations personnel of a potential cask seal leak, system leak, or system malfunction. The method for verifying seal integrity is to monitor the interseal pressure. Normally, the cask seal integrity is verified using installed instrumentation that alarms or indicates. If this system is not operating on one or more casks, monitoring of seal integrity at each affected cask may be performed by alternative means.

SR 3.1.5.2

This Surveillance is modified by a Note. The Note clarifies that meeting the Surveillance is not required, and thus there is not a failure to meet the LCO per SR 3.0.1 and SR 3.0.4 does not apply, prior to the specified Frequency.

To ensure operability of the interseal pressure monitoring system as a remote indicator during STORAGE OPERATIONS, SR 3.1.5.2 verifies the proper functioning and setpoint of the pressure switch or transducer within 7 days of commencing STORAGE OPERATIONS. This verification is a CHANNEL OPERATIONAL TEST (COT) which exercises the pressure switch by reducing the sensed pressure below the setpoint, and verifies the accuracy of the trip setpoint within the required range. Full channel calibration over the range of the instrument is not required because the instrument provides no analog indication. Subsequent operability is verified by a COT every 12 months. This time frame is a reasonable period to address any instrument drift and reliability of the pressure switch.

BASES (continued)

REFERENCES

1. SAR Section 8.2.

2. SAR Section A8.2.

B 3.1 CASK INTEGRITY

B 3.1.6 Cask Maximum Surface Temperature

BASES

BACKGROUND	The design intent of a dry storage cask is for the temporary confinement and shielding of irradiated nuclear fuel assemblies during cask placement on a concrete storage pad outside of the plant power block. The cask is designed and constructed within specific design requirements and parameters, as well as provided with associated design features that result in acceptable heat transfer rates away from the irradiated fuel assemblies through the exterior surfaces of the cask and into the environment.
APPLICABLE SAFETY ANALYSIS	The cask packaging is designed to passively reject decay heat under normal conditions of storage and hypothetical accidents while maintaining appropriate packaging temperatures and pressures within specified design limits. The applicable safety analysis is the heat transfer analyses and thermal model as well as the shielding and confinement analyses presented in the SAR (References 1 and 2). These thermal analyses are also an integral input to other analyses such as the structural analyses.
LCO	A surface temperature in excess of the limit indicates that the cask heat transfer may not be functioning as designed and thus the design conclusions of the safety analyses may not be satisfied.
APPLICABILITY	In order to provide some indication that the cask heat transfer is performing as designed prior to removing the cask from the Auxiliary Building, the check of the surface temperature is performed during LOADING OPERATIONS.

BASES (continued)

ACTIONS

The ACTIONS Table is modified by a Note indicating that a separate Condition entry is allowed for each cask. This Note is acceptable because the surface temperature of one cask is independent of the surface temperature of subsequent casks or adjacent casks. The Required Actions for each Condition provide appropriate compensatory actions for each cask not meeting the LCO. Subsequent casks that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

A.1

If cask surface temperature is above the limit, the cask must be returned to the spent fuel pool and the fuel removed. Once the cask has been placed in the spent fuel pool, the fuel is provided adequate decay heat removal facilities to maintain the loaded fuel within limits. Removal of fuel from the cask places the cask in a condition where this LCO is no longer applicable.

A.2

Violations of this LCO are significant to the extent that notification to the NRC is required within 30 days. A report is to be prepared and submitted to the NRC Region III Office with a copy to the Director, Office of Nuclear Material Safety and Safeguards.

SURVEILLANCE REQUIREMENTS

SR 3.1.6.1

This Surveillance is modified by a Note. The Note clarifies that performing the Surveillance is not required, and thus SR 3.0.4 does not apply, prior to the specified Frequency.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.6.1 (continued)

Prior to TRANSPORT OPERATIONS, the cask outer surface temperature is to be measured and verified to be below the specified limit. The Frequency of this Surveillance also requires a minimum time of 24 hours, after commencing cask draining, to allow the fuel assemblies, basket, and cask body to reach equilibrium temperature, prior to the performance of this Surveillance.

REFERENCES

1. SAR, Section 3.3.
2. SAR, Section A3.3.

B 3.2 CASK RADIATION PROTECTION

B 3.2.1 Cask Surface Contamination

BASES

BACKGROUND	A cask is immersed in the spent fuel pool in order to load the spent fuel assemblies. As a result, the surface of the cask will become contaminated with radioactive material from the spent fuel pool water. In order to minimize radioactive contamination to personnel or the environment this contamination is to be removed prior to moving the cask to the ISFSI pad. By removing cask surface contamination, an uncontaminated ISFSI environment can be maintained that allows ISFSI entry without additional radiological controls to prevent the spread of contamination. An uncontaminated ISFSI environment reduces personnel dose due from loose contamination or airborne contamination. This practice is consistent with ALARA principles (Reference 1).
APPLICABLE SAFETY ANALYSIS	The radiation protection measures implemented at the ISFSI are based on the assumption that the exterior surfaces of the cask have been decontaminated. Failure to decontaminate the surfaces of the casks would lead to higher than projected occupational doses.
LCO	Removable surface contamination limits on the cask exterior surfaces are based on the minimum level of activity that can be routinely detected under a surface contamination control program using direct survey methods. Experience has shown that these limits are low enough to prevent the spread of contamination to clean areas and are significantly less than the levels which would cause significant personnel skin dose.

BASES (continued)

APPLICABILITY

Verification that the cask surface contamination is less than the LCO limit is performed during LOADING OPERATIONS. This verification occurs prior to TRANSPORT OPERATIONS and STORAGE OPERATIONS. Measurement of the cask surface contamination is unnecessary during TRANSPORT OPERATIONS in preparation for UNLOADING OPERATIONS, because surface contamination would have been measured prior to moving the cask to the ISFSI.

ACTIONS

The ACTIONS Table is modified by a Note indicating that a separate Condition entry is allowed for each cask. This Note is acceptable because the outer surface contamination of one cask is independent of the contamination of subsequent casks or adjacent casks. The Required Actions for each Condition provide appropriate compensatory actions for each cask not meeting the LCO. Subsequent casks that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

A.1

If the removable surface contamination of a cask that has been loaded with spent fuel is not within the LCO limits, action must be initiated to decontaminate the cask and bring the removable surface contamination within limits. The Completion Time requires that the decontamination be completed prior to TRANSPORT OPERATIONS, which will prevent the release of contamination to the environment and the ISFSI.

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.2.1.1

This Surveillance is modified by a Note. The Note clarifies that meeting the Surveillance is not required, and thus there is not a failure to meet the LCO per SR 3.0.1 and SR 3.0.4 does not apply, prior to the specified Frequency.

This SR verifies that the removable surface contamination on the cask is less than the limits. The Frequency requires performing the verification once prior to initiating TRANSPORT OPERATIONS. This Frequency is adequate to confirm that the cask can be moved to the ISFSI without spreading loose contamination, and assumes that the cask will not develop surface contamination during TRANSPORT or STORAGE OPERATIONS. Storage of the fuel in the dry, redundantly-sealed cask eliminates the possibility for leakage of contaminated liquids.

REFERENCES

1. SAR Section 7.1.

B 3.2 CASK RADIATION PROTECTION

B 3.2.2 Cask Dose Rates

BASES

BACKGROUND

The design intent of a dry storage cask is for the temporary confinement of irradiated nuclear fuel assemblies and subsequent cask placement on a concrete storage pad outside of the plant power block. The cask is designed and constructed within specific design requirements and parameters, as well as provided with associated design features that result in acceptable dose rates at the exterior surfaces of the cask. Acceptable dose rates are defined as those that provide compliance with 10 CFR Part 20 and 10 CFR Part 72 radiation protection requirements.

Measurement of the resultant initial dose rates of the cask exterior surfaces and verification that the initial cask dose rates are within established limits prior to TRANSPORT OPERATIONS, ensure a specific cask is performing in accordance with its design requirements. Subsequent monitoring of the ISFSI environment dose rates ensures all casks continue to perform in accordance with design requirements.

APPLICABLE SAFETY ANALYSIS

The applicable safety analysis is the shielding analysis and subsequent dose rates from a cask(s) including contribution from direct radiation and in-direct radiation to arrive at the expected dose rates around the ISFSI (Reference 1). These analyses ensure that the offsite dose rates are within the regulatory limits.

LCO

Initial cask exterior surfaces dose rates, for each cask, at each of four specific cask locations, is to be measured and verified to be below limits prior to TRANSPORT OPERATIONS. Ensuring that the surface dose rates are consistent with the calculated surface dose

BASES

LCO (continued)

rates in Reference 1 provides assurance that the offsite dose rates would be consistent with the calculated offsite dose rates in Reference 1. Thus meeting the LCO requirements demonstrates that the dose rates are in compliance with 10 CFR Part 20 and 10 CFR Part 72 radiation protection requirements.

Note that the dose rates in Reference 1 are based on the TN-40HT cask design and conservatively bound operations with a mixture of TN-40 and TN-40HT casks. Thus the LCO may be applied to either a TN-40 or TN-40HT cask.

APPLICABILITY

Verification that exterior cask surface dose rates, at the specified locations, are less than the limits is performed during LOADING OPERATIONS. This verification occurs prior to TRANSPORT OPERATIONS and STORAGE OPERATIONS.

ACTIONS

The ACTIONS Table is modified by a Note indicating that a separate Condition entry is allowed for each cask. This Note is acceptable because the dose rates of one cask is independent of the dose rates of subsequent casks or adjacent casks. The Required Actions for each Condition provide appropriate compensatory actions for each cask not meeting the LCO. Subsequent casks that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

A.1

If any of the four specified exterior surface dose rates are in excess of the specified limit, a specific analysis demonstrating compliance with 10 CFR Part 20 and 10 CFR Part 72 radiation protection requirements is to be performed prior to TRANSPORT OPERATIONS.

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.2.2.1

This Surveillance is modified by a Note. The Note clarifies that performing the Surveillance is not required, and thus SR 3.0.4 does not apply, prior to the specified Frequency.

This SR verifies that a cask exterior surface dose rate, in each of the four specified locations, is less than the respective specified dose rate limit for that location. The Frequency requires performing the verification once prior to TRANSPORT OPERATIONS. This Frequency is adequate to confirm that a cask is in compliance with 10 CFR Part 20 and 10 CFR Part 72 radiation protection requirements and can be moved to the ISFSI.

REFERENCES

1. SAR Section A7.

B 3.3 CASK CRITICALITY CONTROL

B 3.3.1 Dissolved Boron Concentration

BASES

BACKGROUND	The casks are designed to maintain the fuel sub-critical under all postulated fuel arrangements with the effective neutron multiplication factor (k_{eff}), including statistical uncertainties, of ≤ 0.95 (Reference 1). To counteract neutron moderation by water, water placed in the cask is to be borated water to provide the additional neutron absorption necessary to maintain the k_{eff} within the limit.
APPLICABLE SAFETY ANALYSIS	During LOADING OPERATIONS and UNLOADING OPERATIONS, the methods for criticality control rely on borated water used to fill the cask cavity. The borated water provides the additional neutron absorption to counteract the neutron moderating effect of water. Providing a boron concentration of the water in the spent fuel pool water and therefore the cask cavity water at or above the limit, prior to cask loading prevents violation of the criticality design criterion. Criticality analyses were performed for a TN-40HT cask assuming fresh fuel with an initial enrichment of 5.0 weight percent U-235 with all the cavity voids filled with 2450 ppm borated water and reflected all around by water. Analyses assume the fraction of boron-10 in the solution to be that of naturally-occurring boron. The boron concentration limit established for SR 3.3.1.2 was derived from the criticality analyses for the TN-40HT and conservatively bounds the boron requirements for a TN-40 cask. Thus it is conservatively applied to TN-40 loading activities.

BASES (continued)

LCO

The water in the cask cavity must have a boron concentration greater than the limit. The minimum boron concentration limit ensures sub-critical conditions under design basis loading conditions in the cask.

APPLICABILITY

The boron concentration of the water in the cask cavity must be within its limit whenever there is water in the cask cavity. This condition occurs during LOADING OPERATIONS and UNLOADING OPERATIONS.

ACTIONS

The ACTIONS Table is modified by a Note indicating that a separate Condition entry is allowed for each cask. This Note is acceptable because the dissolved boron concentration of one cask is independent of the dissolved boron concentration of subsequent casks or adjacent casks. The Required Actions for each Condition provide appropriate compensatory actions for each cask not meeting the LCO. Subsequent casks that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

A.1

If the dissolved boron concentration in the spent fuel pool and therefore, the cask cavity, is not within limit, loading of any additional fuel assemblies into the cask must be stopped. Without the required concentration of dissolved boron in the water, maintaining the sub-criticality limit in all conditions can not be guaranteed. The immediate Completion Time reflects the importance of prohibiting the introduction of any potential positive reactivity addition into the cask cavity without the required boron concentration.

BASES

ACTIONS (continued)

A.2

If the dissolved boron concentration in the spent fuel pool and therefore, the cask cavity, is not within the limit, all fuel assemblies must be removed from the cask. Removal of fuel from the cask places the cask in a condition where this LCO is no longer applicable. The 24-hour Completion Time takes into consideration the time necessary to unload a fully loaded cask.

SURVEILLANCE REQUIREMENTS

SR 3.3.1.1

This SR specifically applies to LOADING OPERATIONS. The boron concentration of the spent fuel pool water is determined prior to commencing cask loading using chemical analysis of two samples analyzed by different individuals to reduce the risk that a single error could lead to not meeting the LCO.

The requirement to verify the boron concentration within 4 hours prior to commencing LOADING OPERATIONS ensures that the water added to the cask is within the limit. The Frequency is based on the operating experience that boron concentration changes occur very slowly.

SR 3.3.1.2

This Surveillance is modified by a Note. The Note clarifies that meeting the Surveillance is not required, and thus there is not a failure to meet the LCO per SR 3.0.1 and SR 3.0.4 does not apply, prior to the specified Frequency.

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.1.2 (continued)

This SR specifically applies to UNLOADING OPERATIONS. The boron concentration is analyzed as described above. The requirement to verify the boron concentration within 4 hours prior to flooding the cask for UNLOADING OPERATIONS ensures that the water added to the cask cavity is within the limit. The Frequency is based on operating experience the boron concentration changes very slowly.

REFERENCES

1. SAR, Section A3.3.

B 3.4 CASK FUEL LOADING CONTROL

B 3.4.1 Fuel Stored in a Cask

BASES

BACKGROUND	The cask design is based upon certain spent fuel assembly parameters, including fuel type, fuel assembly weight, initial enrichment, maximum burnup, and minimum cooling time. These spent fuel parameters are used in the thermal, structural, radiological, and criticality evaluations performed for the cask. To assure that the spent fuel assemblies to be placed in casks do not exceed these design parameters, functional and operational limits are established for the selected fuel assemblies. The functional and operational limits are established to protect the integrity of the fuel clad barrier and the public from radioactive materials in effluents and direct radiation levels associated with cask operation. Prior to fuel assembly storage in a cask, fuel assemblies are to meet the established Functional and Operating Limits specified in Sections 2.1 through 2.3. Compliance with these limits is to be demonstrated by verification and documentation of the characteristics of each fuel assembly to be stored in a cask.
APPLICABLE SAFETY ANALYSIS	The established Functional and Operating Limits specified in Sections 2.1 through 2.3 are based upon the input parameters used for the various analyses for cask design including fuel thermal, criticality, structural, shielding, and confinement analyses.
LCO	Verification that fuel assembly characteristics are in accordance with the established functional and operating limits will ensure that the safety analyses bound the fuel being loaded.
APPLICABILITY	The verification of fuel assembly compliance with the established functional and operating limits is applicable prior to LOADING OPERATIONS.

BASES (continued)

ACTIONS

The ACTIONS Table is modified by a Note indicating that a separate Condition entry is allowed for each cask. This Note is acceptable because the fuel loading into one cask is independent of the fuel loaded in subsequent casks or adjacent casks. The Required Actions for each Condition provide appropriate compensatory actions for each cask not meeting the LCO. Subsequent casks that do not meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

A.1

If a fuel assembly, previously placed in a cask, is found to not meet the specified functional and operating limits, the fuel assembly is to be immediately removed from the cask. The immediate Completion Time reflects the importance of maintaining the protection and integrity of the fuel clad barrier as well as the public from radioactive materials in effluents and direct radiation levels associated with cask operation by only storing fuel in accordance with cask design requirements.

SURVEILLANCE REQUIREMENTS

SR 3.4.1.1

This Surveillance is modified by a Note. The Note clarifies that performing the Surveillance is not required, and thus SR 3.0.4 does not apply, prior to the specified Frequency.

This SR applies prior to inserting the fuel into the cask. The spent fuel assembly compliance with the Functional and Operating Limits is to be demonstrated by administrative verification. This verification applies to fuel assemblies as well as BPRA's or TPD's. The Frequency is selected to ensure only fuel meeting cask design requirements is inserted into a cask.

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.1.2

This Surveillance is modified by a Note. The Note clarifies that performing the Surveillance is not required, and thus SR 3.0.4 does not apply, prior to the specified Frequency.

The spent fuel assembly identity is to be verified once prior to inserting in a cask and once again prior to final closure of the cask. This verification applies to fuel assemblies as well as BPRA's or TPD's. The Frequency is selected to ensure only fuel meeting cask design requirements are inserted into a cask.

REFERENCES

None.

Enclosure 3 Attachment 3
Cross-Reference Matrix
Current Technical Specifications (CTS) to Revised Technical Specifications (RTS)

For each CTS requirement, action, and surveillance the matrix provides a cross reference to the corresponding RTS requirement, action, or surveillance. The development of the RTS and this matrix was based in part on the following considerations:

- These RTS have been formatted in accordance with the current format adopted for the Prairie Island Nuclear Generating Plant Technical Specifications. NUREG-1745 "Standard Format and content for Technical Specifications for 10 CFR Part 72 Casks Certificates of compliance" was reviewed and, where practical, the NUREG format was incorporated.
- For the RTS the Technical Specification Basis has been relocated to a separate, independent document that will be controlled as specified in the RTS.
- The acronyms used in the Matrix are as described below:

  LCO – Limiting Condition for Operation
  FOL – Functional and Operating Limits
  Def – Definition
  Spec – Specification
  SR – Surveillance Requirement

- The Revised Technical Specification Matrix, provided below, is a cross reference **from** the Current Technical Specifications **to** the Revised Technical Specifications. For each change of the Current Technical Specifications a characterization has been made as to whether the change is: No Change to a technical requirement (NC); a More Restrictive technical requirement (MR); or a Less Restrictive technical requirement (LR). For No Change characterizations, additional explanation notes are provided where determined appropriate. For More Restrictive characterizations, additional explanation notes are provided. For Less Restrictive characterizations, additional explanation notes are provided as well as a summary safety determination.

Cross-Reference Matrix			
CTS	**RTS**	**Comparison**	**Additional Notes , Explanations, and Safety Determination Summary**
Introduction	Deleted	LR	The Technical Specifications are an Appendix to the ISFSI operating license which by definition governs the safety of Prairie Island ISFSI. The current introduction contains no requirements or instructions for control of activities associated with operation of the casks or ISFSI. Therefore deleting the introduction does not affect safety.
Def 1.0.a	Deleted	LR	The term "ADMINISTRATIVE CONTROLS" is a standard industry term and hence the term does not need to be defined in Section 1.1 of the Technical Specifications. Therefore deleting the definition of "ADMINISTRATIVE CONTROLS" does not affect safety.

Enclosure 3 Attachment 3
Cross-Reference Matrix
Current Technical Specifications (CTS) to Revised Technical Specifications (RTS)

Cross-Reference Matrix			
CTS	**RTS**	**Comparison**	**Additional Notes , Explanations, and Safety Determination Summary**
Def 1.0.b	Deleted	LR	Other than for the title of Section 4.0, the term "DESIGN FEATURES" is not used in these Technical Specifications. Therefore deleting the definition of "DESIGN FEATURES" does not affect safety.
Def 1.0.c	Deleted	LR	The term "FUEL ASSEMBLY" is a commonly used term and therefore does not require a specific definition for the purpose of the ISFSI Technical Specification. Therefore deleting the definition of "FUEL ASSEMBLY" does not affect safety.
Def 1.0.d	Deleted	LR	The term "FUNCTIONAL AND OPERATING LIMITS" is the title of Section 2.0 and is a standard industry term. Hence the term does not need to be defined in Section 1.1 of the Technical Specifications. Therefore deleting the definition of "FUNCTIONAL AND OPERATING LIMITS" does not affect safety.
Def 1.0.e	Deleted	LR	The term "LIMITING CONDITIONS" is part of the title of Section 3.0 and is a standard industry term. Hence the term does not need to be defined in Section 1.1 of the Technical Specifications. Therefore deleting the definition of "LIMITING CONDITIONS" does not affect safety.
Def 1.0.f	1.1 – LOADING OPERATIONS	LR	The CTS definition of loading operations includes "all cask preparation steps". This definition would include steps taken prior to placing fuel into the cask. The revised definition applies when the first fuel assemblies is being placed in the cask and ends when cask is supported by the transporter. Hence the revised definition does not cover activities that would be covered under the CTS definition and is therefore less restrictive. However, prior to placing fuel into the cask, there are no capabilities or performance levels of the cask needed to protect the workers or the public, therefore the proposed change is safe.
Def 1.0.g	Deleted	LR	The term "SURVEILLANCE INTERVAL" is not used in the proposed Technical Specifications. Therefore deleting the definition of "SURVEILLANCE INTERVAL" does not affect safety.

Enclosure 3 Attachment 3
Cross-Reference Matrix
Current Technical Specifications (CTS) to Revised Technical Specifications (RTS)

Cross-Reference Matrix			
CTS	**RTS**	**Comparison**	**Additional Notes , Explanations, and Safety Determination Summary**
Def 1.0.h	Deleted	LR	The term "SURVEILLANCE REQUIREMENTS" is a standard industry term and hence the term does not need to be defined in Section 1.1 of the Technical Specifications. Therefore deleting the definition of "SURVEILLANCE REQUIREMENTS" does not affect safety.
FOL 2.1	LCO 3.1.1, & SR 3.1.1.1	MR	Corrected the specification so that the 10 mbar value is applied to the amount of pressure in the cask cavity rather than the amount of vacuum. The new LCO requires that the cask cavity be isolated from the vacuum drying system. Hence this is a more restrictive change.
FOL 2.1, Action 1	Deleted	LR	If the inability to meet the cavity pressure limit is due to the vacuum drying system, then it will have to be checked and repaired in order to satisfactorily complete Surveillance SR 3.1.1.1. If the system is not repaired and thus SR 3.1.1.1 can not be satisfied, LCO 3.1.1 Condition A would be entered and Required Action A.1 will require the cask to be returned to the pool and reflooded. Once the cask is reflooded, the fuel is provided with adequate heat removal and the cask is in a safe condition. Therefore deleting Action 1 does not result in a reduction of safety. However since the specific actions are being deleted, this change was classified as a less restrictive change.
FOL 2.1, Action 2	Deleted	LR	If the inability to meet the cavity pressure limit is due to the cask seals, then they will have to be checked and repaired in order to satisfactorily complete Surveillance SR 3.1.1.1. If the seals are not repaired and thus SR 3.1.1.1 can not be satisfied, LCO 3.1.1 Condition A would be entered and Required Action A.1 will require the cask to be returned to the pool and reflooded. Once the cask is reflooded, the fuel is provided with adequate heat removal and the cask is in a safe condition. Therefore deleting Action 2 does not result in a reduction of safety. However since the specific actions are being deleted, this change was classified as a less restrictive change.

Enclosure 3 Attachment 3
Cross-Reference Matrix
Current Technical Specifications (CTS) to Revised Technical Specifications (RTS)

Cross-Reference Matrix			
CTS	**RTS**	**Comparison**	**Additional Notes , Explanations, and Safety Determination Summary**
FOL 2.1, Action if still unable to meet the FOL	LCO 3.1.1, Required Action A.1	LR	If the cask cavity vacuum drying pressure limit can not be established in the cask, Required Action A.1 would require the cask be placed back in the pool and reflooded. Although this Action does not call for unloading the cask, and hence is considered less restrictive, it will ensure that the fuel cladding is cooled. Therefore replacing the Action in FOL 2.1 with one that calls for reflooding the cask but not unloading it does not result in a reduction of safety.
FOL 2.2	LCO 3.1.2, & SR 3.1.2.2	MR	So that the specification is applicable to both the TN-40 casks and the TN-40HT casks, the allowable low side value has been increased from 19 psia (20 psia minus 1psi) to 19.5 psia. This tightens the allowable range of values and is thus more restrictive. The limit was also converted from psia to mbar using the 68.9 mbar/psi conversion factor.
FOL 2.2, Action 1	Deleted	LR	If the inability to meet the back pressure limit is due to the cask seals, then they will have to be checked and repaired in order to satisfactorily complete Surveillance SR 3.1.2.2. If the seals are not repaired and thus SR 3.1.2.2 can not be satisfied, LCO 3.1.2 Condition A would be entered and Required Action A.1 will require a helium environment be established in the cask. Once a helium environment is established, the heat transfer will be improved and the cask is in a safe state. If the helium environment can not be established, then Condition B is entered and cask returned to the pool and reflooded. Therefore deleting Action 1 does not result in a reduction of safety. However since the specific actions are being deleted, this change was classified as a less restrictive change.
FOL 2.2, Action 2	LCO 3.1.2, Required Action A.2	NC	If the inability to meet the backfill pressure limit is due to exceeding the criterion, then helium will have to be released in order to accomplish the new Required Action A.2. Thus there is no change to the technical requirements.

Enclosure 3 Attachment 3
Cross-Reference Matrix
Current Technical Specifications (CTS) to Revised Technical Specifications (RTS)

Cross-Reference Matrix			
CTS	**RTS**	**Comparison**	**Additional Notes , Explanations, and Safety Determination Summary**
FOL 2.2, Action if still unable to meet the FOL	LCO 3.1.2, Required Action B.1	LR	If a helium environment can not be established in the cask, Required Action B.1 would require the cask be placed back in the pool and reflooded. Although this Action does not call for unloading the cask, and hence is considered less restrictive, it will ensure that the fuel cladding is cooled. Therefore replacing the Action in FOL 2.2 does not result in a reduction of safety.
FOL 2.3	Design Feature 4.2	NC	
FOL 2.3, Action	Deleted	LR	The current Action statement only applies "in the event of a cask drop from a height greater than 18 inches" and includes allowances for subsequently transferring fuel that has been inspected to the ISFSI provided it meets the storage requirements. This allowance is redundant with other specifications that contain the requirements for fuel stored in a cask. Since the allowance is redundant, deleting it does not result in a reduction in safety.
LCO 3.1.1(1)	FOL 2.1.b, FOL 2.1.c, & LCO 3.4.1	NC	Since there are no VANTAGE+ fuel assemblies that meet the other requirements for storage in a TN-40 cask, e.g. enrichment and burnup limits, the inclusion of VANTAGE+ fuel as a part of the OFA fuel type is not a change to the fuel that may be stored in a TN-40 cask.
LCO 3.1.1(2)	FOL 2.2.a, & LCO 3.4.1	NC	
LCO 3.1.1(3)	FOL 2.2.b, & LCO 3.4.1	NC	
LCO 3.1.1(4)	FOL 2.2.c, & LCO 3.4.1	NC	
LCO 3.1.1(5)	FOL 2.1.a, Def of UNDAMAGED FUEL ASSEMBLIES, & LCO 3.4.1	NC	

Enclosure 3 Attachment 3
Cross-Reference Matrix
Current Technical Specifications (CTS) to Revised Technical Specifications (RTS)

Cross-Reference Matrix			
CTS	**RTS**	**Comparison**	**Additional Notes , Explanations, and Safety Determination Summary**
LCO 3.1.1(6)	FOL 2.1.a, Def of UNDAMAGED FUEL ASSEMBLIES, & LCO 3.4.1	NC	
LCO 3.1.1(7)	FOL 2.1.d.ii, & LCO 3.4.1	NC	Corrected technical error of applying term "burnup" to BPRAs.
LCO 3.1.1(8)	FOL 2.1.d.i, & LCO 3.4.1	NC	
LCO 3.1.1(9)	FOL 2.1.e.ii, & LCO 3.4.1	NC	Corrected technical error of applying term "burnup" to TPDs.
LCO 3.1.1(10)	FOL 2.1.e.i, & LCO 3.4.1	MR	To bound the assumptions used in the dose calculations of the TN-40HT casks (and thus have a single specification applicable to both the TN-40 casks and the TN-40HT casks.) the minimum cooling time for a TPD has been increased to 16 years.
LCO 3.1.1(11)	FOL 2.1.f, & LCO 3.4.1	NC	
LCO 3.1.1(12)	FOL 2.1.g, & LCO 3.4.1	NC	
LCO 3.1.1(13)	FOL 2.2.d, & LCO 3.4.1	NC	
LCO 3.1.1, Action	FOL 2.4.1 & LCO 3.4.1 Required Action A.1	NC	
SR 4.1.1	SR 3.4.1.1	NC	
SR 4.1.2	SR 3.4.1.2	NC	
LCO 3.2.1	LCO 3.3.1, SR 3.3.1.1, & SR 3.3.1.2	MR	Increased required boron concentration from 1800 ppm, to 2450 ppm. This increase is necessary to ensure that the boron concentration in the pool is equivalent to or greater than that assumed in criticality analysis for the TN-40HT cask. Increasing the required concentration is conservative for the TN-40 casks.

Enclosure 3 Attachment 3
Cross-Reference Matrix
Current Technical Specifications (CTS) to Revised Technical Specifications (RTS)

Cross-Reference Matrix			
CTS	**RTS**	**Comparison**	**Additional Notes , Explanations, and Safety Determination Summary**
LCO 3.2.1 Action 1	LCO 3.3.1, SR 3.3.1.1, SR 3.3.1.2, & SR 3.0.4	NC	Surveillance SR 3.3.1.1 requires verifying that the dissolved boron concentration limit is satisfied within 4 hours prior to commencing LOADING OPERATIONS. SR 3.0.4 will not allow entry into LOADING OPERATIONS unless SR 3.3.1.1 is satisfied. Surveillance SR 3.3.1.2 requires verifying that the dissolved boron concentration limit is satisfied within 4 hours prior to flooding the cask for UNLOADING OPERATIONS. Hence there would be no activities involving cask loading and unloading unless the boron concentration is above the limit, i.e., they would be suspended,
LCO 3.2.1 Action 2	LCO 3.3.1 Required Action A.1 & A.2	MR	Per SR 3.0.1, failure to meet a Surveillance between performances of the Surveillance, shall be a failure to meet the LCO. Hence if it is discovered that the boron concentration has fallen below the limit then Condition A would be entered and Required Actions A.1 and A.2 taken. Required Action A.1 differs from CTS Action 2 in that it only suspends loading of fuel assemblies but would allow unloading to continue. In addition Required Action A.2 would require all fuel to be removed from the cask within 24 hours. The proposed changes result in a safer end state in that the fuel would be removed from the cask and placed back into the racks in the Spent Fuel Pool thus eliminating any criticality concerns within the cask. Since the proposed Actions require removal of fuel from the cask within 24 hours, the new Actions are more restrictive.

Enclosure 3 Attachment 3
Cross-Reference Matrix
Current Technical Specifications (CTS) to Revised Technical Specifications (RTS)

Cross-Reference Matrix			
CTS	**RTS**	**Comparison**	**Additional Notes , Explanations, and Safety Determination Summary**
SR 4.2.1.1	SR 3.3.1.1	MR	Increased required boron concentration from 1800 ppm, to 2450 ppm. This increase is necessary to ensure that the boron concentration in the pool is equivalent to or greater than that assumed in criticality analysis for the TN-40HT cask. Increasing the required concentration is conservative for the TN-40 casks.
SR 4.2.1.2	SR 3.3.1.2	MR	Increased required boron concentration from 1800 ppm, to 2450 ppm. This increase is necessary to ensure that the boron concentration in the pool is equivalent to or greater than that assumed in criticality analysis for the TN-40HT cask. Increasing the required concentration is conservative for the TN-40 casks.
LCO 3.3.1	LCO 3.1.3, & SR 3.1.3.1	NC	
LCO 3.3.1 Action	LCO 3.1.3 Required Action A.1	MR	While the actions to be taken in the proposed RTS Action are essentially equivalent to those in the CTS, i.e., do what is necessary to establish the leak rate within the limit, the RTS include a required completion time and hence is more restrictive.
SR 4.3.1	SR 3.1.3.1	LR	While the requirement to perform the leak test in accordance with ANSI N14.5 has been relocated to the bases, and hence is considered less restrictive, there is no intended change in how the test is conducted. Therefore the there is no reduction in safety.
LCO 3.4.1	LCO 3.2.1, & SR 3.2.1.1	NC	
LCO 3.4.1 Action	LCO 3.2.1 Required Action A.1	NC	
SR 4.4.1	SR 3.2.1.1	NC	While the proposed SR requires that removable contamination on the exterior surfaces meet the limits rather than just the accessible surfaces, there is no change in technical requirements since only accessible exterior surfaces can be surveyed.
LCO 3.5.1	LCO 3.1.6, & SR 3.1.6.1	NC	

Enclosure 3 Attachment 3
Cross-Reference Matrix
Current Technical Specifications (CTS) to Revised Technical Specifications (RTS)

Cross-Reference Matrix			
CTS	**RTS**	**Comparison**	**Additional Notes , Explanations, and Safety Determination Summary**
LCO 3.5.1 Action	LCO 3.1.6, Required Actions A.1 & A.2	MR	While the actions to be taken in the CTS Action are essentially equivalent to those in the proposed RTS, i.e., unload the cask and send a report to the NRC, the RTS include a required completion time for removing the fuel and hence is more restrictive. Note that the verification that the fuel assemblies meet the requirements of Specification 2.0 is performed in SR 3.4.1.1 and SR 3.4.1.2
SR 4.5.1	SR 3.1.6.1	MR	SR 4.5.1 requires that the temperature measurement not be taken until 24 hours after completing cask loading, while SR 3.1.6.1 requires 24 hours after commencing of cask draining. Since the commencement of cask drain does not occur for several hours after the fuel has been loaded into the cask, SR 3.1.6.1 provides for time for the cask to heat up and is thus more restrictive than SR 4.5.1.
LCO 3.6.1	LCO 3.2.2, & SR 3.2.2.1	LR	The new dose rate limits are based on those associated with the TN-40HT cask. Since the dose analyses for the TN-40HT cask show that the offsite limits are meet with these surface dose rates, verifying that the surface dose rates for a TN-40 cask are less than these limits will also ensure that the offsite doses limits are met. Therefore the proposed surface dose limits do not result in a reduction of safety.

Enclosure 3 Attachment 3
Cross-Reference Matrix
Current Technical Specifications (CTS) to Revised Technical Specifications (RTS)

Cross-Reference Matrix			
CTS	**RTS**	**Comparison**	**Additional Notes , Explanations, and Safety Determination Summary**
LCO 3.6.1 Action	LCO 3.2.2 Required Action A.1	LR	The CTS Action contains 4 separate actions. 1st – Verify correct fuel loading. In the RTS the correct fuel loading has already been verified via SR 3.4.1.1 and SR 3.4.1.2. Hence this action was not included in the RTS 3.2.2 Actions. 2nd – Demonstrate compliance with 10 CFR Part 20 and 10 CFR Part 72. This is retained as Required Action A.1. 3rd – Take appropriate action to comply with acceptable limits. Taking action to satisfy a LCO limit is always an option and does not need to be listed as an option. Hence this Action was not included in the RTS Actions. 4th – If acceptable limits can not be achieved, the cask shall not be placed in service at the ISFSI. This is equivalent to completing Required Action A.1 prior to TRANSPORT OPERATIONS. Since Required Action A.1 does not explicitly call for the verification of the correct fuel loading, it is considered less restrictive. However, the correct fuel loading has already been verified in RTS Surveillances SR 3.4.1.1 and SR 3.4.1.2 and therefore there is no reduction in safety.
SR 4.6.1	SR 3.2.2.1	NC	
SR 4.6.2	Administrative Controls 5.2	NC	
LCO 3.7.1	LCO 3.1.5	MR	RTS SR 3.1.5.1 contains a numerical limit that must be maintained. Hence the LCO it is a more restrictive.
LCO 3.7.1 Action	LCO 3.1.5 Required Action B.1	MR	The CTS Action calls for returning the cask to the Auxiliary building and repairing or replacing seals as necessary. This is the same end state as requiring the cask to be placed in the pool and reflooded, i.e., seals would have to be replaced after reflooding the cask. Hence RTS Required Action B.1 is equivalent to the CTS Action. However, since Required Action B.1 includes a specified completion time it is considered more restrictive.

Enclosure 3 Attachment 3
Cross-Reference Matrix
Current Technical Specifications (CTS) to Revised Technical Specifications (RTS)

Cross-Reference Matrix			
CTS	**RTS**	**Comparison**	**Additional Notes , Explanations, and Safety Determination Summary**
SR 4.7.1	SR 3.1.5.1	MR	SR 3.1.5.1 contains a numerical limit that must be maintained. Hence it is a more restrictive.
SR 4.7.2	SR 3.1.5.2	MR	In addition to requiring an annual test, RTS SR 3.1.5.2 also requires a COT within 7 days of commencing STORAGE OPERATIONS. Hence it is considered more restrictive.
LCO 3.8.1	LCO 3.1.4	NC	
LCO 3.8.1 Action	LCO 3.1.4 Required Action A.1	MR	The CTS Action only requires corrective action if a safety function of the cask is impaired. The RTS Required Action requires action regardless of the impact on a safety function and includes a required completion time. Hence the RTS Required Action is more restrictive.
SR 4.8.1	SR 3.1.4.1 and SR 3.1.4.2	NC	
Table 3/4-1	Deleted	LR	The operating limits contained in CTS Table 3/4-1 are contained within the specific FOLs and LCOs. Thus the information presented in the table is redundant and therefore deleted. Since the limits are contained within the specific FOLs and LCOs, there is no reduction in safety.
Table 3/4-2	Deleted	LR	The SR frequency requirements contained in CTS Table 3/4-2 are contained within the specific LCOs. Thus the information presented in the table is redundant and therefore deleted. Since the SR frequency requirements are contained within the specific LCOs, there is no reduction in safety.
Section 5.0	Section 4.0	NC	No change other than to include TN-40HT casks.
Section 6.1	Section 5.1	NC	
Section 6.2	Section 5.2	NC	
Section 6.3	Section 5.3	NC	

ENCLOSURE 3

ATTACHMENT 4

PI ISFSI SAR PAGE CHANGES (MARKUP)

21 Pages Follow

SECTION 1

INTRODUCTION AND GENERAL DESCRIPTION OF STORAGE SYSTEM

1.1 INTRODUCTION

Discharged spent fuel assemblies from Prairie Island Nuclear Generating Plant, Units 1 and 2, are currently stored on-site in a spent fuel pool. The spent fuel pool provides for long term storage of 1,386 assemblies in high-density storage racks. Typically, 48 spent fuel assemblies per unit are discharged to the spent fuel pool each cycle, which occurs approximately every 16 months. Section 3.1.1 provides a detailed description of the spent fuel. Additional information is contained in the Prairie Island Updated Safety Analysis Report (USAR) (Reference 1).

Under the current fuel cycle management strategy, the spent fuel pool will lose capacity for discharge of a full core in 1993. Storage capacity will be exhausted completely in 1994. Accordingly, additional spent fuel storage capacity is needed.

To support this need and provide storage until the Department of Energy (DOE) accepts title to spent fuel under the requirements of the Nuclear Waste Policy Act of 1982, as amended in 1987, Northern States Power Company (NSP) requested permission to build and operate an on-site Independent Spent Fuel Storage Installation (ISFSI) in compliance with restrictions and requirements of 10CFR72.

NSP chose the TN-40 and TN40HT dry cask storage system designed by Transnuclear, Inc. The TN-40 system is more fully described in Sections 3.3 and 4.2.3 and Appendix 4A.

The TN-40HT system is described in Addendum A. The Sections in Addendum A also contain the analyses and evaluations associated with the design and operation of the TN-40HT system.

The Prairie Island ISFSI includes an Equipment Storage Building which will be used to store the cask lifting yoke and transport vehicle.

Construction of the ISFSI is scheduled to commence in March 1992. The ISFSI is scheduled to begin operation in February 1993.

The capacity of the ISFSI will enable Prairie Island to store an additional 1,920 spent fuel assemblies in 48 casks. The ISFSI will provide adequate capacity to enable Units 1 and 2 to continue operation until expiration of their respective Operating Licenses in 2013 and 2014.

7.3 RADIATION PROTECTION DESIGN FEATURES

7.3.1 STORAGE SYSTEM DESIGN DESCRIPTION

A description of the ISFSI, including layout and characteristics is provided **in Section 4.1.**

The ISFSI has a number of design features which ensure that exposures are ALARA.

- There will be no radioactive systems in the ISFSI other than the storage casks.
- The casks will be loaded, sealed, and decontaminated prior to transfer to the ISFSI.
- The fuel will not be unloaded nor will the casks be opened at the ISFSI.
- The fuel will be stored dry inside the casks, so that no radioactive liquid is available for leakage.
- The casks will be sealed airtight.
- The casks will be heavily shielded to minimize external dose rates.

Also, the ISFSI will not normally be occupied. Therefore, no personnel areas, equipment decontamination areas, contamination control areas, or health physics facilities need be located at the ISFSI. These types of facilities are available at the Prairie Island Nuclear Generating Plant.

Due to the remoteness of the ISFSI from other normally occupied areas and the anticipated occupancy times for performing surveillance activities, the anticipated total effective dose equivalent to any individual member of the public in any period of one calendar year will be well below 0.1 rem in accordance with 10CFR20.1301(a)(1). Accordingly, areas outside the owner-controlled fenced area are unrestricted and the dose to unrestricted areas from the ISFSI cannot exceed 2.00 mrem in any one hour in accordance with 10CFR20.1301(a)(2). Worst case dose rates (assuming design basis fuel in 48 casks) at the outer fence boundary (nuisance fence), which is well within the restricted area boundary, have been calculated to be 1.99 mrem/hr.

7.3.2 SHIELDING

The design of the cask shielding, material of construction, and method of calculating shielding parameters are explained in Appendix 7A. A discussion of the earth berm shielding ~~and resulting attenuation factors~~ is ~~also~~ contained in ~~Appendix 7A~~ [Section A7A]. No special features or remote handling of the casks in the ISFSI are proposed. Portable shielding may be used during cask maintenance, if appropriate.

7.4 ESTIMATED ONSITE COLLECTIVE DOSE ASSESSMENT

Table 7.4-1 shows the estimated design basis occupational exposures to ISFSI personnel during the loading, transport, and emplacement of the storage casks. Dose rates at 1 meter were utilized for all cases except cask transfer, when individuals will typically be at least 2 meters away from the cask.

Table 7.4-2 shows the estimated design basis annual man-rem for surveillance and maintenance activities. Visual surveillance was based on a walkdown of each of the two pads at a distance no closer than 2 meters to the casks. The casks on the opposite pad contribute approximately 1 mrem/hr to the expected dose rate along with contributions from the casks on the near pad. It was assumed that the average dose rate for the surveillance was four times the dose rate calculated at 2 meters from a cask. To estimate the dose rates for operability tests and calibration, the worker was assumed to be located at the monitoring panel at the perimeter fence entrance. During instrument repairs, the worker was assumed to be positioned between two rows of casks. The six surrounding casks (all within 16 feet of the worker) were the predominant dose contributors during repair work, but dose rates from casks on the other pads were also considered.

Both Table 7.4-1 and 7.4-2 provide for each task the estimated time required for the task, number of personnel required, the design basis dose rates, and man-rem.

An evaluation of the additional dose to station personnel from ISFSI operations is contained in Section A7.

~~To evaluate the additional dose to station personnel from ISFSI operations, a conservative analysis has been performed using the dose rate versus distance assumptions given in Appendix 7A and including yearly decay. The occupational dose calculation considers all workers at the Prairie Island Nuclear Generating Plant to be in buildings or in the plant yard. This population includes a normal work force of utility and contractor personnel as well as the increased staffing required during outages and in the summer. With the exception of the upper floor of the Power House and Computer Area, which are above the berm shielding, no credit is taken for shielding of personnel by buildings.~~

~~Table 7.4-3 provides a summary of staffing levels assumed at various site locations. The locations designated on Table 7.4-3 are shown on Figure 7.4-1. This information is considered to be a general estimate of station staffing and does not necessarily reflect actual staffing at any given time. Changes in staffing levels and locations can be expected to occur in the future without affecting the general estimates contained in this section.~~

Except for the Training Building, which is located northwest of the ISFSI casks, the distance from the spent fuel casks to the receptor locations was taken as the distance from the northeast corner of the eastern row of casks to the receptor location shown on Figure 7.4-1.

Distance dependent dose rates due to direct and skyshine gamma and neutron radiation from the casks have been provided in Tables 7A-6 and 7A-7 of Appendix 7A. The direct shine dose rates do not take into account air attenuation or scattering. The data is provided for 9 and 21 years of loading of spent fuel casks. This corresponds to loading arrangements that contain 24 and 48 spent fuel casks respectively. The total dose rate at each of the distances specified in the table is calculated by summing the direct shine and skyshine components at each specified time.

Dose rates at various site locations were conservatively calculated based on the distances from each source using the North-South directed source dose rate vs. distance data. Table 7.4-4 shows the cask to receptor distance, and the dose rate resulting from the casks at each of the assumed onsite receptor locations. Air attenuation was not taken into account in developing these estimates.

Table 7.4-6 summarizes the calculated doses to full time, outage and summer help at the various locations due to the casks. The collective onsite dose by location and the total onsite dose estimates are also shown on this table.

7.5 OFFSITE COLLECTIVE DOSE ASSESSMENT

An evaluation of the offsite collective dose from ISFSI operations is contained in Section A7.

Figure 1.2-1 illustrates the Prairie Island Nuclear Generating Plant site boundary, which is also the boundary of the exclusion area as defined in 10CFR100.3. This exclusion area corresponds to the controlled area for the ISFSI as defined in 10CFR72.3.

In calculating the offsite collective dose, the entire population within a 2 mile radius of the plant was conservatively taken to be at the location of the residence subject to the highest exposure. The residence of highest exposure was found by determining the dose rate to the residence nearest to the spent fuel cask storage source.

The nearest residence, which is shielded by the 17 ft. berm, was determined to be 0.45 miles from the ISFSI in the NW direction.

The dose rate resulting from cask storage as a function of distance for the population that resides in locations which are shielded by the berm is given by Tables 7A-6 and 7A-7 of Appendix 7A. The dose rate at the nearest residence northwest of the ISFSI due to the presence of the casks was conservatively interpolated to be 1.30E-04 mrem/hr, based on the sum of the N-S dose rate data presented in Table 7A-6 and adjusted for berm attenuation and the skyshine data provided in Table 7A-7.

The dose to the population was obtained by taking the dose rate (in rem/hr) for the NW sector and multiplying it by the total population within a two mile radius of the plant to obtain (person-rem)/hr and then multiplying that product by 8,760 hrs/yr to obtain (person-rem)/yr. Because of the conservatism associated with this dose calculation, the dose to the population residing within two miles of the plant, placed at the residence exposed to the highest dose rate, adequately estimates the population dose.

Based on estimated 1985/1986 population data, which showed 464 residents within a two mile radius, the total annual offsite collective dose from cask storage was calculated to be 0.053 person-rem. Table 2.1-1, which is based on estimated 1998 population data, indicates that 414 residents live within two miles of the Prairie Island Nuclear Generating Plant.

Note that this is the maximum dose rate that would occur with 48 casks and would occur when the last two casks are placed in the ISFSI. Thereafter, the dose rate would constantly decrease due to decay.

TABLE 7.4-3

STATION PERSONNEL

LOCATION NUMBER	LOCATION	FULL TIME [1]	OUTAGE[2]	SUMMER HELP[3]
1	Administration Building	190	0	0
2	Training Building	55	0	0
3	NPD Building	26	1	0
4	Construction Warehouse B	15	45	0
5	Parts Warehouse	6	0	0
6	Environmental Lab	2	0	2
7	Computer Area	14	0	5
8	Outage Trailers	3	40	0
9	Security Building	117	25	0
10	Power House	92	192	0
11	Substation	2	2	0
12	Construction Warehouse A	15	45	0
13	NPD Annex Building	27	2	0

NOTES

1. For full time employees, assume 2,500 hours/year.
2. For outage employees, assume 540 hours/year.
3. For summer help, assume 400 hours/year.

TABLE 7.4-4

DOSE RATES AT ONSITE LOCATIONS DUE TO CASK STORAGE

LOCATION NUMBER.	LOCATION	DISTANCE (FT)	DOSE RATE (mrem/hr)
1	Administration Building	1,411	1.15E-03
2	Training Building	773	7.39E-03
3	NPD Building	835	5.90E-03
4	Construction Warehouse B	733	8.53E-03
5	Parts Warehouse	1,288	1.57E-03
6	Environmental Lab	2,349	1.39E-04
7	Computer Area	1,705	5.75E-04
8	Outage Trailers	1,731	5.36E-04
9	Security Building	1,260	1.74E-03
10	Power House	1,434	1.07E-03
11	Substation	2,098	2.38E-04
12	Construction Warehouse A	1,124	2.54E-03
13	NPD Annex Building	716	9.17E-03

TABLE 7.4-6

ANNUAL COLLECTIVE EXPOSURE ESTIMATES TO ONSITE PERSONNEL

LOC NO	LOCATION	FULL TIME (PERSON-rem)	OUTAGE (PERSON-rem)	SUMMER HELP (PERSON-rem)	TOTAL (PERSON-rem)
1	Administration Building	5.46E-01	0.00E+00	0.00E+00	5.46E-01
2	Training Building	1.02E+00	0.00E+00	0.00E+00	1.02E+00
3	NPD Building	3.84E-01	3.19E-03	0.00E+00	3.87E-01
4	Construction Warehouse B	3.20E-01	2.07E-01	0.00E+00	5.27E-01
5	Parts Warehouse	2.36E-02	0.00E+00	0.00E+00	2.36E-02
6	Environmental Lab	6.95E-04	0.00E+00	1.11E-04	8.06E-04
7	Computer Area	2.01E-02	0.00E+00	1.15E-03	2.13E-02
8	Outage Trailers	4.02E-02	1.16E-02	0.00E+00	1.56E-02
9	Security Building	5.09E-01	2.35E-02	0.00E+00	5.32E-01
10	Power House	2.46E-01	1.11E-01	0.00E+00	3.57E-01
11	Substation	1.19E-03	2.57E-04	0.00E+00	1.45E-03
12	Construction Warehouse A	9.53E-02	6.17E-02	0.00E+00	1.57E-01
13	NPD Annex Building	6.19E-01	9.90E-03	0.00E+00	6.29E-01
	TOTAL	**3.78E+00**	**4.28E-01**	**1.26E-03**	**4.22E+00**

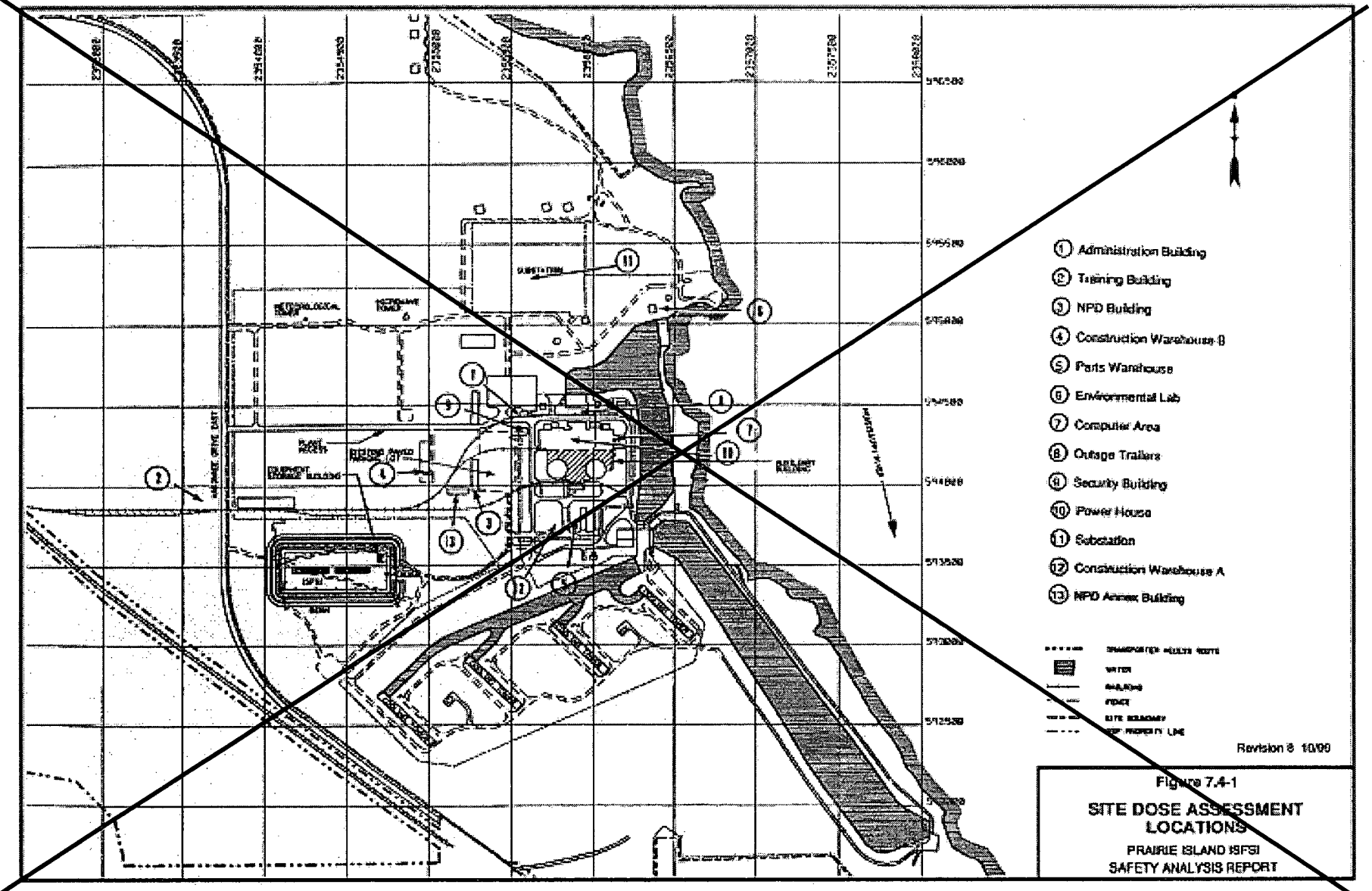


Figure 7.4-1

SITE DOSE ASSESSMENT LOCATIONS

PRAIRIE ISLAND ISFSI
SAFETY ANALYSIS REPORT

FIGURE 7.4-1

The models described above pertain to an individual storage cask. The evaluation of the ISFSI dose rates, i.e., from the array of casks, is contained in Section A7A.

~~The models described above pertain to an individual storage cask. The arrangement for the Prairie Island ISFSI is two storage pads, each containing 24 casks as shown in Figure 1.3-1. To evaluate the dose rate from this array of casks, it is assumed that each cask contains 40 design basis fuel assemblies. When the casks are placed on the storage pad, the fuel has cooled for 10 years. It is further assumed that at the start of the first year, eight casks are placed in the middle of the west pad and two casks are added each year thereafter, alternating ends. The pitch of the casks on the storage pad is 18 ft.~~

~~As casks are added to the pad, the dose rate increases but not in direct proportion to the number of casks. The dose rate is affected by one row of casks blocking the other row, and decay of the source term for casks that have been on the pad for several years. Direct radiation is not the only component of the dose; skyshine also contributes to the total dose rate.~~

~~Source terms (gamma and neutron) for decay times from 10 to 30 years were utilized in a series of XSDRNPM (spherical) calculations to determine dose rates as a function of fuel decay time. The results were normalized to a cooling time of 10 years and are shown in Figure 7A-7.~~

~~Under the assumptions previously given, it takes 9 years to fill the first (west) pad and 21 years to completely fill both pads with 48 casks. Dose rates were calculated in both the N-S direction and E-W direction away from the ISFSI. Both direct radiation and indirect radiation (skyshine) were evaluated at the centerline of the west pad (9 years) and at the centerline of the east pad (21 years) in the N-S direction and also at the centerline of the pad(s) in the E-W direction.~~

7A.3 DIRECT RADIATION N-S

The evaluation of the ISFSI dose rates, i.e., from the array of casks, is contained in Section A7A.

~~Direct radiation in the N-S direction is mainly from the outside (N or S) row of casks on the pads. The direct dose is determined for each of the 12 (24)outside row(s) casks by spherical XSDRNPM analyses for the appropriate radius to the dose point. Decay factors from figure 7A-7 are applied to correct each cask for its cooling time on the pad.~~

~~To evaluate the direct dose contribution from the 12 (24) casks on the opposite row(s), a QAD-CGGP evaluation was performed. The relative dose rate from the outside row of casks was calculated at each dose point. The dose rate from the opposite row of casks was then calculated with the outside row of casks modeled as uranium cylinders so that only line of sight radiation hit the detector.~~

~~The dose rates from each cask were totaled and a fraction calculated. The results of these analyses are given in Table 7A-5, 7A-5a and 7A-5b. To calculate the total direct dose, the direct dose from the outside row of casks is increased by the appropriate fraction (i.e. multiplied by 1+ fraction).~~

7A.4 DIRECT RADIATION E-W

The evaluation of the ISFSI dose rates, i.e., from the array of casks, is contained in Section A7A.

~~Direct radiation on the centerline of the pad(s) comes mainly from the two end casks. The end casks essentially block all dose contribution from the other casks. To confirm this, QAD-CGGP analyses were made, similar to the ones previously discussed, to evaluate direct radiation contribution from casks behind the end casks. This analysis showed the casks behind the two end casks had no significant contribution. The appropriate distance from the end cask (10 year decay) to the dose point is calculated and the dose rate interpolated from the spherical XSDRNPM calculations mentioned previously. The calculated dose rate is then doubled for both casks. Table 7A-6 lists the results of the direct dose calculation assuming no earth berm is present.~~

7A.5 INDIRECT RADIATION (SKYSHINE)

The evaluation of the ISFSI dose rates, i.e., from the array of casks, is contained in Section A7A.

~~In addition to direct radiation from the array of storage casks, indirect radiation makes a contribution to the total dose rate around the ISFSI site. This indirect radiation is from direct radiation emanating upward and scattered by air into the surrounding area. The computer program SKYSHINE II (Reference 7) is utilized to evaluate the skyshine dose contribution for the Prairie Island ISFSI.~~

~~The SKYSHINE code uses an equivalent point source for its calculation. The results of the spherical XSDRNPM calculations at 180 meters are used to calculate equivalent gamma and neutron point sources. Since the XSDRNPM-XSDOSE calculations assume no air attenuation, the equation describing the dose rate from a point source is:~~

$$DR = \sum \frac{Si\ Di}{4\pi R^2} = \frac{So}{4\pi R^2} \sum fi\ Di$$

~~So = total source, fi = fraction of source at energy group i~~

Di = flux to dose conversion factor for group i

For gamma, the source terms from Table 7.2-6 give an equivalent single cask point source of 1.052E10 γ/sec. For neutron, the source terms from Table 7.2-5 give an equivalent point source of 2.310E7 n/sec.

Utilizing the SKYSHINE II code, with the equivalent point sources modified by the appropriate decay factor, the skyshine dose from 24 casks (first full pad) and 48 casks (both pads full) was calculated. The results are shown in Table 7A-7.

7A.6 EARTH BERM

The evaluation of the ISFSI dose rates, i.e., from the array of casks, is contained in Section A7A.

As shown in Figures 2.5-6 and 2.5-7, an earth berm is placed around the ISFSI as additional radiation shielding. The berm is a minimum of 17 feet high having a minimum of 6 feet of soil thickness to reduce area dose rates. The soil at the Prairie Island site consists almost entirely of quartz. For this analysis, it is assumed that the earth berm is 50% quartz, 40% void and 10% water. Assuming the density of quartz (SiO_2) is 2.6 g/cc, the atom densities for the analysis are:

Si - 1.303E-2

O - 2.9405E-2

H - 6.6917E-3

An XSDRNPM calculation is performed to calculate the attenuation factor of the berm. The spherical model in Figure 7A-5 is surrounded by earth and the dose rate calculated at 100 meters. Table 7A-8 shows the results of the analysis.

7A.7 DOSE RATE AROUND THE ISFSI

The evaluation of the ISFSI dose rates, i.e., from the array of casks, is contained in Section A7A.

The total dose resulting from cask storage is calculated by adding the direct and skyshine dose rates. Table 7A-6 shows the total maximum dose rate, without earth berms, around the ISFSI site. Figures 7A-10 and 7A-11 show the dose rates with the berm. As can be seen in the figures, the attenuation factor for six feet of berm thickness essentially eliminates the direct radiation dose component.

TABLE 7A-5
RELATIVE DOSE FROM FRONT AND BACK ROW OF TN-40 CASKS (WEST PAD AT 9 YEARS)

RELATIVE CASK DOSE RATES AT SPECIFIED DISTANCE (METERS) FRONT ROW

CASK #	DECAY FACTOR	30	50	75	100	150	180	250	300	350	400	500	600	800
1	0.482	1.696E-03	6.077E-04	2.692E-04	1.512E-04	6.705E-05	4.654E-05	2.410E-05	1.673E-05	1.229E-05	9.403E-06	6.017E-06	4.177E-06	2.349E-06
1A	0.482	1.587E-03	5.904E-04	2.665E-04	1.503E-04	6.689E-05	4.646E-05	2.408E-05	1.672E-05	1.228E-05	9.401E-06	6.016E-06	4.176E-06	2.349E-06
2	0.526	1.404E-03	5.660E-04	2.608E-04	1.485E-04	6.654E-05	4.629E-05	2.403E-05	1.670E-05	1.227E-05	9.394E-06	6.013E-06	4.175E-06	2.348E-06
4	0.611	1.194E-03	5.287E-04	2.527E-04	1.459E-04	6.601E-05	4.603E-05	2.397E-05	1.667E-05	1.225E-05	9.384E-06	6.009E-06	4.173E-06	2.348E-06
6	0.734	9.984E-04	4.867E-04	2.427E-04	1.425E-04	6.532E-05	4.569E-05	2.387E-05	1.662E-05	1.222E-05	9.371E-06	6.004E-06	4.171E-06	2.347E-06
8	0.895	8.271E-04	4.423E-04	2.311E-04	1.384E-04	6.446E-05	4.527E-05	2.376E-05	1.657E-05	1.220E-05	9.354E-06	5.997E-06	4.168E-06	2.346E-06

RELATIVE CASK DOSE RATES AT SPECIFIED DISTANCE (METERS) BACK ROW

1	0.482	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
1A	0.482	3.709E-04	6.074E-05	9.416E-06	5.847E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
2	0.526	1.040E-03	1.548E-04	7.134E-05	1.256E-05	5.435E-07	9.279E-09	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
4	0.611	9.327E-04	3.880E-04	9.286E-05	3.601E-05	4.503E-06	1.536E-06	3.484E-08	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
6	0.734	4.973E-04	4.104E-04	2.037E-04	4.196E-05	9.572E-06	4.497E-06	5.746E-07	1.027E-07	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
8	0.895	1.456E-05	3.783E-04	2.286E-04	1.042E-04	1.378E-05	8.182E-06	1.358E-06	4.735E-07	1.039E-07	1.387E-08	0.000E+00	0.000E+00	0.000E+00

FRACTION (BACK ROW/FRONT ROW)

	3.700E-01	5.057E-01	4.845E-01	2.822E-01	1.058E-01	6.750E-02	1.857E-02	8.035E-03	2.036E-03	3.548E-04	0.000E+00	0.000E+00	0.000E+00

$$\text{Fraction} = \frac{\sum DB_i \times DY_i}{\sum DF_i \times DY_i}$$

DB= dose from back row.

DF= dose from front row.

DY= decay factor

EAST PAD 21 YEARS

TABLE 7A-5a
RELATIVE CASK DOSE RATES AT SPECIFIED DISTANCE (METERS) FRONT ROW

CASK #	DECAY FACTOR	30	50	75	100	150	180	250	300	350	400	500	600	800
10	0.388	1.696E-03	6.077E-04	2.692E-04	1.512E-04	6.705E-05	4.654E-05	2.410E-05	1.673E-05	1.229E-05	9.403E-06	6.017E-06	4.177E-06	2.349E-06
11	0.415	1.696E-03	6.077E-04	2.692E-04	1.512E-04	6.705E-05	4.654E-05	2.410E-05	1.673E-05	1.229E-05	9.403E-06	6.017E-06	4.177E-06	2.349E-06
12	0.454	1.587E-03	5.934E-04	2.665E-04	1.503E-04	6.689E-05	4.646E-05	2.408E-05	1.672E-05	1.228E-05	9.401E-06	6.016E-06	4.176E-06	2.349E-06
13	0.482	1.587E-03	5.934E-04	2.665E-04	1.503E-04	6.689E-05	4.646E-05	2.408E-05	1.672E-05	1.228E-05	9.401E-06	6.016E-06	4.176E-06	2.349E-06
14	0.526	1.404E-03	5.660E-04	2.608E-04	1.485E-04	6.654E-05	4.629E-05	2.403E-05	1.670E-05	1.227E-05	9.394E-06	6.013E-06	4.175E-06	2.348E-06
15	0.565	1.404E-03	5.660E-04	2.608E-04	1.485E-04	6.654E-05	4.629E-05	2.403E-05	1.670E-05	1.227E-05	9.394E-06	6.013E-06	4.175E-06	2.348E-06
16	0.611	1.194E-03	5.287E-04	2.527E-04	1.459E-04	6.601E-05	4.603E-05	2.397E-05	1.667E-05	1.225E-05	9.384E-06	6.009E-06	4.173E-06	2.348E-06
17	0.67	1.194E-03	5.287E-04	2.527E-04	1.459E-04	6.601E-05	4.603E-05	2.397E-05	1.667E-05	1.225E-05	9.384E-06	6.009E-06	4.173E-06	2.348E-06
18	0.734	9.984E-04	4.867E-04	2.427E-04	1.425E-04	6.532E-05	4.569E-05	2.387E-05	1.662E-05	1.223E-05	9.371E-06	6.004E-06	4.171E-06	2.347E-06
19	0.808	9.984E-04	4.867E-04	2.427E-04	1.425E-04	6.532E-05	4.569E-05	2.387E-05	1.662E-05	1.223E-05	9.371E-06	6.004E-06	4.171E-06	2.347E-06
20	0.895	8.271E-04	4.423E-04	2.311E-04	1.384E-04	6.446E-05	4.527E-05	2.376E-05	1.657E-05	1.220E-05	9.354E-06	5.997E-06	4.168E-06	2.346E-06
21	1	8.271E-04	4.423E-04	2.311E-04	1.384E-04	6.446E-05	4.527E-05	2.376E-05	1.657E-05	1.220E-05	9.354E-06	5.997E-06	4.168E-06	2.346E-06

RELATIVE CASK DOSE RATES AT SPECIFIED DISTANCE (METERS) BACK ROW

10	0.388	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000
11	0.415	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000
12	0.454	3.709E-04	6.074E-05	9.416E-06	5.847E-08	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000
13	0.482	3.709E-04	6.074E-05	9.416E-06	5.847E-08	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000
14	0.526	1.040E-03	1.548E-04	7.134E-05	1.256E-05	5.435E-07	9.279E-09	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000
15	0.565	1.040E-03	1.548E-04	7.134E-05	1.256E-05	5.435E-07	9.279E-09	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000
16	0.611	9.327E-04	3.880E-04	9.286E-05	3.601E-05	4.503E-06	1.536E-06	3.484E-08	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000
17	0.67	9.327E-04	3.880E-04	9.286E-05	3.601E-05	4.503E-06	1.536E-06	3.484E-08	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000
18	0.734	4.973E-04	4.104E-04	2.037E-04	4.196E-05	9.572E-06	4.497E-06	5.746E-07	1.027E-07	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000
19	0.808	4.973E-04	4.104E-04	2.037E-04	4.196E-05	9.572E-06	4.497E-06	5.746E-07	1.027E-07	0.000E+000	0.000E+000	0.000E+000	0.000E+000	0.000E+000
20	0.895	1.456E-05	3.783E-04	2.286E-04	1.042E-04	1.778E-05	8.182E-06	1.358E-06	4.735E-07	1.039E-07	1.387E-08	0.000E+000	0.000E+000	0.000E+000
21	1	1.456E-05	3.783E-04	2.286E-04	1.042E-04	1.778E-05	8.182E-06	1.358E-06	4.725E-07	1.039E-07	1.387E-08	0.000E+000	0.000E+000	0.000E+000

FRACTION (BACK ROW/FRONT ROW)

		4.221E-01	4.862E-01	4.377E-01	2.282E-01	8.572E-02	5.388E-02	1.368E-02	5.335E-03	1.159E-03	2.020E-04	0.000E+000	0.000E+000	0.000E+000

WEST PAD 21 YEARS

TABLE 7A-5b
RELATIVE CASK DOSE RATES AT SPECIFIED DISTANCE (METERS) FRONT ROW

CASK #	DECAY FACTOR	30	50	75	100	150	180	250	300	350	400	500	600	800
9	0.36	4.630E-04	3.115E-04	1.897E-04	1.225E-04	6.079E-04	4.344E-05	2.325E-05	1.632E-05	1.207E-05	9.275E-06	5.964E-06	4.153E-06	2.341E-06
7	0.318	3.931E-04	2.783E-04	1.769E-04	1.170E-04	5.942E-05	4.274E-05	2.305E-05	1.622E-05	1.201E-05	9.244E-06	5.951E-06	4.146E-06	2.339E-06
5	0.278	3.368E-04	2.488E-04	1.646E-04	1.115E-04	5.797E-05	4.199E-05	2.283E-05	1.611E-05	1.195E-05	9.209E-06	5.937E-06	4.139E-06	2.337E-06
3	0.242	2.910E-04	2.229E-04	1.528E-04	1.060E-04	5.646E-05	4.119E-05	2.259E-05	1.599E-05	1.189E-05	9.170E-06	5.921E-06	4.131E-06	2.335E-06
1a	0.213	2.535E-04	2.002E-04	1.418E-04	1.006E-04	5.490E-05	4.035E-05	2.234E-05	1.586E-05	1.182E-05	9.129E-06	5.903E-06	4.123E-06	2.332E-06
1	0.213	2.225E-04	1.803E-04	1.315E-04	9.534E-05	5.330E-05	3.948E-05	2.207E-05	1.573E-05	1.174E-05	9.084E-06	5.885E-06	4.114E-06	2.329E-06
1	0.213	1.955E-04	1.629E-04	1.220E-04	9.025E-05	5.168E-05	3.859E-05	2.179E-05	1.559E-05	1.166E-05	9.037E-06	5.865E-06	4.104E-06	2.326E-06
1a	0.213	1.748E-04	1.476E-04	1.133E-04	8.538E-05	5.005E-05	3.768E-05	2.150E-05	1.544E-05	1.158E-05	8.986E-06	5.884E-06	4.094E-06	2.323E-06
2	0.228	1.564E-04	1.342E-04	1.052E-04	8.072E-05	4.842E-05	3.675E-05	2.119E-05	1.528E-05	1.149E-05	8.933E-06	5.821E-06	4.083E-06	2.319E-06
4	0.259	1.406E-04	1.224E-04	9.781E-05	7.630E-05	4.680E-05	3.581E-05	2.088E-05	1.512E-05	1.140E-05	8.877E-06	5.798E-06	4.072E-06	2.316E-06
6	0.293	1.271E-04	1.120E-04	9.104E-05	7.212E-05	4.520E-05	3.487E-05	2.056E-05	1.495E-05	1.130E-05	8.818E-06	5.773E-06	4.059E-06	2.312E-06
8	0.338	1.154E-04	1.028E-04	8.485E-05	6.819E-05	4.363E-05	3.390E-05	2.023E-05	1.477E-05	1.120E-05	8.758E-06	5.747E-06	4.046E-06	2.308E-06

RELATIVE CASK DOSE RATES AT SPECIFIED DISTANCE (METERS) BACK ROW

9	0.36	4.174E-04	2.785E-04	1.714E-04	1.122E-04	4.866E-05	3.518E-05	6.416E-06	2.376E-06	1.354E-06	5.733E-07	1.464E-07	2.224E-08	9.711E-35
7	0.318	2.596E-04	1.067E-32	1.169E-04	1.076E-04	4.771E-05	3.356E-05	6.889E-06	4.025E-06	1.681E-06	9.404E-07	2.448E-07	4.502E-08	9.820E-35
5	0.0278	2.580E-05	9.668E-33	5.657E-05	1.028E-04	5.149E-05	3.467E-06	7.112E-06	4.595E-06	2.528E-06	1.232E-06	3.464E-07	1.203E-07	3.509E-09
3	0.242	1.172E-32	4.959E-06	3.103E-05	8.900E-05	5.268E-05	3.385E-05	7.394E-06	4.830E-06	3.168E-06	1.563E-06	5.616E-07	1.925E-07	1.497E-08
1a	0.213	1.031E-32	3.474E-05	6.023E-33	6.795E-05	5.174E-05	3.618E-05	1.761E-05	4.963E-06	3.440E-06	2.201E-06	7.260E-07	2.268E-07	2.532E-08
1	0.213	9.125E-33	7.405E-05	5.205E-33	4.013E-05	5.032E-05	3.699E-05	1.779E-05	5.079E-06	3.574E-06	2.542E-06	8.294E-07	3.465E-07	5.754E-08
1	0.213	8.120E-33	6.916E-05	4.862E-33	3.484E-05	4.887E-05	3.670E-05	1.823E-05	7.100E-06	3.659E-06	2.678E-06	1.053E-06	4.661E-07	8.133E-08
1a	0.213	7.265E-33	4.039E-05	4.541E-33	3.759E-06	4.734E-05	3.588E-05	1.748E-05	1.234E-05	3.727E-06	2.756E-06	1.404E-06	5.338E-07	1.115E-07
2	0.228	6.531E-33	8.812E-06	8.036E-07	1.612E-06	4.337E-05	3.503E-05	1.834E-05	1.245E-05	4.130E-06	2.809E-06	1.593E-06	5.838E-07	1.271E-07
4	0.259	5.899E-33	1.143E-05	9.603E-06	3.071E-33	3.694E-05	3.418E-05	1.901E-05	1.284E-05	9.084E-06	2.855E-06	1.678E-06	7.621E-06	1.678E-07
6	0.293	5.351E-33	4.637E-33	2.105E-05	2.916E-33	3.125E-05	3.328E-05	1.942E-05	1.215E-05	9.121E-06	2.969E-06	1.739E-06	9.773E-07	2.237E-07
8	0.338	4.873E-33	4.274E-33	3.387E-05	2.768E-33	2.550E-05	3.114E-05	1.943E-05	1.261E-05	9.229E-06	4.673E-06	1.776E-06	1.088E-06	2.641E-07

FRACTION (BACK ROW/FRONT ROW)

		3.059E-01	2.546E-01	3.388E-01	5.221E-01	8.365E-01	8.272E-01	6.462E-01	5.021E-01	3.958E-01	2.512E-01	1.681E-01	1.093E-01	3.942E-02

TABLE 7A-6

TOTAL DOSE RATE (TN-40 CASKS) (mrem/hr)

ISFSI N-S DOSE RATES AT SPECIFIED DISTANCES (METERS) mrem/hr (WITHOUT BERM)

YEAR	30	50	75	100	150	180	250	300	350	400	500	600	800
GAMMA DOSE RATE													
9	8.72E-01	4.25E-01	2.08E-01	1.07E-01	4.30E-02	2.90E-02	1.41E-02	9.60E-03	6.92E-03	5.23E-03	3.30E-03	2.28E-03	1.27E-03
21	9.82E-01	4.83E-01	2.50E-01	1.41E-01	6.65E-02	4.64E-02	2.30E-02	1.51E-02	1.06E-02	7.77E-03	4.79E-03	3.25E-03	1.78E-03
NEUTRON DOSE RATE													
9	2.44E-01	1.18E-01	5.68E-02	2.87E-02	1.14E-02	7.68E-03	3.83E-03	2.63E-03	1.92E-03	1.47E-03	9.40E-04	6.53E-04	3.67E-04
21	2.82E-01	1.39E-01	7.20E-02	4.15E-02	2.08E-02	1.47E-02	7.49E-03	4.96E-03	3.54E-03	2.59E-03	1.62E-03	1.10E-03	6.06E-04

ISFSI E-W DOSE RATES AT SPECIFIED DISTANCES (METERS) mrem/hr (WITHOUT BERM)

YEAR	30	50	75	100	150	180	250	300	350	400	500	600	800
GAMMA DOSE RATE													
9	2.18E-01	8.00E-02	3.64E-02	2.08E-02	9.32E-03	6.50E-03	3.37E-03	2.34E-03	1.72E-03	1.32E-03	8.24E-04	5.85E-04	3.29E-04
21	2.18E-01	8.00E-02	3.64E-02	2.08E-02	9.32E-03	6.50E-03	3.37E-03	2.34E-03	1.72E-03	1.32E-03	8.24E-04	5.85E-04	3.29E-04
NEUTRON DOSE RATE													
9	4.70E-02	1.78E-02	8.09E-03	4.60E-03	2.08E-03	1.44E-03	7.49E-04	5.20E-04	3.82E-04	2.92E-04	1.87E-04	1.30E-04	7.31E-05
21	4.70E-02	1.78E-02	8.09E-03	4.60E-03	2.08E-03	1.44E-03	7.49E-04	5.20E-04	3.82E-04	2.92E-04	187E-04	1.30E-04	7.31E-05

TABLE 7A-7

TOTAL SKYSHINE GAMMA DOSE RATE AT SPECIFIED DISTANCES (METERS) mrem/hr

YEAR	30	50	75	100	150	180	250	300	350	400	500	600	800
9	3.60E-02	2.20E-02	1.33E-02	8.51E-03	3.86E-03	2.56E-03	9.84E-03	5.17E-04	2.79E-04	1.53E-04	5.09E-05	1.69E-05	2.16E-06
21	7.20E-02	4.39E-02	2.65E-02	1.70E-02	7.71E-03	5.14E-03	1.97E-03	1.03E-03	5.57E-04	3.06E-04	1.02E-04	3.38E-05	4.32E-06

SKYSHINE NEUTRON DOSE RATE AT SPECIFIED DISTANCES (METERS) mrem/hr

9	4.35E-02	2.70E-02	1.71E-02	1.17E-02	6.19E-03	4.42E-03	2.18E-03	1.38E-03	8.98E-04	5.94E-04	2.86E-04	1.39E-04	3.61E-05
21	8.70E-02	5.40E-02	3.41E-02	2.34E-02	1.24E-02	8.84E-03	4.36E-03	2.77E-03	1.80E-03	1.19E-03	5.73E-04	2.78E-04	7.21E-05

TABLE 7A-8

ATTENUATION FACTOR FOR EARTH BERM

BERM THICKNESS (ft)	GAMMA DOSE (mrem/hr)	NEUTRON DOSE (mrem/hr)	ATTENUATION FACTOR	
			γ	N
0	0.0104	0.0023	1.0	1.0
6	7.150E-7	7.094E-9	6.875E-5	3.084E-6
8	8.386E-8	1.885E-10	8.046E-6	8.196E-8
10	1.065E-8	5.98E-12	1.024E-6	2.601E-9

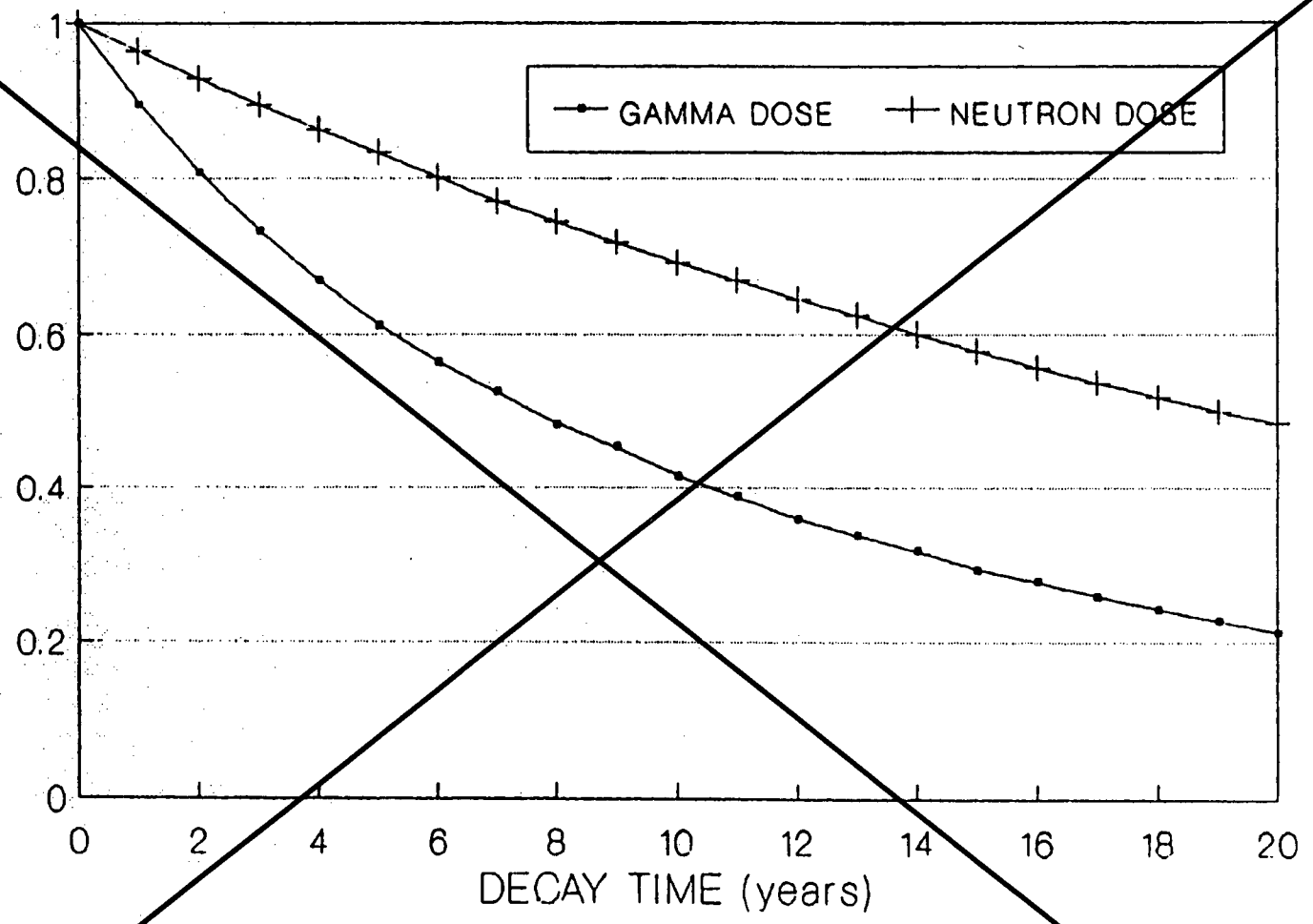
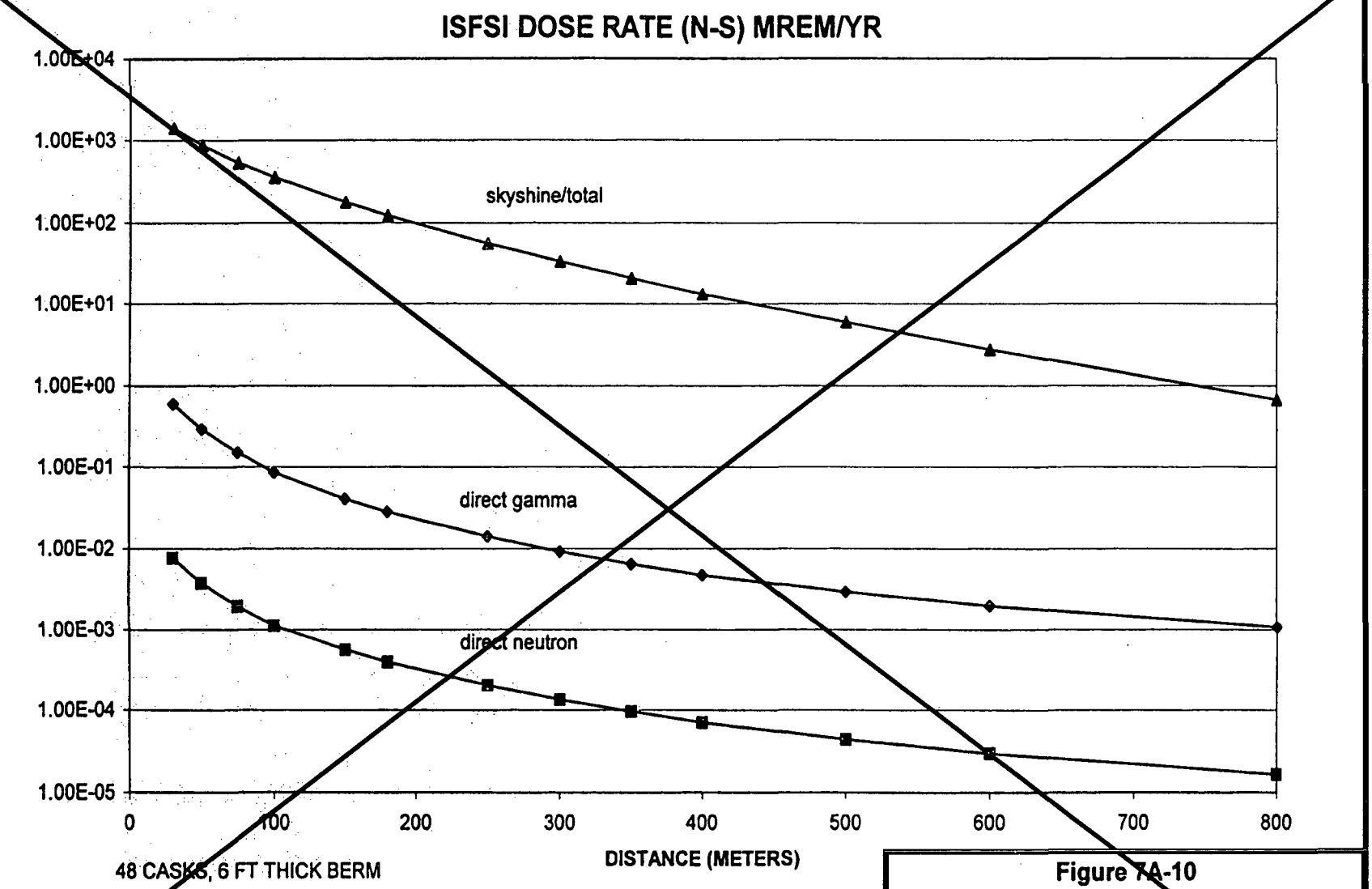


Figure 7A-7

RELATIVE DOSE RATE FACTOR (NORMALIZED TO 10 YR DECAY)

REVISION: 0

PRAIRIE ISLAND ISFSI
SAFETY ANALYSIS REPORT

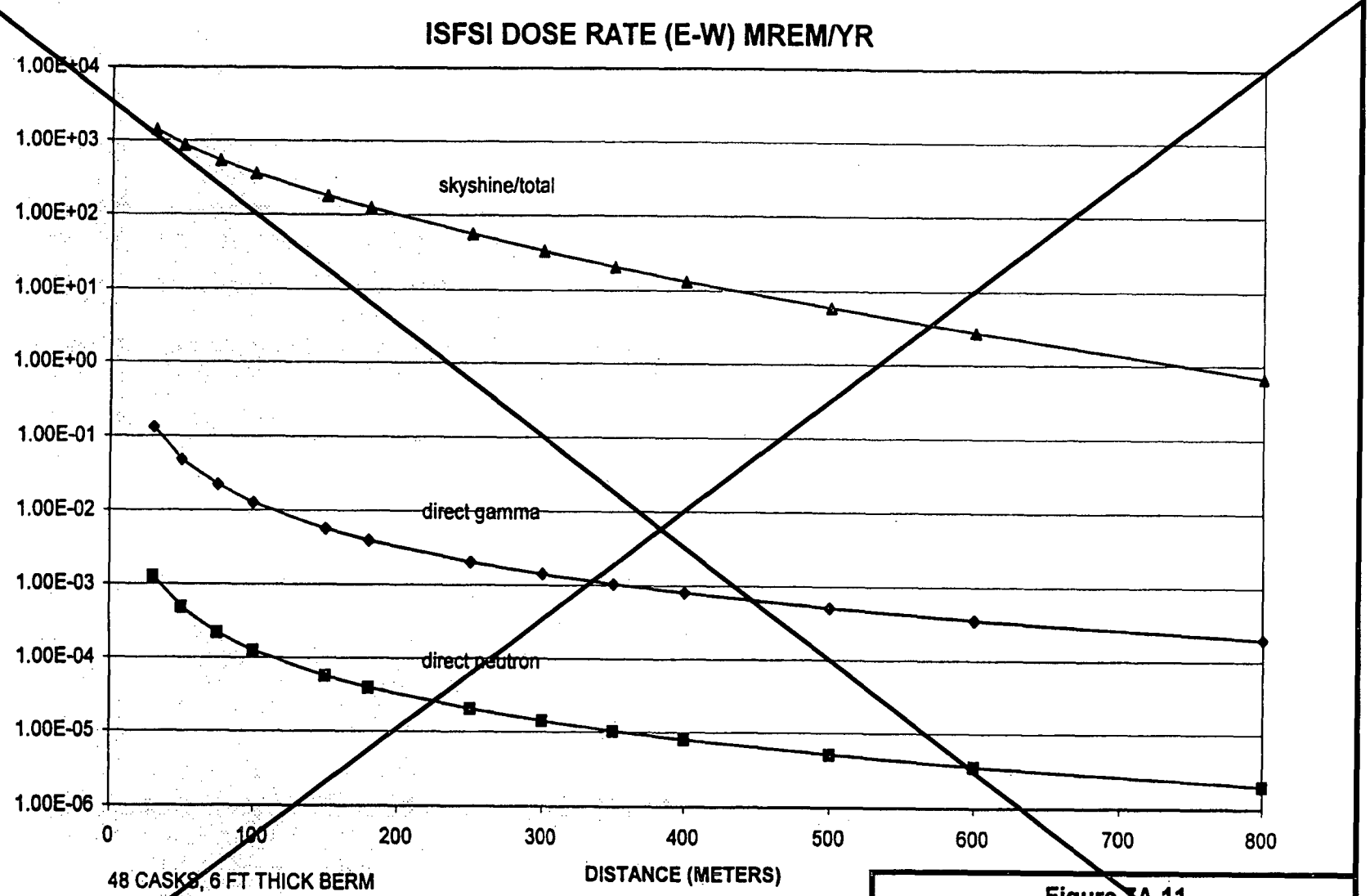


Revision 8 10/99

Figure 7A-10

ISFSI DOSE RATE (N-S DIRECTION MREM/YR)

PRAIRIE ISLAND ISFSI
SAFETY ANALYSIS REPORT



Revision 8 10/99

Figure 7A-11

ISFSI DOSE RATE (E-W DIRECTION MREM/YR)

PRAIRIE ISLAND ISFSI
SAFETY ANALYSIS REPORT

ENCLOSURE 3

ATTACHMENT 5

PI ISFSI SAR PAGE CHANGES (RETYPED)

5 Pages Follow

SECTION 1

INTRODUCTION AND GENERAL DESCRIPTION OF STORAGE SYSTEM

1.1 INTRODUCTION

Discharged spent fuel assemblies from Prairie Island Nuclear Generating Plant, Units 1 and 2, are currently stored on-site in a spent fuel pool. The spent fuel pool provides for long term storage of 1,386 assemblies in high-density storage racks. Typically, 48 spent fuel assemblies per unit are discharged to the spent fuel pool each cycle, which occurs approximately every 16 months. Section 3.1.1 provides a detailed description of the spent fuel. Additional information is contained in the Prairie Island Updated Safety Analysis Report (USAR) (Reference 1).

Under the current fuel cycle management strategy, the spent fuel pool will lose capacity for discharge of a full core in 1993. Storage capacity will be exhausted completely in 1994. Accordingly, additional spent fuel storage capacity is needed.

To support this need and provide storage until the Department of Energy (DOE) accepts title to spent fuel under the requirements of the Nuclear Waste Policy Act of 1982, as amended in 1987, Northern States Power Company (NSP) requested permission to build and operate an on-site Independent Spent Fuel Storage Installation (ISFSI) in compliance with restrictions and requirements of 10CFR72.

NSP chose the TN-40 and TN40HT dry cask storage system designed by Transnuclear, Inc. The TN-40 system is more fully described in Sections 3.3 and 4.2.3 and Appendix 4A.

The TN-40HT system is described in Addendum A. The Sections in Addendum A also contain the analyses and evaluations associated with the design and operation of the TN-40HT system.

The Prairie Island ISFSI includes an Equipment Storage Building which will be used to store the cask lifting yoke and transport vehicle.

Construction of the ISFSI is scheduled to commence in March 1992. The ISFSI is scheduled to begin operation in February 1993.

The capacity of the ISFSI will enable Prairie Island to store an additional 1,920 spent fuel assemblies in 48 casks. The ISFSI will provide adequate capacity to enable Units 1 and 2 to continue operation until expiration of their respective Operating Licenses in 2013 and 2014.

7.3 RADIATION PROTECTION DESIGN FEATURES

7.3.1 STORAGE SYSTEM DESIGN DESCRIPTION

A description of the ISFSI, including layout and characteristics is provided in Section 4.1.

The ISFSI has a number of design features which ensure that exposures are ALARA.

- There will be no radioactive systems in the ISFSI other than the storage casks.
- The casks will be loaded, sealed, and decontaminated prior to transfer to the ISFSI.
- The fuel will not be unloaded nor will the casks be opened at the ISFSI.
- The fuel will be stored dry inside the casks, so that no radioactive liquid is available for leakage.
- The casks will be sealed airtight.
- The casks will be heavily shielded to minimize external dose rates.

Also, the ISFSI will not normally be occupied. Therefore, no personnel areas, equipment decontamination areas, contamination control areas, or health physics facilities need be located at the ISFSI. These types of facilities are available at the Prairie Island Nuclear Generating Plant.

Due to the remoteness of the ISFSI from other normally occupied areas and the anticipated occupancy times for performing surveillance activities, the anticipated total effective dose equivalent to any individual member of the public in any period of one calendar year will be well below 0.1 rem in accordance with 10CFR20.1301(a)(1). Accordingly, areas outside the owner-controlled fenced area are unrestricted and the dose to unrestricted areas from the ISFSI cannot exceed 2.00 mrem in any one hour in accordance with 10CFR20.1301(a)(2). Worst case dose rates (assuming design basis fuel in 48 casks) at the outer fence boundary (nuisance fence), which is well within the restricted area boundary, have been calculated to be 1.99 mrem/hr.

7.3.2 SHIELDING

The design of the cask shielding, material of construction, and method of calculating shielding parameters are explained in Appendix 7A. A discussion of the earth berm shielding is contained in Section A7A. No special features or remote handling of the casks in the ISFSI are proposed. Portable shielding may be used during cask maintenance, if appropriate.

7.4 ESTIMATED ONSITE COLLECTIVE DOSE ASSESSMENT

Table 7.4-1 shows the estimated design basis occupational exposures to ISFSI personnel during the loading, transport, and emplacement of the storage casks. Dose rates at 1 meter were utilized for all cases except cask transfer, when individuals will typically be at least 2 meters away from the cask.

Table 7.4-2 shows the estimated design basis annual man-rem for surveillance and maintenance activities. Visual surveillance was based on a walkdown of each of the two pads at a distance no closer than 2 meters to the casks. The casks on the opposite pad contribute approximately 1 mrem/hr to the expected dose rate along with contributions from the casks on the near pad. It was assumed that the average dose rate for the surveillance was four times the dose rate calculated at 2 meters from a cask. To estimate the dose rates for operability tests and calibration, the worker was assumed to be located at the monitoring panel at the perimeter fence entrance. During instrument repairs, the worker was assumed to be positioned between two rows of casks. The six surrounding casks (all within 16 feet of the worker) were the predominant dose contributors during repair work, but dose rates from casks on the other pads were also considered.

Both Table 7.4-1 and 7.4-2 provide for each task the estimated time required for the task, number of personnel required, the design basis dose rates, and man-rem.

An evaluation of the additional dose to station personnel from ISFSI operations is contained in Section A7.

7.5 OFFSITE COLLECTIVE DOSE ASSESSMENT

An evaluation of the offsite collective dose from ISFSI operations is contained in Section A7.

The models described above pertain to an individual storage cask. The evaluation of the ISFSI dose rates, i.e., from the array of casks, is contained in Section A7A.

7A.3 DIRECT RADIATION N-S

The evaluation of the ISFSI dose rates, i.e., from the array of casks, is contained in Section A7A.

7A.4 DIRECT RADIATION E-W

The evaluation of the ISFSI dose rates, i.e., from the array of casks, is contained in Section A7A.

7A.5 INDIRECT RADIATION (SKYSHINE)

The evaluation of the ISFSI dose rates, i.e., from the array of casks, is contained in Section A7A.

7A.6 EARTH BERM

The evaluation of the ISFSI dose rates, i.e., from the array of casks, is contained in Section A7A.

7A.7 DOSE RATE AROUND THE ISFSI

The evaluation of the ISFSI dose rates, i.e., from the array of casks, is contained in Section A7A.

7A.8 EXPERIMENTAL RESULTS

The calculated dose rates for the TN-40 cask are essentially the same as for the TN-24 storage cask, which has a previously approved TSAR. A TN-24 prototype cask (TN-24P) has been fabricated and loaded with 24 Westinghouse 15x15 fuel assemblies. The assemblies had about four years cooling time with a burnup of around 30,000 MWD/MTU. Thermal and shielding tests were conducted at INEL on this loaded cask. The results are detailed in EPRI Report NP-5128 (Reference 8). The measured contact dose rates (mrem/hr) at mid height radially and at the center of the steel lid and bottom (no polypropylene disks or protective cover) were: 17g, 3n; 52g, 30n; and 145g, 90n respectively. At one meter from the surface they became, 10g, 2n; 23g, 12n; and 55g, 25n respectively. Although a direct comparison with the calculated values is difficult because of the different fuel parameters, it can be seen that the dose rates around the TN-24P cask are within expected values and therefore, the expected dose rates around the TN-40 should also compare favorably with the calculated values.