

TECHNICAL SPECIFICATION BASES

For

THREE MILE ISLAND UNIT 2

INDEPENDENT SPENT FUEL STORAGE INSTALLATION

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B 2.0 FUNCTIONAL AND OPERATING LIMITS

B 2.1.1 Spent Fuel Stored at ISFSI

BASES

BACKGROUND

The material to be stored at the TMI-2 ISFSI consists of canisters containing core debris removed from the damaged TMI Unit 2 during defueling operations. TMI-2 was a Babcock & Wilcox (B&W) pressurized water reactor. The TMI-2 CANISTERS contain the remains of the TMI-2 core. Records of the contents of each canister were kept and define the materials to be stored. Retrieved materials from the TMI-2 core include:

- Rubble bed debris.
- Partially intact fuel assemblies.
- Debris bed stratified material.
- Miscellaneous core component pieces (e.g., fuel rod segments, spacer grids, end fittings, control rod assembly spiders, springs, fuel pellets, etc.).
- In-core instrument assemblies.

There are three types of TMI-2 CANISTERS that will be stored at the TMI-2 ISFSI:

- TMI-2 *Fuel* canisters (large pieces of core debris).
- TMI-2 *Knockout* canisters (fines generated from the use of the debris vacuum system).
- TMI-2 *Filter* canisters (fines generated from the use of the debris vacuum system and defueling water cleanup system).

The TMI-2 CANISTERS are currently stored in a fuel pool at the INL Test Area North (TAN). Since the TAN Hot Shop is scheduled for decommissioning as part of the overall INL plan, dry storage of the TMI-2 CANISTERS has been selected as the interim storage approach. The dry storage for the TMI-2 CANISTERS will utilize an adaptation of the standardized NUHOMS[®] system (NUHOMS[®]-12T). Each NUHOMS[®]-12T Dry Shielded Canister (DSC) contains up to 12 TMI-2 CANISTERS. NUHOMS[®] is a proven system for dry storage, which has been in use at reactor sites since March of 1989. The INL TMI-2 ISFSI is designed to provide temporary dry storage for 100% of the TMI-2 CANISTERS. The ISFSI design includes an extra HSM with a pre-installed DSC overpack in case a challenged canister needs additional confinement. The INL TMI-2 ISFSI and NUHOMS[®]-12T components are also designed to allow retrieval of the TMI-2 CANISTERS for further processing, alternate storage, or disposal.

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B 2.1.1 Spent Fuel Stored at ISFSI (continued)

The most notable differences between the TMI-2 CANISTERS and commercial fuel assemblies are:

- TMI-2 core debris is canisterized whereas commercial fuel is clad. The canisters contain TMI-2 core debris and debris from core handling equipment resulting from the 1979 TMI-2 accident.
- The TMI-2 CANISTERS provide a much stronger structural element, as compared to commercial fuel assemblies, for support within the DSC basket.
- The heat load for the TMI-2 CANISTER (maximum 60 watts, average 29 watts) is much less than a commercial spent fuel assembly (approximately 1000 watts).
- The TMI-2 CANISTERS have the potential for hydrogen gas generation due to radiolysis.

Based on these considerations, the NUHOMS[®] system is modified to accommodate these conditions. Specifically, the NUHOMS[®]-12T DSC will be modified to include venting of the DSC through high efficiency particulate air (HEPA) grade filters during storage. The vent system will allow for release of the hydrogen gas and will allow for monitoring and/or purging of the system during operation.

APPLICABLE
SAFETY ANALYSIS

The design criteria and subsequent safety analysis of the DSC and HSM assumed certain characteristics and limitations for the spent fuel elements that are stored. Specification 2.1.1 assures that these assumptions remain valid by preventing undried spent fuel or spent fuel not analyzed from being introduced into the ISFSI. ISFSI SAR Section 3.1.1 identifies the irradiation history and maximum thermal heat generation for the fuel, which are the design bases for the ISFSI.

FUNCTIONAL AND
OPERATING LIMITS
VIOLATIONS

The following Functional and Operating Limits violation responses are applicable.

2.2.1

If Functional and Operating Limit 2.1.1 is violated, the limitations on the spent fuel in the ISFSI have not been met. Actions must be taken to place the affected spent fuel in a safe condition. It is acceptable for the affected fuel elements to remain in the DSC if that is determined to be a safe condition.

(continued)

B 2.1.1 Spent fuel Stored at ISFSI (continued)

2.2.2 & 2.2.3

Notification of the violation of a Functional and Operating Limit to the NRC is required within 24 hours. Written reporting of the violation must be accomplished within 30 days. This notification and written report are independent of any notification and report required by 10 CFR 72.75.

REFERENCES

1. Safety Analysis Report, Section 3.1.1, Material to be Stored, and Section 3.3.4, Nuclear Criticality Safety.
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B 3.0 LIMITING CONDITION FOR OPERATION (LCO) APPLICABILITY

BASES

LCOs LCO 3.0.1, 3.0.2, 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 item is in the specified conditions of the Applicability statement of each Specification).

LCO 3.0.2 LCO 3.0.2 establishes the ACTIONS associated with an LCO that shall be met upon discovery of a failure to meet the LCO. The Completion Time of each Required Action for an ACTIONS Condition is applicable from the time an ACTIONS Condition is entered. The Required Actions establish those remedial measures, which must be taken within specified Completion Times when the requirements of an LCO are not met. This Specification establishes:

- 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 stated.

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. 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, which permit continued operation, which 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 Specifications.

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LCO 3.0.2
(continued)

The Completion Times of the Required Actions are also applicable when a system or component is removed from service intentionally when the item is in the specified conditions of the Applicability Statement. 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 should not be made for operational convenience.

LCO 3.0.3

This specification is not applicable to an ISFSI. The placeholder is retained for consistency with the power reactor technical specifications.

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 precludes placing the item in a specified condition stated in that Applicability (e.g., Applicability desired to be entered) when the following exist:

- a. Facility 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 facility being required to exit the Applicability desired to be entered to comply with the required Actions.

Compliance with the Required Actions, which permit continued operation of the facility for an unlimited period in a specified condition, provides an acceptable level of safety for continued operation. This is without regard to the status of the facility. 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 should not be interpreted as endorsing the failure to exercise the good practice of restoring systems or components before entering an associated specified condition in the Applicability.

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LCO 3.0.4
(continued)

The provisions of LCO 3.0.4 shall not prevent changes in specified conditions in the Applicability required to comply with ACTIONS. In addition, the provisions of LCO 3.0.4 shall not prevent changes in specified conditions in the Applicability related to the unloading of an DSC or an HSM.

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

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 determined to not meet the LCO to comply with ACTIONS. The sole purpose of this Specification is to provide an exception to LCO 3.0.2 (e.g., to not with the applicable Required Action(s) to allow the performance of SRs 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 testing. This Specification does not provide time to perform any other preventive or corrective maintenance.

LCO 3.0.6

This specification is not applicable to an ISFSI. The placeholder is retained for consistency with the power reactor technical specifications.

LCO 3.0.7

This specification is not applicable to an ISFSI. The placeholder is retained for consistency with the power reactor technical specifications.

B 3.0 SURVEILLANCE REQUIREMENT (SR) APPLICABILITY

BASES

SRs SR 3.0.1 through 3.0.4 establish 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 Surveillances are performed to verify the systems, components, and 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.

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 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 not to be met between required Surveillance performances.

Surveillances do not have to be performed when the facility 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 determined to not meet the LCO because the ACTIONS define the applicable remedial measures. Surveillances have to be met and performed in accordance with SR 3.0.2 before returning equipment to service. Upon completion of maintenance, appropriate post maintenance testing is required. 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 facility 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.

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B 3.0 SR APPLICABILITY (continued)

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 which 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 not suitable for conducting the Surveillance (e.g., transient conditions or other ongoing Surveillance or maintenance activities).

The 25% extension does not significantly degrade the reliability resulting from 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 as 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 which 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% single extension to this Completion Time is that such an action usually verified no loss of function has occurred by checking the status of redundant or diverse components or accomplishes the function of the affected 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.

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B 3.0 SR APPLICABILITY (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 less, applies from the time it is discovered the Surveillance has not been performed in accordance with SR 3.0.2, and not at the time the specified Frequency was not met.

This delay period provides adequate time to complete Surveillances which have been missed. This delay period permits the completion of a Surveillance before complying with Required Actions or other remedial measures which 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 results 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 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.

If a Surveillance is not completed within the allowed delay period, then the equipment is considered to not meet the LCO 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 does not meet the LCO 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 the Specification, or within the Completion Time

of the ACTIONS, restores compliance with SR 3.0.1.

(continued)

B 3.0 SR APPLICABILITY (continued)

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 into specified conditions in the Applicability for which these systems and components ensure safe operation of the facility.

The provisions of this Specification should not be interpreted as endorsing the failure to exercise the good practice of restoring systems or components 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, 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 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, failure 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 which may (or may not) apply to specified condition changes.

The provisions of SR 3.0.4 shall not prevent changes in specified conditions in the Applicability required to comply with ACTIONS. In addition, the provisions of LCO 3.0.4 shall not prevent changes in specified conditions in the Applicability related to the unloading of an DSC or an HSM.

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 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 before the performance or completion of a Surveillance. A Surveillance which 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.

B 3.1 DSC INTEGRITY

B 3.1.1 Leak Testing DSC Vent Housing Seals

BASES

BACKGROUND The radioactive material which the TMI-2 ISFSI confines is TMI-2 core debris and the associated contaminated materials. During fuel loading operations, the transportation cask is uprighted, the DSC is installed into the cask, the previously dewatered/dried TMI-2 CANISTERS are placed into the DSC, the DSC top cover plate is installed, the DSC is welded closed, the DSC vent housings are installed (one at the DSC Purge Port and one at the DSC Vent Port), and the cask lid is bolted.

The DSC has a series of barriers to ensure the confinement of radioactive materials. The DSC is vented to reduce the accumulation of gases generated due to radiolysis. The DSC cavity gases will vent through the HEPA filters into the HSM cavity which in turn is vented through holes provided in the rear access door.

APPLICABLE The confinement of radioactivity during the storage of spent fuel in a DSC is ensured by the use of multiple SAFETY ANALYSIS confinement barriers. The fuel pellet matrix and fuel cladding were severely damaged during the TMI-2 reactor accident and, therefore, no reliance for confinement of radioactivity is placed on the fuel pellet matrix or the fuel cladding. The TMI-2 CANISTERS provide the first barrier for confinement of radioactive materials. The TMI-2 CANISTERS have two small penetrations which are left open during storage but which do not provide direct paths for fuel debris and do not compromise the canister confinement function. Once inside the sealed DSC, the TMI-2 CANISTERS are confined by the DSC shell and by multiple barriers at the top of the DSC. The DSC confinement boundary includes the DSC shell, the vent system HEPA grade filters, the top shield plug and its weld, the top cover plate and its weld, and the inner bottom cover plate and weld. The failure and degradation of confinement barriers is considered in the analysis of accidents and off-normal events.

(continued)

B 3.1.1 Leak Testing DSC Vent Housing Seals (continued)

LCO Verifying vent housing seal integrity ensures the only vent path for the DSC is through the HEPA filters.

APPLICABILITY DSC vent housing seal integrity is verified after the DSC is loaded into its HSM and periodically during STORAGE OPERATIONS to confirm that the DSC confinement barrier has not been compromised during shipment to the ISFSI or during the extended storage period.

ACTIONS

A.1

The initial concern upon discovery of degraded seals is the increased potential for radioactive material contamination near the DSC vent housing. A survey for radioactive material contamination of the accessible areas of the junction at the DSC vent housing and the DSC cover plate addresses the immediate concern.

A.2.1

After the DSC has been shipped and loaded into the ISFSI, the seals can be repaired or replaced in the ISFSI. The COMPLETION TIME specified for STORAGE OPERATIONS permits reasonable time to reseal or replace and to recognize the low motive force available to transport radioactive materials through the leaking vent seal.

A.2.2.2

The replaced or reseated seal must be leak checked to meet the LCO for continued STORAGE OPERATIONS.

B.1

If the seal cannot be repaired or replaced and tested to satisfy the LCO, then the survey of radioactive material contamination needs to be repeated during STORAGE OPERATIONS until the LCO is restored.

B.2

If the seal cannot be repaired or replaced and tested to satisfy the LCO, then concerns related to the adequacy of the seal design and maintenance must be addressed in a written report. This written report is expected to address the characterization and extent of condition, cause or engineering analysis, and corrective actions.

(continued)

B 3.1.1 Leak Testing DSC Vent Housing Seals (continued)

ACTIONS
(continued)

C.1

If the metallic seals are replaced with elastomeric seals and the LCO is restored within 7 days, then the reporting requirement of B.2 would not be invoked. In this case ACTION C.1 ensures that NRC is kept informed of the degradation of the original seal design.

C.2

Elastomeric seals conforming to the design requirements in the SAR may be used in place of the metallic seals. In such a case, the elastomeric seals are not considered to have the same design life as the metallic seals. The design life of the elastomeric seals specified for service at the DSC vent housings is expected to exceed 15 years. Therefore, a replacement interval not to exceed 5 years is considered conservative.

SURVEILLANCE
REQUIREMENTS

SR 3.1.1.1

The method for performing the leak check of the DSC vent housing seals conforms with ANSI N14.5.

The leak check for metallic seals is performed after the DSC is loaded into the ISFSI. During prolonged storage at the ISFSI, the leak check for metallic seals is repeated every five years which provides a frequency comparable to similar uses of mechanical sealing systems.

SR 3.1.1.2

The method for performing the leak check of the DSC vent housing seals conforms with ANSI N14.5.

The leak check for elastomeric seals is performed after any metallic seal is replaced with an elastomeric seal as required by ACTION A.2.2. During prolonged storage at the ISFSI, the leak check for elastomeric seals is repeated every year to reflect the assumed reduced design life of the elastomeric seals compared to metallic seals.

REFERENCES

1. SAR Section 8.1.4, Storage with Leakage of Vent or Purge Port Seals
 2. SAR Section 8.2.7, DSC Leakage.
 3. SAR Section 4.3.1, Ventilation and Offgas Requirements
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B 3.1 DSC INTEGRITY

B 3.1.2 DSC Handling Temperature Limit

BASES

BACKGROUND Within the TAN Hot Shop, DSC handling as a function of temperature are governed by TAN procedures. Before commencing activities, outside air temperatures are evaluated and low temperature limits are imposed for operational considerations and to provide defense-in-depth against the potential for brittle fracture of the ferritic steels used in the DSC confinement boundary.

APPLICABLE SAFETY ANALYSIS The structural analyses of the TMI-2 CANISTERS, the DSC, and the transport casks (MP-187 or OS-197 CASK) demonstrate that cask drops at heights up to 80" will not result in compromise of the DSC or TMI-2 CANISTER integrity. The drop of a DSC from a transport skid/trailer is not considered credible.

If an incredible cask drop or other mishandling of the cask or DSC were to occur, the low temperature limit imposed on all movements of loaded casks and DSCs when outside the TAN Hot Shop is intended to provide additional assurance that the DSC confinement boundary is not compromised.

LCO The DSC temperature must be confirmed to be not less than 20 degrees F before transporting or otherwise handling the DSC outside the TAN Hot Shop.

The ambient air temperature must also be confirmed to not be less than 0 degrees F before transporting or otherwise handling the DSC outside the TAN Hot Shop. The 0⁰F temperature limit is consistent with the Standardized NUHOMS[®] Transfer Cask to ensure adequate material impact toughness for the transfer cask carbon steel structural shell during extreme winter conditions.

APPLICABILITY This temperature limit applies to all movements of a DSC containing TMI-2 CANISTERS while outside the TAN Hot Shop. When the DSC is inside the HSM, it is not being handled. Requiring this Technical Specification to be applicable during TRANSFER OPERATIONS covers all licensed activities between the TAN Hot Shop and the HSM, to include inserting or withdrawing the DSC into or out of the HSM.

(continued)

B 3.1.2 DSC Handling Temperature Limit (continued)

ACTIONS

A.1

If the DSC temperature is not within limits, then the planned activities shall not be started. If the DSC temperature is within limits but the ambient air temperature is not within limits, then there is concern that the DSC temperature could fall below limits during the planned activities and the planned activities shall not be started.

Once activities have commenced and if the ambient air temperature falls below the lower limit, then the DSC shall be placed in a safe condition. If the DSC is on the road, then the safest condition (considering the hazards associated with leaving the DSC in place) may be to complete the transport operation. If the DSC is just outside the TAN Hot Shop, then the safest condition may be to move the DSC back into the TAN Hot Shop.

SURVEILLANCE
REQUIREMENTS

SR 3.1.2.1

Measuring the DSC temperature, if possible, before commencing handling operations outside the TAN Hot Shop confirms the DSC temperature is at or above the lower temperature limit. If measuring the DSC temperature is not possible, the transport cask external temperature may be measured and the DSC temperature may be calculated.

SR 3.1.2.2

In addition to measuring or calculating the DSC temperature, the ambient air temperature shall be measured before commencing handling operations outside the TAN Hot Shop to ensure the DSC is not subjected to excessive cooling rates during handling operations. Ambient air temperature will be monitored throughout handling activities.

REFERENCES

1. SAR Section 8.2.5, Accidental Cask Drop.
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B 3.2 RADIATION PROTECTION

B 3.2.1 HSM Dose Rates

BASES

BACKGROUND The regulations at 10 CFR Part 72 set limits on the control of occupational radiation exposure and radiation doses to the general public due to the operation of an ISFSI. Occupational radiation exposure should be kept as low as reasonably achievable (ALARA) and within the limits of 10 CFR Part 20. Radiation doses to the public are limited for both normal and accident conditions.

The HSM is a massive, prefabricated, reinforced concrete vault that serves to provide shielding for the DSC containing TMI-2 CANISTERS and to minimize the radiation dose rate from the ISFSI. The HSM includes a steel lined door which is removed for insertion and retrieval of the DSC and an access door on the rear wall for monitoring and maintenance of the DSC vent and purge HEPA filters. The roof, walls, and floor of the HSM are a minimum of two feet thick. The access door used for DSC transfer has a stepped flange sized to facilitate docking of the transport cask and configured to minimize streaming of radiation through the HSM opening during DSC transfer.

APPLICABLE The HSM peak and average surface dose rates
SAFETY ANALYSIS are not assumptions in any accident analysis, but are used to ensure compliance with regulatory limits on occupational dose and dose to the public.

LCO The following limits on the HSM surface dose rates are based on the shielding analysis summarized in the SAR. The limits were selected to minimize radiation exposure to the general public and maintain occupational dose ALARA to personnel working in the vicinity of the HSMs.

The HSM dose rates shall not exceed:

- a. 100 mrem/hour average on the outside surface of the front HSM door on the DSC centerline; and
- b. 20 mrem/hour average on the outside surface of the end shield wall of each group of HSMs.

The LCO specifies the dose rates as gamma radiation limits because the LCO was developed before the potential impact of the reactor startup neutron sources on the TMI-2 core debris was recognized. Based on the information regarding the presence of the AmBeCm source material, the HSM dose rate limits are implemented by combining gamma and neutron radiation measurements and comparing the total effective dose equivalent rate to the above LCO.

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B 3.2.1 HSM Dose Rates (continued)

APPLICABILITY Verification that HSM surface dose rates are less than the LCO limits is performed after each DSC is loaded and secured in a HSM, the HSM door is installed, and the rear wall access door is closed and secured.

ACTIONS

A.1

Perform analysis to verify compliance with the ISFSI offsite radiation protection requirements of 10 CFR Part 20 and 10 CFR Part 72. Corrective actions, such as the installation of temporary or permanent shielding, shall be taken to reduce the dose rates to the LCO limits, if possible.

A.2 & A.5

Upon entry into Condition A, verbal notification to NRC shall be provided within 24 hours of discovery. The verbal notification shall be followed by a letter report within 30 days of discovery summarizing the results of the evaluation and the actions taken.

A.3

If the HSM surface dose are not within limits, certain conditions should be checked: the probable radiation source causing the excessive dose, the records of the DSC surface dose rates after loading at TAN, the proper positioning of the DSC on the support structure, proper installation of the HSM front and rear access doors, and the spacing of the HSMs.

A.4

If the HSM dose rates are exceeded, corrective actions such as providing supplemental shielding, shall be taken to reduce the dose rates within limits.

B.1 & B.2

If the ISFSI offsite radiation protection limits of 10 CFR Part 20 or 10 CFR Part 72 are exceeded, supplemental shielding must be provided to reduce the dose rates within limits, or the DSC must be transported back to TAN for corrective action, such as removal and repackage of TMI-2 CANISTERS.

(continued)

B 3.2.1 HSM Dose Rates (continued)

SURVEILLANCE
REQUIREMENTS

SR 3.2.1.1

After each DSC is placed in an HSM and the HSM is secured,
the dose rates for that HSM are verified.

REFERENCES

1. SAR Section 7.3.2, Shielding.
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B 3.2 RADIATION PROTECTION

B 3.2.2 Vent System HEPA Filters

BASES

BACKGROUND

The DSC is vented to reduce the accumulation of gases generated due to radiolysis. A venting system is provided inside the HSM with access through the rear wall. The DSC cavity gases will vent through the HEPA filters into the HSM cavity which in turn is vented through holes provided in the rear access door. The ability to close off the vents and sample ahead of and behind the HEPA filters provides the capability to periodically monitor gas composition and rate of change. Although not anticipated, pressure build-up in the DSC and radioactive material release from the HSM can be checked. The design features and operation and maintenance procedures will assure that the system can be monitored, tested, and purged (if necessary) during system operation.

The DSC top shield plug and ventport dose rates were calculated using a three-dimensional MCNP model of the fuel debris, canisters, DSC basket, and DSC. The TMI-2 debris is assumed to be homogenized within each TMI-2 CANISTER, and the design basis source term is applied to each canister. Dose rates at the surface of the vent were calculated using a point detector. Dose rates on the shield plug surface were calculated using a surface crossing tally located at the center of the plug.

Every operational aspect of the NUHOMS[®] system, from canister loading through, sealing, transport, transfer, and operation is designed to assure that exposure to personnel is ALARA. Dose rates are kept ALARA by the shielded DSC end plugs and shielded cask. The vent and purge ports have been designed with bends and shield plates to minimize streaming during DSC sealing and filter change-outs. Many engineered design features are incorporated into the NUHOMS[®] system which minimize occupational exposure to plant personnel during placement of fuel in dry storage as well as off-site dose to the nearest neighbor during storage. The resulting dose at the controlled area boundary is well within the limits specified by 10 CFR 72.

Because the predicted dose rates for the NUHOMS[®]-12T system are well below those predicted for previous NUHOMS[®] systems, occupational exposures for the TMI-2 ISFSI are bounded by those observed at other installations. Based on experience from operating NUHOMS[®] systems at Oconee, Calvert Cliffs, and Davis-Besse, the occupational dose for placing a DSC with TMI-2 core debris into dry storage is much less than one person-rem. With the use of effective procedures and experienced ISFSI personnel, the total accumulated dose can be reduced below 500 person-mrem per DSC.

(continued)

B 3.2.2 Vent System HEPA Filters (continued)

APPLICABLE
SAFETY ANALYSIS

The DSC is vented to reduce the accumulation of gases generated due to radiolysis. The majority of volatile fission products were released during and since the TMI-2 reactor accident of 1979. The remaining fission products are low-volatiles and are entrained within the fuel matrices. Release of remaining fission products from the fuel debris would require extremely high temperatures or pressures. Therefore, no significant radioactive releases are expected through the venting system. Because the DSC is vented to the atmosphere, there is no driving pressure to force material into the environment. In the event that any material does escape the DSC, the venting system includes a bank of HEPA grade filters.

The geometry of the DSC vent is offset to avoid radiation streaming. Any restriction of the filters is expected to be dust or other nonradioactive material. If the radiation field at the vent approaches the limits specified, the cause will be evaluated and corrective action taken.

LCO

The surface dose rate of each HSM rear access door shall not exceed 100 mrem/hour; and the surface dose rate of each HEPA filter housing shall not exceed 1200 mrem/hour. Every operational aspect of the NUHOMS[®] system, from canister loading through, sealing, transport, transfer, and operation is designed to assure that exposure to personnel is ALARA. Dose rates external to the vent and purge ports were calculated as well as the dose rates for the other DSC surfaces to account for the radiation streaming through the vent. A limiting condition is specified to assure that exposure to personnel is ALARA even though the actual limits are not exceeded.

The LCO specifies the dose rates as gamma radiation limits because the LCO was developed before the potential impact of the reactor startup neutron sources on the TMI-2 core debris was recognized. Based on the information regarding the presence of the AmBeCm source material, the HSM dose rate limits are implemented by combining gamma and neutron radiation measurements and comparing the total effective dose equivalent rate to the above LCO.

APPLICABILITY

The HEPA filter housings on a DSC are surveyed after the loaded DSC is placed in the HSM and begins STORAGE OPERATIONS.

(continued)

B 3.2.2 Vent System HEPA Filters (continued)

ACTIONS

A.1

If the surface dose rate limits of the HEPA vent filter housing or HSM rear access door and vent opening are exceeded or increase significantly, then the cause shall be evaluated in order to avoid these doses or dose increases in future STORAGE OPERATIONS.

A.2

If the surface dose rate limits of the HEPA vent filter housing or HSM rear access door and vent opening are exceeded, then corrective actions shall be taken to restore the dose rates within limits.

SURVEILLANCE
REQUIREMENTS

SR 3.2.2.1

A radiation survey shall be performed periodically at the vent of each loaded DSC. This Frequency is allowed to decrease as the amount of time increases without significant radiation or without significant increases in radiation at that vent. The Frequency for a DSC is reset to the most frequent performance of the Surveillance upon entry into CONDITION A at that DSC vent.

REFERENCES

1. SAR Section 7.3.2, Shielding.
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B 3.2 RADIATION PROTECTION

B 3.2.3 DSC Hydrogen Concentration

BASES

BACKGROUND The DSC is vented to reduce the accumulation of gases generated due to radiolysis. A venting system is provided inside the HSM with access through the rear wall. The DSC cavity gases will vent through the HEPA filters into the HSM cavity which in turn is vented through holes provided in the rear access door. The ability to close off the vents and sample ahead of and behind the HEPA filters provides the capability to periodically monitor gas composition and rate of change. Although not anticipated, pressure build-up in the DSC and radioactive material release from the HSM will be checked periodically. The design features and operation and maintenance procedures will assure that the system will be monitored, tested, and purged (if necessary) at adequate intervals to ensure safety.

APPLICABLE During storage, the DSC cavity is vented to the atmosphere
SAFETY ANALYSIS through HEPA grade filters. No significant releases are expected from the DSC for the following reasons: (1) Much of the volatile fission product inventory was released during the accident and the remainder is entrapped within the fuel matrix as determined by extensive examinations performed on the core materials following the accident; (2) Any differential pressure between the DSC and the atmosphere is not enough to provide a driving force for a release; (3) The DSC cavity is vented to the atmosphere through HEPA grade filters. Excessive temperatures would be required to release any volatile fission products from the fuel matrix.

The vent system allows for the removal of hydrogen or other gases generated due to radiolysis. The periodic test will verify that the hydrogen concentration stays at acceptable levels. If the hydrogen concentration approaches the limits specified, the DSC will be purged and the filters replaced.

(continued)

B 3.2.3 DSC Hydrogen Concentration (continued)

LCO The limiting hydrogen concentration allowed for continued operation is 10% of the flammability limit to allow for diffusion of hydrogen from within the TMI-2 CANISTERS to the point of gas sampling at the DSC vent. Because the hydrogen flammability limit is 5% by volume, the LCO is 0.5% by volume.

APPLICABILITY The gas from a DSC is sampled after the loaded DSC is placed in the HSM and begins STORAGE OPERATIONS.

ACTIONS A.1

If the hydrogen concentration within a DSC is exceeded, the hydrogen concentration within that DSC is reduced by purging the gas within that DSC until the hydrogen concentration is verified by sample to be within limits.

A.2

After purging a DSC to reduce the hydrogen concentration, the HEPA filter bank for that DSC shall be replaced to ensure the filters, if restricted, do not impede the diffusion of hydrogen from the TMI-2 CANISTERS.

SURVEILLANCE
REQUIREMENTS SR 3.2.3.1

A gas sample shall be taken periodically at the vent of each loaded DSC. The Frequency is initially specified as monthly for the first year. This Frequency is allowed to decrease as the amount of time increases without significant accumulation of hydrogen gas at that vent. The Frequency for a DSC is reset to the most frequent performance of the Surveillance upon entry into CONDITION A at that DSC vent. The initial monthly sampling rate is based on the conservative hydrogen generation estimate of 0.007 liters per hour per TMI-2 CANISTER and the design of the DSC vent system to defuse hydrogen concentration.

- REFERENCES
1. SAR Section 7.3.3, Ventilation
 2. SAR Section 8.2.8, Accident Pressurization of DSC.
 3. SAR Appendix C, Radiolysis.
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