Enclosure 3 to E-54658

RAI Responses with associated application change pages

(Public Version)

License Application, Attachment A, "Proposed License Conditions"

RAI PLC-1:

Provide a description of onsite and offsite insurance coverage, as described in the License Application, Attachment A, "Proposed License Conditions," proposed license condition No. 19, which states:

> "The Licensee shall obtain onsite and offsite insurance coverage in the amounts committed to by ISP in the ISP license application."

The NRC staff could not find a description of onsite and offsite insurance coverage in the license application

Response to RAI PLC-1:

ISP has revised the License Application by adding Section 1.6.4, "Insurance," to specify the minimum insurance that ISP will have in place before accepting spent nuclear fuel on site at the CISF for reception and storage.

Impact:

License Application Section 1.6.4 has been added as described in the response.

Proprietary Information on Pages 1-8 and 1-9
Withheld Pursuant to 10 CFR 2.390

RAI PLC-2:

Clarify the terms, "to the extent practicable," and, "by this test," contained in Proposed License Condition 22 which states, "Prior to removing the shipping cask closure lid, the gas inside the shipping cask shall be sampled to verify that the canister confinement boundary is intact *to the extent reasonably practicable by this test.*"

As written, the license condition is vague and does not identify a specific procedure, test, or acceptance criteria.

This information is needed to determine compliance with 10 CFR 72.24(b), (c), (d), (e) and (l) and 72.120(a).

Response to RAI PLC-2:

ISP has revised the License condition to clarify that the test to be performed is that referenced in Sections 5.1.3.1, 7.2, 8.2 and the operating procedures in the appendices in accordance with QP-10.02. License Condition 22 is revised to read, "A Post-Transportation Verification shall include an evacuated volume helium leak test on 100% of the canisters that are received at the WCS CISF to ensure that the accessible portions of the confinement boundary are leak tight as defined in ANSI N 14-5 following transport to the site." The language in Section 4.5.5 of the SAR is also updated consistent with this change.

The confinement boundary of each canister is leak tested in accordance with ANSI-N 14.5 during fabrication and during closure of the canister. The reference "to the extent practicable" is meant to acknowledge the fact that due to the geometry of the canisters it is impossible to leak test the entire confinement boundary once fabrication and closure of the canister is complete. Incorporation by reference is employed in Sections A.11.1, B.11.1, C.11.1, D.11.1, E.11.1.1, E.11.2.1, F.11.1.1 and G.11.1.1 to define the confinement boundary for each canister. By way of example, SAR Section C.11.1 incorporates Figure K.3.1-1 by reference from TN Document NUH-003, Revision 14, "Updated Final Safety Analysis Report for the Standardized NUHOMS® Horizontal Modular Storage System for Irradiated Nuclear Fuel." (Basis for NRC CoC 72-1004). Figure K.3.1-1 from the NUHOMS® SAR provides the figure that shows the components and welds that make up the confinement boundary for the 61BT DSC. Figure K.3.1-1, reproduced below, shows that portions of the confinement boundary are enclosed by other welded components (bottom cover plate, top cover plate etc.). Since all of the other canisters have similar designs, Figure K.3.1-1 is representative for all.

Impact:

SAR Section 4.5.5 and License Condition 22 have been revised as described in the response.

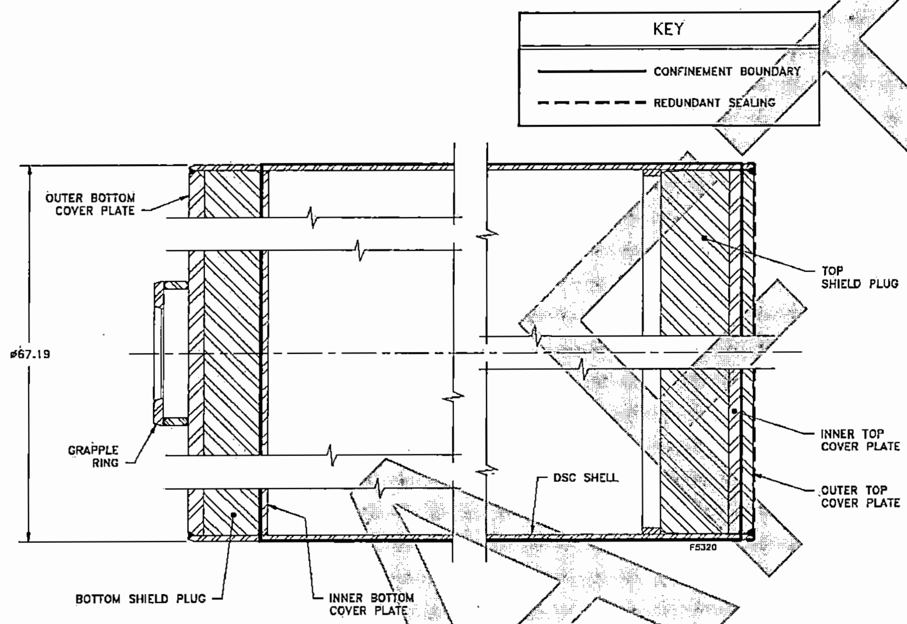


Figure K.3.1-1
61BT-DSC Confinement Boundary

License No. SNM-1050 | Amendment No. 0

LICENSE FOR INDEPENDENT STORAGE OF SPENT NUCLEAR FUEL AND HIGH-LEVEL RADIOACTIVE WASTE

SUPPLEMENTARY SHEET

Docket or Reference No. 72-1050

19. The Licensee shall obtain onsite and offsite insurance coverage in the amounts committed to by ISP in the ISP license application.

20. The Licensee shall submit License Amendment(s) to this license to incorporate applicable portions of License Renewals listed below, within 120 days of the effective date of License Renewal Approval for each of the following:

    (1) Aging Management Program (AMP) for NUHOMS® Systems

    The Licensee shall commit to the AMPs committed to in the approved License Renewal of CoC 1004 for all NUHOMS® Spent Fuel Canisters and storage overpacks.

    (2) AMP for NAC Systems

    The Licensee shall commit to the AMPs committed to in the approved License Renewal of CoC 1015 AND 1025 AND 1031 for all applicable NAC Spent Fuel Canisters and storage overpacks.

RAI PLC-2

21. The Licensee shall submit a Startup Plan to the NRC at least 90 days prior to receipt and storage of the material identified in 6.A, 6.B, 7.A or 7.B at the facility.

22. *A Post-Transportation Verification shall include an evacuated volume helium leak test on 100% of the canisters that are received at the WCS CISF to ensure that the accessible portions of the confinement boundary are leak tight as defined in ANSI N 14-5 following transport to the site.*

23. Prior to commencement of operations, the Licensee shall have an executed contract with the U.S. Department of Energy (DOE) or other SNF Title Holder(s) stipulating that the DOE or the other SNF Title Holder(s) is/are responsible for funding operations required for storing the material identified in 6.A, 6.B, 7.A or 7.B at the CISF as licensed by the U.S. Nuclear Regulatory Commission.

24. Prior to receipt of the material identified in 6.A, 6.B, 7.A or 7.B, the Licensee shall have a financial assurance instrument required pursuant to 10 CFR 72.30 acceptable to the U.S. Nuclear Regulatory Commission.

25. *The licensee shall submit a Startup Plan to the NRC no later than 90 days prior to receipt and storage of canisterized spent nuclear fuel and GTCC waste at the WCS CISF.*

26. This license is effective as of the date of issuance shown below.

RAI NP-13-2

FOR THE NUCLEAR REGULATORY COMMISSION

John McKirgan, Chief
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material
Safety and Safeguards

Date of Issuance December XX, 20XX

Attachments: Appendix A –WCS Interim Storage Facility Technical Specifications

4.5.5 Temporary Isolation Areas

Transportation casks arriving at the CISF via rail spur will be visually inspected and radiation dose rate and contamination surveys will be performed.

If initial radiological surveys preclude completion of the other steps of receipt inspection, ISP will isolate the rail car or move the rail car to the CHB and establish appropriate radiological controls. ISP will document the damage, notify the NRC of the condition and develop a corrective action plan. ISP will evaluate the use of movable shielding to protect personnel from radiation exposure while the damaged cask is on site.

If initial radiological surveys do not prevent further receipt inspection, ISP will move the transportation cask to the CHB. ISP will assess the safety features of the transportation cask including seal leak testing and *an evacuated volume helium leak test of each canister as prudent measures to verify* that the canister integrity is intact. If ISP concludes that the transportation cask is capable of performing its intended safety functions, ISP will proceed with the receipt as per established procedure.

If the assessment indicates that the transportation cask integrity is not intact, ISP will ensure the cask continues to be isolated, document the damage, notify the NRC of the condition and develop a corrective action plan. ISP will establish measures to ensure control for contamination and maintain doses ALARA.

ISP will utilize swipes and air samples that will be processed on ISP calibrated Canberra® gas flow proportional gross alpha/beta counters, ISP calibrated Perkin & Elmer® Liquid Scintillation Counters, and ISP calibrated Ortec® Gamma Spectroscopy counters or equivalent equipment. Sipping analysis will be performed on a calibrated gas chromatograph or equivalent equipment.

All Indicated Changes are in response to RAI PLC-2

License Application, Appendix A, "Proposed Technical Specifications"

RAI TS-1:

Specify the total design basis heat load for each of the storage cask designs to be used at the WCS CISF. Ensure the design basis values are included in the appropriate section of the Technical Specifications.

WCS CISF SAR Section 8.1.1, "Criteria," states, "Thermal assessments documented in this Chapter and associated Appendices verify that the WCS CISF characteristics and environmental conditions are bounded by the cask thermal analyses." However, the total design basis heat load for each type of canister received at the site is not provided in the Technical Specifications or anywhere else in the application. The NRC staff needs to evaluate whether thermal analyses of the storage cask systems proposed for use at the WCS CISF are bounding.

This information is needed to determine compliance with 10 CFR 72.44(c).

Response to RAI TS-1:

Only canisters that have been previously approved by the NRC to store and transport commercial light water (pressurized water reactor (PWR) and boiling water reactor (BWR)) spent nuclear fuel and greater than class C (GTCC) waste will be received at the WCS CISF. The controls for limiting the total design basis heat load for each of the storage cask designs received at the WCS CISF include those placed on the cask systems by the NRC-issued site licenses or certificates of compliance for the included transportation and storage systems. The approved systems are incorporated by reference by listing each in Section 2.1 of the proposed WCS CISF Technical Specifications. Additionally, the design basis storage heat loads are incorporated by reference in the WCS CISF SAR appendices (see SAR Tables A.3-1, B.3-1, C.3-1, D.3-1, E.3-1 and G.3-1).

As long as the canister is loaded to an amendment authorized in the WCS CISF site-specific license, there is no need to include the loaded configuration details in the WCS CISF technical specifications. The systems will be licensed under the existing storage LCOs for the design basis storage heat loads just as they would at the originating site. The design basis heat loads were initially needed to load SNF canisters into the various storage systems at Part 50 licensed facilities.

Design basis thermal performance for canisters in storage is, in general, significantly higher than that of the canisters in its licensed transportation cask. Thus, the canisters received at the WCS CISF following transportation will be significantly below their design basis storage heat loads and therefore will have additional margin against the referenced cask thermal analyses.

The design basis heat loads are not repeated in technical specifications.

Impact:

No change as a result of this RAI.

RAI TS-2:

Clarify why the Technical Specifications are not consistent among the different storage systems to be used at WCS CISF. Ensure the Technical Specifications include any appropriate additional requirements for all storage systems.

Sections 3.2 through 3.4 of WCS CISF Technical Specifications provide Limiting Conditions for Operation (LCOs) and Surveillance Requirements (SRs) for all NAC storage systems, but equivalent LCOs and SRs are not provided for TN America's dry storage systems. The applicant should ensure the Technical Specifications include appropriate additional requirements for the TN America's storage systems or provide adequate justification why this information is not needed. The NRC staff needs this information to determine that adequate protection is provided during storage to preclude any important to safety materials from exceeding safety limits.

This information is needed to determine compliance with 10 CFR 72.122 and 72.44(c).

Response to RAI TS-2:

NAC and TN Americas storage systems cover a more than 20-year licensing history. Over that time, the NRC has approved each amendment and system. This has resulted in not only differences within the certificates of compliance (CoCs) and Materials Licenses themselves, but also in substantial differences between storage systems. The proposed WCS CISF Technical Specifications (TS) are derived from these as-approved conditions within each storage system CoC or Material License. The WCS CISF will receive previously loaded canisters from specific sites. The WCS CISF site-specific license and LCOs are written to accommodate this. Section 2.1 of the proposed WCS CISF TS requires that the authorized canister be loaded to a specific CoC and amendment or Material License and amendment. As long as a canister is loaded to one of these amendments, the canister is authorized to be received at the WCS CISF. The proposed WCS CISF technical specification LCOs are derived from these amendments and where appropriate incorporated directly. Thus, each system will continue to operate in accordance with the NRC approved operating requirements after receipt at the WCS CISF. To require the WCS CISF TS to be harmonized across all systems would disrupt the relationship to the as-approved NRC issued CoCs or Materials License and associated TS, which are justified within the final safety analysis report for each system.

There are no LCOs for the NUHOMS® Systems because all of the LCOs in the source license are based on original loading operations and are not applicable at the WCS CISF Site.

Impact:

No change as a result of this RAI.

RAI TS-3:

Ensure the Technical Specifications (TS) include the appropriate information regarding the minimum center-to-center spacing between two canisters for vertical systems such as NAC-MPC, NAC-UMS, and MAGNASTOR.

The minimum center-to-center spacing between two canisters for vertical systems is not provided in the Proposed Technical Specifications. Section 4.3, "Storage Area Design Features," of the proposed TS state that the Vertical Concrete Casks for NAC-MPC, NAC-UMS, and MAGNASTOR Systems shall meet the minimum center-to-center spacing requirements presented in the WCS CISF SAR. The minimum spacing values should be included in the TS because these values are used to perform the thermal evaluations for normal, off-normal, and accident-level conditions of storage.

This information is needed to determine compliance with 10 CFR 72.44(c).

Response to RAI TS-3:

The minimum center-to-center spacing requirements are presented in the WCS CISF proposed Technical Specifications (TS) in the same manner as they are presented in the licensing basis for the MAGNASTOR system, i.e., the minimum spacing values are not included in the TS, but instead the TS require that the minimum spacing values be maintained as designated in the SAR. Note, the NAC-MPC and NAC-UMS do not include such language in their corresponding TS. However, the MAGNASTOR FSAR and NAC-MPC FSAR for Yankee Rowe and Connecticut Yankee states the effects of surrounding casks are considered negligible with a 15-foot center to center spacing. For the NAC-MPC LACBWR system, air flow within the concrete cask is not required to meet all normal, off-normal, and accident conditions.

Impact:

No change as a result of this RAI.

RAI TS-4:

Ensure that appropriate details of the Horizontal Storage Module (HSM) Thermal Monitoring Program that is used to monitor the thermal performance of each HSM is included in the Technical Specifications (TS).

Section 5.1.3, "HSM Thermal Monitoring Program," of the Proposed Technical Specifications states that the intent of the program is to prevent conditions that could lead to exceeding the concrete and fuel clad temperature criteria. Section

5.1.3 also states that each user must implement either TS 5.1.3(a) OR 5.1.3(b). As the cask user, the applicant is required to implement one of the above TSs; however, it is not clear which TS would be implemented to monitor the thermal performance of each HSM at the site. The applicant should provide details of the program, per either TS 5.1.3(a) or TS 5.1.3(b). For example, if TS 5.1.3(a) is implemented, the user shall develop and implement procedures to perform visual inspection of HSM inlets and outlets on a daily basis. The NRC staff needs this information to make sure adequate protection is implemented to avoid conditions that could lead to safety-related components exceeding applicable safety limits.

This information is needed to determine compliance with 10 CFR 72.44.

Response to RAI TS-4:

In general, the existing individual General License NUHOMS® Technical Specifications (TS) allow users to choose between the two methods for implementing the required HSM Thermal Monitoring Program. ISP originally thought providing flexibility in the TS consistent with that provided to General Licensees would allow ISP to perform both thermal monitoring with the thermocouples provided in the horizontal storage module (HSM) roofs and perform visual inspections every 24 hours. This would allow ISP to continue to meet the Technical Specification requirement if there was a breakdown associated with one of the approved methods. However, because the daily visual inspection program does not require thermocouples, readouts and other equipment subject to breakdown, ISP will rely on this approach. Therefore, Section 5.1.3(b) is removed in its entirety from the proposed TS. The existing language in proposed TS 5.1.3(a) provides sufficient detail to ensure that the requirements for performing visual inspections are captured in the implementing procedures that must be in place before placing loaded canisters into storage. Sections A.4.4; A.5.1.3 Step 2; B.4.4; B.5.1.3 Step 2; C.4.4; C.5.1.3 Step 2; D.4.4; and D.5.1.3 Step 2 have also been updated to remove references to TS 5.1.3(b).

Impact:

SAR Sections A.4.4, A.5.1.3, B.4.4, B.5.1.3, C.4.4, C.5.1.3, D.4.4, and D.5.1.3 have been revised as described in the response.

TS 5.1.3 has been revised as described in the response.

5.0 Administrative Controls (continued)

5.1.3 HSM Thermal Monitoring Program

This program provides guidance for temperature measurements that are used to monitor the thermal performance of each HSM. The intent of the program is to prevent conditions that could lead to exceeding the concrete and fuel clad temperature criteria. Each user must implement TS 5.1.3(a).

a. Daily Visual Inspection of HSM Inlets and Outlets (Front Wall and Roof Birdscreens)

The user shall develop and implement procedures to perform visual inspection of HSM inlets and outlets on a daily basis. There is a possibility that the HSM air inlet and outlet openings could become blocked by debris, as postulated and analyzed in the SAR accident analyses for air vent blockage. The procedures shall ensure that blockage will not exist for periods longer than assumed in the SAR analyses.

Perform a daily visual inspection of the air vents to ensure that HSM air vents are not blocked for more than 40 hours. If visual inspection indicates blockage, clear air vents and replace or repair birdscreens if damaged. If the air vents are blocked or could have been blocked for more than 40 hours, evaluate existing conditions in accordance with the site corrective action program to confirm that conditions adversely affecting the concrete or fuel cladding do not exist.

(continued)

All Indicated Changes are in response to RAI TS-4

A.4.4 Storage Module Thermal Monitoring System

As described in Section 5.1.3, HSM Thermal Monitoring Program of the Technical Specifications [A.4-3], *daily visual inspection of the inlet and outlet vents of the HSM and removing any identified debris* prevents conditions that could lead to exceeding the concrete and SNF clad temperature criteria. *In addition, instrumentation that can be used for monitoring HSM roof concrete temperatures is also provided for each HSM.*

24. Replace the TC top cover plate and ram access cover plate. Secure the skid to the transfer vehicle.

25. Move the transfer vehicle and TC to the designated area. Return the remaining transfer equipment to the Storage Area.

A.5.1.3 Monitoring Operations

1. Perform routine security surveillance in accordance with the security plan.

2. Perform a daily visual surveillance of the HSM air inlets and outlets (bird screens) to verify that no debris is obstructing the HSM vents in accordance with Section 5.1.3(a) of the Technical Specification [A.5-2] requirements.

B.4.4 Storage Module Thermal Monitoring System

As described in Section 5.1.3, AHSM Thermal Monitoring Program of the Technical Specifications [B.4-3], *daily visual inspection of the inlet and outlet vents of the HSM and removing any identified debris* prevents conditions that could lead to exceeding the concrete and fuel clad temperature criteria. *In addition, instrumentation that can be used for monitoring HSM roof concrete temperatures is also provided for each HSM.*

All Indicated Changes are in response to RAI TS-4

23. The transfer vehicle can be moved, as necessary, to install the AHSM door. Install the AHSM door and secure it in place.

24. Replace the TC top cover plate and ram access cover plate. Secure the skid to the transfer vehicle.

25. Move the transfer vehicle and TC to the designated area. Return the remaining transfer equipment to the Storage Area.

26. Remove the AHSM Door and adjust the seismic restraints on the DSC one week following initial placement.

B.5.1.3 Monitoring Operations

27. Perform routine security surveillance in accordance with the security plan.

28. Perform a daily visual surveillance of the AHSM air inlet and outlet (bird screens) to verify that no debris is obstructing the AHSM vents in accordance with Section 5.1.3(a) of the Technical Specification [B.5-2] requirements.

C.4.4 Storage Module Thermal Monitoring System

As described in Section 5.1.3, HSM Thermal Monitoring Program of the Technical Specifications [C.4-3], *daily visual inspection of the inlet and outlet vents of the HSM and removing any identified debris* prevents conditions that could lead to exceeding the concrete and fuel clad temperature criteria. *In addition, instrumentation that can be used for monitoring HSM roof concrete temperatures is also provided for each HSM.*

All Indicated Changes are in response to RAI TS-4

26. Replace the TC top cover plate and ram access cover plate. Secure the skid to the transfer vehicle.

27. Move the transfer vehicle and TC to the designated area. Return the remaining transfer equipment to the Storage Area.

C.5.1.3 Monitoring Operations

1. Perform routine security surveillance in accordance with the security plan.

2. Perform a daily visual surveillance of the EOS-HSM air inlets and outlets (bird screens) to verify that no debris is obstructing the HSM vents in accordance with Section 5.1.3(a) of the Technical Specification [C.5-2] requirements.

All Indicated Changes are in response to RAI TS-4

D.4.4 Storage Module Thermal Monitoring System

As described in Section 5.1.3, HSM Thermal Monitoring Program of the Technical Specifications [D.4-3], *daily visual inspection of the inlet and outlet vents of the HSM and removing any identified debris* prevents conditions that could lead to exceeding the concrete and fuel clad temperature criteria. *In addition, instrumentation that can be used for monitoring HSM roof concrete temperatures is also provided for each HSM.*

All Indicated Changes are in response to RAI TS-4

24. The transfer vehicle can be moved, as necessary, to install the HSM door. Install the HSM door and secure it in place. The door may be welded for security.

25. Remove the unloading flange and replace the cask spacer ring.

26. Replace the TC top cover plate and ram access cover plate. Secure the skid to the transfer vehicle.

27. Move the transfer vehicle and TC to the designated area. Return the remaining transfer equipment to the Storage Area.

D.5.1.3 Monitoring Operations

1. Perform routine security surveillance in accordance with the security plan.

2. Perform a daily visual surveillance of the HSM air inlets and outlets (bird screens) to verify that no debris is obstructing the HSM vents in accordance with Section 5.1.3(a) of the Technical Specification [D.5-2] requirements.

RAI TS-5:

Ensure that the Proposed Technical Specifications include adequate administrative controls such as limiting the amount of flammable material (including diesel fuel) to the equivalent of 50 gallons of diesel fuel.

Table 3-1 in Appendices A-D of the application for the Rancho Seco/MP187/NUHOMS® Systems list the WCS CISF design criteria as 300 gallons of diesel fuel. Table 3-1 in Appendices E-G of the application for the NAC systems list the WCS CISF design criteria as 50 gallons of diesel fuel.

WCS CISF SAR Section 3.3.6 states: "The CTS and the VCT are quantity limited (< 50 gallons) and are described in Section 12.2.1. The transfer vehicle for the NUHOMS® System is also quantity limited (< 60 gallons) and will not be in the Cask Handling Building (CHB) during handling of the vertical systems. As the NUHOMS® System is evaluated for fire with 300 gallons of diesel fuel, the quantity of fuel in the transfer vehicle is bounded for NUHOMS® Systems operations." On the other hand, Section SAR 7.5.3.8, "On-Site Accidents" states, "During operations, the amount of flammable liquids that are in the CHB will be administratively controlled to ensure the amount of flammable liquids is maintained below the fire load limits for the respective systems (e.g., 300 gallons of diesel fuel for NUHOMS® Systems). In combination with fuel limitations and a fire suppression system, the fire hazard for the building is adequately mitigated (see WCS CISF SAR Section 3.3.6)."

The information provided in WCS CISF SAR Table 3-1 of Appendices A-G, and WCS CISF SAR Section 3.3.6, and Section 7.5.3.8 appears to be inconsistent with regards to the WCS CISF design criteria for fire/explosions protection; therefore, administrative controls should be included in the Proposed Technical Specifications to limit the amount of combustible material to the equivalent of 50 gallons of diesel fuel to make sure WCS CISF is bounded. Also, inconsistencies in the application should be fixed or clarified. The NRC staff needs this information to determine that adequate protection is provided to preclude any important to safety material from exceeding safety limits.

This information is needed to determine compliance with 10 CFR 72.44, 72.122(b), and 72.122(c).

Response to RAI TS-5:

Section 4.5 has been included in the proposed Technical Specifications (TS) limiting the amount of flammable liquids during LOADING OPERATIONS below the fire load limits for the respective systems in the safety analysis report (SAR), and to specifically limit the amount fuel in the transfer equipment to 50 gallons when handling NAC vertical systems and less than 300 gallons for the NUHOMS® Systems.

In addition, SAR Section 7.5.3.8 has been updated to reference the 50-gallon diesel fuel equivalent limit for the NAC-MPC, NAC-UMS and MAGNASTOR Systems.

Impact:

SAR Section 7.5.3.8 has been revised as described in the response.

TS Section 4.5 has been added as described in the response.

4.0 Design Features (continued)

- Trolley Beam (spanning the Lift Beams & also mounted on Self Propelled Dollies) - ASME NOG-1
- Standard Lift Links - ASME B30.26
- Standard Shackles - ASME B30.26
- Standard Slings - ASME B30.9
- Transfer Cask Lift Plates - ANSI N14.6
- Air Operated Chain Hoist (suspended from Trolley Beam) – ASME NUM-1 Qualified with Rated Load per ASME HST-5
- Canister Lift Adapter (which mates with canister) – ANSI N14.6

• The VCT with CANISTER lifting devices used with the CTS shall be designed, fabricated, operated, tested, inspected and maintained in accordance with the guidance of NUREG-0612, Section 5.1. The specific applicable standard being applied to each primary VCT is as follows:

  - Hydraulic Locking Telescoping Boom Assemblies – ASME B30.1
  - Lift Beam(s) (spanning the Telescoping Boom Assemblies) ANSI N14.6
  - Cask Lift Links - ANSI N14.6

4.5 Design Basis Site Specific Parameters and Analyses

The potential for fire and explosion shall be addressed by limiting the amount of flammable liquids during LOADING OPERATIONS below the fire load limits for the respective systems in the SAR. This includes the condition that the fuel tank of the cask handling equipment used to move the loaded VCC onto or from the Storage Pads contains no more than 50 gallons of fuel and no more than 300 gallons for the NUHOMS® Systems.

All Indicated Changes are in response to RAI TS-5

runway support beams and 10% of the suspended load is applied horizontally along the longitudinal axis of the steel crane runway support beams.

The positions of the cranes are varied along the crane runways to determine the worst case for maximum stresses on the steel crane runway support beams. To determine worst-case loadings on the beams, crane lifting trolleys are positioned to one side of each crane with the two cranes adjacent to each other. In addition, the worst-case location of the overhead bridge cranes is determined for the overall structure design.

7.5.3.8 On-Site Accidents

WCS CISF-initiated explosions are not considered credible since insufficient explosive materials are present to initiate an event that would result in the destruction of the building. During operations, the amount of flammable liquids that are in the CHB will be administratively controlled to ensure the amount of flammable liquids is maintained below the fire load limits for the respective systems (e.g., 300 gallons of diesel fuel *equivalent* for NUHOMS® *and 50 gallons of diesel fuel equivalent for the NAC-MPC, NAC-UMS, and MAGNASTOR Systems*). In combination with fuel limitations and a fire suppression system, the fire hazard for the building is adequately mitigated (see WCS CISF SAR Section 3.3.6).

7.5.3.9 Off-Site Accidents

Off-site accidents are addressed in WCS CISF SAR Section 12.2.2.

All Indicated Changes are in response to RAI TS-5

RAI TS-6:

Clarify which version of ACI-349 is called out in Operating Procedures - Administrative and Management Control Section 5.1.3.b.iv of the Proposed Technical Specifications.

Based on the context of the information provided in the Proposed Technical Specifications, Administrative Controls Section 5.1.3.b.iv, it appears that the information referenced is an outdated version of ACI-349 (1985 version with the 1990 Revisions). The ACI-349 standard has been revised in 2006 and again in 2013. Note that starting in the 2006 revision, the thermal considerations were moved to Appendix E.

This information is needed to determine compliance with 10 CFR 72.24(c)(4).

Response to RAI TS-6:

In response to RAI TS-4, ISP has removed Section 5.1.3(b), including Section 5.1.3.b.iv, from the Technical Specification (TS). The HSM Thermal Monitoring Program is now completely implemented by daily visual inspections of the inlet and outlet vents with no associated evaluations required.

Impact:

No change as a result of this RAI.

RAI TS-7:

Ensure that Proposed Technical Specifications Section 5.1.3.b.v clearly explains what measurements or other evidence will be used to determine that, "off-normal or accident temperature limits for fuel cladding have been exceeded," and what procedures or tests will be used to "verify that the canister confinement is maintained."

The Proposed Technical Specifications, Operating Procedures - Administrative and Management Control Section 5.1.3.b.v, include these statements but there is no specific procedure or SAR section referenced.

This information is needed to determine compliance with 10 CFR 72.24(b) and (l), 72.120(a) and 72.122(h)(1).

Response to RAI TS-7:

In response to RAI TS-4, ISP has removed Section 5.1.3(b), including Section 5.1.3.b.v, from the Technical Specification (TS). The HSM Thermal Monitoring Program is now completely implemented by daily visual inspections of the inlet and outlet vents.

Impact:

No change as a result of this RAI.

RAI TS-8:

Ensure the application provides the appropriate inspection requirements and acceptance criteria in Proposed Technical Specifications Section 5.2.2, "Cask Drop," Inspection Requirement, which states, "The NUHOMS® CANISTER will be inspected for damage after any STC with CANISTER side drop of 15 inches or greater."

This information is needed to determine compliance with 10 CFR 72.24(c)(4) and 72.120(a).

Response to RAI TS-8:

For NUHOMS® Systems, the accident involving the drop the shielded transfer cask (STC) with the CANISTER and its spent fuel contents during transfer operations is evaluated as a non-mechanistic accident. The structural analysis demonstrates that the basket integrity is retained and the STC and the CANISTER maintain their confinement functions. Therefore, the inspection and acceptance criteria are traditionally provided in the applicable accident analysis sections of the safety analysis report (SAR).

As a result, the inspection requirements and the acceptance criteria are clarified in the SAR Section A.12.2.2, B.12.2.2, C.12.2.2 and D.12.2.2.

Impact:

SAR Sections A.12.2.2, B.12.2.2, C.12.2.2, and D.12.2.2 have been revised as described in the response.

Corrective Action

Consistent with Section 8.2.1.4 of Volume I of [A.12-1], the canister shall be inspected for damage, for drop heights greater than fifteen inches, as necessary. Removal of the transfer cask top cover plate may require cutting of the bolts in the event of a corner drop onto the top end. These operations will take place in the Cask Handling Building. The extent of the damage will also be evaluated using calculations to demonstrate that there is no impact to the ability of the canister to continue to perform its intended design functions.

Following recovery of the transfer cask and transfer of the canister in the HSM, the transfer cask will be inspected, repaired, and tested as appropriate prior to reuse. For recovery of the cask and contents, it may be necessary to develop a special sling/lifting apparatus to move the transfer cask from the drop site to the Cask Handling Building. This may require several weeks of planning to ensure all steps are correctly organized. During this time, temporary shielding may be added to the transfer cask to minimize onsite exposure to WCS CISF operations personnel. The transfer cask would be roped off to ensure the safety of personnel.

A.12.2.3 Earthquakes

Cause of Accident

Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical are shown in Table 1-2, Table 1-5 and Figure 1-5. The site-specific response spectra are used in the WCS CISF SSI analysis to obtain the enveloped acceleration spectra at the HSM CG and base. Section A.7.5 demonstrates that the enveloping WCS CISF site-specific seismic forces remain below their applicable capacities for the NUHOMS® MP187 Cask System components.

Accident Analysis

The structural, thermal, and radiological consequences and the recovery measures required to mitigate an earthquake are addressed in Sections 8.3.2.2, 8.3.2.1 of Volume II and 8.3.2.1 of Volume III of [A.12-1]. In addition, Chapter A.8 demonstrates that the thermal analysis performed for the NUHOMS® MP187 Cask System in [A.12-1] is bounding for WCS CISF conditions.

A.12.2.4 Lightning

Cause of Accident

The likelihood of lightning striking the HSM Model 80 and causing an off-normal or accident condition is not considered a credible event. Simple lightning protection equipment for the HSM structures is considered a miscellaneous attachment acceptable per the HSM design.

Accident Analysis

The structural, thermal, and radiological consequences and the recovery measures required to mitigate the effects of a drop accident are addressed in Section 8.2.1.3 of Volume I of [B.12-5] for the MP187 cask in the transfer configuration. Section 3.6 of [B.12-1] demonstrates that the canister remains leak tight and the basket maintains its configuration following the drop event. In addition, Chapter B.8 demonstrates that the thermal analysis performed for the NUHOMS® MP187 Cask System in [B.12-1] is bounding for WCS CISF conditions.

Corrective Action

Consistent with Section 11.2.5.4 of [B.12-1], the canister will be inspected for damage *for drop heights greater than fifteen inches*, as necessary. Removal of the transfer cask top cover plate may require cutting of the bolts in the event of a corner drop onto the top end. These operations will take place in the Cask Handling Building. *The extent of the damage will also be evaluated using calculations to demonstrate that there is no impact to the ability of the canister to continue to perform its intended design functions.*

Following recovery of the transfer cask and transfer of the canister in the AHSM, the transfer cask will be inspected, repaired and tested as appropriate prior to reuse.

For recovery of the cask and contents, it may be necessary to develop a special sling/lifting apparatus to move the transfer cask from the drop site to the Cask Handling Building. This may require several weeks of planning to ensure all steps are correctly organized. During this time, temporary shielding may be added to the transfer cask to minimize on-site exposure to WCS CISF operations personnel. The transfer cask would be roped off to ensure the safety of personnel.

B.12.2.3 Earthquakes

Cause of Accident

Site-specific ground-surface uniform hazard response spectra (UHRS) with 1E-4 annual frequency of exceedance (AFE) having peak ground acceleration (PGA) of 0.250 g horizontal and 0.175 g vertical are shown in Table 1-2, Table 1-5 and Figure 1-5. The site-specific response spectra are used in the WCS CISF SSI analysis to obtain the enveloped acceleration spectra at the HSM CG and base. Section B.7.5 demonstrates that the enveloping WCS CISF site-specific seismic forces remain below their applicable capacities for the MP187 cask and Standardized Advanced NUHOMS® System components.

C.12.2.2 Drop Accidents

Cause of Accident

Sections K.11.2.5.1 and K.3.7.5.1 of [C.12-1] discusses the cask drop for the MP197HB cask in the transfer configuration when it contains the canister.

Accident Analysis

The structural and thermal consequences for the effect of a drop accident are addressed in Section K.11.2.5.2 for the canister and in Appendix C.8 for the MP197HB cask in the transfer configuration. This analysis demonstrates that the canister remains leak tight and the basket maintains its configuration following the drop event. In addition, Chapter C.8 presents the thermal analysis performed for the MP197HB cask for WCS CISF conditions.

Accident Dose Calculations

The accident dose calculations presented in Section K.11.2.5.3 of [C.12-1], are very conservative because the MP197HB cask consists of a solid neutron shield, the source terms for the contents of the canister have significantly decayed prior to transportation to the WCS CISF and the boundary is approximately 0.75 miles from the WCS CISF.

Corrective Action

Consistent with Sections K.11.2.5.4 and 8.2.5.4 of [C.12-1], the canister will be inspected for damage *for drop heights greater than fifteen inches*, as necessary. Removal of the transfer cask top cover plate may require cutting of the bolts in the event of a corner drop onto the top end. These operations will take place in the Cask Handling Building. *The extent of the damage will also be evaluated using calculations to demonstrate that there is no impact to the ability of the canister to continue to perform its intended design functions.*

Following recovery of the transfer cask and transfer of the canister in the HSM, the transfer cask will be inspected, repaired and tested as appropriate prior to reuse.

For recovery of the cask and contents, it may be necessary to develop a special sling/lifting apparatus to move the transfer cask from the drop site to the cask handling building. This may require several weeks of planning to ensure all steps are correctly organized. During this time, temporary shielding may be added to the transfer cask to minimize on-site exposure to WCS CISF operations personnel. The transfer cask would be roped off to ensure the safety of the personnel.

All Indicated Changes are in response to RAI TS-8

D.12.2.2 Drop Accidents

Cause of Accident

Sections T.11.2.5.1 and T.3.7.4.1 of [D.12-1] discusses the cask drop for the MP197HB cask in the transfer configuration when it contains the canister.

Accident Analysis

The structural thermal consequences for the effects of a drop accident are addressed in Section T.11.2.5.2 of [D.12-1] for the canister and in Appendix D.8 for the MP197HB cask in the transfer configuration. This analysis demonstrates that the canister remains leak tight and the basket maintains its configuration following the drop event. In addition, Chapter D.8 presents the thermal analysis performed for the MP197HB cask for WCS CISF conditions.

Accident Dose Calculations

The accident dose calculations presented in Section T.11.2.5.3 of [D.12-1], are very conservative because the MP197HB cask consists of a solid neutron shield, the source terms for the contents of the canister have significantly decayed prior to transportation to the WCS CISF and the boundary is approximately 0.75 miles from the WCS CISF.

Corrective Action

Consistent with Sections T.11.2.5.4 and 8.2.5.4 of [D.12-1], the canister will be inspected for damage *for drop heights greater than fifteen inches*, as necessary. Removal of the transfer cask top cover plate may require cutting of the bolts in the event of a corner drop onto the top end. These operations will take place in the Cask Handling Building. *The extent of the damage will also be evaluated using calculations to demonstrate that there is no impact to the ability of the canister to continue to perform its intended design functions.*

Following recovery of the transfer cask and transfer of the canister in the HSM, the transfer cask will be inspected, repaired and tested as appropriate prior to reuse.

For recovery of the cask and contents, it may be necessary to develop a special sling/lifting apparatus to move the transfer cask from the drop site to the cask handling building. This may require several weeks of planning to ensure all steps are correctly organized. During this time, temporary shielding may be added to the transfer cask to minimize on-site exposure to WCS CISF operations personnel. The transfer cask would be roped off to ensure the safety of personnel.

All Indicated Changes are in response to RAI TS-8

Safety Analysis Report (SAR), Chapter 3, "Principal Design Criteria"

RAI NP-3-1:

Clarify the application of ASME NOG-1, "Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)," to the design of the canister transfer system (CTS).

The design criteria specified for the canister transfer system is inconsistent. WCS CISF SAR Section 3.2.3.5 states the 1989 edition of ASME NOG-1 [Ref. 3- 26] was used for the static design load combinations, while WCS CISF SAR Section 3.2.8.3 indicates that the important-to-safety canister transfer system load combinations were in accordance with the 2010 edition of ASME NOG-1 [Ref. 3-34].

This information is needed to determine compliance with the 10 CFR 72.24(c)(4).

Response to RAI NP-3-1:

All calculations and design specifications have been reviewed and ISP has revised SAR Section 3.2.3.5 to reference ASME NOG-1, 2010 Edition. Reference [3-26] is also updated to indicate that this reference is not used. ISP also verified that Reference [3-26] was only used in Section 3.2.3.5 of the SAR.

Impact:

SAR Sections 3.2.3.5 and 3.8 have been revised as described in the response.

RAI NP-3-6

For the Vertical Storage Systems storage pad *and the NUHOMS® NITS storage pad*, the soil material properties used are the static properties, equal to or lower than the dynamic soil properties and, therefore, conservative for use in an equivalent static analysis. The soil properties used in the equivalent static *analyses* for the Vertical Storage System storage pads *and the NUHOMS® NITS storage pads* are given in Appendix C of [3-33] and are listed in Table 7-38.

RAI NP-3-1

The design criteria used for the Canister Transfer System (CTS) is specified in ASME NOG-1, Section 4000 [*3-34*]. All of the load combinations identified in paragraph 4140 have been evaluated. Controlling load combinations have been used to determine component stresses and then are compared to applicable allowable stresses. The sum of simultaneously applied loads (static and dynamic) do not result in stress levels which would cause any permanent deformation, and thus, the CTS fully meets the requirements of ASME NOG-1 [*3-34*].

CHB structural steel components are analyzed and designed to resist the specified loading combinations in the IBC [3-10]. Static analysis methods are used for determining forces and moments on structural steel members as a result of applied service loading conditions. Dynamic analysis methods are used for determining structural steel member forces and moments for factored loading conditions where structural components are subjected to seismic loads.

Seismic analysis information for the NUHOMS® and Vertical Storage System design criteria are fully described in Appendices A.3, B.3, C.3, D.3, E.3, F.3 and G.3.

3.2.3.6 Critical Damping Values

Critical damping values are in accordance with Regulatory Guide 1.61 [3-27] for a SSE.

3.2.3.7 Basis for Site-Development Analysis

Site-specific vibratory ground motion is determined through evaluation of the seismology, geology, and the seismic and geologic history of the site and surrounding region. This information is contained in the site-specific PSHA (Chapter 2, Attachment D).

3.2.3.8 Soil Supported Structures

The soil supported structures that are analyzed for the CISF design basis ground motion are the ITS Storage Pads and the CTS. The CHB is analyzed based on criteria established by the IBC [3-10].

3-22 Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation."

3-23 Title 10, Code of Federal Regulations, Part 72, "License Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste."

3-24 ASCE-7 (formerly ANSI A58.1), Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers, 1995.

3-25 McGuire, R.K., Silva, W.J. and Constantino, C.J., 2001, Technical basis for revision of regulatory guidance on design ground motions: Hazard- and risk-consistent ground motion spectra guidelines, U.S. Nuclear Regulatory Commission NUREG/CR-6728.

3-26 *Not Used.*

3-27 Regulatory Guide 1.61, Damping Values For Seismic Design of Nuclear Power Plants, U.S. Nuclear Regulatory Commission, October 1973.

3-28 ASCE-4, Seismic Analysis of Safety-Related Nuclear Structures and Commentary on Standard for Seismic Analysis of Safety-Related Nuclear Structures, American Society of Civil Engineers, 1986.

3-29 NUREG-0554, Single-Failure-Proof Cranes for Nuclear Power Plants, U.S. Nuclear Regulatory Commission, 1979.

3-30 ASME B30.2-2005 Overhead and Gantry Cranes.

3-31 NUREG/CR-6407, (INEL-95/0551), Classification of Transportation Packaging and Dry Spent Fuel Storage System Components According to Importance to Safety, 1996.

3-32 Electric Power Research Institute (EPRI), 2013, Ground motion model (GMM) review project, Final Report.

3-33 Geoservices, LLC, Project No. 31-151247, "Report of Geotechnical Exploration: Consolidated Interim Storage Facility (CISF) Andrews, Texas," August 20, 2015.

3-34 ASME NOG-1-2010, "Rules for Construction of Overhead Gantry Cranes (Top Running Bridge, Multiple Girder)," The American Society of Mechanical Engineers, 2010.

All Indicated Changes are in response to RAI NP-3-1

RAI NP-3-2:

Provide the quality assurance classification and justification for the MP187 and the MP197HB transportation/transfer casks that will be used at the WCS CISF.

WCS CISF SAR Appendices A.3.1.4 and B.3.1.4 identify the MP187 as being qualified for transfer operations and SAR Appendices C.3.1.4 and D.3.1.4 identify the MP197HB as being qualified for transfer operations. WCS CISF SAR Table 7-1: WCS CISF Structures and QA Classification identify the transfer casks as important to safety, but the quality assurance classification of these Structures, Systems, and Components are not included in WCS CISF SAR Table 3-5, "Quality Assurance Classification of Structures, Systems, and Components as Utilized at the WCS CISF."

This information is needed to determine compliance with 10 CFR 72.24(c) and (d).

Response to RAI NP-3-2:

The requested information for the NUHOMS® MP187 transportation cask, referenced in SAR Appendices A.3.1.4 and B.3.1.4, are provided in the response to RAI NP-15-2. SAR Section A.3.1 was revised and Tables A.3-5 through A.3-6 were added to the SAR as described in the response to RAI NP-15-2 to provide the quality assurance classifications for the NUHOMS® MP187 cask.

The requested information for the NUHOMS® MP197HB transportation cask, referenced in SAR Appendices C.3.1.4 and D.3.1.4, is included on in the bill of materials (BOM) of Drawing MP197HB-71-1002, Revision 6 which is incorporated by reference in Section C.4.6 (See Item 8) of the SAR.

Finally, see the response to RAI NP-15-5, which dealt with the justification for the quality classification for both the MP187 and MP197HB transportation/transfer casks.

Impact:

No change as a result of this RAI.

RAI NP-3-3:

Provide the safety classification and quality assurance classification of the NAC Transfer casks for the transfer of Transportable Storage Canisters (TSCs) for the NAC-MAGNASTOR, NAC-UMS and the NAC-MPC systems.

The WCS CISF SAR Appendices E-G identify NAC Transfer casks for the transfer of TSCs for the NAC-MAGNASTOR, NAC-UMS and the NAC-MPC systems. The safety classification of SSCs for these systems is referenced to the respective UFSARs for these systems in WCS CISF Appendices E-G Section 3.1.2.1, however the transfer cask is not classified as either important to safety or not important to safety in the WCS CISF SAR and the quality assurance classification of these SSCs is not included in WCS CISF SAR Table 3-5, "Quality Assurance Classification of Structures, Systems, and Components as Utilized at the WCS CISF."

This information is needed to determine compliance with 10 CFR 72.24(c) and (d).

Response to RAI NP-3-3:

ISP has revised Table 3-5 in the SAR to include the safety classifications and quality assurance categories for of the NAC transfer casks used in the transfer of TSCs for the NAC-MAGNASTOR, NAC-UMS and the NAC-MPC systems. All of the transfer casks are classified as important-to-safety (ITS) and have a quality assurance classification of B.

References:

1. Tables 2.3-1 and 2.3-2 of NAC-MPC Final Safety Analysis Report, Revision 10, January 2014.

2. Table 2.3-1 of NAC-UMS Universal Storage System Final Safety Analysis Report, Revision 10, October 2012.

3. Table 2.4-1 of MAGNASTOR Final Safety Analysis Report, Revision 7, July 2015.

Impact:

SAR Table 3-5 has been revised as described in the response.

Table 3-5
Quality Assurance Classification of Structures, Systems, and Components as Utilized at the WCS CISF(1)

Important-To-Safety	Not Important-To-Safety
Classification Category A	Facility Infrastructure
SNF Canister	Security and Administration Building
	Storage Pads (NUHOMS® Storage Overpacks)
Classification Category B	Overhead Building Cranes
Storage Overpacks	Overhead Building Crane Lifting Devices
Canister Transfer System *(See Note 3)*	Electrical Power
Vertical Cask Transporter	
Classification Category C	Facility Lighting
Storage Pads (Vertical Concrete Storage overpacks)	NUHOMS® Cask Transfer Trailer
Cask Handling Building	Radiation Monitors
	Temperature Monitoring System
Treated as Category C	Communication System
Derailer (See Note 2)	Fire Protection System
CAS (See Note 2)	Potable Water System
Security Lighting (See Note 2)	Sanitary Waste/Septic Systems
Security Cameras (See Note 2)	Facility Roads
Security Alarm Systems (See Note 2)	Railroad Line Components
Backup Electric Power (Generators) (See Note 2)	Associated Support Equipment

Notes:

(1) Quality Assurance Classifications for each of the Storage Systems SSCs are addressed in Table 3-4.

(2) Treated as ITS Category C with the exception 10 CFR Part 21 does not apply.

(3) The Canister Transfer System includes transfer casks for the NAC MAGNASTOR, UMS, and MPC systems.

All Indicated Changes are in response to RAI NP-3-3

RAI NP-3-4:

Clarify the information provided in WCS CISF SAR Section 3.3.7.1, "Spent Fuel or High-Level Radioactive Waste Handling and Storage," which states:

> *A recovery method for the unlikely loss of confinement event is independent of any bare fuel handling facilities.*

Provide specific information on the recovery method(s) that will be used for the systems incorporated by reference.

This information is needed to determine compliance with 10 CFR 72.120(a).

Response to RAI NP-3-4

As described in the introduction to Chapter 11 of the SAR, the design and licensing basis for all of the of the canisterized systems authorized for storage at the WCS CISF is that the canister maintains confinement for all normal, off-normal and accident conditions. In addition, the confinement boundary of each canister type authorized for storage at the WCS CISF is evaluated to demonstrate that the confinement boundary of the canisters is not adversely impacted during transport to the WCS CISF. The canisters are also subject to the applicable NRC-approved Aging Management Program during storage, at both the originating site and at the WCS CISF, based on the original canister load date. Therefore, as the ability to handle bare fuel is not a credible event, it is not part of the licensing basis and, to remove any confusion related to this issue, the bullet referenced in the RAI question has been removed from Section 3.3.7.1 of the SAR.

Impact:

SAR Section 3.3.7.1 has been revised as described in the response.

There is a fire suppression system in the CHB that is installed to mitigate the consequences of a fire.

WCS CISF initiated explosions are not considered credible since no explosive materials are present. The effects of externally initiated explosions are bounded by the design basis tornado generated missile load analysis performed for the authorized storage systems.

3.3.7 Material Handling and Storage

This section of the principal design criteria establishes requirements that satisfy 10 CFR 72.128(a) and (b) [3-23], which identify general design criteria that requires SNF storage and handling systems be designed to ensure adequate safety under normal and accident conditions and that radioactive waste treatment facilities be provided.

3.3.7.1 Spent Fuel or High-Level Radioactive Waste Handling and Storage

To meet WCS CISF functional requirements to receive, transfer, store and retrieve canisterized SNF and GTCC waste, the following criteria are established for the WCS CISF design.

Storage and handling systems are designed to allow ready retrieval of the canisters for shipment off-site, and the cask/canister handling systems are designed in accordance with 10 CFR 72.128(a) [3-23] to ensure adequate safety under normal and accident conditions. The following criteria for cask systems are also satisfied.

- Cask systems are designed and certified to withstand a drop event from heights specified in the Technical Specifications [3-1] for each individual system. WCS CISF operation procedures and limitations ensure casks are within these heights.
- Cask systems designed to transfer canisters are designed to withstand the impact of the postulated tornado missiles during transfer operations. For this event, "designed to withstand" is defined as no impact on ITS functions except the following: A partial loss of shielding is allowed to the extent evaluated.
- Cask systems utilizing vertical transfer must be qualified for a 6-inch drop of the storage overpack or transportation cask lid during transfer operations.

The CHB cranes and associated cask/canister lifting equipment are designed utilizing the standards identified in the Technical Specifications [3-1].

3.3.7.2 Radioactive Waste Treatment

Radioactive contamination is anticipated to be negligible because SNF and GTCC waste is packaged in sealed canisters. Small volumes of solid radioactive wastes are expected. Waste will be managed in accordance with Section 3.3.7.3.

All Indicated Changes are in response to RAI NP-3-4

RAI NP-3-6:

Revise the discussion in WCS CISF SAR Section 3.2.3.5 to clarify whether the same soil property data presented in WCS CISF SAR Table 7-38 are also being used for WCS CISF SAR Section 7.6.4, "Soil Structure Interaction of NUHOMS NITS Storage Pad."

The present SAR discussion covers only the soil property data used for the NAC system storage pad. The SAR Section 3.2.3.5 discussion on the soil properties data should be revised to also cover the NUHOMS NITS Storage Pad.

This information is needed to determine compliance with 10 CFR 72.24(c)(3), 72.24(d)(1) and (2) and 72.122(b).

Response to RAI NP-3-6:

The NUHOMS® not important-to-safety (NITS) storage pad is covered by the soil properties discussed in Table 7-38, as stated at the end of Section 7.6.5.4 Subsection "Soil Modeling" (page 7-93). Section 3.2.3.5 has been revised to include reference to the NUHOMS® NITS storage pad. These soil properties are not used in Section 7.6.4 discussing the soil-structure interaction (SSI) analysis for the NUHOMS® NITS Storage Pad, but in Section 7.6.5 discussing the equivalent static analyses for the NUHOMS® NITS Storage Pad.

Impact:

SAR Section 3.2.3.5 has been revised as described in the response.

RAI NP-3-6

For the Vertical Storage Systems storage pad *and the NUHOMS® NITS storage pad*, the soil material properties used are the static properties, equal to or lower than the dynamic soil properties and, therefore, conservative for use in an equivalent static analysis. The soil properties used in the equivalent static *analyses* for the Vertical Storage System storage pads *and the NUHOMS® NITS storage pads* are given in Appendix C of [3-33] and are listed in Table 7-38.

RAI NP-3-1

The design criteria used for the Canister Transfer System (CTS) is specified in ASME NOG-1, Section 4000 [*3-34*]. All of the load combinations identified in paragraph 4140 have been evaluated. Controlling load combinations have been used to determine component stresses and then are compared to applicable allowable stresses. The sum of simultaneously applied loads (static and dynamic) do not result in stress levels which would cause any permanent deformation, and thus, the CTS fully meets the requirements of ASME NOG-1 [*3-34*].

CHB structural steel components are analyzed and designed to resist the specified loading combinations in the IBC [3-10]. Static analysis methods are used for determining forces and moments on structural steel members as a result of applied service loading conditions. Dynamic analysis methods are used for determining structural steel member forces and moments for factored loading conditions where structural components are subjected to seismic loads.

Seismic analysis information for the NUHOMS® and Vertical Storage System design criteria are fully described in Appendices A.3, B.3, C.3, D.3, E.3, F.3 and G.3.

3.2.3.6 Critical Damping Values

Critical damping values are in accordance with Regulatory Guide 1.61 [3-27] for a SSE.

3.2.3.7 Basis for Site-Development Analysis

Site-specific vibratory ground motion is determined through evaluation of the seismology, geology, and the seismic and geologic history of the site and surrounding region. This information is contained in the site-specific PSHA (Chapter 2, Attachment D).

3.2.3.8 Soil Supported Structures

The soil supported structures that are analyzed for the CISF design basis ground motion are the ITS Storage Pads and the CTS. The CHB is analyzed based on criteria established by the IBC [3-10].

RAI NP-3-7:

Clarify the basis or scope supporting classification of the Canister Transfer System (CTS) and Vertical Cask Transporter (VCT) as important to safety (ITS) Category B systems in WCS CISF SAR Table 3-5, "Quality Assurance Classification of Structures, Systems, and Components as Utilized at the WCS CISF."

NUREG/CR-6407, "Classification of Transportation Packaging and Dry Spent Fuel Storage System Components Accordance to Importance to Safety," defines ITS Category B as structures, systems and components (SSCs) whose failure or malfunction could indirectly result in a condition adversely affecting public health and safety. Thus, the failure of a Category B item, in conjunction with the failure of an additional item, could result in an unsafe condition. NUREG/CR-6407 defines ITS Category A as SSCs whose failure or malfunction could directly result in a condition adversely affecting public health and safety. Thus, the failure of a single item could cause loss of primary containment leading to release of radioactive material, loss of shielding, or unsafe geometry compromising criticality control.

The CTS and VCT handling systems each contain components, such as certain structural members and special lifting devices, whose failure could cause canisters loaded with fuel to drop under conditions (i.e., drop heights and overpack configurations) that have not been evaluated to show that primary containment and a safe geometry would be maintained. Therefore, to clarify the classification and scope, either provide an evaluation showing a single component failure within the CTS or VCT handling systems would not directly result in a condition adversely affecting public health and safety to justify classification of the overall systems as ITS Category B or designate portions of the CTS and VCT handling systems as ITS Category A.

This information is needed to determine compliance with 10 CFR 72.122(a).

Response to RAI NP-3-7:

The CTS is designed as a single failure proof system for MAGNASTOR Transfer Cask (MTC) and canister handling. Section 7.5.1.5 of the SAR describes the safety features for the CTS and gives the basis for categorizing the CTS as a single failure-proof system. As such, the CTS has an overall classification as Category B.

As described in Section 7.5.2, failure modes for VCT operations associated with the handling of the loaded vertical concrete casks (VCC's) are bounded by existing drop analyses and the VCT can therefore be considered having an overall classification as Category B. For the instance of the VCT upending the transport cask and removing it or placing it onto the railcar, the VCT in this operation is designed to be single failure proof.

Impact:

No change as a result of this RAI.

SAR Chapter 4, "Facility Design"

RAI NP-4-1:

Provide additional information to support the differences between the required tests and maintenance activities described in WCS CISF SAR Section 4.5.1, "Transportation Cask Repair and Maintenance Activities," and specific repair and maintenance activities provided in the SARs for each of the systems incorporated by reference. Alternatively, revise WCS CISF SAR Section 4.5.1 and state all maintenance activities for the transportation casks will follow requirements outlined in Chapter 8 of the SARs for the systems incorporated by reference.

The NRC staff notes the following potential inconsistencies between WCS CISF SAR Section 4.5.1 and SARs of the transportation systems incorporated by reference:

- The NAC STC and NAC-UMST both have quick-disconnect fittings (e.g., vent, drain, inner lid interseal test and interlid ports) for which there are required inspections for proper function during each cask loading and unloading operation. See Table 8.2-1 of each SAR. (Section 8.2.4 of the NAC STC and the NAC-UMST SAR). These connectors shall be replaced, as required, and at a minimum of every 2 years. Neither the required inspections nor the periodic replacement are described in the WCS CISF SAR.
- MP197HB has a structural test in its SAR Section A.8.2.1 and dimensional testing of the trunnions. Neither are described in the WCS CISF SAR.
- Some transportation systems such as the MP187 and the MP197HB require periodic fastener replacement with frequencies that are based on either time or number of uses. The periodic replacement of these fasteners is not described in the WCS CISF SAR.
- The reference to nondestructive examination in the paragraph under Trunnion Inspections in WCS CISF SAR Section 4.5.1 is not descriptive. Clarify whether this is something other than visual testing (VT) and/or beyond the requirements identified in the Chapter 8 of the transportation SARs for the systems incorporated by reference. The NRC staff notes that the NAC-UMS requires periodic penetrant testing (PT) of trunnions (see NAC-UMST SAR Section 8.2.1).

This information is needed to determine compliance with 10 CFR 72.120(a).

Response to RAI NP-4-1:

ISP has revised Section 4.5.1 of the SAR to state that any transportation cask maintenance and repair activity conducted at WCS CISF will be performed in accordance with the applicable NRC Certificate of Compliance (CoC) for Radioactive Materials Packages (Part 71), and Chapter 8 of the Transportation SAR referenced in the CoC.

Impact:

SAR Section 4.5.1 has been revised as described in the response.

The maintenance activities *that may be* carried out at the CHB include*, but are not limited to*:

- Leak Tests
- Fastener Inspections and Replacement
- Impact Limiter Inspections
- Seal Areas and Groove Inspections
- Trunnion Inspections
- Rupture Disk and Gasket Inspections

Any transportation cask maintenance and repair activity conducted at WCS CISF will be performed in accordance with the applicable NRC Certificate of Compliance for Radioactive Materials Packages (Part 71), and Chapter 8 of the Transportation SAR referenced in the Certificate. ISP will be a registered user for all transportation casks used at WCS CISF and perform any transportation cask maintenance and repair activity under an approved NRC Quality Assurance Program.

4.5.2 Rail Side Track

A rail side track will depart from the existing Waste Control Specialists rail loop and extend north and to the east into the PA and the CHB. There is sufficient rail length for 10 rail cars to be inside the PA before proceeding to the CHB. Unloaded rail cars will exit the CHB and continue east on the rail sidetrack which will connect back into the existing Waste Control Specialists rail loop. Figure 1-1 shows the Waste Control Specialists Site, Existing Rail Loop, and the new WCS CISF Side Track.

4.5.3 Transportation Cask Queuing Areas

The rail side track that brings rail cars to the CHB has queuing length of approximately 1,000 feet inside of the PA. This length will accommodate five primary rail cars and five accompanying buffer cars, all within the PA. Once a rail car has been unloaded, it will be released through the east end of the CHB and outside of the PA.

In addition to the main side track, there is an additional parallel storage rail line that departs the new sidetrack to inside the PA. This line terminates near the eastern edge of the PA. This provides approximately 800 feet of additional track length inside the PA for rail car storage and staging. Figure 1-3 shows the main side track as well as the parallel storage rail line.

4.5.4 Receiving Area

When the transportation cask arrives at the WCS CISF, the transportation cask and cradle are visually inspected for damage prior to entry into the OCA. The receiving area is shown on Figures 1-2 and 1-3.

All Indicated Changes are in response to RAI NP-4-1

RAI NP-4-2:

Describe, or provide a reference to, the testing procedure and the acceptance criteria for Impact Limiter weight tests to detect the absorption of moisture for the NAC-STC and the TN MP197HB. WCS CISF SAR Section 4.5.1 states:

> *In addition, the impact limiters are inspected to verify that a significant amount of water has not been absorbed and that degradation of the energy absorbing material has not occurred. These inspections are performed by weighing the impact limiter and visual examination of the impact limiters and welds.*

Weight testing of impact limiters appears to be used only in the NAC-UMST (NAC-UMST SAR Section 8.2.3) and the MP187 (ADAMS Accession No.

ML063520505), which include acceptance criteria. The acceptance tests and maintenance chapters of the SARs for the NAC-STC and the MP197HB do not include testing procedures and acceptance criteria for evaluating the possibility of moisture absorption of the impact limiters. However, the MP197HB does require leak testing of the impact limiters to identify evidence of cracking in the welds (MP197HB SAR Section A.8.2.3.2).

This information is needed to determine compliance with 10 CFR 72.120(a).

Response to RAI NP-4-2:

MP197HB Impact limiters:

A visual examination of the impact limiters will be performed before each shipment to ensure that the impact limiters have not been degraded between leakage test intervals. If there is no evidence of weld cracking or other damage that could result in water in-leakage, the wood will not be degraded. If there is visual damage, the impact limiter will be removed from service, repaired, if possible, and inspected/tested for degradation of the wood.

Impact limiters will be leakage tested once every five years to ensure that water has not entered the impact limiters. If the leakage test indicates that the impact limiters have a leak, a humidity test will be performed to verify that there is no free water in the impact limiters.

MP 187 Impact limiters:

Prior to each use, a visual examination of the impact limiter pipe plugs at the end of the impact limiter will be inspected for damage and replaced prior to use if damaged.

Annually, a visual inspection of the impact limiter foam will be conducted for water absorption by removing the pipe plugs and inspecting the foam in the limiters, respectively. Additionally, each impact limiter shall be weighed. The impact limiters shall be removed from service if there is more than a 3% increase in weight when compared to the weight documented at the completion of fabrication.

Impact:

No change as a result of this RAI.

RAI NP-4-3:

Describe the administrative controls that will be used to ensure the lift height of the NUHOMS transportation cask is maintained at or below 80 inches with respect to the following areas identified in Section 5.1.1 of NUREG-0612:

- Definition of safe load paths (How will the operator determine load height?)
- Procedures (What level of oversight will be provided and what actions will be taken if load exceeds height limit?)
- Operator training (How will the crane operator and any supervisors be qualified?)
- Crane inspection, testing, and maintenance (How will proper performance of crane controls be verified?)

The NRC staff found that the specified administrative controls do not provide sufficient information to fully demonstrate conformance with the guidance contained in Section 5.1.1 of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants: Resolution of Generic Technical Activity A-36," because the administrative controls used to maintain that load height were not specified other than by specifying the load height limit in the applicable procedure descriptions in the FSAR. WCS CISF SAR Section 4.7.2 states that the two 130-ton overhead bridge cranes would be provided for transferring loaded NUHOMS fuel canisters within transportation casks from a rail car to the transfer trailer. This section of the WCS CISF SAR also states that the cranes would be administratively controlled to maintain the NUHOMS cask at or below the analyzed 80-inch drop height, and that, as indicated in Section 7.5.3.1 of the WCS CISF SAR, lifts performed by the overhead bridge crane would be governed by the guidance of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants: Resolution of Generic Technical Activity A-36," to minimize the potential for release of radioactive material from a spent fuel cask.

This information is needed to determine compliance with 10 CFR 72.24(h).

Response to RAI NP-4-3:

The overhead cranes in the Cask Handling Building (CHB) will be installed with limit switches and the lifting procedures will specify the use of physical limit switches when the loaded NUHOMS® casks are being lifted. Limit switches are adjustable electromechanical components that are commonly used to regulate industrial machinery and are widely used in crane operations. One of the most common applications of limit switches in overhead crane operation is to control the length of the travel of the hoist which determines the height of the load.

As the crane approaches the end of its pre-set travel limit (maximum allowed cask lifting height), an electrical or mechanical switch will trigger and begin to slow down the hoist motion to notify the operator that the load is approaching the maximum allowed lifting height. If the hoist continues to travel, the limit switch will cut power to the hoist at the pre-set height limit, preventing the load from being lifted any higher.

The training program applicable to these activities is described in Sections 13.3.1.3 and 13.3.1.4 of the SAR.

Limit switch settings are coordinated with the configuration of rigging and lift beam assembly components to ensure that cask is not lifted above its maximum allowed drop height. Before the start of each shift involving lifting a cask, the limit switch is tested to verify that it is set at the correct height and that it is functioning correctly. The lifting procedure will require that two independent individuals sign-off that the forgoing has been completed prior to any lift of a loaded NUHOMS® cask. In addition to the pre-shift limit switch test and inspection, the overhead cranes and their components will be inspected and maintained as recommended by the crane manufacturer and in accordance with the requirements in ASME B30.2 "Overhead and Gantry Cranes".

SAR Section 4.7.2 has been updated to clearly state that the overhead cranes shall include limit switches as described above.

Any violation of the above will be documented in the ISP Corrective Action Program. In the highly unlikely event a cask is lifted above 80 inches, the cask will be placed in a safe condition and a stop work will be immediately issued in addition to the follow-on corrective action.

Impact:

SAR Section 4.7.2 has been revised as described in the response.

4.7.2 Overhead Bridge Cranes

The CHB houses two 130 ton overhead bridge cranes. These cranes are classified as NITS. The cranes are provided for the purpose of loading and unloading NUHOMS® transportation casks off or on the rail car and to or from the Transfer Trailer. The cranes *shall include limit switches that shall be procedurally verified to be pre-set, limiting the travel (lifting height)* so that they do not lift the NUHOMS® casks above their analyzed drop height. Section 7.5.3.1 provides additional information on the overhead bridge cranes. The NUHOMS® casks will be lifted by the crane utilizing the WCS Lift Beam Assembly, which is referenced in Section 4.10.

4.7.3 NUHOMS® Transfer System

For the NUHOMS® Systems, the transportation cask containing the loaded canister is received in the loading bay. After the cask has been received, including removal of the personnel barrier and impact limiters, the WCS Lift Beam Assembly is used to offload the transportation cask from the railcar to the transfer skid. The WCS Lift Beam Assembly is shown in drawing WCS01-2100 (referenced in Section 4.10). The transfer vehicle then moves the cask and canister out to the storage pad where the canister is transferred to the HSM. Equipment is provided for removing or attaching such items as impact limiters, personnel barriers and cask tie downs from the transportation casks. The NUHOMS® Transfer Equipment is shown in Figure 4-1 through Figure 4-3. Section 5.1.3.1.1 describes the transfer process for the NUHOMS® system.

4.7.4 NAC Cask Transfer System

For the NAC Systems, the transportation cask containing the loaded canister is also received in the loading bay. After the transportation cask has been received, including removal of the impact limiters, the VCT is driven over, essentially straddling the railcar, and is positioned to engage the transportation cask upper trunnions. The VCT then raises and moves towards the rear of the cask to raise and lift the transportation cask from the railcar. The VCT then lowers the transportation cask to 3-6" off the ground. The railcar is removed from the unloading area and the VCT moves the cask to the CTS. The VCT is shown in Figure 4-4.

Transfer preparations follow the placement of the transportation cask and VCCs within the CTS. Unloading operations for the transportation cask follow SAR requirements, which leaves the transportation cask in a state of readiness for content removal. The VCC is prepared for loading in accordance with SAR requirements, leaving it in readiness for the transfer operation. These operations do not require a "system", but will require lifting equipment in the area for handling the equipment indicated.

There is an area inside the CHB for VCC staging for VCCs awaiting loading via the CTS. Additional staging areas are available outside the security boundaries of the WCS CISF.

RAI NP-4-5:

Revise WCS CISF SAR Section 4.4.1, "Equipment Decontamination" to: 1) define the term "weeping," and 2) address decontamination of the interior of transportation packages and transfer casks.

WCS CISF SAR Section 4.4.1 states "the only radioactive wastes are solid wastes generated from residual quantities of radioactive contamination that may be encountered on the surfaces of the transportation casks due to weeping." It is not clear what the applicant means by the term "weeping." Additionally, WCS CISF SAR Section 4.4.1 discusses decontamination of the exterior of incoming transportation packages, but does not discuss decontamination of the interior surfaces of transportation packages or transfer casks after removing spent fuel canisters. These decontamination activities could be a significant contributor to solid decontamination waste, and should be discussed in this section.

This information is needed to determine compliance with 10 CFR 72.126.

Response to RAI NP-4-5:

The following definition of "weeping" is found in NRC Information Notice 85-46, Clarification of Several Aspects of Removable Surface Contamination Limits for Transport Packages.

> [Weeping] is a phenomena whereby certain casks, after their removal from underwater storage basins (pools) and decontamination, subsequently exhibit an increase in the level of removable radioactive surface contamination during and after transport. This increase is believed to be the result of a "weeping" or "sweating" of previously entrapped activity within surface pores, fissures, etc. Its occurrence and magnitude appear to be dependent on such variables as cleanup methods, surface porosity, types of detergents used, surface treatment history, duration of and temperature during transport, and the period of time between completion of transportation and performance of a contamination survey.

Only the transportation casks that have been submerged in contaminated water (fuel pools) are expected to exhibit "weeping." Because the interior of the casks and exterior surfaces of the canisters are protected from coming in contact with contaminated pool water during loading operations, ISP does not anticipate that decontamination of the interior of transportation packages will be performed at the WCS CISF. Transportation packages will be returned as "empty packages" under Department of Transportation (DOT) regulations (49 CFR 173.428 (d)) and are not expected to exceed the contamination limits specified in 49 CFR 173.428 (d).

Finally, the transfer casks used to transfer the canisters included as part of the NAC vertical systems from their transportation casks to the vertical concrete casks (VCCs) are never submerged in contaminated water and the exterior surfaces of the canisters are clean; therefore, the transfer casks are not expected to exhibit this phenomena nor become contaminated.

As requested, Section 4.4.1 (and 4.9 References) of the SAR have been updated to reflect the above information.

Impact:

SAR Sections 4.4.1 and 4.9 have been revised as described in the response.

4.4 Decontamination Systems

4.4.1 Equipment Decontamination

The WCS CISF handles only canisterized SNF and GTCC waste; therefore, the only radioactive wastes are solid wastes generated from residual quantities of radioactive contamination that may be encountered on the surfaces of the transportation casks due to weeping *(See Reference [4-13] for discussion related to weeping)*.

The potential for radionuclide contamination of the outside surface of the canisters *and inner surfaces of the transportation/transfer casks* is minimized by using design concepts for each of the canisters identified in Table 1-1 that preclude intrusion of spent fuel pool water into the annular gap between the transfer cask and the canister while they are submerged in the pool water at the originating nuclear power plants. *Similarly, the transfer casks used to transfer the canisters included as part of the NAC vertical systems from their transportation casks to the VCCs are never submerged in contaminated water and, as the exterior surfaces of the canisters are clean, the transfer cask does not require decontamination.*

The transportation cask externals are also surveyed and decontaminated, as necessary, before the cask leaves the originating site for transport to the WCS CISF. Radioactive wastes generated during the canister and transportation cask loading operations are processed at the originating site.

After a transportation cask arrives at the WCS CISF, if the outer surface of the transportation cask is found to be contaminated, decontamination methods would be conducted using dry decontamination methods only resulting in the generation of Dry Active Wastes (DAW). The DAW that may be generated would consist of anti-contamination garments, rags, and associated health physics material. This solid waste would be packaged and temporarily stored in a designated radiologically controlled area until the waste is characterized and shipped to a licensed disposal facility. Section 6.1 addresses onsite waste sources.

4.4.1.1 Major Components and Operating Characteristics

The WCS CISF is designed as a "start-clean/stay-clean" facility. The spent fuel storage canisters are sealed by welding at the originating nuclear power plants to preclude any leakage of radionuclides. As a result of the "start-clean/stay-clean" operational design, incidental radioactive waste volumes generated by the WCS CISF operations are reduced to the extent practicable, in compliance with 10 CFR 72.24(f) and 10 CFR 72.128(a)(5).

All Indicated Changes are in response to RAI NP-4-5

4.9 References

4-1 NUREG-1567, "Standard Review Plan for Spent Fuel Dry Storage Facilities," Revision 0, U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, March 2000.

4-2 NRC Regulatory Guide 3.48, "Standard Format And Content For The Safety Analysis Report For An Independent Spent Fuel Storage Installation Or Monitored Retrievable Storage Installation (Dry Storage)," Rev 1.

4-3 Proposed SNM-1050, WCS Consolidated Interim Storage Facility Technical Specifications, Amendment 0.

4-4 "TN Americas LLC Quality Assurance Program Description Manual for 10 CFR Part 71, Subpart H and 10 CFR Part 72, Subpart G," current revision.

4-5 Title 10, Code of Federal Regulations, Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste."

4-6 IEEE 692, 2013, Institute of Electrical and Electronics Engineers, "Criteria for Security Systems for Nuclear Power Generating Stations".

4-7 NFPA 70, 2016, National Fire Protection Association, "National Electric Code"

4-8 IBC, 2009, International Building Code.

4-9 NFPA 101, 2015, National Fire Protection Association, "Life Safety Code."

4-10 Not Used.

4-11 Drawing NAC004-C-002, Rev. 0, "ISFSI Pad Licensing Design Structural Concrete Plan, Sections, and Details."

4-12 NFPA 25. 2014, National Fire Protection Association, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems

4-13 *NRC Information Notice No. 85-46, "Clarification of Several Aspects of Removable Surface Contamination Limits for Transport Packages," dated June 10, 1985.*

RAI NP-4-6:

Revise WCS CISF SAR Section 4.5, "Transportation Casks and Associated Components," discussion regarding the transportation casks design for protecting the canisters from the effects of environmental conditions, natural phenomena, and accidents.

The spent fuel transportation casks, which are designed in accordance with the 10 CFR Part 71 requirements, do not specifically address the effects of environmental conditions, natural phenomena, and accidents associated with 10 CFR 72.122(b) provisions. As such, the basis for citing the transportation cask evaluation results to address broadly the canister storage operation at WCS ICSF is unclear.

This information is needed to determine compliance with 10 CFR 72.24(c)(3) and 72.24(d)(1) and (2).

Response to RAI NP-4-6:

WCS CISF SAR Section 4.5, "Transportation Casks and Associated Components," has been revised to delete reference to transportation cask designs providing protection of canisters from the effects of environmental conditions, natural phenomena, and storage accidents. The revised sentence now reads:

> Transportation casks are designed and certified in accordance with 10 CFR 71 to protect the casks and canisters during normal conditions of transport and severe hypothetical transport accidents.

Impact:

SAR Section 4.5 has been revised as described in the response.

4.5 Transportation Casks and Associated Components

Transportation casks are used to transport the canisters from the originating sites to the WCS CISF. The transportation casks are designed in accordance with 10 CFR Part 71 *requirements*.

The transportation casks are shipped by rail to and from the WCS CISF with impact limiters, a shipping cradle, and tie downs. At the WCS CISF, the transportation cask is unloaded from the rail car inside the CHB and, depending on the Cask System, moved to the CTS where the transportation cask is opened and the canister is removed or transferred to the Storage Pad where the canister is removed. After the canister is unloaded, the transportation cask is resealed and shipped off site.

Transportation casks used at the WCS CISF are referenced in Sections 1.6.1.1 and 1.6.2.1. The additional components discussed in this section include:

- Transportation Cask repair and maintenance
- Rail Side Track
- Transportation Cask Queuing Areas
- Receiving Area
- Temporary Isolation Areas

4.5.1 Transportation Cask Repair and Maintenance Activities

If visual inspections reveal the need for repairs or maintenance, these activities will be performed either at the WCS CISF or in another appropriate location, based on the nature of the work to be performed. Radiation protection personnel will provide input and monitor these activities. Work will be performed under the NRC approved WCS CISF Quality Assurance Program Description [4-4] in accordance with written procedures that meet the transportation license requirements under 10 CFR Part 71.

If transportation cask repair or maintenance activities are necessary, the designated location for them to be conducted is in a section of the CHB as shown on Figure 1-7 or at a vendor designated location. Special contamination control measures are not required because the SNF or GTCC waste is contained within a sealed canister.

The following describes the types of repair and maintenance activities that will be performed at the CHB on the transportation casks transporting canisters to the WCS CISF. Maintenance activities are limited primarily to those needed to support routine use of transportation casks. Those maintenance activities are required in the transportation certificates, which reference Chapter 8 of the Transportation Cask SARs. The only expected radiological hazards would be from surface contamination on the outsides of the casks due to weeping from the cask surfaces that were exposed to contaminated SNF pool water. Prior to performing any maintenance activities, health physics personnel will survey the casks as required and incorporate the appropriate restrictions and controls to be observed during the planned maintenance activity.

SAR Chapter 5, "Operational Systems & Procedures"

RAI NP-5-1:

Describe how the air-powered chain hoist used as part of the Canister Transfer System (CTS) satisfies the single-failure-proof criteria of NUREG-0612. The response should specify the degree of conformance with ASME NUM-1, "Rules for Construction of Cranes, Monorails, and Hoists (with Bridge or Trolley or Hoist of the Underhung Type)," criteria for Type IA or IB hoists, and, if compared to the Type IB criteria, justify the lack of redundant torque transfer mechanisms between the braking device and the chain considering the effects of fatigue and wear over the course of the facility's operations.

WCS CISF SAR Section 5.2.1.3.2, Safety Features, states:

> The CTS fully meets the single-failure-proof criteria of NUREG-0612 [5-4], providing a combination of fail-safe features and redundant design factors, as well as structures designed to the criteria of ASME NOG-1 for compliance with NUREG-0554 for single-failure-proof critical load handling. Additionally, failure modes and effect analyses (FMEA) have been performed to further demonstrate the design adequacy.

As described in WCS CISF SAR Section 7.5.1, "Canister Transfer System," the CTS includes an air-powered chain hoist for transfer of NAC fuel canisters from the transportation to the storage casks. The chain hoist is described as having a single disc brake of 200% design capacity and inherent air-motor braking acting through the gear train, but the NUREG-0612 criteria specify redundant holding brakes acting via redundant gear trains. Therefore, the described design does not appear to fully satisfy the single-failure-proof criteria of NUREG-0612.

This information is needed in order to confirm compliance with 10 CFR 72.24(c)(4).

Response to RAI NP-5-1:

The air-powered chain hoist is designed in accordance with ASME B30.16 and implemented with increased safety factors per ASME NUM-1 for a type 1B hoist to provide enhanced safety as required by NUREG-0612, including several safety features not typically found on commercially available hoists. NUM-1 crane standards incorporate design requirements specific to the concerns of "two blocking" or "load hang-up", and ensure that the cranes are designed either to withstand all such incidents without damage or loss of load, or to make the likelihood of their occurrence extremely small.

The system has a design rated load of 110 tons, which is two times larger than the maximum critical load (MCL) of 55 tons. Since the system is designed for a safety factor of 5 times the rated load, the overall factor of safety to the MCL load is 10 to 1.

The chain hoist meets the ASME NUM-1, Type 1B critical load handling hoist standards.

i. Redundant braking comprised of:

- An air actuated disc type brake (primary), and
- Drive train braking (redundant)

ii. Controlled lowering speed of no greater than 9 inches per minute (field test results confirm 6 inches per minute lowering speed)

iii. Redundant two blocking protection via an upper limit switch (primary) and the air stall feature (redundant)

iv. Load test to 300% of the 55 ton MCL, which exceeds the ASME NUM-1 requirements

v. Rigorous testing including:

- Hoist speed and brake holding
- Drive train braking (redundant brake)
- Limit switch operation
- Load hang up and two blocking protection (redundant with the limit switch) via air stall

Annual complete hoist and drive train inspection to preclude any fatigue failure of hoist components, along with pre-use inspections prior to each use:

i. Usage of the chain hoist will be a small fraction of the usage considered "normal service" by ASME B30.16 from both load and frequency perspectives. "Normal Service" is defined as "uniform loads less than 65% of rated load for not more than 25% of the time".

ii. Annual inspections include the manufacturers recommended inspections of all components, including fasteners, gears, shafts, bearings, sheaves, chain guides, springs, covers, load chain sheaves, motor components, brake components, load chain end anchors and the chain.

Impact:

No change as a result of this RAI.

SAR Chapter 7, "Installation Design and Structural Evaluation"

RAI NP-7-2:

Describe the inspection and maintenance programs associated with the Canister Transfer System (CTS), including the air-powered chain hoist and the hydraulic jacking tower components.

WCS CISF SAR Section 7.5.1.13, "Maintenance," addresses maintenance and inspection of CTS components. However, the guidance in NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," specifies inspection, testing, and maintenance to a specific consensus standard for overhead cranes, and the specified actions do not fully correspond with those included in the applicable consensus standards for hydraulic gantries and chain hoists in the ASME B30 series, "Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings."

This information is needed to determine compliance with 10 CFR 72.24(n).

Response to RAI NP-7-2:

To impose the applicable consensus standards related to inspection and maintenance program requirements for the hydraulic gantries and chain hoists in the ASME B30 series for the CTS, SAR Section 7.5.1.13 has been revised to add a reference to ASME B30.1 Chapter1-6 for hydraulic gantries and ASME B30.16-Chapter 16-2 chain hoists.

Impact:

SAR Section 7.5.1.13 has been revised as described in the response.

- Check hose reel hoses for damage.
- Check all hoses that are exposed to sunlight for cracks.
- Check cylinder bolts and lock washers.
- Check wheel box bolts for tightness.
- Check pressure gauges and operating pressure.
- Visually check all boom and base exterior welds for cracks.
- Check the hydraulic oil filter.
- Verify lift and propel handles are shifted to the desired position.
- Thoroughly clean all hydraulic connection points.
- Engage all safety devices.
- Check all system surfaces to be sure they are clean.
- Touch-up any paint damaged areas.
- Check track and top of lift beams for debris.
- Perform a "no-load" test for the full range of motion and speed. Perform a functional test using the transfer cask and empty canister.
- *The hydraulic gantries shall be maintained in accordance with ASME B30.1-Chapter1-6 [7-27].*
- *The chain hoists shall be maintained in accordance with ASME B30.16-Chapter 16-2 [7-13].*

Local firms with hydraulic gantry crane operating and maintenance experience are used to perform specialized periodic inspection and maintenance.

7.5.1.14 Operating Manual

Operating and maintenance manuals for the gantry crane and the canister chain hoist are provided at the conclusion of shop manufacturing and load testing. The manuals incorporate features of the equipment specific to WCS CISF. The manuals provide information and procedures for use in checking, testing and operating the CTS and the canister chain hoist.

7.5.1.15 Quality Assurance

The WCS CISF Quality Assurance Program is implemented to ensure that the requirements of NUREG-0554 with regards to design, fabrication, installation, testing and operation of crane systems for safe handling of critical loads are implemented. The CTS and associated components are procured under the QA program. Detailed quality assurance requirements for suppliers are identified in the supporting QA plan. There are two graded quality categories for the CTS, defined as Quality Categories B and C.

RAI NP-7-13:

Revise WCS CISF SAR Section 7, "Installation Design and Structural Evaluation," to add Concrete Casks (e.g., CC1 through CC4) to the item 2 description for the NAC MAGNASTOR storage cask system on WCS CISF SAR page 7-1. Alternately, provide an appropriate SAR note for generic use of the terminology, "Vertical Concrete Cask (VCC)," to also cover the MAGNASTOR overpacks, CC1 through CC4.

This information is needed to determine compliance with 10 CFR 72.24(c)(3) and 72.24(d)(1) and (2).

Response to RAI NP-7-13:

A note has been added to "VCCs" on WCS SAR Page 7-1 to state that references to "VCC" is generic since there are several different designs for the NAC-MPC, NAC-UMS, and MAGNASTOR storage systems.

Impact:

SAR Section 7.0 has been revised as described in the response.

7. INSTALLATION DESIGN AND STRUCTURAL EVALUATION

This chapter presents the structural description, design, design criteria and design analysis for important-to-safety (ITS) structures to be employed at the Interim Storage Partners' (ISP's) WCS Consolidated Interim Storage Facility (WCS CISF) including:

1. The NUHOMS® system HSMs (Model 80, Model 102 and AHSM), the various models of DSCs, and the use of the MP197HB and MP187 transportation casks for on-site transfer of the DSCs.
2. The NAC system Vertical Concrete Casks (VCCs) and canisters (UMS, MPC and MAGNASTOR), Vertical Cask Transporter (VCT), and the Canister Transfer System (CTS) including transfer casks. *Note: "VCC" is used generically to refer to the different vertical concrete overpack designs for the NAC-MPC, NAC-UMS, and MAGNASTOR storage systems and includes all of the vertical overpacks listed in Table 7-2.*

Structures described in this chapter include the confinement structures, systems and components (SSCs), CTS, VCT, storage pads for the vertical systems and structures classified as ITS.

All Indicated Changes are in response to RAI NP-7-13

RAI NP-7-14:

Revise the WCS CISF SAR page 7-3 statement, "No new analyses are required for the NAC storage system," to recognize that a seismic reconciliation soil- structure interaction analysis is performed in SAR Section 7.6.3, "Soil Structure Interaction of the VCC Storage Pad," to demonstrate seismic stability of the VCCs using the site-specific design basis earthquake motions.

This information is necessary to determine compliance with 10 CFR 72.24(c)(3), 72.24(d)(1) and (2) and 72.122(b).

Response to RAI NP-7-14:

SAR Page 7-3 has been updated as requested to recognize the seismic reconciliation soil-structure interaction analysis documented in SAR Section 7.6.3.

Impact:

SAR Section 7.2 has been revised as described in the response.

7.2 Confinement SSCs

Only NRC-approved storage systems are used at the WCS CISF. The proposed cask systems to be utilized at the WCS CISF are evaluated against site parameters and are generally shown to bound the site parameters. Sections 3.2 and 3.3 address the design criteria for the WCS CISF ITS Structures, Systems and Components. Section 3.3.2 specifically addresses confinement. Section 3.2 addresses the design criteria for the cask systems authorized for storage at the WCS CISF. Table 3-1 cross-references the appendices that discuss those design criteria in more detail. Tables A.3-1, B.3-1, C.3-1, D.3-1, E.3-1, F.3-1, and G.3-1 compare the WCS CISF design criteria with the design criteria for each cask system. Where the actual site parameters exceed the bounds of those assumed in the individual cask certificates of compliance, the difference is addressed for those areas affected by the variations and are documented in the appropriate WCS CISF SAR Chapter, and associated Appendices. No new analyses are required for the NAC storage systems *except those provided in SAR Section 7.6.3, "Soil Structure Interaction of the VCC Storage Pad," to demonstrate seismic stability of the VCCs using the site-specific design basis earthquake motions.* Tables A.3-1, B.3-1, C.3-1, and D.3-1 include cross references where new evaluations are described for the NUHOMS® Systems.

Spent nuclear fuel (SNF) characteristics are addressed in the individual canister/cask system structural evaluations which are provided in Appendices A.7, B.7, C.7, D.7, E.7, F.7 and G.7 and thermal safety evaluations which are provided in Appendices A.8, B.8, C.8, D.8, E.8, F.8 and G.8, for each canister/cask system. It is required that packages received at the WCS CISF are loaded in accordance with SAR and regulatory requirements applicable at the site where the SNF was originally loaded and stored. To provide assurance that the packages received at the WCS CISF are acceptable for storage, prior to receipt of a canister, a records review is performed to verify that the canister being received was fabricated, loaded, stored and maintained in accordance with the Site Specific or General License requirements and will comply with WCS CISF License Conditions and Technical Specifications. In addition, a receipt inspection of the canisters is performed upon arrival at the WCS CISF, which includes a post transport package evaluation in accordance with reference [7-1].

The primary confinement boundary for each of the six storage systems used at the WCS CISF is a metal canister that is welded shut. All components of the canister confinement boundary are classified as important-to-safety. Section 3.4 and Table 3-4 provide references where the classification of the SSCs can be found in the WCS CISF SAR Appendices and in the FSARs for each of the storage systems.

A description of the confinement boundary for each of the six systems used at the WCS CISF is provided in the locations in the Appendices of the WCS CISF SAR identified in Table 7-24.

All Indicated Changes are in response to RAI NP-7-14

SAR Chapter 8, "Thermal Evaluation"

RAI NP-8-1:

Provide bounding site specific ambient temperatures which account for seasonal variations.

Seasonal variations must be accounted for as ambient temperatures may persist for periods of time sufficient for the cask systems to reach steady state conditions, which may differ from the use of an annual average, as analyzed in the respective FSARs.

The applicant has not clearly defined an ambient temperature which considers seasonal variations. According to the monthly averaged values provided, Table 1-2 of the license application seems to provide a value that bounds seasonal variations. The applicant needs to clearly state how a bounding site-specific ambient temperature which considers seasonal variations is obtained.

This information is needed to determine compliance with 10 CFR 72.122 and 72.128.

Response to RAI NP-8-1:

The site-specific ambient temperatures are derived from meteorological data presented in SAR Table 2-2, Summary of Maximum and Minimum Temperatures for Andrews, TX (Period of Record: 1962 to 2010). The table includes the seasonal variation in ambient temperatures.

The ambient temperatures for the NUHOMS® Systems in Table 1-2 ranges from 44.1 to 81.5 °F. These values represent the lowest mean monthly temperature at Andrews (from Table 2-2) which occurs in January (44.1 °F) and the highest mean monthly temperature (81.5 °F) which occurs in July.

NAC's storage casks have all been licensed to slightly different criteria and methodologies when it comes to the site ambient environmental conditions. Each NAC system is evaluated to their own unique licensing requirements and verified to meet the WCS CISF site parameters. In Table 1-2, the ambient temperature for the NAC systems (67.1 °F) is presented as a yearly average. The annual mean monthly temperature for Andrews from Table 2-2 is 63.5 °F. To bound the effects of seasonal variation in the ambient temperature at the WCS site (which ranges from 44.1 to 81.5 °F), NAC Storage systems rely on the analyses done for off-normal conditions using a minimum three-day average temperature of 27.9 °F and a maximum three-day average temperature of 89.4°F.). These analyses are described in the WCS SAR appendices for each NAC system.

SAR Sections E.3.1.1.6, E.3.2.1.6, F.3.1.1.6 and G.3.1.1.6 have been revised to more clearly demonstrate how the design basis thermal analysis incorporated by reference from each of the NAC General Licenses remain bounding for the site specific temperature data included Chapter 2 of the SAR.

Impact:

SAR Sections E.3.1.1.6, E.3.2.1.6, F.3.1.1.6, and G.3.1.1.6 have been revised as described in the response.

E.3.1.1.6 Environmental Temperatures

A temperature of 75°F was selected to bound all annual average temperatures in the United States, except the Florida Keys and Hawaii. The 75°F normal temperature was used as the base for thermal evaluations. The evaluation of this environmental condition is discussed along with the thermal analysis models in Chapter 4.0 of Reference E.3-1. The thermal stress evaluation for the normal operating conditions is provided in Section 3.4.4 of Reference E.3-1. Normal temperature fluctuations are bounded by the severe ambient temperature cases that are evaluated as off-normal and accident conditions.

Off-normal, severe environmental conditions were defined as -40°F with no solar loads and 100°F with solar loads. An extreme environmental condition of 125°F with maximum solar loads is evaluated as an accident case to show compliance with the maximum heat load case required by ANSI-57.9 (Section 11.2.10). Thermal performance was also evaluated for the cases of: (1) half the air inlets blocked; and (2) all air inlets and outlets blocked. Thermal analyses for these cases are presented in Sections 11.1.1 and 11.2.8 of Reference E.3-1. The evaluation based on ambient temperature conditions is presented in Section 4.4 of Reference E.3-1. Solar insolance is as specified in 10 CFR 71.71 and Regulatory Guide 7.8.

Per the NAC-MPC Certificate of Compliance (CoC), the environmental conditions that are required to be met are the following:

- *the maximum average yearly temperature allowed is 75°F*
- *the maximum 3-day average temperature extremes shall be greater than -40°F and less than 125°F*
- *the maximum 3-day average ambient temperature allowed is 100°F*

All of these conditions are met at the WCS site and are addressed in WCS SAR Section 2.3.3.1 and WCS SAR Tables 2-2 and 2-13. Specifically, SAR Table 2-2 gives a maximum yearly average temperature for the site of 63.5°F, which is less than the 75°F limit. This table also gives the maximum temperature extremes for the site of -1.0°F and 113°F, which is within the 3-day average temperature extreme limits of -40°F and 125°F. WCS SAR Table 2-13 gives a maximum 3-day average temperature of 93.5°F, which is less than the 100°F limit. Therefore, all environmental temperature limits for the NAC-MPC system at the WCS facility are met.

All Indicated Changes are in response to RAI NP-8-1

E.3.2.1.4 Snow and Ice Loadings

The snow and ice loadings design criteria that are defined in Section 2.2 of Reference E.3-1 for the NAC-MPC apply to the MPC-LACBWR system in their entirety. These design criteria are described in WCS CISF SAR Appendix E, Section E.3.1.1.4. Therefore, no further site-specific evaluations are required.

E.3.2.1.5 Combined Load Criteria

The combined load design criteria that are defined in Section 2.2 of Reference E.3-1 for the NAC-MPC apply to the MPC-LACBWR system in their entirety. These design criteria are described in WCS CISF SAR Appendix E, Section E.3.1.1.5. Therefore, no further site-specific evaluations are required.

E.3.2.1.6 Environmental Temperatures

The environmental temperatures design criteria that are defined in Section 2.2 of Reference E.3-1 for the NAC-MPC apply to the MPC-LACBWR system in their entirety with exception to the maximum extreme heat limit, which is 105°F. The applicable design criteria are described in WCS CISF SAR Appendix E, Section E.3.1.1.6.

Per the NAC-MPC Certificate of Compliance (CoC), the environmental conditions that are required to be met are the following:

- *the maximum average yearly temperature allowed is 75°F*
- *the maximum 3-day average temperature extremes shall be greater than -40°F and less than 125°F*
- *the maximum 3-day average ambient temperature allowed is 100°F*

All of these conditions are met at the WCS CISF and are addressed in SAR Section 2.3.3.1 and SAR Tables 2-2 and 2-13. Specifically, SAR Table 2-2 gives a maximum yearly average temperature for the site of 63.5°F, which is less than the 75°F limit. This table also gives the maximum temperature extremes for the site of -1.0°F and 113°F, which is within the 3-day average temperature extreme limits of -40°F and 125°F. SAR Table 2-13 gives a maximum 3-day average temperature of 93.5°F, which is less than the 100°F limit. Therefore, all environmental temperature limits for the NAC-MPC system at the WCS CISF are met.

All Indicated Changes are in response to RAI NP-8-1

The transfer cask is a special lifting device. The lifting trunnions and supports are designed and fabricated to the requirements of ANSI N14.6 and NUREG-0612. The remainder of the structure is designed and fabricated to ANSI/ANS-57.9. The combined shear stress or maximum tensile stress during the lift (with 10 percent load factor) shall be $\leq S_y/6$ and $S_u/10$ for a nonredundant load path, or shall be $\leq S_y/3$ and $S_u/5$ for redundant load paths. The ferritic steel material used for the load bearing members of the transfer cask shall satisfy the material toughness requirements of ANSI N14.6, paragraph 4.2.6. The structural evaluations presented in Reference F.3-1 demonstrate that the transfer cask meets all of the design criteria. Therefore, no further site-specific evaluations are required.

F.3.1.1.6 Environmental Temperatures

A temperature of 76°F was selected to bound all annual average temperatures in the United States, except the Florida Keys and Hawaii. The 76°F normal temperature was used as the basis for thermal evaluations. The evaluation of this environmental condition is discussed along with the thermal analysis models in Chapter 4.0 of Reference F.3-1. The thermal stress evaluation for the normal operating conditions is presented in Section 3.4.4 of Reference F.3-1. Normal temperature fluctuations are bounded by the severe ambient temperature cases that are evaluated as off-normal and accident conditions.

Off-normal, severe environmental conditions are defined as -40°F with no solar loads and 106°F with solar loads. An extreme environmental condition of 133°F with maximum solar loads is evaluated as an accident case (Section 11.2.7 of Reference F.3-1) to show compliance with the maximum heat load case required by ANSI-57.9. Thermal performance is also evaluated for the cases of: (1) half the air inlets blocked; and (2) all air inlets and outlets blocked. Thermal analyses for these cases are presented in Sections 11.1.2 and 11.2.13 of Reference F.3-1. The evaluation based on ambient temperature conditions is presented in Section 4.4 of Reference F.3-1. Solar insolance is as specified in 10 CFR 71.71 and Regulatory Guide 7.8.

Per the NAC-UMS Certificate of Compliance (CoC), the environmental conditions that are required to be met are the following:

- *the maximum average yearly temperature allowed is 76°F*
- *the maximum 3-day average temperature extremes shall be greater than -40°F and less than 133°F*
- *the maximum 3-day average ambient temperature allowed is 106°F*

All Indicated Changes are in response to RAI NP-8-1

All of these conditions are met at the WCS CISF and are addressed in SAR Section 2.3.3.1 and SAR Tables 2-2 and 2-13. Specifically, SAR Table 2-2 gives a maximum yearly average temperature for the site of 63.5°F, which is less than the 76°F limit. This table also gives the maximum temperature extremes for the site of -1.0°F and 113°F, which is within the 3-day average temperature extreme limits of -40°F and 133°F. SAR Table 2-13 gives a maximum 3-day average temperature of 93.5°F, which is less than the 106°F limit. Therefore, all environmental temperature limits for the NAC-UMS system at the WCS CISF are met.

F.3.1.2 Safety Protection Systems

The NAC-UMS relies upon passive systems to ensure the protection of public health and safety, except in the case of fire or explosion. As discussed in Section 2.3.6 of Reference F.3-1, fire and explosion events are effectively precluded by site administrative controls that prevent the introduction of flammable and explosive materials into areas where an explosion or fire could damage installed NAC-UMS systems. The use of passive systems provides protection from mechanical or equipment failure.

F.3.1.2.1 General

The NAC-UMS is designed for safe, long-term storage of spent nuclear fuel. The NAC-UMS will survive all of the evaluated normal, off-normal, and postulated accident conditions without release of radioactive material or excessive radiation exposure to workers or the general public. The major design considerations that are incorporated in the NAC-UMS to assure safe long-term fuel storage are:

1. Continued confinement in postulated accidents.
2. Thick concrete and steel biological shield.
3. Passive systems that ensure reliability.
4. Inert atmosphere to provide corrosion protection for stored fuel cladding and enhanced heat transfer for the stored fuel.

All Indicated Changes are in response to RAI NP-8-1

G.3.1.1.6 Environmental Temperatures

A temperature of 76°F is defined as the design base normal operations temperature for MAGNASTOR in storage. This temperature conservatively bounds the maximum average annual temperature in the 48 contiguous United States, specifically, Miami, FL, at 75.6°F and meets the normal condition thermal boundary defined in NUREG-1536. Use of this design base establishes a bounding condition for existing and potential ISFSI sites in the United States. The evaluation of this environmental condition along with the thermal analysis models are presented in Chapter 4 of Reference G.3-1. The thermal stress evaluation for the normal operating conditions is included in Chapter 3 of Reference G.3-1. Normal temperature fluctuations are bounded by the severe ambient temperature cases that are evaluated as off-normal and accident events.

Off-normal, severe environmental events are defined as -40°F with no solar loads and 106°F with solar loads. An extreme environmental condition of 133°F with maximum solar loads is evaluated as an accident case to show compliance with the maximum heat load case required by ANSI/ANS-57.9. Thermal performance is also evaluated assuming both the half blockage of the concrete cask air inlets and the complete blockage of the air inlets. Solar insolation is as specified in 10 CFR 71.71 and Regulatory Guide 7.8.

Per the MAGNASTOR Certificate of Compliance (CoC), the environmental conditions that are required to be met are the following:

- *the maximum average yearly temperature allowed is 76°F*
- *the maximum 3-day average temperature extremes shall be greater than -40°F and less than 133°F*
- *the maximum 3-day average ambient temperature allowed is 106°F*

All of these conditions are met at the WCS CISF and are addressed in SAR Section 2.3.3.1 and SAR Tables 2-2 and 2-13. Specifically, SAR Table 2-2 gives a maximum yearly average temperature for the site of 63.5°F, which is less than the 76°F limit. This table also gives the maximum temperature extremes for the site of -1.0°F and 113°F, which is within the 3-day average temperature extreme limits of -40°F and 133°F. SAR Table 2-13 gives a maximum 3-day average temperature of 93.5°F, which is less than the 106°F limit. Therefore, all environmental temperature limits for the MAGNASTOR system at the WCS CSIF are met.

All Indicated Changes are in response to RAI NP-8-1

RAI NP-8-2:

Provide thermal evaluation, analysis, and results to demonstrate that all cask systems meet the WCS CISF site specific environmental conditions.

WCS CISF SAR Appendices A.8, B.8, C.8, and D.8 of the application provide a normal ambient temperature design criteria for the NUHOMS®-MP187, Standardized Advanced NUHOMS®, Standardized NUHOMS®-61BT, and Standardized NUHOMS®-61BTH Type 1 cask systems, respectively. Appendices E.8, F.8, and G.8 of the application state that for the NAC-MPC, NAC-UMS, and MAGNASTOR, the maximum average yearly temperatures allowed are 75°F, 76°F, and 76°F, respectively. A definition of normal ambient temperature for the site is not clear in the application but according to the monthly averaged values provided (mean monthly temperature of 81.5°F [considering seasonal variations] on SAR Table 2-2, "Summary of Maximum and Minimum Temperatures for Andrews, TX, Period of Record: 1962 to 2010"), SAR Table 1-2 would provide a value that seems to bound seasonal variations and the value seems to bound storage systems described in Appendices A-D of the application; however, Table 1-2 is not bounded by the systems described in Appendices E.8, F.8, and G.8. Therefore, a thermal evaluation is needed for these systems based on the normal ambient temperature presented in Table 1-2.

The NRC staff needs this information to verify that no thermal limits are exceeded for any of the cask systems stored at WCS CISF.

This information is needed to determine compliance with 10 CFR 72.122 and 72.128.

Response to RAI NP-8-2:

As described in the response to RAI NP-8-1, SAR Sections E.3.1.1.6, E.3.2.1.6, F.3.1.1.6, and G.3.1.1.6 have been revised to more clearly demonstrate how the design basis thermal analysis incorporated by reference from each of the NAC general licenses remain bounding for the site specific temperature data included Chapter 2 of the SAR. SAR Table 1-2 has been clarified to include all of the applicable temperatures used demonstrate how the design basis thermal analysis incorporated by reference for each NAC systems that are derived from Chapter 2 of the SAR. The maximum three-day average temperature cited in SAR Section 2.3.3.1 has also been corrected to be consistent with the value reported in SAR Table 2-13.

Impact:

SAR Section 2.3.3.1 and Table 1-2 have been revised as described in the response.

Table 1-2
Summary of WCS CISF Principal Design Criteria
(3 pages)

Design Parameter	Design Criteria	Condition	Applicable Codes, Standards and Basis
Cask Drop	For NUHOMS® Systems: Transfer Cask Horizontal side drop or slap down 80 inches VCCs for MPC Systems: Drop height 6 inches VCCs for UMS and MAGNASTOR Systems: Drop height 24 inches	Accident	N/A
Transfer Load	For NUHOMS® Systems only: Normal insertion load 60 kips Normal extraction load 60 kips	Normal	NA
Transfer Load	For NUHOMS® Systems only: Maximum insertion load 80 kips Maximum extraction load 80 kips	Off-Normal/ Accident	N/A
Ambient Temperatures (NUHOMS® Systems)	Normal temperature 44.1 – 81.5°F	Normal	Section 2.3.3.1
Off-Normal Temperature (NUHOMS® Systems)	Maximum temperature 113°F	Off-Normal	Section 2.3.3.1
Extreme Temperature (NUHOMS® Systems)	Maximum temperature 113°F	Accident	Section 2.3.3.1
Solar Load (Insolation)	Horizontal flat surface insolation 2949.4 BTU/day-ft^2 Curved surface solar insolation 1474.7 BTU/day-ft^2	Normal	10 CFR Part 71
Ambient Temperatures (NAC Systems)	*Maximum* Yearly Average Temperature 67.1°F	Normal	Section 2.3.3.1
Off-Normal Temperature (NAC Systems)	Minimum 3 Day Average temperature 27.9°F Maximum 3 Day Average temperature *93.5*°F	Off-Normal	Section 2.3.3.1

All Indicated Changes are in response to RAI NP-8-2

Measurements for all parameters, listed in Table 2-11, are taken at 10-minute, 60-minute and 24-hour averages and recorded/stored on a dedicated Campbell Scientific data logger at each station. Routinely the data loggers automatically download their content to a server in Dallas, TX for long-term storage. Data loggers can be remotely accessed via password protected radio telemetry; and the server can be securely accessed via a password protected Internet connection. Table 2-11 lists the meteorological parameters measured and at what heights. Information for the Met One Towers and the WeatherHawk Series regarding range, accuracy, and resolution is listed in Table 2-12.

2.3.3.1 Maximum and Minimum Temperatures

The Western Regional Climate Center (www.wrcc.dri.edu) has historic temperature data for Andrews, TX. The temperature data currently available spans from 1962 until 2010. The average maximum and minimum temperatures, the record high temperature and low temperature for each month, and the annual high and low temperature for these years is shown on Table 2-2. Table 2-2 was used to provide normal, off-normal, and extreme temperature information for the WCS CISF site.

Normal Temperature (NUHOMS® System): The normal temperature range is taken as the low and high mean monthly temperature (44.1°F to 81.5°F).

Normal Temperature (NAC System): The normal ambient temperature is taken as the maximum yearly average temperature. In addition to the temperature information provided in Table 2-2, temperature data from the Midland-Odessa monitoring station between 2000 and 2015 was used to provide yearly average temperatures (Table 2-13). The maximum yearly average temperature is 67.1°F.

Off-Normal Temperature (NUHOMS® System): The NUHOMS® System uses the extreme high temperature to evaluate that system for off-normal temperature conditions. That value is taken as the highest temperature recorded over the time period (113°F) in the data set represented in Table 2-2. The off-normal minimum temperature is 30.1°F, which is the minimum mean daily temperature shown in Table 2-2.

Off-Normal Temperature (NAC System): The NAC System uses a rolling average temperature to evaluate that system for the off-normal temperature condition. In addition to the temperature information provided in Table 2-2, temperature data from the Midland-Odessa monitoring station between 2000 and 2015 was used to provide 3-day average ambient temperatures. These temperatures are determined by taking the daily average temperature averaged over three consecutive days for each day of the year. The lowest average 3-day temperature and the highest average 3-day temperature is shown in Table 2-13. The minimum average and maximum average values averaged over the data set represented in Table 2-13 are 27.9°F and 93.5°F.

All Indicated Changes are in response to RAI NP-8-2

SAR Chapter 9, "Radiation Protection"

RAI NP-9-1:

Ensure that the shielding analysis in the WCS CISF SAR Section 9.4, "Estimated On-Site Collective Dose Assessment," includes the appropriate information specifying the neutron and gamma cross section libraries used to determine off site dose rates.

Both NAC Analysis 30039-5001, Rev. 0, and Areva Calculation WCS01-0503, Rev. 0, specify which version of MCNP is used for each part of the dose rate analysis, but do not specify which neutron and gamma cross section libraries are used. The WCS CISF SAR should include this information.

This information is needed to determine compliance with 10 CFR 72.104 and 72.106, and 10 CFR 20.1201 and 20.1301.

Response to RAI NP-9-1:

The gamma and neutron cross-section libraries used to determine off-site dose rates have been added to SAR Section 9.4.1, including additional Table 9-8.

Impact:

SAR Section 9.4.1 been revised and SAR Table 9-8 has been added described in the response.

No credit is taken for the presence of any landscape features or site buildings, which would provide additional shielding. In addition to the HSMs, a number of vertical casks are adjacent to the HSM, as indicated in Figure 9-2. No credit is taken for any blocking provided by the vertical casks.

MCNP5 v1.40 is used in the analysis and all cross-sections utilized are provided with the computer program. All gamma cross-sections are from the ENDF/B-VI data set. The neutron cross sections are also from the ENDF/B-VI data set with the exception of iron (in the concrete) and gadolinium. Neutron cross-sections utilized are provided in Table 9-8.

NAC Systems

The WCS CISF is modeled explicitly. Shielding by NAC systems and NUHOMS® HSMs is included in the model. Dose rates are calculated using point detectors and superimposed mesh tallies. For the location specific dose rates, point detectors were used. Neutron, gamma, and neutron-induced gammas (N-Gamma) are accounted for in the shielding evaluation. Neutron induced gammas generated within the cask shielding are included in the imported gamma surface currents. N-Gamma cases and results for the VCCs only include gammas induced from neutron interactions in air surrounding the cask systems.

9.4.1.1 Dose Rate Results

Dose rates are computed at various locations around the WCS CISF using point detectors, as indicated on Figure 9-1 and Figure 9-2. Dose rates are computed for gamma radiation, neutron radiation and secondary gamma radiation created when neutrons are absorbed in air, soil or concrete. Fluxes are converted to dose rates using ANSI/ANS-6.1.1-1977 flux to dose rate conversion factors.

The total dose rate is computed as the sum of the gamma, neutron, and secondary gamma components. The gamma and neutron dose rate is approximately 90% and 10% of the total dose rate, respectively. The 1-sigma MCNP statistical uncertainty is also provided for the total dose rate. All reported dose rate results are well-converged. Coordinates of the detectors are given in the State Plane Coordinate System (SPCS).

Dose rate results for the general area around the WCS CISF are summarized in Table 9-5. Dose rate results for the locations around the facility and PA of the WCS CISF are summarized in Table 9-6. Coordinates of the detectors are given in the SPCS.

9.4.1.2 Direct Dose Rate

The point detector output provides both the total and uncollided dose rate. The uncollided dose rate is representative of the "direct" component of the dose rate. The direct dose rate is provided in Table 9-5 and Table 9-6 in the "Direct" column.

Table 9-8
MCNP Neutron Cross-Sections, NUHOMS® Systems

Isotope	*Cross-Section Library Source*
1001.62c	*ENDF/B-VI*
5010.66c	*ENDF/B-VI*
5011.66c	*ENDF/B-VI*
7014.62c	*ENDF/B-VI*
8016.62c	*ENDF/B-VI*
11023.62c	*ENDF/B-VI*
13027.62c	*ENDF/B-VI*
14000.60c	*ENDF/B-VI*
19000.62c	*ENDF/B-VI*
20000.62c	*ENDF/B-VI*
22000.62c	*ENDF/B-VI*
26056.62c (soil)	*ENDF/B-VI*
26000.55c (concrete)	*LANL/T*
64000.35c	*LLNL*

RAI NP-9-2:

Ensure that the WCS CISF SAR includes the appropriate written policy that states management's commitment to maintain exposures to workers and the public As Low As Is Reasonably Achievable (ALARA) levels and addresses both facility design and operations. Consistent with 10 CFR 20.1101, the policy should include the following provisions as set forth in NUREG-1567, section 11.4.1.1.:

- No practice involving radiation exposure will be undertaken unless evaluation of the practice demonstrates that its use will produce a net benefit to society.
- All exposures will be kept ALARA, with technological, economic, and social factors considered.
- Individual dose limits will be established that are appropriate for practices involving radiation exposure, and exposures to individuals will not exceed these limits.
- Supervisors will integrate appropriate radiation protection controls into all work activities.
- Workers will be appropriately instructed in the objectives and implementation of the ALARA program, with this information included in training modules.
- There will be strict compliance with all regulatory requirements and license conditions regarding procedures, radiation exposures, and releases of radioactive materials.
- A comprehensive program will be maintained, and periodically evaluated, to ensure that both individual and collective doses meet ALARA objectives and do not exceed acceptable levels.

This information is needed to determine compliance with 10 CFR 20.1101.

Response to RAI NP-9-2:

ISP had added SAR Section 9.1.4, "ISP ALARA Policy," which is the policy written by ISP maintaining the commitment of their management to maintain exposure levels to workers and the public As Low As Reasonably Achievable (ALARA).

Impact:

SAR Section 9.1.4 has been added as described in the response.

Cask System	Canister	Overpack	Operational Considerations
NUHOMS®-MP187 Cask System	FO-DSC	HSM (Model 80)	Section 7.1.3 of [9-3]
	FC-DSC		
	FF-DSC		
	GTCC Canister		
Standardized Advanced NUHOMS® System	NUHOMS® 24PT1	AHSM	Section 10.1.3 of [9-5]
Standardized NUHOMS® System	NUHOMS® 61BT	HSM Model 102	Section 7.1.3 of [9-4]
	NUHOMS® 61BTH Type 1		
NAC-MPC	Yankee Class	VCC	Appendix E.9
	Connecticut Yankee		
	LACBWR		
	GTCC-Canister-CY		
	GTCC-Canister-YR		
NAC-UMS	Classes 1 through 5	VCC	Appendix F.9
	GTCC-Canister-MY		
MAGNASTOR	TSC1 through TSC4	CC1 through CC4	Appendix G.9
	GTCC-Canister-ZN		

9.1.4 ISP ALARA Policy

The following sets forth ISP's policy on radiation protection principles and practices for maintaining occupational and public doses that are as low as reasonably achievable (ALARA) in the operation of its WCS Consolidated Interim Storage Facility (WCS CISF). This policy is based on three fundamental principles as described in International Commission on Radiological Protection (ICRP) Publication 103, "The 2007 Recommendations of the International Commission on Radiological Protection." Those principles are: (1) justification of exposure; (2) optimization of protection; and (3) limitation of individual dose. The policy also describes management's commitment to implement those principles.

Fundamental Principles of Radiation Protection and ALARA

The first principle, justification, states that "any decision that alters the radiation exposure situation should do more good than harm" (ICRP Publication 103). Decisions associated with justification do not simply take radiation doses into account, but should also encompass all of the possible benefits and detriments of the actions proposed. Thus, a decision may be justified by conclusions that the benefits of improved safety outweigh the detriment of occupational exposure and other detriments associated with taking the action.

All Indicated Changes are in response to RAI NP-9-2

The second principle, optimization, states that "the likelihood of incurring exposure, the number of people exposed, and the magnitude of their individual doses should be kept as low as reasonably achievable, taking into account economic and societal factors" (ICRP Publication 103). All exposures shall be kept ALARA, with technological, economic, and social factors considered. Once a particular exposure has been justified, it is necessary to take actions to reduce exposures to ALARA.

The third principle, limitation, states that "the total dose to any individual from regulated sources in planned exposure situations other than medical exposure of patients should not exceed the appropriate limits" (ICRP Publication 103). Individual dose limits shall be established that are appropriate for practices involving radiation exposure, and exposures to individuals shall not exceed these limits. Limits for occupational exposure are contained in 10 CFR 20.1201, "Occupational Dose Limits for Adults;" 10 CFR 20.1206, "Planned Special Exposures;" 10 CFR 20.1207, "Occupational Dose Limits for Minors;" and 10 CFR 20.1208, "Dose Equivalent to an Embryo/Fetus." Exceeding an occupational exposure limit is a significant violation and subject to enforcement.

Management Commitment

It will be a management priority that all personnel working with radioactive material be made aware of our commitment to the ALARA philosophy and that they be instructed in the procedures to be used to keep their exposures as low as possible. Supervisors and workers shall be appropriately instructed in the objectives and implementation of the ALARA program, with this information included in training modules.

It is management's direction that supervisors integrate appropriate radiation protection controls into all work activities. Management will make all reasonable modifications to procedures, equipment, and facilities to reduce exposures to ALARA.

Management has delegated authority to our RSO to ensure adherence to ALARA principles. The RSO shall emphasize the ALARA philosophy to all personnel working with radioactive material, and shall instruct workers to review current procedures and propose changes to reduce exposure levels. Management shall support the RSO in instances where this authority must be asserted. Strict compliance with all regulatory requirements and license conditions regarding procedures, radiation exposures, and releases of radioactive materials shall be met.

A comprehensive program shall be maintained, and periodically evaluated, to ensure that both individual and collective doses meet ALARA objectives and do not exceed acceptable levels.

All Indicated Changes are in response to RAI NP-9-2

RAI NP-9-3:

Ensure that WCS CISF SAR Section 9.6.2.4, "Environmental Monitoring," includes appropriate details on the facility Radiological Environmental Monitoring Program (REMP).

WCS CISF SAR Section 9.6.2.4 provides minimal details about the REMP for the WCS facility. The NRC staff needs to evaluate details, including: 1) number of samples; 2) sample locations; 3) collection frequency; 4) sample analysis to be performed; and 5) sample analysis frequency. The SAR should also include a map of suitable scale that identifies the sampling locations to show distance and direction of monitoring stations, with release points and relevant boundaries (e.g., controlled area boundary, site boundary) also indicated on the map. Additionally, the WCS CISF SAR description of the REMP should include the approach for determining background levels and the contribution of the facility's incremental releases to background levels. The WCS CISF SAR should include the results of the background level determination.

This information is needed to determine compliance with 10 CFR 72.104.

Response to RAI NP-9-3:

ISP has revised SAR Section 9.6.2.4 to include 1) number of samples; 2) sample locations; 3) collection frequency; 4) sample analysis to be performed; and 5) sample analysis frequency. References to figures in Chapter 4 and Chapter 6 of the WCS CISF Environmental Report (ER) have also been included for the current monitoring locations and proposed owner controlled area (OCA) dosimeter monitoring locations.

Additionally, the information is included within the WCS CISF ER, Chapter 4 Section 4.12.2.3 Summary of Environmental Monitoring Program. ISP joint venture member Waste Control Specialists conducts a comprehensive environmental sampling and analysis program, commonly referred to as the consolidated REMP. As part of the REMP, samples of media and effluents, including gases and vapor, air particulates, soil, sediment, fauna, vegetation, surface water, waste waters, and groundwater, are collected and analyzed. A monitoring network of optically stimulated luminescence (OSL) is also used to measure ambient gamma radiation. The sampling media and sampling locations included in the REMP provide a measure of the routine operations within and around the facility and monitor the potential impact of the facility operations on the off-site environment, including the general public. ER Figures 4.12-7 through 4.12-12 show the locations of the various types of environmental samples that are collected at Waste Control Specialists. One of the background locations (Station 9) is located in the bottom right corner of ER Figures 4.12-7, 4.12-9, 4.12-10 and 4.12-12.

References:

1. WCS CISF Environmental Report, Chapter 4 and Chapter 6.

Impact:

SAR Section 9.6.2.4 has been revised as described in the response.

9.6.2.4 Environmental Monitoring

NP-9-3

ISP will establish a Radiological Environmental Monitoring Program (REMP) that will demonstrate compliance with 10 CFR 72.104. Details of this program are described in *Chapter 4 of the ISP Environmental Report and Figure 4.12-7 through Figure 4.12-12 show the locations being monitored under the current REMP program.*

In establishing the environmental monitoring program for SNF storage, ISP will build upon ISP joint venture member, Waste Control Specialists current monitoring program for ISP joint venture member, Waste Control Specialists *SP&D Facilities*. This program will include the following monitoring parameters: perimeter dosimetry (Landauer Inlight® Environmental X9 (beta/X/gamma) or equivalent), soil, and air locations. This program will be implemented by the radiation safety department in accordance with written procedures.

NP-9-4

Waste Control Specialists uses the Luxel+ Ta (beta/photon/neutron) dosimeter for area monitoring under the radiation safety area monitoring program *(minimum of eight locations on the inner fence of the PA)* and the Landauer Inlight® Environmental X9 (beta/photon) dosimeter for perimeter environmental monitoring program *at the OCA boundary (for reference, see Figure 6-1-1 in Chapter 6 of the ISP Environmental Report). All dosimeters will be analyzed on a quarterly basis.* Environmental boundary air *and soil* monitoring (i.e., Low Volume air sampling and High Volume air sampling) will be performed at a minimum of two locations *on the north OCA boundary (for reference, see Figure 4.12-7 and Figure 4.12-9 in Chapter 4 of the ISP Environmental Report),* in addition to the locations currently performed under the REMP. Analyses will be for gross alpha/beta and gamma spectrometry and performed by a certified offsite laboratory *on a quarterly basis. Air samples will be collected monthly for each location and composited for a quarterly analysis. Soil samples will be collected and analyzed annually unless air samples indicate the need to take additional samples.*

NP-9-3

NP-9-4

NP-9-3

9.6.3 Maximum Off-Site Annual Dose

The nearest residence in Lea County, New Mexico is approximately 4 miles from the WCS CISF at SPCS coordinate (541732.42, 6873002.59). At this distance, the computed total dose rate is 4.83E-14 mrem/hr. With continuous occupancy of 8,760 hours per year, the total dose is 4.23E-10 mrem, which is essentially zero and less than the dose from natural background radiation.

9.6.4 Liquid Releases

As described in Section 6.1.2.1, there are no radioactive liquid radioactive wastes to monitor for the WCS CISF.

RAI NP-9-4:

Ensure the WCS CISF SAR Section 9.6.2.4 includes information clearly stating how neutron doses will be determined at the Owner Controlled Area (OCA) boundary dosimeter locations.

WCS CISF SAR Section 9.6.2.4 states that the Landauer Inlight® Environmental X9 (beta/photon) dosimeter will be used for the perimeter environmental monitoring program. As neutrons will represent some fraction of OCA boundary dose, and the referenced dosimeter does not detect neutrons, it is not clear how the neutron component of the dose will be determined.

This information is needed to determine compliance with 10 CFR 72.104.

Response to RAI NP-9-4:

As stated in SAR Table 9-6 , based on the amount of material and the storage system(s), the average neutron dose rate inside the protected area will be 7.174E-2 mrem/hr (average of locations DSB-01 through DSB-10 from Table 9-6). Based on this information, the OCA boundary will be monitored using the Landauer Inlight® Environmental X9 (beta/photon) dosimeter. Additionally, as stated in SAR Section 9.6.2.4, the Landauer Luxel+ Ta (beta/photon/neutron) dosimeter will be used for the radiation safety area monitoring program on the inner fence of the protected area at a minimum of eight locations and more locations can be added if routine monitoring with the Ludlum 12-4 neutron monitoring instrument indicates the need for additional locations. This is to ensure that the dose estimates stated in Table 9-6 will be monitored on a quarterly basis. This data will be used to assess the dose, if any, at the OCA boundary.

Impact:

SAR Section 9.6.2.4 has been revised as described in the response.

9.6.2.4 Environmental Monitoring

NP-9-3

ISP will establish a Radiological Environmental Monitoring Program (REMP) that will demonstrate compliance with 10 CFR 72.104. Details of this program are described in *Chapter 4 of the ISP Environmental Report and Figure 4.12-7 through Figure 4.12-12 show the locations being monitored under the current REMP program.*

In establishing the environmental monitoring program for SNF storage, ISP will build upon ISP joint venture member, Waste Control Specialists current monitoring program for ISP joint venture member, Waste Control Specialists *SP&D Facilities*. This program will include the following monitoring parameters: perimeter dosimetry (Landauer Inlight® Environmental X9 (beta/X/gamma) or equivalent), soil, and air locations. This program will be implemented by the radiation safety department in accordance with written procedures.

NP-9-4

NP-9-3

NP-9-4

NP-9-3

Waste Control Specialists uses the Luxel+ Ta (beta/photon/neutron) dosimeter for area monitoring under the radiation safety area monitoring program *(minimum of eight locations on the inner fence of the PA)* and the Landauer Inlight® Environmental X9 (beta/photon) dosimeter for perimeter environmental monitoring program *at the OCA boundary (for reference, see Figure 6.1-1 in Chapter 6 of the ISP Environmental Report). All dosimeters will be analyzed on a quarterly basis.* Environmental boundary air *and soil* monitoring (i.e., Low Volume air sampling and High Volume air sampling) will be performed at a minimum of two locations *on the north OCA boundary (for reference, see Figure 4.12-7 and Figure 4.12-9 in Chapter 4 of the ISP Environmental Report),* in addition to the locations currently performed under the REMP. Analyses will be for gross alpha/beta and gamma spectrometry and performed by a certified offsite laboratory *on a quarterly basis. Air samples will be collected monthly for each location and composited for a quarterly analysis. Soil samples will be collected and analyzed annually unless air samples indicate the need to take additional samples.*

9.6.3 Maximum Off-Site Annual Dose

The nearest residence in Lea County, New Mexico is approximately 4 miles from the WCS CISF at SPCS coordinate (541732.42, 6873002.59). At this distance, the computed total dose rate is 4.83E-14 mrem/hr. With continuous occupancy of 8,760 hours per year, the total dose is 4.23E-10 mrem, which is essentially zero and less than the dose from natural background radiation.

9.6.4 Liquid Releases

As described in Section 6.1.2.1, there are no radioactive liquid radioactive wastes to monitor for the WCS CISF.

RAI NP-9-5:

Ensure that WCS CISF SAR Section 9.5.2 includes appropriate information on radiation detection equipment and instrumentation to be used at the WCS CISF.

WCS CISF SAR Section 9.5.2 provides information on the radiation protection facilities at WCS, but only limited information on the radiation detection equipment and instrumentation to be used. The SAR should include information regarding the operational sensitivity and range, and frequency and methods of calibration for all of the equipment and instrumentation identified in the SAR.

This information is needed to determine compliance with 10 CFR 20.1501(c).

Response to RAI NP-9-5:

ISP has updated Section 9.5.2 of the SAR to include the radiation and detection equipment and instrumantation information requested and added SAR Section 9.8, "Supplemental Data," with the listed instrumentation technical description pages.

Impact:

SAR Section 9.5.2 has been revised and Section 9.8 has been added as described in the response.

- Counting laboratory locations are shown in Figure 9-6. Figure 9-7 shows building layouts and general equipment for each laboratory.

Equipment and instrumentation provided to support radiation protection functions are as follows:

- A proportional counter for contamination smears to define surface contamination and the need for decontamination *with detection capabilities ≤ 1.5 cpm.*
- Hand and foot contamination monitors stationed at building exits to prevent the spread of contamination
- Portable monitoring equipment to augment fixed detector systems *with detection capabilities as follows; 0.1 mR/hr to 999.9 mR/hr and/or 0.1 R/hr to 999.9 R/hr for GM detectors, 0.2 – 50,000 mR/hr with selectable range scales from x1 - x10k for Ion Chambers, 0 - 10,000 mrem/hr for Moderated Neutron Detectors with Gamma rejection up to 10R/hr.*
- Personnel protective equipment and clothing
- Personnel dosimetry instrumentation and equipment, including the following:
  - Optically stimulated luminescence monitoring for permanent exposure records
  - Self-reading dosimeters for instantaneous readout and personnel exposure control
  - Computer hardware/software to record and analyze radiological monitoring/sampling and personnel exposure data.

Radiological instrument storage and maintenance will also be located in the Security and Administration Building, along with a low-radiation background count room containing *calibrated* laboratory equipment for measuring radioactivity. *Count room instrumentation will be calibrated onsite using NIST traceable sources per the manufacturer's specifications. Portable monitoring instrumentation will be calibrated at an offsite vendor with the proper calibration qualifications to perform such calibrations per the manufacturer's specifications to NIST traceable standards applicable to the nuclides of interest at the WCS CISF.*

All Indicated Changes are in response to RAI NP-9-5

Access to the PA is controlled through a single access point in the Security and Administration Building (see Figure 1-2, the WCS CISF Site Boundary Layout). Personal dosimetry is issued and controlled in this building to individuals entering the PA. External radiation dose monitoring will be accomplished through the use of dosimeters (OSLs or equivalent) and self-reading dosimeters (SRDs) or digital alarming dosimeters (DADs). All operating personnel inside the Cask Handling Building and on the storage pads will utilize alarming dosimeters during the canister transfer process to warn of excessively high direct radiation and provide further assurance that occupation exposures will not exceed the limits of 10 CFR Part 20. The official dose of record of external dose to *beta, gamma, and neutron radiation* will be obtained from the personal dosimetry issued to each Radiation Worker (OSL or equivalent), with *calibrated* SRDs or DADs used as a means for tracking dose between dosimetry processing periods and as a backup to the dosimeters.

The Radiation Protection Program addresses the use of respiratory protection equipment, self-reading dosimetry, dose tracking and methods for data analysis and interpretation. Provisions exist in the Security and Administration Building for donning and doffing personal protective equipment, which could be necessary in the event of contamination in the Cask Handling Building.

Contamination of equipment or personnel is not expected to occur under normal conditions of operation. In accordance with the ISP policy of preventing generation of liquid radioactive waste, any necessary decontamination of equipment and personnel will be conducted using methods that produce only solid radioactive waste. Decontamination methods would typically include wiping the contaminated item with rags or paper wipes.

During routine storage operations at the WCS CISF, the only radiological instrumentation in use in the storage area will be the dosimeters, as described in Section 9.3.5. Routine radiological surveys will use instruments that are controlled by the Radiation Protection Program and governed by existing procedures. Portable instrumentation is calibrated at an approved certified offsite vendor. Procedures for radiological instrumentation will be established and applied to instruments used at the WCS CISF.

9.8 Supplemental Data

The following Instrumentation Specifications are enclosed as noted below:

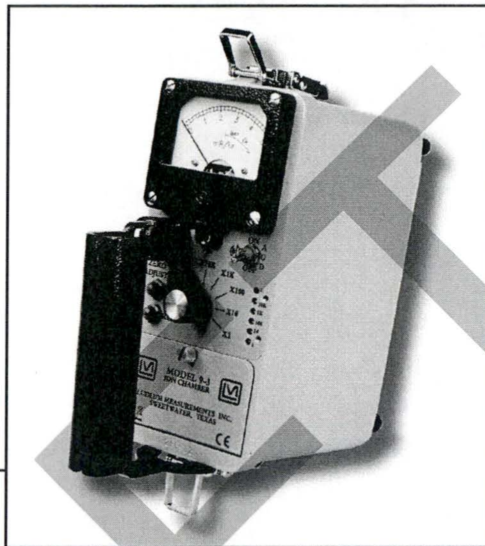
1. *Mirion Technologies Series 5 XLB Automatic Low Background Alpha/Beta Counting System*
2. *Ludlum Measurements, Inc., Model 9-3 Ion Chamber*
3. *Ludlum Measurements, Inc., Model 12-4 Neutron Dose Ratemeter*
4. *Ludlum Measurements, Inc., Model 78 Stretch Scope Exposure Ratemeter*
5. *Ludlum Measurements, Inc., Model 79 Carbon Fiber Stretch Scope*

Model 9-3
Ion Chamber Survey Meter

Ludlum Measurements, Inc.

Features

- Five Range Ion Chamber
- 1000 mg/cm^2 Retractable Beta Shield
- Low Battery Warning
- High Background Zero Capability
- Audio Proportional to Reading
- Rugged Construction
- Adjustable Shoulder Strap Included



Model 9-3 Ion Chamber
(shoulder strap not shown)
Below: Retractable Beta Shield

Specifications
Part Number: 48-3633

DETECTOR

RANGE: typically 0.2–50000 mR/hr
LINEARITY: reading within 10% of true value
ENERGY RESPONSE: within 20% of true value from 40 keV to 2 MeV
RESPONSE TIME: approximately 5 seconds for 90% of final meter deflection on the x1 and x10 scales, and 2 seconds on the x100, x1k, and x10k scales
CHAMBER VOLUME: 220 cm^3 (13.4 in^3)
WINDOW: 7 mg/cm^2 metalized polyester; with slide open, allows gamma detection to 6 keV
WINDOW AREA: 40 cm^2 (6.2 in^2) (31.5 cm^2 [4.9 in^2] open with optional 79% open screen)
CHAMBER CONSTRUCTION: carbon coated acrylic
BETA SHIELD: retractable 1000 mg/cm^2 phenolic slide
SIDE WALL: 1000 mg/cm^2 aluminum and acrylic

INSTRUMENT CONTROLS

ZERO ADJUST: allows limited background subtract, and also used to compensate for electrometer drift
AUDIO: On/Off; when On, click rate relates to meter reading
BAT TEST: pushbutton used to check battery capacity
RESET: causes chamber discharge to re-establish a current reading
RANGE SELECTION: instrument Off, plus x10k, x1k, x100, x10, and x1
CALIBRATION CONTROLS: individual potentiometers for each range

METER

METER: 6.4 cm (2.5 in.) arc, 1 mA, pivot-and-jewel suspension
METER DIAL: 0–5 mR/hr, BAT TEST (others available)
AUDIO: built-in unimorph speaker with ON/OFF switch
POWER: 2 each "AA" cell batteries housed in a sealed externally-accessible compartment
BATTERY LIFE: x100 and higher ranges at full scale without display light, 1050 hours; at x 1 and x10 in low background without display light, 1500 hours
CONSTRUCTION: cast and drawn aluminum with beige powder coating
TEMPERATURE RANGE: -20 to 50 °C (-4 to 122 °F), temperature compensation maintains calibration within 15% of 25 °C reading
SIZE: 23.4 x 8.9 x 21.6 cm (9.2 x 3.5 x 8.5 in.) (H x W x L) including instrument handle
WEIGHT: 1.6 kg (3.6 lb) including batteries

Ludlum Measurements, Inc. P.O. Box 810, Sweetwater, Texas 79556
Web: http://www.ludlums.com **Tel**: 800-622-0828 / 325-235-5494 / **Fax**: 325-235-4672 / **Email**: sales@ludlums.com

Feb 2019

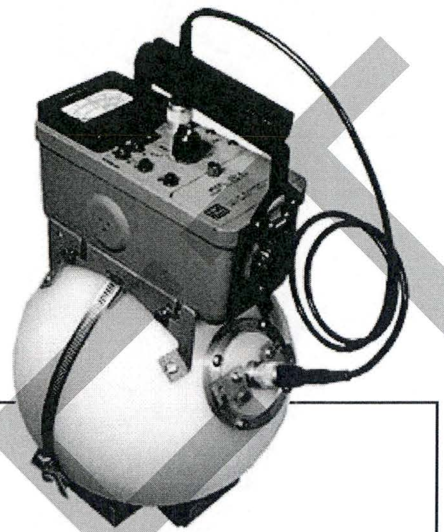
Supplemental Data added in response to RAI NP-9-5

Model 12-4
Neutron Dose Ratemeter

Ludlum Measurements, Inc.

Features

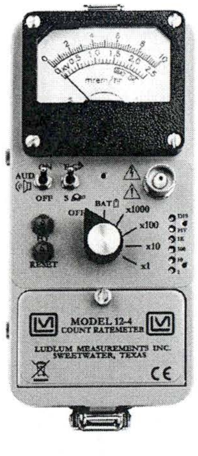
- Moderated Neutron Detector
- Range: 0–100 mSv/h (0–10,000 mrem/hr)
- Gamma Rejection up to 0.1 Sv/h (10 R/hr)
- Rugged
- 4-Range Analog Meter
- Complete Turn-Key System



Specifications
Part Number: 48-1200

INDICATED USE: neutron dose rate
MEASUREMENT RANGE: 0–100 mSv/h (0–10,000 mrem/hr)
DETECTOR: ^{3}He proportional detector, 1.6 x 2.5 cm (0.6 x 1.0 in.) (D x L), surrounded by a 22.9 cm (9.0 in.) diameter cadmium loaded polyethylene sphere
SENSITIVITY: typically 10 cpm per µSv/h (100 cpm per mrem/hr) (bare AmBe neutrons)
LINEARITY: reading within 10% of actual value
ENERGY RESPONSE: provides an appropriate inverse RPG curve for neutrons from thermal through 7 MeV, provides response up to 12 MeV
GAMMA REJECTION: < 10 cpm through 0.1 Sv/hr (10 R/hr) (^{137}Cs gamma)
OPERATING VOLTAGE: approximately 1200 Vdc
THRESHOLD: -2 mV
WORKING ENVIRONMENT: splashproof shields for outdoor use
METER DIAL: 0–10 mrem/hr, 0–2.5 kV, BAT TEST (other dials available)
HIGH VOLTAGE: adjustable from 400–2500 V (can be read on meter)
DISCRIMINATOR: adjustable from 1–50 mV
CONTROLS:

1. Multipliers: x1, x10, x100, x1000
2. Response: toggle switch for FAST (4 seconds) or SLOW (22 seconds) from 10% to 90% of final reading
3. Reset: pushbutton to zero meter
4. HV Test: pushbutton to display the high voltage on the meter
5. Audio: built-in unimorph speaker (greater than 60 dB at 61 cm [2 ft]) with ON/OFF switch



CALIBRATION: accessible from front of instrument (protective cover provided)
POWER: 2 "D" cell batteries (housed in sealed compartment that is externally accessible)
BATTERY LIFE: typically 600 hours with alkaline batteries (battery condition can be checked on meter)
CONSTRUCTION: cast and drawn aluminum with beige powder coat finish
TEMPERATURE RANGE: -20 to 50 °C (-4 to 122 °F)
SIZE: 43.2 x 22.9 x 26.7 cm (17.0 x 9.0 x 10.5 in.) (H x W x L)
TOTAL WEIGHT: 8.3 kg (18.3 lb); with batteries

Options

Lighted Handle: (PN 4464-154) meter-illuminating self-contained handle with 3-position rocker switch (On, Off, OnCall)
Shoulder Harness (PN 4363-413) nylon strap with wide comfort pad help ease task of carrying heavier instruments
Carrying Case: (PN 2310377) rugged, foam-padded, padlockable transport and storage case with hinged lid & trunk stay
Portable Scaler Option: (PN 4464-114) adds scaler counting capability with digital readout to analog ratemeter
Headphones: headphones provide superior audio in noisy or crowded environments. Several models are available.

Ludlum Measurements, Inc. P.O. Box 810, Sweetwater, Texas 79556
Web: http://www.ludlums.com **Tel:** 800-622-0828 / 325-235-5494 / **Fax**: 325-235-4672 / **Email**: sales@ludlums.com

Nov 2017

Supplemental Data added in response to RAI NP-9-5

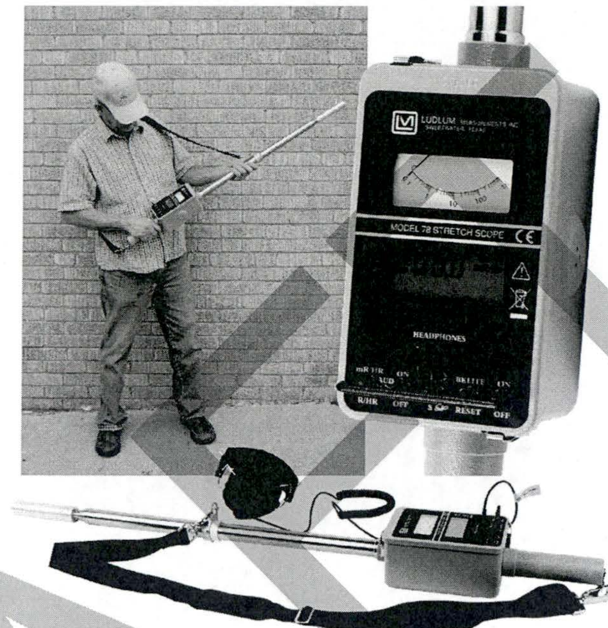
Model 78
Stretch Scope Exposure Ratemeter

Ludlum Measurements, Inc.

Features
- 0.1 mR/hr to 1000 R/hr
- (Sv version also available)
- 1 m (42 in.) to 3.8 m (12.4 ft) Telescoping Stainless Pole
- Dual Analog/Digital Display
- Splashproof Buttons
- Energy Compensated GM Detectors

Introduction

The Model 78 Stretch Scope keeps the user a safe distance from high rad areas, and reaches areas difficult to access with other probes. The wide detection range is accomplished using dual energy-compensated GM detectors. The backlit digital LCD delivers precise 4-digit measurement values, which can be programmed to display units of R or Counts, and is accompanied by icons and messages for operational status of the instrument. Rate changes are conveniently viewed on the accompanying analog meter. Clip-on shoulder strap is included.



(shown with optional headset)

Specifications
Part Number: 48-2832

CE

WORKING ENVIRONMENT: splashproof shields for outdoor use (environmental rating of IP52)
DETECTORS: 2 energy-compensated GM tubes
ENERGY RESPONSE: within 25% of true value from 60 keV–3 MeV
DISPLAY: 4-digit LCD display with 1.3 cm (0.5 in.) digits, and 6.4 cm (2.5 in.) analog meter
DISPLAY RANGE: 000.0-999.9 with indicators of mR/hr and R/hr (Sv display also available)
MEASURED RANGE: 0.1 to 999.9 mR/hr or 0.1 to 999.9 R/hr
BACKLIGHT/RESET: temporary action 2-position toggle switch to turn backlight on for preset amount of time, or zero meter and display
METER DIAL: 0–1k 4-decade logarithmic
RANGE SELECTION: 2-position toggle switch to select between mR/hr and R/hr
LINEARITY: reading within 10% of true value
AUDIO: built-in click-per-event audio with ON/OFF switch
RESPONSE: dependent on number of counts present: typical times FAST 4–25 seconds, or SLOW 4–60 seconds, from 10% to 90% of final reading
POWER: 2 "D" cell batteries (housed in sealed handle)
BATTERY LIFE: typically 250 hours with alkaline batteries (low battery indicated on display)
METER: 6.4 cm (2.5 in.) arc, 1 mA analog type
CONSTRUCTION: aluminum housing with beige powder coat paint, and polished stainless steel telescope
TEMPERATURE RANGE: -20 to 50 °C (-4 to 122 °F)
SIZE: 12.2 x 10.9 x 105.9 cm retracted; 377.2 cm fully extended (4.8 x 4.3 x 41.7 in. retracted; 148.5 in. fully extended) (H x W x L, fully extended L)
WEIGHT: 2.9 kg (6.4 lb), including batteries

Options:
Case: water, crush- and dust proof wheeled case with custom foam pads protect & transport instrument PN 4272-444
Headphone: dual volume controls, padded ear cups, adjustable head strap, 3 m (10 ft) cord PN 47-3708

Also Available
Model 78-1: same as above, but in Sv units (1 µSv/h to 10,000 mSv/h), Part No. 48-3743

Ludlum Measurements, Inc. P.O. Box 810, Sweetwater, Texas 79556
Web: http://www.ludlums.com **Tel**: 800-622-0828 / 325-235-5494 / **Fax**: 325-235-4672 / **Email**: sales@ludlums.com

April 2016

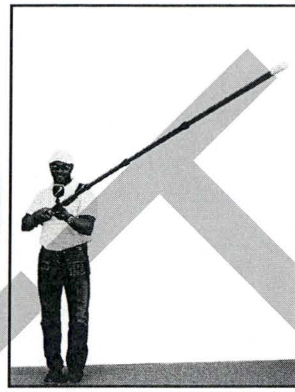
Supplemental Data added in response to RAI NP-9-5

Model 79
Carbon Fiber Stretch Scope

Ludlum Measurements, Inc.

Features

- Light Weight - Approximately 1/3 the Weight of Comparable Instruments
- 1.1 m (45 in.) to 4.5 m (177 in.) Telescoping Carbon Fiber Pole
- 10 µSv/h–10 Sv/h (1 mR/hr–1000 R/hr)
- 1 µSv/h (0.1 mR/hr) Display Resolution
- Backlit Auto-Ranging LCD with Adjustable Viewing Angle
- Simple Green, Yellow, and Red Status Indicators
- 3-Button Intuitive Interface for Easy Operation
- USB Port and All-Digital Calibration



Introduction

The Model 79 Stretch Scope provides the operator with the ability to investigate areas of suspected gamma contamination while remaining at a greater distance from potentially high fields of radioactivity. The 4.5 m telescoping pole allows the attached detector to reach areas difficult to access with other types of instruments.

A large, easy-to-read LCD display rotates to maximize ease of viewing. Padded shoulder strap (included), warning tone, and easy, intuitive design are also featured. The unit's body is made of durable,high-impact, plastic with splash-resistant construction allowing outdoor use.

The Model 79 has three modes of operation - RATE, MAX, and COUNT. Measurements can be collected in two sets of units (primary and secondary) for RATE and MAX modes in cps, cpm, Sv/h, mrem/hr, and R/hr units. The user can choose by simply pressing the Units button. An internal switch is used to enable or disable the front-panel setup feature to protect desired settings from inadvertent modification. Setup is also available via software from Ludlum Measurements.

Specifications

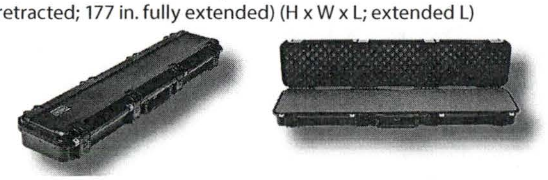
Part Number: 48-3966 (*an adjustable shoulder strap is included*)

DETECTOR: Geiger-Mueller (GM)
ENERGY RESPONSE: Within 25% of true value from 60 keV to 3 MeV
LINEARITY: Reading within 10% of true value
LCD DISPLAY: 3 digit LCD with large 13.4 mm (0.53 in.) digits, (k)cps, (k)cpm, (k)Bq, (k)dpm, (µ)(m)R(/h), (µ)(m)Sv(/h), (µ)(m)rem(/h), low-battery indicator, MAX, ALARM, MUTE
DISPLAY RANGE: 0.0 cps to 99.9 kcps; 0.00 cpm to 999 kcpm; 0.00 Bq to 99.9 kBq; 0.00 dpm to 999 kdpm; 0.00 µR/h to 999 R/h; 0.00 µSv/h to 999 Sv/h; 0.00 µrem/h to 999 rem/h. Display range can be set to limit display to calibrated range
BACKLIGHT: Built-in ambient light sensor automatically activates low-power LED backlight, unless internal dipswitch is set to continuous-On (will reduce battery life). Alarm light intensity varies based on ambient light levels.
USER CONTROLS:
- ON/OFF/ACK - Press to turn ON; Tap to acknowledge alarms and silence alarm tone; Press to reset Sigma Audio alarm; Turn "click" audio On/Off; Turn Sigma Audio beep On/Off; Hold for OFF
- MODE - Alternates between NORMAL (count rate), MAX (captures peak rate), and COUNT (user-selectable preset count time from 0 to 10 minutes). Number of modes can be reduced in setup.
- UNITS - Changes the units between primary or secondary units

RESPONSE TIME: User-selectable from 1 to 60 seconds, or Auto-Response Rate FAST or SLOW
WARM-UP TIME: Less than 2 minutes
ALARMS: Count rate, exposure/dose, and scaler alarm setpoints adjustable over the display range
OVERLOAD: High count rate saturation protection prevents false display of lower count rates
ZERO PROTECTION: After a user-settable time interval (default 60 seconds) of no pulses from detector, the instrument will flash zero reading and the alarm audio will be triggered
DEAD TIME CORRECTION: Employs first and second order corrections for extended performance
AUDIO: greater than 75 dB at 0.6 (2 ft), approximately 4 kHz
POWER: two alkaline or two rechargeable "AAA" batteries
BATTERY LIFE: approximately 100 hours of operation, 24-hour low battery warning
CONSTRUCTION: display unit: high-impact plastic with separate battery compartment; telescoping pole: carbon fiber
TEMPERATURE RANGE: -20 to 50 °C (-5 to 122 °F), may be certified for operation from -40 to 65 °C (-40 to 150 °F)
SIZE: 20.3 x 8.1 x 114 cm retracted; 4.5 m fully extended (8.0 x 3.2 x 45 in. retracted; 177 in. fully extended) (H x W x L; extended L)
WEIGHT: 1.4 kg (3 lb), including batteries and shoulder strap

Options:

Stereo Audio Option: Part Number 4498-697
Lumic Calibration Software Kit: Part Number 4498-1020
Case: (right) water-, crush- and dust-proof case with custom foam pads to protect and transport instrument (Part Number 2312979)



Ludlum Measurements, Inc. P.O. Box 810, Sweetwater, Texas 79556
Web: http://www.ludlums.com **Tel:** 800-622-0828 / 325-235-5494 / **Fax:** 325-235-4672 / **Email:** sales@ludlums.com

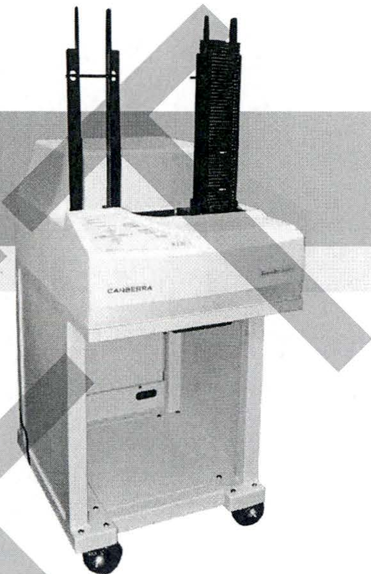
May 2019

Supplemental Data added in response to RAI NP-9-5

MIRION
TECHNOLOGIES

Series 5 XLB™

Automatic Low Background Alpha/Beta Counting System



KEY FEATURES

- Automatic single detector, ultra-low background counting system
- Enhanced low background capability
- Gas Stat digital gas conservation and monitoring system
- Fifty planchet sample changer with 100 sample capacity optional
- Molded low background passive shielding with interlocking design
- Reduced system footprint and integrated cart
- High performance dual anode 5.7 cm (2.25 in.) gas flow detector with ultra-thin gold sputtered window; single anode one inch detector option available
- Advanced electronic diagnostics continuously monitor operating conditions
- Universal auto-sensing power supply
- Coded positive sample carrier identification
- External or sample changer based bar code reader
- CE compliant

DESCRIPTION

Superior Counting Performance, Unparalleled System Features

The Series 5 XLB low background alpha/beta counter offers a completely integrated, computer controlled system for maximum flexibility.

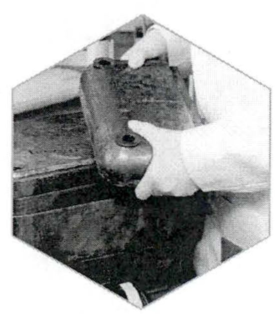
The Series 5 platform is designed to count samples the way they are prepared in a laboratory. Sensible and smart, Series 5 counters provide integrated intelligence to satisfy the most demanding applications and routine analysis.

Enhanced Low Background and Productivity

Due to increasing environmental regulations to reach lower detection limits, sample count times have increased reducing the overall sample throughput in the laboratory. The Series 5 system incorporates enhanced technology to reduce system background and increase sample throughput. Using an improved guard detector, the system sensitivity for high energy, cosmic background is increased, enabling the anti-coincidence circuitry to detect and reject more spurious background events.

The beta background for the Series 5 counter has been reduced by as much as 35% over older systems. Beta backgrounds as low as 0.5 cpm can be achieved. This means that the Series 5 family of low background counters can count twice as many samples for a given detection limit as a counter with a beta background of 1.0 cpm – impressive performance from an impressive system.

Custom Molded Shield



Using a graded shielding system, the Series 5 system counts samples with more accuracy than any other low background counter.

The molded shield system provides 10 cm (4 in.) of custom molded lead surrounding the detector. The shield comprises interlocking modules which weigh no more than 27 kg (60 lb) each for safety and ease of assembly.

Supplemental Data added in response to RAI NP-9-5

Time Proven Reliability

The sample changer of the Series 5 family is time and field proven. The highly reliable design of the automated sample changer transports and counts samples day after day providing worry free operation. When work counts and time is precious, count on a system to deliver results and reliability.

Ultra-Thin Detector Windows

The standard gas flow detector of the Series 5 family of systems incorporates a high performance pancake-style 5.7 cm (2.25 in.) detector. The entrance window of the detector is made with state-of-the-art technology and special materials to provide the highest counting efficiency and the lowest alpha background of any counter.

Positive Sample Identification and Bar Code – The Advantage

Today's changing requirements demand sample identification that is maintained through the counting data. Data defensibility is a priority. The Series 5 system incorporates a unique combination of carrier and sample identification systems to maintain chain-of-custody. Two methods of sample identification are linked to the final data report. The sample carrier is uniquely coded for routine analysis. The Series 5 counter can be configured with an automatic sample bar code reader. When present, the sample bar code is automatically captured by Apex-Alpha/Beta™ software and stored with the sample count data, forming the missing link in sample custody in the count room. Only Mirion sample carriers are washable for easy cleaning and decontamination.

Circuitry So Advanced, It Thinks for Itself

The electronics package of the Series 5 family of counting systems provides the most advanced control and monitoring system available to assure accurate results. The Series 5 incorporates hardware diagnostics which continuously monitor internal and external parameters including gas pressure and flow, system voltage, power distribution, and other system critical parameters. The user is alerted on the front panel if any of these parameters falls below normal operation thresholds.

Human Factor Engineering

Often computer controlled analytical equipment requires additional laboratory space for the computer system and peripherals. The Series 5 counter addresses that problem with an integrated mobile cart that provides all of the support necessary for the computer, monitor, keyboard, and pointing device. The optional S5-ACCKIT includes a monitor support shelf tray, printer support tray, and a gas tank bracket. The retractable printer shelf opens to hold printer and supplies. The Series 5 system is designed to be a completely integrated, self contained counting system with the industry's smallest footprint.

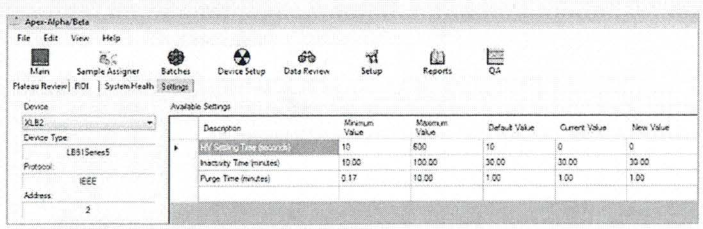
Gas Stat Gas Conservation System

Conventional low background counters have manual gas flow control and use the equivalent of a 1A gas cylinder on the average of once per six weeks. Changing gas supplies usually means re-verification of critical system calibrations which can be an unnecessary time consuming process. Not only time, but the impact on data quality can become significant issues when frequent re-calibrations must be performed, due to a change in gas quality.

The Series 5 system includes Gas Stat, the industry standard for gas management, which eliminates the high frequency of re-calibrations due to counting gas changes. Gas Stat is a microprocessor-controlled gas monitoring and control system that provides worry free operation by eliminating the need to adjust manual flow meters. The normal gas flow rate is set by the operator through software control, and flow rates are digitally displayed in real time on the computer screen.

The Series 5 hardware senses when the system is not counting samples, and automatically reduces the gas flow rate to a low quiescent flow to maintain detector gas quality. This prevents atmospheric impurities from diffusing into the detector and causing questionable results. When the user starts a count, Gas Stat automatically purges the detector and resets the flow rate to normal. Gas Stat uses a preset maximum flow rate for the detector purging; so, it is virtually impossible to cause window damage due to over pressurization.

Gas Stat effectively increases the useful life of the gas supply, thereby reducing the frequency of instrument re-verification, saving time and improving the quality of counting data.



Supplemental Data added in response to RAI NP-9-5

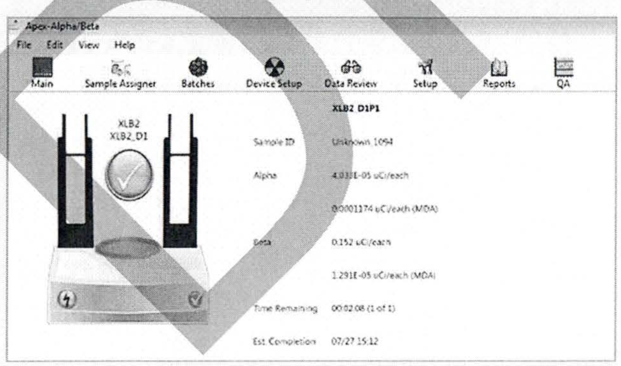
Software – Powerful and Flexible

The Series 5 counter has been designed to take full advantage of computer-based system integration. Series 5 XLB system can be operated with the legacy Eclipse™ software, or can use the state-of-the-art Apex-Alpha/Beta software to provide the optimum combination of power and ease of use for a low background system.

Apex-Alpha/Beta software includes a Microsoft SQL Server Express database for fast and efficient data storage. Custom reports can be easily developed for your application or presentation using an integrated reporting tool without the need for any third-party software. See the Apex-Alpha/Beta specification sheet for more detail on its advanced features.

Final activity results can be viewed on-screen for each sample as it is counted. An intuitive, symbolic icon tool bar provides access to functions at the push of a button.

No other counter can match the advanced automation capabilities and features of the Series 5 XLB counter and Apex-Alpha/Beta Software.



Software – Powerful and Flexible

SPECIFICATIONS

*All specifications are based on measurements performed at a Mirion manufacturing facility with 5.7 cm (2.25 in.) detector with ultra-thin window, unless noted otherwise.

To achieve lower Beta background, the Gamma detector can be replaced with a Lead Plug (7081577).

PERFORMANCE

Background:

	WARRANTY	
	Standard system or Gamma system with lead plug installed	Gamma system with NaI detector installed
Gross (alpha+beta)	≤0.80 cpm	≤1.1 cpm
Alpha	≤0.1 cpm	≤0.1 cpm
Beta	≤0.75 cpm	≤1.0 cpm

Efficiency:

- 4π efficiency measured with a NIST traceable standard point source 5.08 x 0.3 cm (2 in. x 1/8 in.) planchet in 0.3 cm (1/8 in.) insert.

	Warranty
Alpha (^{210}Po)	≥38%
Beta ($^{90}Sr/^{90}Y$)	≥45%

- Counting efficiency is dependent on operating voltage, source thickness and distance from detector. Backscattering of high energy emitters produces higher than expected efficiency.

Spillover:

- ≤1.0% ^{210}Po alpha into beta channel with the system adjusted for a ≤0.1% spillover of ^{90}Sr beta into the alpha channel.

Detector Plateau:

- Alpha (^{210}Po) – ≤2.5% slope/100 V: ≥800 V plateau.
- Beta (^{90}Sr) – ≤2.5% slope/100 V: ≥200 V plateau.

Sample Count Rate:

- 500000 cpm with ≤1.5% deadtime loss.

Counting Time Preset:

- Adjustable between 0.2 and 9999 minutes.

PHYSICAL

Sample Changer Capacity:

- Standard – 50 samples.
- Optional – 100 samples.

Weight:

- Net weight less cart – standard system 324 kg (716 lb).
- Net weight cart with casters 54 kg (120 lb).

Dimensions:

(Height x Width x Depth)

- Table Top Model – 37 x 58 x 76 cm (14.5 x 23 x 30 in.).
- With 50 Sample Capacity – 75 x 58 x 76 cm (29.5 x 23 x 30 in.).
- With 100 Sample Capacity – 124 x 58 x 76 cm (49 x 23 x 30 in.).
- Cart With Casters – 76 x 58 x 76 cm (30 x 23 x 30 in.).

POWER REQUIREMENTS

The Series 5 counter is equipped with a universal power supply and automatically adapts to voltage and frequency.

- 100–240 V ac at 50/60 Hz.
- 100 W maximum.

ENVIRONMENTAL

- Operating Temperature – 0 to 50 °C (32 to 122 °F).
- Operating Humidity – 0 to 80% relative, non-condensing.
- Meets the environmental conditions specified by EN 61010, Installation Category I, Pollution Degree 2.

Supplemental Data added in response to RAI NP-9-5

ORDERING INFORMATION

5XLB Models:

These models include on-site installation and one year on-site warranty. Requires computer, monitor, printer and Apex-Alpha/Beta (S556C) Software.

- S5X2050 – Includes basic S5XLB counter, 2.25 in. detector, 50 sample towers, carrier plates, carrier inserts (5/16 & 1/8 deep), planchets and cart.
- S5X2100 – Includes basic S5XLB counter, 2.25 in. detector, 100 sample towers, carrier plates, carrier inserts (5/16 & 1/8 deep), planchets and cart.
- S5XG2050 – Includes S5XLB counter with gamma option, 2.25 in. gas flow detector, 2X2 NAI, 50 sample towers, carrier plates, carrier inserts (5/16 & 1/8 deep), planchets and cart.
- S5XG2100 – Includes S5XLB counter with gamma option, 2.25 in. gas flow detector, 2X2 NAI, 100 sample towers, carrier plates, carrier inserts (5/16 & 1/8 deep), planchets and cart.

Export 5XLB Models:

Models with "E" do not include on-site installation. Requires computer, monitor, printer and Apex-Alpha/Beta Software.

- S5X2050E – Includes basic S5XLB counter, 2.25 in. detector, 50 sample towers, carrier plates, carrier inserts (5/16 & 1/8 deep), planchets and cart.
- S5X2100E – Includes basic S5XLB counter, 2.25 in. detector, 100 sample towers, carrier plates, carrier inserts (5/16 & 1/8 deep), planchets and cart.
- S5XG2050E – Includes S5XLB counter with gamma option, 5.7 cm gas flow detector, 50.8 x 50.8 mm NAI, 50 sample towers, carrier plates, carrier inserts (7.9 & 3.2 mm deep), planchets and cart.
- SXG2100E – Includes S5XLB counter with gamma option, 5.7 in. gas flow detector, 50.8 x 50.8 mm NAI, 100 sample towers, carrier plates, carrier inserts (7.9 & 3.2 mm deep), planchets and cart.

MISCELLANEOUS

- AB-CPU7 – Windows 7 PC with LCD monitor.
- AB-CPU10 – Windows 10 PC with LCD monitor.
- S556C – Apex-Alpha/Beta Software.
- S550C – Eclipse Software (Existing Eclipse Users Only).
- LB-Integ – Integration of customer supplied computer.
- 488PCI – IEEE-488 Card and Cable (PCI Bus).
- 488USB – IEEE-488 Interface (USB).
- S5-ACCKIT – S5 Mobile Cart Accessory Kit including Monitor Tray, Printer Tray, and Gas Tank Bracket.
- XLB-GR – Single Stage Gas Regulator.

ACCESSORIES

- 6200-12 – Carrier Inserts 2 x 1/16 in.
- 6200-13 – Carrier Inserts 2 x 1/8 in.
- 6200-14 – Carrier Inserts 2 x 1/4 in.
- 6200-09 – Carrier Inserts 2 x 5/16 in.
- 6200-21 – Carrier Inserts 1 x 1/16 in.
- 6200-22 – Carrier Inserts 1 x 1/8 in.
- 6200-23 – Carrier Inserts 1 x 1/4 in.
- 6200-24 – Carrier Inserts 1 x 5/16 in.
- 6200-137 – Plastic Carrier Inserts 2 x 1/4 in.
- 6200-96 – Carrier Plates Coded 1–50
- 6200-97 – Carrier Plates Coded 51–100
- 6200-88 – Carrier Plates Coded 101–150
- 1750-06 – Group Plates A – E
- 1750-07 – Group Plates F – J
- 1400-156 – Uncoded Carrier Plates
- 1750-475 – End Carrier Plates
- 1750-23 – Carrier Plate Cassette
- 6200-476 – 60 mm Carrier Insert Disk
- 6200-477 – 60 mm Carrier Insert Ring

Replacement Detectors and Windows

- S5-F2 – 2.25 in. detector for XLB, S5E and Solo
- WIND280 – Replacement premium 2.25 in. ultra-thin window
- WIND280AL – Replacement standard 2.25 in. thin window

ISO 9001 SYSTEM CERTIFIED MERIDEN CT SMYRNA GA OAK RIDGE TN CONCORD ON

CANBERRA

Supplemental Data added in response to RAI NP-9-5

RAI NP-9-6:

Ensure that WCS CISF SAR Section 9 includes appropriate information about the facility health physics program.

Table 10A-2 of Draft NUREG-2215, "Standard Review Plan for Spent Fuel Dry Storage Systems and Facilities," contains a list of program elements expected to be included as part of a facility health physics program. Many of these elements are included in various sections of the SAR. However, several elements are missing, including:

- Requirements for initial and refresher radiation protection training, contents (topics), and health physics-related qualification of workers;
- Provisions to inform female workers of fetal protection requirements, to monitor fetal dose, and to provide alternatives to minimize fetal dose;
- Requirements and procedures for calibration, maintenance, and care of radiation detection, monitoring, and dosimetry instruments and records; and
- Preparing of reports and records for health physics program contents and audits, surveys, calibrations, and personnel monitoring results.

The description of the health physics program in the SAR should be revised to include these elements or justification should be provided for the alternative proposed.

This information is needed to determine compliance with 10 CFR 20.1208, 20.1501(b), 20.1501(c) and (d), 20.2103, and 10 CFR Part 20 Subparts L and M.

Response to RAI NP-9-6:

ISP has revised SAR Section 9 to include a new Section 9.5.4, "Radiological Worker Training," which includes the information requested. SAR Section 9.5.1 has also been updated to point to Section 9.5.4 for the details related to these training requirements.

In addition, the current Waste Control Specialists Radiation Safety Program is a 10 CFR 20 compliant program. Although the program is under the agreement state oversite, the regulatory requirements are therefore compliant with 10 CFR 20.1208, 20.1501(b), 20.1501(c) and (d), 20.2103, and 10 CFR Part 20 Subparts L and M.

Impact:

SAR Section 9.5.1 has been updated and Section 9.5.4 has been added as described in the response.

The WCS CISF is designed and operated to provide radiation protection for workers in conformance with applicable regulatory criteria so that occupational radiation exposures are maintained ALARA.

Operation of the WCS CISF is in accordance with an ALARA policy that includes, as a minimum, the following criteria:

- Maintaining radiological releases and exposures to personnel below the applicable limits of 10 CFR Part 20.
- Ensuring that all exposures are kept ALARA, with technological, economic and social factors taken into consideration.
- Integrating appropriate radiation protection controls and ALARA program guidelines into all work activities, including those for design, operations, maintenance, and decommissioning.
- *Ensuring that all personnel understand that no practice involving radiation exposure will be undertaken unless its use produces a net benefit and that all personnel shall follow ALARA procedures at all times.*
- Restricting access to radiologically controlled areas.
- Tracking individual and collective doses to identify trends, causes, and take appropriate corrective actions for adverse trends.
- Conducting periodic training and exercises for management, radiation workers and other site personnel in radiation protection principles and procedures, individual and group protective measures, site procedures and emergency response.
- Integrating ALARA considerations into the WCS CISF design and procedure change activities, including appropriate experience gained during the loading and transfer operations at other ISFSIs relative to radiation control.

WCS CISF personnel including administration, security staff and railroad personnel involved in the delivery to and shipment from the WCS CISF of transport packages will be trained in accordance with 10 CFR Parts 19 and 20. These workers are considered "Radiation Workers" and the occupational radiation dose limits specified in 10 CFR Part 20 Subpart C apply. Individuals (visitors) not trained in accordance with 10 CFR Part 19 are considered members of the public and the dose limits specified in 10 CFR Part 20 Subpart D apply.

ISP minimizes radiation dose to non-radiation workers by the following means:

- ISP will control the number of non-radiation workers admitted to both the Owner Controlled Area (OCA) and to the WCS CISF.
- Commercial and industrial deliveries to ISP will be required to be accepted outside the OCA, for further transfer on site by radiation workers.
- Authorized visitors and other members of the public will be under escort while in the OCA and the WCS CISF.

9.5 Radiation Protection Program During Operation

The major radiation protection functions of the Radiation Protection Program during operations of the Cask Handling Building are described in this section. The WCS CISF Radiation Protection Program is planned and organized in accordance with the criteria of NRC Regulatory Guides 8.8 and 8.10, and NUREG-0761.

9.5.1 Organization and Functions

The corporate structure of the applicant for the WCS CISF is addressed in Section 13.1.

The organizational structure of the WCS CISF, including the setting of the Radiation Safety Officer, is addressed in Section 13.1.1.2 and depicted in Figure 13-1.

The Personnel Functions, Responsibilities, and Authorities of those with responsibilities in the Radiation Protection Program are addressed in Section 13.1.2.2.

The Qualification requirements of those with responsibilities in the Radiation Protection Program are addressed in Section 13.1.3.1.

The WCS CISF training program is addressed in Section 13.3. It includes both technical and radiological training topics for the WCS CISF. Additionally, the Radiological Training Program topics are covered below in Section 9.5.4.

9.5.2 Equipment, Instrumentation and Facilities

A sufficient inventory and variety of operable and calibrated portable and fixed radiological instrumentation will be maintained to allow for effective measurement and control of radiation exposure and radioactive material and to provide back-up capability for inoperable equipment. Equipment will be able to assess sources of gamma, neutron, beta, and alpha radiation, including the capability to measure the range of dose rates and radioactivity concentrations expected. Radiation protection procedures will govern instrument calibration, instrument inventory and control, and instrument operation.

Facility requirements to support the WCS CISF radiation protection functions are shared between the WCS CISF and ISP joint venture member Waste Control Specialists and are as follows.

- Instrument calibration area LLRW
- Personnel change rooms, including lockers
- Access control stations for entrance to and exit from radiation areas and, if needed, temporary contamination control areas
- Office space to accommodate Radiation Protection staff
- Counting laboratory

All Indicated Changes are in response to RAI NP-9-6

- Perform, monitor and record environmental monitoring of boundaries.

9.5.4 Radiological Worker Training

Radiation workers at the WCS CISF will receive Radiation Worker training under the Radiation Safety Program. Rad Worker Training includes the following topics:

- *Technical Topics*
  - *Sources of radiation (natural and man-made),*
  - *Basic atomic and nuclear physics,*
  - *Types of radiation and their characteristics (alpha, beta, gamma, x-ray, neutron),*
  - *Radiation units,*
  - *Biological effects,*
  - *Risks of occupational exposure (NRC Regulatory Guide 8.29),*
  - *Radiation measurement and survey instruments,*
  - *External dosimetry (TLD, OSL, SRD, extremity),*
  - *Time, distance, and shielding,*
  - *Internal dosimetry methods (whole-body counting, urinalysis, and fecal analysis), contamination control (sources of contamination, protective clothing/PPE, controlled areas and exiting, and personnel surveys),*
  - *Personnel and equipment decontamination,*
  - *Airborne radioactivity,*
  - *Respiratory protection and coordination with industrial/chemical hazards,*
  - *Prenatal radiation exposure (NRC Regulatory Guide 8.13),*
  - *First aid considerations,*
  - *Radiological waste reduction,*
  - *Introduction to mock-up training.*
- *Administrative Topics*
  - *ISP radiation safety policy,*
  - *Role of the RSO and RST,*
  - *Authority of radiation safety personnel,*
  - *ALARA philosophy and practices,*
  - *Regulatory and administrative limits; minimizing exposure,*
  - *Federal and State Regulations and License provisions for the protection of personnel from radiation and radioactive material,*

All Indicated Changes are in response to RAI NP-9-6

- *Radiological postings,*
- *Radiological surveys (purposes, methods),*
- *Control and removal of contaminated equipment,*
- *Introduction to WCS CISF operational procedures (additional, separate training is required for procedural qualification),*
- *Introduction to ISP quality assurance (additional, separate training is required for procedural qualification),*
- *Investigation and reporting of abnormal exposures,*
- *Obtaining exposure records,*
- *Responsibilities of individuals,*
- *Radiological emergencies,*
- *Respiratory protection program,*
- *Radiation work permits (RWPs).*

The training session is followed by a written test, which must be passed at the 80% level of competency before unescorted access is allowed into a Restricted Area.

The RSO/Director of Health and Radiation Safety may authorize individuals with documented radiation safety training and experience from other sites or utilities, such as the DOE, to challenge any training requirement and demonstrate the requisite level of knowledge in radiation safety by:

- *Successfully passing a written exam that includes basic radiation safety training principles and facility/WCS CISF specific information; and*
- *Successful discussion and performance of practical factors.*

RAI NP-9-7:

Ensure that WCS CISF SAR Section 9.1.2 clearly provides what is meant by, "remote inspection of storage overpack vents for blockage."

This statement appears on WCS CISF SAR Page 9-5 as part of a discussion of measures to minimize dose to WCS personnel by avoiding the need to perform daily walkdowns near the storage casks. It is not clear how remote vent inspection would be accomplished, and such inspections are not discussed further in the SAR. The SAR should be revised to clarify remote inspections, this verbiage should be removed from Section 9.1.2, or justification should be provided for the proposed alternative approach.

This information is needed to determine compliance with 10 CFR 20.1101(b).

Response to RAI NP-9-7:

One of the methods used to determine whether vents are blocked on vertical concrete casks (VCCs) is to measure the outlet vent temperatures and compare them to the WCS CISF ambient temperature. (See proposed Technical Specifications 3.32 and 3.42). Temperature monitoring systems installed on the outlet vents allow for the remote readout of vent temperatures, which minimizes radiation dose to WCS CISF personnel by eliminating the need to perform daily walkdowns, to take measurements, or to read instrumentation near the VCC. For the NUHOMS® overpacks, a physical inspection of the vents is required as the option to use similar temperature measurements was removed as part of ISPs response to RAI TS-4. Visual inspection of the of vents for the line of NUHOMS® overpacks can be performed from the front of the array and does not require that the personnel performing the inspection be too near the vents or other storage overpacks.

SAR Section 9.1.2 has been modified to include this clarification.

Impact:

SAR Section 9.1.2 has been revised as described in the response.

The storage pads are sized to provide adequate spacing between storage casks or modules to permit workers to function efficiently during operations and maintenance. This helps minimize dose by limiting time spent by workers in the vicinity of storage casks.

The design of the storage systems includes a metal canister that is sealed by welding for SNF and GTCC waste confinement. This design precludes the release of radioactive effluents during normal operations, which fully satisfies the requirement of 10 CFR 72.126(d) to design the facility to provide means to limit the release of radioactive materials in effluents during normal operations to levels that are ALARA. This design also requires minimum maintenance and surveillance requirements by ISP personnel.

The *VCC* temperature monitoring system *installed on the outlet vents* enables data acquisition from remote readout of temperatures or inspection; this minimizes radiation dose to WCS CISF personnel by avoiding the need to perform daily walkdowns, or take measurements, or read instrumentation near the *VCCs*. *The NUHOMS® storage overpack vents are covered by screens which prevent internal blockage of the vents. The back-to-back array allows visual inspection of screens for debris to be performed from low dose areas on the storage pad.*

ALARA considerations have been incorporated into the WCS CISF design in accordance with 10 CFR 72.126(a) using guidance from Regulatory Guide 8.8, Regulatory Position 2 [9-16], as described below:

- Regulatory Position 2a on access control of radiation areas is satisfied by use of a security gate and a fence surrounding the WCS CISF Protected Area (PA) to prevent unauthorized access.
- Regulatory Position 2b on radiation shielding is satisfied by the shielding design for the transportation, storage, and transfer casks that minimizes personnel exposures during operations. The design of the storage cask air inlet and outlet ducts also prevents direct radiation streaming. The Security and Administration Building is located approximately 340 ft. (100 meters) from the nearest storage pad, and approximately 1130 ft. (345 meters) from the Cask Handling Building. Dose rates are sufficiently low at these distances such that shielding of the Security and Administration Building is unnecessary to assure dose rates are ALARA to personnel in the building.
- Regulatory Position 2c on process instrumentation and controls is satisfied since the cask temperature monitoring system will utilize a data acquisition system to record cask temperature instrumentation readings. This will avoid time spent by WCS CISF personnel near the storage casks to make daily cask vent blockage and temperature surveillances.

All Indicated Changes are in response to RAI NP-9-7

RAI NP-9-8:

Address an apparent typographical error in WCS CISF SAR Section 9.3.2.1, "Controlled Area."

The third paragraph of WCS CISF SAR Section 9.3.2.1 starts with the sentence: "ISP will establish access controls to ensure that unauthorized access inside the OCA and the PA." This sentence is incomplete and should be clarified.

Response to RAI NP-9-8:

ISP has revised Section 9.3.2.1 to include the information requested.

> "ISP will establish access controls to ensure that unauthorized access inside the OCA and the PA is prevented."

Impact:

SAR Section 9.3.2.1 has been revised as described in the response.

Access to the PA is controlled through a single access point in the Security and Administration Building (see Figure 1-2). Personal dosimetry is issued and controlled in this building to individuals entering the PA. Provisions exist in this building for donning and doffing personal protective equipment, such as anti-contamination clothing and/or respirators, which could be necessary in the event of contamination in the Cask Handling Building as a result of off-normal or accident conditions. Provisions for personnel decontamination are also contained in the Security and Administration Building. The PA also includes the storage area and Cask Handling Building. In accordance with the WCS CISF Radiation Protection Program During Operation (Section 9.5), radiation protection personnel will monitor radiation levels in the PA and establish access requirements as needed.

9.3.2.1 Controlled Area

Within the OCA, a restricted area is established to control access to radiation areas in order to maintain worker exposures ALARA.

The WCS CISF PA boundary will be posted as "restricted area, radioactive material area, dosimetry and RWP required for entry." The WCS CISF Cask Handling Building will be posted as a Radiation Area or High Radiation Area per 10 CFR Part 20 limits. In posting contamination areas, ISP will use the limits in Waste Control Specialists State radioactive material license RML R04100 which can be found in 30 TAC 336.364 Appendix G [9-19].

ISP will establish access controls to ensure that unauthorized access inside the OCA and the PA *is prevented*. These controls will be established for radiation protection, security, and safeguards purposes. The site layout, including a description of barriers and gates that will be used to preclude ready access into the OCA of the WCS CISF is provided in the Physical Security Plan.

9.3.2.2 Restricted Area

The restricted area is located on the site such that a minimum distance from any stored SNF to the security boundaries is at least 330 feet in order to maintain exposures within regulatory limits.

9.3.3 Shielding

9.3.3.1 Cask Handling Building Shielding

The ALARA considerations for the CISF Cask Handling Building are the same as the transportation casks since the canisters will still be in the transportation cask. While shielding is provided by the Cask Handling Building, no credit is taken in the shielding/exposure analysis. Shielding from the radiation sources within the canisters is provided by the transportation/transfer casks, transfer casks and storage overpacks. Table 9-4 provides the cross reference to the applicable appendix and section for each canister/storage overpack where each system is discussed.

RAI NP-9-9:

Ensure that all the collective dose estimates from transportation and storage cask operations in the WCS CISF SAR Appendices are provided so that all operating procedure steps that could expose personnel are included.

It is not clear that all operating procedure steps that could expose personnel to radiation are captured in the collective dose estimates in WCS CISF SAR Sections A.9, B.9, C.9, D.9, E.9, F.9, and G.9. For example, inspection of Table B.9-2 indicates that step 11 for installing the cask shear key plug assembly, and steps 13 and 14 for sampling and leak testing the transportation package, are not reflected in the dose estimate. Similarly, Table B.9-3 does not include steps for removing the AHSM door, ensuring vents are clear of debris, and lubrication of support rails. All of these steps involve personnel close to a loaded transportation package or storage overpack, and should be reflected in the collective dose assessment. The applicant should ensure that all of the collective dose assessments from the cited Appendixes accurately reflect the operating procedures for the various cask systems.

This information is needed to determine compliance with 10 CFR 20.1101(b).

Response to RAI NP-9-9:

The occupational collective dose estimates in WCS CISF SAR include all transportation and storage cask operations that could cause exposure to personnel. The way the dose estimates are listed in the SAR does not share a one-to-one with the detailed list of operating procedures estimates in WCS CISF SAR Sections A.9, B.9, C.9, D.9, E.9, F.9, and G.9, because the lists serve two different purposes. The list of operating procedure steps provides a detailed list of instructions that need to be followed in precise order to effect a particular operation, while the list of dose estimates are organized to capture the procedural steps that cause the potential exposure to personnel.

The occupational collective dose estimates in WCS CISF SAR are conservative compared with doses that have been measured during actual transportation and storage cask operations.

Specifically, the occupational collective dose estimates in WCS CISF SAR are based on dose rates from existing shielding analysis in storage UFSARs and transportation cask SARs considering design basis sources (no additional cooling time due to pool cooling or storage on ISFSI pads), main cask operations, and personnel and durations based on engineering judgment and experience to provide an overall total bounding estimate. Past experience shows that the total occupational collective dose estimates in Orano TN SAR, using a similar approach of over-estimate actual pool-to-pad occupational collective dose by a factor of about 4 to 10: for example, actual pool-to-pad dose performance ranging from 200 mrem to 606 mrem for 10 BWR canisters loading while estimated at 2370 mrem in CoC 1004 UFSAR Chapter T.10.

Additional occupational collective doses related specific cask or horizontal storage module (HSM) operations may be estimated for dose budgeting using appropriate dose rates from storage FSARs and transportation cask SARs in conjunction with appropriate distance, personnel and duration.

Impact:

No change as a result of this RAI.

RAI NP-9-10:

Ensure that the collective dose estimates from transportation and storage cask operations in the WCS CISF SAR Appendices are provided so that all the cited distances and dose rates are appropriate for the specific operating step, and that the total dose calculations are correct.

It is not clear that all cited distances and dose rates for each operating step, and total dose calculations, are correct for the collective dose assessments in WCS CISF SAR Sections A.9, B.9, C.9, D.9, E.9, F.9, and G.9 of the WCS CISF SAR. For example, inspection of Table G.9-1 indicates the following inconsistencies:

- For the process step "Perform radiation and contamination survey of MAGNATRAN Cask," the table indicates a worker distance of greater than two meters. It is not clear how personnel would be able to decontaminate the transportation package from that distance.
- For process steps "Inspect top impact limiter security seal and verify it is intact and correct ID," and "Remove Personnel Barrier and complete surveys," it appears that the dose calculations are incorrect. For the first step, one person working for 15 minutes in a dose field of 20 millirem per hour should be five millirem total, instead of the table reading of one. For the second step, two people working for 30 minutes in a 20 millirem per hour dose field should equate to 20 millirem total, instead of the table reading of 32.
- For the process step "[Using VCT, move empty MAGNASTOR VCC to transfer position in CTF and set down adjacent to MAGNATRAN cask. Set up appropriate work platforms/man lifts for access to top of VCC and MAGNATRAN]," the table indicates a distance of greater than two meters, and an associated dose rate of zero millirem per hour. Personnel will need to be closer than two meters to the MAGNATRAN package to set up work platforms around it, and other activities in the table list non-zero values for estimated dose for similar distances.
- The process steps "[Remove vent port cover and connect pressure test system to vent port to check for excessive pressure. If pressure is high, take sample and check. If clean vent to HEPA filter]," and "[Remove 48 MAGNATRAN lid bolts, install alignment pins and lid lifting hoist rings/slings and remove inner lid and store. Remove alignment pins]," both cite worker distances of half a meter. However, the table cites different dose fields for the same distance (50 millirem per hour for the first step, and 30 millirem per hour for the second).

These inconsistencies, and any others in the collective dose estimates of WCS CISF SAR Sections A.9, B.9, C.9, D.9, E.9, F.9, and G.9 of the WCS CISF SAR, should be revised or justified.

This information is needed to determine compliance with 10 CFR 20.1101(b).

Response to RAI NP-9-10:

The contamination and radiation surveys take place in two separate steps. The first, is performed with the personnel barrier in place, therefore working at >2m with dose rates of 10mrem/hr. The second set of contamination and radiation surveys take place after the personnel barrier is removed, therefore working at 1m with dose rates of 20 mrem/hr. Decontamination, if required, takes place when the personnel barrier and impact limiters have been removed. A statement will be added to SAR Tables E.9-1, F.9-1, and G.9-1 to clarify that decontamination will be added to the second contamination survey activity. During the review of these items, it was determined that a step to remove the security seal was also needed. SAR Tables E.9-1, F.9-1, and G.9-1 have been revised to add this step to the dose tables.

For process steps "Inspect top impact limiter security seal and verify it is intact and correct ID," and "Remove Personnel Barrier and complete surveys," the entries in the table noted in the RAI are not correct and should be 5 person-mrem and 20 person-mrem respectively. SAR Tables E.9-1, F.9-1, and G.9-1 have been revised accordingly. SAR Sections E.9, F.9.1.3, and G.9 have been updated to be consistent with the changes in the Tables.

With respect to set up of appropriate work platforms/man lifts for access to top of vertical concrete cask (VCC) and MAGNATRAN, the zero dose rates are correct. There will be semi-permanent scaffolding that is able to be moved into place once the transport cask is set into the unloading area.

The estimated dose rates for removing the vent port cover and connecting the pressure test system to the vent port to check for excessive pressure are different from those for removing lid bolts, installing alignment pins, and they originate on the inner lid due to the location of the port covers being inside of the lid bolt circle. The radial position dose rates increase moving toward the center of the cask. While the workers would be at the same area of the cask to perform each of these two activities, the removal of the port covers and connecting of the pressure test system would require the worker to reach slightly farther across the top of the cask. No changes to the table entries are required for these steps.

Impact:

SAR Sections E.9, F.9.1.3, and G.9; and Tables E.9-1, F.9-1, and G.9-1 have been revised as described in the response.

E.9 RADIATION PROTECTION

Chapter 5 of Reference E.9.3-1 provides the shielding evaluation of the NAC-MPC storage system. The system is provided in three configurations. The Yankee Class NAC-MPC is designed to store up to 36 Yankee Class spent fuel assemblies or Yankee Class reconfigured fuel assemblies and is referred to as the Yankee-MPC. The Connecticut Yankee-MPC, referred to as the CY-MPC, is designed to store up to 26 Connecticut Yankee spent fuel assemblies, CY-MPC reconfigured fuel assemblies or CY-MPC damaged fuel cans. The analysis of the Yankee Class spent fuel is performed using the SAS4 code series. The analysis of the Connecticut Yankee spent fuel is performed using the MCBEND code. Separate models are used for each of the fuel types.

The Dairyland Power Cooperative (DPC) La Crosse Boiling Water Reactor (LACBWR) MPC, referred to as MPC-LACBWR, is designed to store up to 68 LACBWR spent fuel assemblies, including up to 32 LACBWR damaged fuel cans. The shielding evaluation of the MPC-LACBWR system is presented in Appendix 5.A of Chapter 5 to Reference E.9.3-1.

The regulation governing spent fuel storage, 10 CFR 72, does not establish specific cask dose rate limits. However, 10 CFR 72.104 and 10 CFR 72.106 specify that for an array of casks in an Independent Spent Fuel Storage Installation (ISFSI), the annual dose to an individual outside the controlled area boundary must not exceed 25 mrem to the whole body, 75 mrem to the thyroid and 25 mrem to any other organ during normal operations. In the case of a design basis accident, the dose to an individual outside the area boundary must not exceed 5 rem to the whole body or any organ. The ISFSI must be at least 100 meters from the owner controlled area boundary. In addition, the occupational dose limits and radiation dose limits for individual members of the public in 10 CFR Part 20 (Subparts C and D) must be met. Reference E.9.3-1, Chapter 10, Section 10.3, demonstrates NAC-MPC compliance with the requirements of 10 CFR 72 with regard to annual and occupational doses at the owner controlled area boundary. Chapter 5 of Reference E.9.3-1 presents the shielding evaluations of the NAC-MPC storage system. Dose rate profiles are calculated as a function of distance from the side, top and bottom of the NAC-MPC storage and transfer casks. Shielded source terms from the NAC-MPC storage cask are calculated to establish owner controlled area boundary dose estimates due to the presence of the ISFSI.

Table E.9-1 provides estimated occupational exposures for receipt and handling of the YR-MPC, CY-MPC, and MPC-LACBWR at the WCS CISF. For each procedural step, the number of workers, occupancy time, worker distance, dose rates, and total dose are estimated. Dose rates used were obtained and estimated via the listed references in the table. The total occupational exposure for receiving, transferring and placing these canisters on the storage pad in their storage overpack (VCC) is 864 person-mrem each. The total collective dose for unloading a YR-MPC, CY-MPC or MPC-LACBWR canister from its VCC and preparing it for transport off-site is bounded by the loading operations (864 person-mrem). Operations for retrieving these canisters from the VCC and off-site shipment are identical to loading operations, except in reverse order.

All Indicated Changes are in response to RAI NP-9-10

Table E.9-1
Estimated Occupational Collective Dose for Receipt of NAC-STC Cask Loaded with YR-MPC, CY-MPC, or MPC-LACBWR TSC and Transfer to MPC VCC

8 Sheets

Process Step	Number of Workers	Occupancy Time (hours)	Worker Location Around Cask	Worker Distance (m)	Total Dose Rate (mrem/hr)	Total Dose (person-mrem)[1]	Reference SAR/FSAR Section/Table/Figure
Perform radiation and contamination survey of STC Cask.	2	0.5	All Around	2	4	2	SAR Figure 5.1-6, Figure 5.1-11, and Table 5.1-10
Inspect top impact limiter security seal and verify it is intact and correct ID.	1	0.25	Surface of Top Impact Limiter	<1	<1	1	SAR Figure 5.1-6, Figure 5.1-11, and Table 5.1-10
Remove Personnel Barrier and complete surveys.	2	0.5	Center of cask	1.5	15	15	SAR Figure 5.1-6, Figure 5.1-11, Figure 5.4-10, and Table 5.1-10
Remove Security Seal	*1*	*0.1*	*Top Impact Limiter Periphery*	*≥ 1*	*≤ 1*	*1*	*SAR Figure 5.1-6, Figure 5.1-11, Figure 5.4-10, and Table 5.1-10*
Visually inspect Cask surface for transport/road damage and record.	1	0.25	All Around	2	<4	1	SAR Figure 5.1-6, Figure 5.1-11, Figure 5.4-10, and Table 5.1-10
Attach slings to top Impact Limiter and remove attachment nuts/rods. Remove and store Impact Limiter.	2	0.5	Surface of Top Impact Limiter	1	< 1	1	SAR Figure 5.1-6, Figure 5.1-11, and Table 5.1-10

All Indicated Changes are in response to RAI NP-9-10

Table E.9-1
Estimated Occupational Collective Dose for Receipt of NAC-STC Cask Loaded with YR-MPC, CY-MPC, or MPC-LACBWR TSC and Transfer to MPC VCC

8 Sheets

Process Step	Number of Workers	Occupancy Time (hours)	Worker Location Around Cask	Worker Distance (m)	Total Dose Rate (mrem/hr)	Total Dose (person-mrem)[1]	Reference SAR/FSAR Section/Table/Figure
Attach slings to bottom Impact Limiter and remove attachment nots/rods. Remove and store Impact Limiter.	2	0.5	Surface of Bottom Impact Limiter	1	< 1	1	SAR Figure 5.1-6, Figure 5.1-11, and Table 5.1-10
Perform contamination survey of cask surfaces. If necessary, decontaminate the cask until acceptable smearable contamination levels are achieved.	*2*	*0.5*	*All Around*	*>1*	*≤ 20*	*20*	*SAR Figure 5.1-16, Figure 5.1-11, and Table 5.1-10*
Release Front Tie-Down Assembly.	2	1	Top Side STC Cask Surface	1	25	50	SAR Figure 5.1-6, Figure 5.1-11, Figure 5.4-10, and Table 5.1-10
Engage Vertical Cask Transporter (VCT) Lift Arms to Front Trunnions and rotate cask to vertical orientation.	2	1	Top Side STC Cask Surface	>2	5	10	SAR Figure 5.1-6, Figure 5.1-11, Figure 5.4-10, and Table 5.1-10

All Indicated Changes are in response to RAI NP-9-10

Table E.9-1
Estimated Occupational Collective Dose for Receipt of NAC-STC Cask Loaded with YR-MPC, CY-MPC, or MPC-LACBWR TSC and Transfer to MPC VCC

8 Sheets

Process Step	Number of Workers	Occupancy Time (hours)	Worker Location Around Cask	Worker Distance (m)	Total Dose Rate (mrem/hr)	Total Dose (person-mrem)[1]	Reference SAR/FSAR Section/Table/Figure
Using the VCT, lift and move loaded MPC VCC and position it in the designated storage location.	2	1	VCT Platform	>2	10	20	Operation performed from VCT and FSAR Figure 5.4.2-7
Prepare empty STC cask for empty return transport.	2	4	CTF	1	0	0	Empty cask preparation activities
				Total (person-mrem)		864	

Note:
1. Rounded up to the nearest whole number

Maximum dose rates for the standard or advanced transfer cask with a wet and dry canister cavity are shown in Table 5.1-3 of Reference F.9.2-1, for design basis PWR fuel. Under wet canister conditions, the maximum surface dose rates with design basis PWR fuel are 259 (<1%) mrem/hr on the cask side and 579 (<1%) mrem/hr on the cask bottom. The cask side average surface dose rate under wet conditions is 137 (<1%) mrem/hr, and the bottom average surface dose rate is 258 (<1%) mrem/hr. Under dry conditions, the maximum surface dose rates are 410 (<1%) mrem/hr on the cask side and 819 (<1%) mrem/hr on the cask bottom. Cask average surface dose rates are 306 (<1%) mrem/hr on the side and 374 (<1%) mrem/hr on the bottom. In normal operation, the bottom of the transfer cask is inaccessible during welding of the canister lids.

Maine Yankee Site-Specific fuel assembly configurations are either shown to be bounded by the analysis of the standard design basis fuel assembly configuration of the same type (PWR or BWR), or are shown to be acceptable contents by specific evaluation of the configuration.

Table F.9-1 provides estimated occupational exposures for receipt and handling of the NAC-UMS system loaded with PWR fuel at the WCS CISF. For each procedural step the number of workers, occupancy time, worker distance, dose rates, and total dose are estimated. Dose rates used were obtained and estimated via the listed references in the table. The total occupational exposure for receiving, transferring and placing these canisters on the storage pad in their storage overpack (VCC) is 883 person-mrem each.

The total collective dose for unloading a NAC-UMS PWR canister from its VCC and preparing it for transport off-site is bounded by the loading operations (883 person-mrem). Operations for retrieving these canisters from the VCC and off-site shipment are identical to loading operations, except in reverse order. The collective dose for unloading is bounded because during storage at the WCS CISF the source terms will have decayed reducing surface dose rates. The total collective dose is the sum of the receipt, transfer, retrieval, and shipment is 1,728 person-mrem.

All Indicated Changes are in response to RAI NP-9-10

Table F.9-1
Estimated Occupational Collective Dose for Receipt of NAC Universal Transport Cask Loaded with PWR SNF in Class 1 or 2 TSC and Transfer to UMS Class 1 or Class 2 VCC
6 Sheets

Process Step	Number of Workers	Occupancy Time (hours)	Worker Location Around Cask	Worker Distance (m)	Total Dose Rate (mrem/hr)	Total Dose (person-mrem)[1]	Reference SAR/FSAR Section/Table/Figure
Perform radiation and contamination survey of UTC	2	0.25	All Around UTC Cask	>2	10	5	SAR Figure 5.1-1 and Table 5.1-1
Inspect top and bottom impact limiter security seals and verify they are intact and correct IDs.	1	0.5	Top and Bottom Impact Limiters	>1	<6	3	SAR Figure 5.1-1 and Table 5.1-1
Remove Security Seal	*1*	*0.1*	*Top Impact Limiter Periphery*	*>1*	*<1*	*1*	*SAR Figure 5.1-1 and Table 5.1-1*
Remove Personnel Barrier and complete surveys	2	0.5	Center of cask	>1	<20	20	SAR Figure 5.1-1 and Table 5.1-1
Visually inspect UTC Cask surface for transport/road damage and record	1	0.25	All Around UTC Cask	2	10	3	SAR Figure 5.1-1 and Table 5.1-1
Attach slings to top Impact Limiter and remove attachment nuts/rods. Remove and store Impact Limiter. Remove and store front impact limiter positioner and screws.	2	1	Top Impact Limiter Surface of UTC	1	< 1	2	SAR Figure 5.1-1 and Table 5.1-1
Attach slings to bottom Impact Limiter and remove attachment nots/rods. Remove and store Impact Limiter. Remove and store bottom impact limiter positioner and screws.	2	1	Bottom Impact Limiter Surface of UTC	1	6	12	SAR Figure 5.1-1 and Table 5.1-1
Release Front Tie-Down Assembly	2	1	Top Side UTC Surface	>1	50	100	SAR Figure 5.1-1 and Table 5.1-1

All Indicated Changes are in response to RAI NP-9-10

Table F.9-1
Estimated Occupational Collective Dose for Receipt of NAC Universal Transport Cask Loaded with PWR SNF in Class 1 or 2 TSC and Transfer to UMS Class 1 or Class 2 VCC
6 Sheets

Process Step	Number of Workers	Occupancy Time (hours)	Worker Location Around Cask	Worker Distance (m)	Total Dose Rate (mrem/hr)	Total Dose (person-mrem)[1]	Reference SAR/FSAR Section/Table/Figure
Perform contamination survey of cask surfaces. If necessary, decontaminate the cask until acceptable smearable contamination levels are achieved.	*2*	*0.5*	*All Around UTC Cask*	*>1*	*<20*	*20*	*SAR Figure 5.1-1 and Table 5.1-1*
Engage Vertical Cask Transporter (VCT) Lift Arms to Primary Front Trunnions and rotate cask to vertical orientation	2	1	Top Side UTC Surface	>2	10	20	SAR Figure 5.1-1 and Table 5.1-1
Lift and Remove UTC from the Transport Skid Rear Rotation Trunnions and move cask to gantry Canister Transfer Facility (CTF), set cask down and release VCT Lift Arms. Establish Radiation Control boundaries.	2	2	Top Side UTC Surface	>2	10	40	SAR Figure 5.1-1 and Table 5.1-1
Using VCT, move empty UMS VCC (Class 1 or 2, as required) to transfer position in CTF and set down adjacent to UTC cask. Set up appropriate work platforms/man lifts for access to top of VCC and UTC.	2	1	Top of Empty VCC	>2	0	0	Empty VCC
Remove VCC Lid and bolts, and VCC Shield Plug.	2	1	Top of Empty VCC	1	0	0	Empty VCC

All Indicated Changes ar[illegible] response to RAI NP-9-10

Table F.9-1
Estimated Occupational Collective Dose for Receipt of NAC Universal Transport Cask Loaded with PWR SNF in Class 1 or 2 TSC and Transfer to UMS Class 1 or Class 2 VCC
6 Sheets

Process Step	Number of Workers	Occupancy Time (hours)	Worker Location Around Cask	Worker Distance (m)	Total Dose Rate (mrem/hr)	Total Dose (person-mrem)[1]	Reference SAR/FSAR Section/Table/Figure
Install the VCC Shield Plug.	2	0.5	Top of VCC	1	25	35	Operation performed on top of VCC Figure 5.4-5
Install and bolt in place the VCC lid.	2	1	Top of VCC	1	25	50	Operation performed on top of VCC Figure 5.4-5
Using the VCT, lift and move loaded UMS VCC and position it in the designated storage location.	2	1	VCT Platform	>4	10	20	Operation performed from VCT and FSAR Figure 5.4-2
Remove installed transport cavity spacer and place in approved IP-1 container. Prepare empty UTC cask for empty return transport. Transfer and rotate UTC on the transport/shipping frame. Install transport tie-downs and impact limiters.	3	9	CTF/VCT/Rail Car	1 to 4	0	0	Empty cask preparation activities
					Total (person-mrem)	883	

Note:
1. Rounded up to the nearest whole number

All Indicated Changes are in response to RAI NP-9-10

PWR fuel assemblies may contain nonfuel hardware – i.e., reactor control components (RCCs), burnable poison rod assemblies (BPRAs), guide tube plug devices (GTPDs), neutron sources/neutron source assemblies (NSAs), hafnium absorber assemblies (HFRAs), instrument tube tie components, in-core instrument thimbles, and steel rod inserts (used to displace water from the lower section of guide tubes), and components of these devices, such as individual rods. The analysis shows that for the design basis fuel, the system meets the requirements of 10 CFR 72.104 and 10 CFR 72.106 and complies with the requirements of 10 CFR 20 with regard to annual and occupational doses at the owner-controlled area boundary.

Minimum cool times prior to fuel transfer and storage are specified as a function of minimum assembly average fuel enrichment and maximum assembly average burnup (MWd/MTU). To minimize the number of loading tables, PWR and BWR fuel assemblies are grouped by bounding fuel and hardware mass. Key characteristics of each assembly grouping are shown in Section 5.2 of Reference G.9-1. Refer to Section 5.8.9 of Reference G.9-1 for detailed loading tables meeting the system heat load limits.

Source terms for the various vendor-supplied fuel types are generated using the SCALE 4.4 sequence as discussed in Section 5.2 of Reference G.9-1. Three-dimensional MCNP shielding evaluations provide dose rates for transfer and concrete casks at distances up to four meters. NAC-CASC, a modified version of the SKYSHINE-III code, calculates site boundary dose rates for either a single cask or cask array. See Section 5.6 of Reference G.9-1 for more detail on the shielding codes.

Table G.9-1 provides estimated occupational exposures for receipt and handling of the NAC-MAGNASTOR system loaded with PWR fuel at the WCS CISF facility. For each procedural step the number of workers, occupancy time, worker distance, dose rates, and total dose are estimated. Dose rates used were obtained and estimated via the listed references in the table. The total occupational exposure for receiving, transferring and placing these canisters on the storage pad in their storage overpack (VCC) is 1,035 person-mrem each.

The total collective dose for unloading a NAC-MAGNASTOR PWR canister from its VCC and preparing it for transport off-site is bounded by the loading operations (1,035 person-mrem). Operations for retrieving these canisters from the VCC and off-site shipment are identical to loading operations, except in reverse order. The collective dose for unloading is bounded because during storage at the WCS CISF the source terms will have decayed reducing surface dose rates. The total collective dose is the sum of the receipt, transfer, retrieval, and shipment is 2,046 person-mrem.

All Indicated Changes are in response to RAI NP-9-10

Table G.9-1
Estimated Occupational Collective Dose for Receipt of NAC MAGNATRAN Cask Loaded with PWR SNF in MAGNASTOR TSC and Transfer to MAGNASTOR VCC
7 Sheets

Process Step	Number of Workers	Occupancy Time (hours)	Worker Location Around Cask	Worker Distance (m)	Total Dose Rate (mrem/hr)	Total Dose (person-mrem)[1]	Reference SAR/FSAR Table/Figure
Perform radiation and contamination survey of MAGNATRAN Cask.	*1*	0.5	All Around MAGNATRAN Cask	>2	10	*5*	SAR Figure 5.1-1, Table. 5.1-3, Figure 5.8-7, Figure 5.8-11, Figure 5.8-14, Figure 5.8-15
Inspect top impact limiter security seal and verify it is intact and correct ID.	1	*0.1*	Top Impact Limiter *Periphery*	>1	*<1*	1	SAR Figure 5.1-1, Table. 5.1-3, Figure 5.8-7, Figure 5.8-11, Figure 5.8-14, Figure 5.8-15
Remove Security Seal	*1*	*0.1*	*Top Impact Limiter Periphery*	*≥1*	*<1*	*1*	*SAR Figure 5.1-1, Table 5.1-3, Figure 5.8-7, Figure 5.8-11, Figure 5.8-14, and Figure 5.8-15*
Remove Personnel Barrier	2	0.5	Center of MAGNATRAN Cask	1	<20	*20*	SAR Figure 5.1-1, Table. 5.1-3, Figure 5.8-7, Figure 5.8-11, Figure 5.8-14, Figure 5.8-15
Attach slings to top Impact Limiter and remove 32 retention nuts/rods. Remove and store Impact Limiter.	2	1	Top of MAGNATRAN Cask	>1	< 5	10	SAR Figure 5.1-1, Table. 5.1-3, Figure 5.8-7, Figure 5.8-11, Figure 5.8-14, Figure 5.8-15
Attach slings to bottom Impact Limiter and remove 32 retention nuts/rods. Remove and store Impact Limiter.	2	1	Bottom of MAGNATRAN Cask	>1	< 5	10	SAR Figure 5.1-1, Table. 5.1-3, Figure 5.8-7, Figure 5.8-11, Figure 5.8-14, Figure 5.8-15

All Indicated Changes are in response to RAI NP-9-10

Table G.9-1
Estimated Occupational Collective Dose for Receipt of NAC MAGNATRAN Cask Loaded with PWR SNF in MAGNASTOR TSC and Transfer to MAGNASTOR VCC
7 Sheets

Process Step	Number of Workers	Occupancy Time (hours)	Worker Location Around Cask	Worker Distance (m)	Total Dose Rate (mrem/hr)	Total Dose (person-mrem)[1]	Reference SAR/FSAR Table/Figure
Perform contamination survey of cask surfaces. If necessary, decontaminate the cask until acceptable smearable contamination levels are achieved.	*2*	*0.5*	*Top, side, and bottom of MAGNATRAN*	*>1*	*<20*	*20*	*SAR Figure 5.1-1, Table 5.1-3, Figure 5.8-7, Figure 5.8-11, Figure 5.8-14, and Figure 5.8-15*
Visually inspect MAGNATRAN Cask surface for transport/road damage and record.	*1*	*0.25*	*All Around Cask*	*≥4*	*2.5*	*1*	*SAR Figure 5.1-1, Table. 5.1-3, Figure 5.8-7, Figure 5.8-11, Figure 5.8-14, Figure 5.8-15*
Release Front Tie-Down Assembly.	2	1	Top Side MAGNATRAN Cask Surface	1	50	100	SAR Figure 5.1-1, Table. 5.1-3, Figure 5.8-7, Figure 5.8-11, Figure 5.8-14, Figure 5.8-15
Remove front trunnion plugs and bolts, and ring segments, and store.	2	0.5	Top Side MAGNATRAN Cask Surface	1	50	50	SAR Figure 5.1-1, Table. 5.1-3, Figure 5.8-7, Figure 5.8-11, Figure 5.8-14, Figure 5.8-15
Install front trunnions and bolts and torque to specified value.	2	1	Top Side MAGNATRAN Cask Surface	1	50	100	SAR Figure 5.1-1, Table. 5.1-3, Figure 5.8-7, Figure 5.8-11, Figure 5.8-14, Figure 5.8-15
Engage Vertical Cask Transporter (VCT) Lift Arms to Front Trunnions and rotate cask to vertical orientation on rear rotation trunnions.	2	1	Top Side MAGNATRAN Cask Surface	>2	10	20	SAR Figure 5.1-1, Table. 5.1-3, Figure 5.8-7, Figure 5.8-11, Figure 5.8-14, Figure 5.8-15

All Indicated Changes are in response to RAI NP-9-10

Table G.9-1
Estimated Occupational Collective Dose for Receipt of NAC MAGNATRAN Cask Loaded with PWR SNF in MAGNASTOR TSC and Transfer to MAGNASTOR VCC
7 Sheets

Process Step	Number of Workers	Occupancy Time (hours)	Worker Location Around Cask	Worker Distance (m)	Total Dose Rate (mrem/hr)	Total Dose (person-mrem)[1]	Reference SAR/FSAR Table/Figure
Lift and Remove MAGNATRAN from the Transport Skid Rear supports and move cask to gantry Canister Transfer Facility (CTF), set cask down and release VCT Lift Arms. Establish Radiation Control boundaries.	2	2	Top Side MAGNATRAN Cask Surface	>2	10	40	SAR Figure 5.1-1, Table. 5.1-3, Figure 5.8-7, Figure 5.8-11, Figure 5.8-14, Figure 5.8-15
Using VCT, move empty MAGNASTOR VCC to transfer position in CTF and set down adjacent to MAGNATRAN cask. Set up appropriate work platforms/man lifts for access to top of VCC and MAGNATRAN.	2	1	Top Of Empty MAGNASTOR VCC	>4	2.5	5	Empty VCC */ Loaded MAGNATRAN*
Remove VCC Lid and bolts, and VCC Shield Plug.	2	1	Top Of Empty MAGNASTOR VCC	1	0	0	Empty VCC
Install Transfer Adapter on VCC and connect hydraulic system.	2	1	Top Of Empty MAGNASTOR VCC	1	0	0	Empty VCC

All Indicated Changes are in response to RAI NP-9-10

Table G.9-1
Estimated Occupational Collective Dose for Receipt of NAC MAGNATRAN Cask Loaded with PWR SNF in MAGNASTOR TSC and Transfer to MAGNASTOR VCC
7 Sheets

Process Step	Number of Workers	Occupancy Time (hours)	Worker Location Around Cask	Worker Distance (m)	Total Dose Rate (mrem/hr)	Total Dose (person-mrem)[1]	Reference SAR/FSAR Table/Figure
Remove vent port cover and connect pressure test system to vent port to check for excessive pressure. If pressure is high, take sample and check. If clean vent to HEPA filter.	1	0.5	Top of Cask	0.5	50	25	FSAR Table 5.1.3-1, FSAR Section 5.8.3.3.2 + MAGNATRAN Closure Lid Thickness 7.75 in.
Remove 48 MAGNATRAN lid bolts, install alignment pins and lid lifting hoist rings/slings and remove inner lid and store. Remove alignment pins.	2	1	Top of Cask	0.5	30	60	FSAR Table 5.1.3-1, FSAR Section 5.8.3.3.2 + MAGNATRAN Closure Lid Thickness 7.75 in.
Install adapter ring to inner lid recess and torque captured bolts.	2	0.5	Top of Cask	0.5	30	30	FSAR Table 5.1.3-1, FSAR Section 5.8.3.3.2 Remote operation from side of MAGNATRAN
Install transfer adapter plate on adapter ring and install and torque the four transfer adapter plate bolts.	2	1	Top of Cask	1	15	30	FSAR Table 5.1.3-1, FSAR Section 5.8.3.3.2 Remote operation from side of MAGNATRAN
Install TSC Lid Lifting Adapter Plate and bolts on the MAGNASTOR Closure Lid, and torque to specified value.	2	1	Top of Cask	0.5	75	150	FSAR Table 5.1.3-1, FSAR Section 5.8.3.3.2 Remote operation from side of MAGNATRAN

All Indicated Changes are in response to RAI NP-9-10

Table G.9-1
Estimated Occupational Collective Dose for Receipt of NAC MAGNATRAN Cask Loaded with PWR SNF in MAGNASTOR TSC and Transfer to MAGNASTOR VCC
7 Sheets

Process Step	Number of Workers	Occupancy Time (hours)	Worker Location Around Cask	Worker Distance (m)	Total Dose Rate (mrem/hr)	Total Dose (person-mrem)[1]	Reference SAR/FSAR Table/Figure
Using the CTF crane, lower the appropriate MAGNASTOR Transfer Cask (MTC) and set it down on the transfer adapter on the MAGNATRAN Cask.	2	1.5	Top of Cask	>4	<1	3	Remote handling operation
Remove lock pins and open shield doors with hydraulic system.	1	0.5	Top of Cask	1	15	8	FSAR Table 5.1.3-1, FSAR Section 5.8.3.3.2 + 2 inch TSC Lid Lift Adapter Plate Remote operation from side of MTC/MAGNATRAN
Using the CTF, lower the Air-Powered Chain Hoist hook through the MTC and engage to the TSC Lift Adapter Plate.	2	1.5	Remote Operating Location	>4	<5	15	Remote operation using CTF mounted cameras
Using the Chain Hoist System slowly lift the TSC into the MTC.	2	1	Remote Operating Location	>4	<5	10	Remote operation using CTF mounted cameras
Close the MTC shield doors and install lock pins.	1	0.5	Bottom of MTC	0.5	30	15	Operation from side of MTC FSAR Section 5.8.3.3.2 and Figure 5.8.3-17
Lower the TSC onto the shield doors and using the CTF, lift the MTC off of the MAGNATRAN transfer adapter plate.	2	1	Remote Operating Location	>4	<5	10	Remote operation using CTF mounted cameras

All Indicated Changes ar[illegible] response to RAI NP-9-10

Table G.9-1
Estimated Occupational Collective Dose for Receipt of NAC MAGNATRAN Cask Loaded with PWR SNF in MAGNASTOR TSC and Transfer to MAGNASTOR VCC
7 Sheets

Process Step	Number of Workers	Occupancy Time (hours)	Worker Location Around Cask	Worker Distance (m)	Total Dose Rate (mrem/hr)	Total Dose (person-mrem)[1]	Reference SAR/FSAR Table/Figure
Unbolt and remove TSC Lift Adapter Plate from the top of the TSC and store.	2	1	Top of MAGNASTOR TSC	1	75	150	FSAR Figure 5.8.3-20 and operation performed on top of transfer adapter mounted on VCC
Using mobile crane, remove transfer adapter plate from VCC and store.	2	1	Top of MAGNASTOR VCC	1	10	20	Remote operation using CTF mounted cameras after connection of lifting slings
Install and bolt in place the VCC lid.	2	1	Top of MAGNASTOR VCC	1	25	50	Operation performed from top of VCC Figure 5.8.3-10
Using the VCT, lift and move loaded UMS VCC and position it in the designated storage location.	2	1	VCT Platform	>4	10	20	Operation performed from VCT and FSAR Figure 5.8.3-8
Prepare empty MAGNATRAN cask for empty return transport. Transfer and rotate to horizontal MAGNATRAN cask on the transport/shipping frame. Install transport tie-downs, impact limiters and personnel barrier.	3	9	CTF/VCT/Rail Car	1 to 4	0	0	Empty cask preparation activities
					Total (person-mrem)	1,035	

Note:

1. Rounded up to the nearest whole number.

All Indicated Changes ar... response to RAI NP-9-10

SAR Chapter 11 "Confinement Evaluation"

RAI NP-11-1:

Provide information on corrective actions that would be taken if leak testing does not meet acceptance criteria for the post transportation leakage testing performed at the WCS CISF.

In response to RSI P-9-1, "Description of actions that will be taken if a leakage rate test does not meet the acceptance criterion in a post transport package evaluation," the applicant stated: "Although the procedure does not specify what actions will be taken should testing fail to satisfy an acceptance criterion, the Quality Assurance program implementing procedure on Test Control dictates that test failure will be managed through the corrective program. This will be defined within operational test procedures prior to implementation."

To enable the NRC staff to assess the corrective actions taken at the WCS CISF, the applicant should describe in detail the corrective actions taken for each type of cask system to ensure that the confinement safety is maintained.

This information is needed to determine compliance with 10 CFR 72.24(e) and (l).

Response to RAI NP-11-1:

RAI NP-11-4 provides information about the corrective actions that would be taken if leak testing does not meet the acceptance criteria for the post transportation leakage testing to be performed at the WCS CSIF. As discussed in the response to RAI NP-11-4, non-conforming canisters will need to be evaluated on a case-by-case basis and the specific conditions of the canister.

Impact:

No change as a result of this RAI.

RAI NP-11-2:

Provide (a) a limit for the release of radioactive gas (volume) for the gas sampling performed for each of the canister types to be received at the WCS CISF and (b) guidance to prevent/minimize risks caused by the release of radioactive gas during gas sampling, taking into account ALARA concerns.

In its response to RSI 9.4, the applicant stated that the likelihood of releasing radioactive gases during post-transport sampling is small because canisters are seal welded and tested to assure compliance with the leaktight standard of ANSI N14.5 or equivalent. The exceptions to this are FO-, FC- and FF-DSCs that were leak-tested to a leakage rate of 10^{-5} ref-cm^3/sec.

Even though the likelihood of the release of radioactive gases is small, the applicant should provide the limit on the volume of radioactive gas to be released for each of the canister types received at the WCS CISF and guidance to prevent/minimize risk caused by the releasing radioactive gases during gas sampling, taking into account ALARA concerns.

This information is needed to determine compliance with10 CFR 72.24(e).

Response to RAI NP-11-2:

The release of radioactive material into the space between the canister and cavity inside the sealed transportation cask is a beyond design basis event. As discussed in the response to RAI NP-11-4, the canister has been shown to maintain confinement under all normal, off-normal, and accident conditions for storage and the WCS CISF SAR includes evaluations that demonstrate that the canisters maintain confinement under all normal conditions of transport (NCT). Therefore, release of radioactive material is not a credible event and does not require further evaluation.

Impact:

No change as a result of this RAI.

RAI NP-11-3:

Explain the gas sampling process in sufficient detail to demonstrate that gas sampling would be appropriately performed during post-transportation verification of canisters received at the WCS CISF.

The applicant proposed License Condition No. 22, which would provide that "Prior to removing the shipping cask closure lid, the gas inside the shipping cask shall be sampled to verify that the canister confinement boundary is intact to the extent reasonably practicable by this test."

However, a description of the gas sampling process is not provided in the application (e.g., QP-10.02) and the applicant did not describe:

(a) Whether gas sampling would be performed for each canister or just a certain number of the "bounding" canisters from each site of origin. The applicant should clarify whether the canister selection basis for post-transportation verification described in Section 5.2 of QP-10.02 is applicable to gas sampling;

(b) What rationale is used for not performing sampling for all canisters received at the WCS CISF;

(c) The acceptance criteria (e.g., gas volume/concentration) for gas sampling performed on the canisters received at the WCS CISF.

This information is needed to determine compliance with 10 CFR 72.24(e) and 72.44(c)(1)(i).

Response to RAI NP-11-3:

Response to Item a:

In response to RAI PLC-2, Condition 22 has been updated to clarify that Post-Transportation Verification shall include an evacuated volume helium lead test on 100% of the canisters that are received at the WCS CISF. The gas inside a shipping cask will only be sampled for radioactive gas if required by its 10 CFR Part 71 Certificate of Compliance.

ISP Procedure, QP-10.02, "Post Transport Package Evaluation," Section 5.1.3 states: "The visual inspection of the two canisters that are identified using Electric Power Research Institute (EPRI) report, Susceptibility Assessment Criteria for Chloride-Induced Stress Corrosion Cracking (CISCC) of Welded Stainless Steel Canisters for Dry Cask Storage Systems (Report No. 3002005371, September 2015) as likely needing inspections and enhanced monitoring from each reactor and/or ISFSI site combined with the helium leak check of 100% of the canisters that are received at the WCS CISF form a robust Post-Transportation Package Evaluation program that provides reasonable assurance that the canister confinement barrier remains intact and that the canister remains able to perform its safety function and is therefore acceptable to place back into storage at the WCS CISF."

Response to Item b:

Electric Power Research Institute (EPRI) report, Susceptibility Assessment Criteria for Chloride-Induced Stress Corrosion Cracking (CISCC) of Welded Stainless Steel Canisters for Dry Cask Storage Systems (Report No. 3002005371, September 2015), states that: "Only a subset of [Dry Cask Storage Systems] (DCSSs) using welded stainless steel (SS) canisters is likely to need inspections and enhanced monitoring programs in order to detect potential CISCC initiation and propagation prior to through wall growth."

The EPRI Susceptibility Assessment Criteria for CISCC of Welded Stainless Steel Canisters for DCSSs report identifies a set of criteria that may be used to rank welded SS canisters at ISFSIs with regard to the relative priority for inspections. The report summarizes the major factors that affect the susceptibility of stainless steel dry storage canisters to atmospheric CISCC. It then develops assessment criteria based on these factors. Criteria and associated numerical ranking values are developed for both the relative CISCC susceptibility of ISFSIs and of different canisters at a given ISFSI.

Through the evaluation and grading of each canister's susceptibility to CISCC, ISP will have the ability to assess all canister from each generating facility. Using these assessments, ISP will perform visual examination of the two canister most likely to present CISCC. Additionally, all canisters will have helium leak testing performed in accordance with ISP Procedure QP-10.02. Post Transport Package Evaluation.

This inspection program is informed by the design basis for the canisters and consideration of radiological dose expenditures to site personnel.

Response to Item c:

Helium is present in the atmosphere at very small amounts (about 5 parts per million in normal air). The final two steps are to purge and evacuate the interstitial space and while monitoring the evacuated space with the helium mass spectrometer leak detection unit for the required period of time necessary to confirm that the canister is meeting performance specifications (10^{-9} atm·cm^3/s).

References:

1. Susceptibility Assessment Criteria for Chloride-Induced Stress Corrosion Cracking (CISCC) of Welded Stainless Steel Canisters for Dry Cask Storage Systems (Report No. 3002005371, September 2015).

2. ISP Procedure, QP-10.02, "Post Transport Package Evaluation," Revision 2.

3. EOS01-0105, Procurement Specification for the NUHOMS EOS-37PTH Dry Shielded Canisters.

4. ANSI N14.5-1997, "Leakage Test on Packages for Shipment for Radioactive Materials."

5. ASNT SNT-TC-1A, "Personnel Qualification and Certification in Nondestructive Testing," 2006 Edition.

Impact:

No change as a result of this RAI.

RAI NP-11-4:

Provide a deadline by which to return a canister to the place of origin, or other facility licensed to perform fuel loading procedures, in License Application, Appendix A, "Proposed Technical Specifications.", if the canister does not pass the gas sampling testing and the post-transportation leakage testing acceptance criterion and therefore cannot be stored at the WCS CISF. If a deadline is not specified, the application should discuss how storage of such canisters is considered and accounted for in the site's safety analyses (e.g. normal and accident doses due to confinement and shielding, thermal time limits) and operating procedures.

The applicant needs to provide the information for each type of canister or each type of cask system used at the WCS CISF.

This information is needed to determine compliance with 10 CFR 72.24(g) and 72.44(c)(1).

Response to RAI NP-11-4:

The timeline by which a canister will be returned to the place of origin, or to another facility licensed to perform fuel loading procedures, will depend on the specific corrective actions required to address the condition identified by the corrective action evaluation performed. As discussed below, this event will be extremely rare and will not result in a number of canisters with this condition.

The design and licensing basis for all of the canisters acceptable for storage at the CISF is that confinement is maintained for all normal, off-normal, and accident conditions of storage at the originating site and during storage at the WCS CISF. In addition, the design and licensing basis for the WCS CISF demonstrates that the canisters maintain confinement for all normal conditions of transport in the transportation cask used to transport the canister to the CISF. Therefore, there is no credible scenario under which a canister will fail the post-transportation leakage test. The post-transportation leakage test is not part of the design or licensing basis for the continued integrity of the confinement boundary for the canisters rather, as described in SAR Section 5.1.3.1, it is a prudent measure being taken to confirm that a canister remains able to perform its safety function and is, therefore, acceptable for storage at the WCS CISF.

In order to ensure that only conforming canisters are shipped to the WCS CISF, Section 1.2.4 of the SAR and Condition 9 of the proposed Materials License for the WCS CISF describe in detail the canisters that are acceptable for storage at the CISF. SAR Section 1.2.4.2, "Pre-Shipment Review of Canisters," describes the process that ISP will use to verify that every spent fuel canister received at the WCS CISF complies with the terms, conditions of use, and technical specifications of one of the six storage systems listed in Section 2.1 of the Technical Specifications, when stored in the canister's approved overpack. ISP will not provide its permission to a shipper to release a canister for shipment to the CISF until it has been confirmed that the canister meets the requirements. In accordance with 10 CFR 73.37(b)(1)(ii), the shipper must "coordinate shipment itineraries to ensure that the receiver [IPS] at the final delivery point is present to accept the shipment."

Finally, in the highly unlikely event that a non-conforming canister is found as part of receipt inspection, the canister will be placed in a safe condition and the issue will be entered into the ISP Corrective Action Program and the corrective action would be subject to a reportability determination in accordance with 10 CFR Part 21, 10 CFR 72.242, 10 CFR Part 71.95, and 49 CFR Part 171.15 among other regulations. The ISP reportabiity determination procedure provides the regulatory requirements for reporting to the appropriate agency, including deadlines for such notifications. The non-conforming canister will need to be evaluated on a case-by-case basis, and depending on the specific conditions of the canister. The canister will be immediately placed in a safe condition and, following the applicable evaluations the appropriate licensing actions, will be initiated to resolve the situation. The corrective actions will include, but not be limited to, the following:

1. Notify the NRC as required. Conferring with the NRC as needed.
2. Maintain the canister inside the transportation cask in its transportation configuration until appropriate corrective actions are determined. The safety for temporary storage will be confirmed using Part 71 analysis as appropriate.
3. Develop a specific action plan with a specific timeframe which will include input from the NRC discussions.
4. Obtain agency approvals as necessary.
5. Proceed with corrective actions within the timeframes specified.

Impact:

No change as a result of this RAI.

SAR Chapter 12, "Accident Analysis"

RAI NP-12-1:

Provide a conclusion for the fire and explosion analysis in WCS CISF SAR Appendix A.12.2.5.

State whether the analysis in the Rancho Seco SAR Section 8.2.5, "Fire" is the same or bounding for the WCS site.

This information is needed to determine compliance with 10 CFR 72.122 (c).

Response to RAI NP-12-1:

Section A.12.2.5 has been modified in order to provide a conclusion for the fire and explosion analysis.

The maximum amount of fuel allowed in the Cask Handling Building (CHB) or on the storage pad(s) in the vicinity of the NUHOMS® storage overpacks is limited by administrative procedure in accordance with the Technical Specifications (TS), which provides a limit of 300 gallons of diesel fuel for transfer and storage operations involving the NUHOMS® Systems. Therefore, the fire evaluated in Section 8.2.5 of Volume I of the "Rancho Seco Independent Spent Fuel Storage Installation Safety Analysis Report," NRC Docket No. 72-11, Revision 4. (Reference [A.12-1] of the SAR) is the same as the worst-case fire at the WCS CISF.

Impact:

SAR Section A.12.2.5 has been revised as described in the response.

Accident Analysis

Should lightning strike in the vicinity of the HSM the normal storage operations of the HSM will not be affected. The current discharged by the lightning will follow the low impedance path offered by the surrounding structures or the grounding system installed around each block of HSMs. The heat or mechanical forces generated by current passing through the higher impedance concrete will not damage the HSM. Since the HSM requires no equipment for its continued operation, the resulting current surge from the lightning will not affect the normal operation of the HSM.

Since no accident conditions will develop as the result of a lightning strike near the HSM, no corrective action would be necessary. In addition, there would be no radiological consequences

A.12.2.5 Fire and Explosion

Cause of Accident

Sections 3.3.6 and 8.2.5 of Volume I of [A.12-1] provide the potential sources of fire and explosion that may occur at the WCS CISF. *As described in Section 3.3.6, the CHB does not contain permanent flammable material other than some electrical and electronic components. The maximum amount of fuel in the CHB or on the Storage Pad(s) in the vicinity of the NUHOMS® Storage Overpacks is limited by administrative procedure in accordance with the Technical Specifications which provides a 300 gallon of diesel fuel limit for transfer and storage operations involving the NUHOMS®-MP187 System. Therefore, the fire evaluated in Section 8.2.5 of Volume I of [A.12-1] is the same as the worst case fire at the WCS CISF. Any fire involving a canister in a HSM would be bounded by the fire analyzed for the canister in a transfer cask. Direct engulfment of the HSM is not credible and the concrete HSM acts as a significant insulating firewall to protect the canister from the high temperatures of the fire. Explosions are not considered credible in the CHB since no explosive materials are present.*

Accident Analysis

The structural, thermal, and radiological consequences and the recovery measures required to mitigate a fire accident are addressed in Section 8.2.5 of Volume I of [A.12-1]. *Section 8.2.5 of Volume I of [A.12-1] also demonstrates that the MP187 cask performs its safety functions during and after the postulated fire/explosion accident.* Per Section 8.2.5.3 of Volume I of [A.12-1] the maximum flammable fuel either during the transfer operation or inside the WCS CISF is 300 gallons of diesel fuel.

All Indicated Changes are in response to RAI NP-12-1

RAI NP-12-2:

Provide accident analysis for the GTCC systems that address drop accidents, floods, lightning, tornado and wind missiles, and tip over for the NAC GTCC systems.

WCS CISF SAR Appendix H.8 addresses earthquakes and fire/explosion, but none of the other accidents listed are analyzed for the GTCC systems.

This information is needed to determine compliance with 10 CFR 72.122(b).

Response to RAI NP-12-2:

Accident analyses for the greater than Class C (GTCC) systems that address drop accidents, floods, lightning, tornado and wind missiles, and tip over have been incorporated into Appendix H by reference.

Specifically, Section H.8.2 has been revised to add a paragraph to state that since the structural design criteria for the GTCC storage systems used at WCS CISF are the same as the structural design criteria used for the storage systems listed in Table 1-1, the results of the accident analyses for the storage systems (which include drop accidents, floods, lightning, tornados and wind missiles, and tip-over) bound the results for the same accidents involving the GTCC storage systems. The statement will further clarify that these accident analyses are presented in Appendix A.12 (NUHOMS®-MP187 Cask System), Appendix E.12 (NAC-MPC), Appendix F.12 (NAC-UMS) and Appendix G.12 (NAC-MAGNASTOR).

Impact:

SAR Section H.8.2 has been revised as described in the response.

H.8.2 Accident Analyses for the WCS CISF

The accident conditions are listed in Table 1-2 of this SAR. The various GTCC waste canisters are comparable to the SNF canisters for the associated Cask System listed in Table 1-1 of this SAR for the parameters provided in Section H.8.1 above. Accident pressurization is not considered a credible event due to the very low heat load of the GTCC waste canisters.

Since the structural design criteria for the GTCC storage systems used at WCS CISF are the same as the structural design criteria used for the storage systems listed in Table 1-1, the results of the accident analyses for the storage systems (which include drop accidents, floods, lightning, tornados and wind missiles, and tip-over) bound the results for the same accidents involving the GTCC storage systems. These accident analyses are presented in Appendix A.12 (NUHOMS®-MP187 Cask System), Appendix E.12 (NAC-MPC), Appendix F.12 (NAC-UMS), and Appendix G.12 (NAC-MAGNASTOR).

H.8.2.1 Accidental GTCC Canister/Cask Drop

Section 5.2.2 of the Technical Specifications [H.8-1] addresses required inspections following a cask drop.

H.8.2.2 GTCC Canister Leakage

The various GTCC canister shells are designed with pressure retaining features to prevent leakage of contaminated materials. There are no credible conditions that can breach the canister shell or fail the welds at each end of the canisters. The GTCC waste closure lid welds are multi-pass closure welds and are the same as closure welds for canisters loaded with SNF. Performance of a multi-pass closure weld on GTCC waste canisters ensures no leakage path through the closure lid to shell weld. Some of the canisters also include a redundant closure lid with multi pass welds providing an additional barrier to leakage at the ends.

H.8.2.3 Accident Pressurization

The various GTCC canisters contain insignificant heat loads. In addition, temperature variations in the various GTCC shell assemblies are small. Since the heat load is small and the material temperatures are only slightly greater than ambient, the temperature variations at any point in the shell are approximately equal to the variation in ambient temperature. These small temperature cycles do not result in damage to, or failure of, the GTCC shell assemblies.

H.8.2.4 Earthquake

A seismic event is not expected to negatively impact the GTCC waste canisters. The GTCC waste canisters are comparable to the previously analyzed SNF canisters for the associated Cask System listed in Table 1-1 of this SAR.

RAI NP-12-3:

Provide a technical basis for the offsite explosion analysis and explain why the 1,660 feet criteria is applicable for the operations at the quarry.

The analysis in WCS CISF SAR Section 12.2.2, "Offsite Accident Analysis," appears to utilize the analysis for a truck transport on a highway using the guidance from Regulatory Guide 1.91. Provide additional information to support that the material limit of 50,000 lbs used in the accident analysis is applicable to the quarry operation located northwest of the facility. In addition, provide information to support the assessment for potential future quarry operations in the area.

This information is needed to determine compliance with 10 CFR 72.122(b), (c) and (e).

Response to RAI NP-12-3:

Permian Basin Materials, LLC (PBM) operates an aggregates quarry and concrete ready-mix facility near the CISF in New Mexico. PBM shares a property boundary with Waste Control Specialists and this boundary is approximately 4,000 feet from the CISF Protected Area. Actual blasting activities are further away, but distances vary depending on exact locations.

PBM does not have any permits or licenses with the U.S. Bureau of Alcohol Tobacco and Firearms (BATF) or any other state or federal agency to store explosives on their property. Blasting activities are handled by a blasting contractor that delivers the blasting agents by truck to the quarry. The blasting agents are delivered, placed, and detonated all in the same day so that no explosives are stored at the quarry. The fact that delivery, placement, and blasting have to occur on the same day limits the amount of explosives that can be delivered in one day. The blasting contractor, ORICA USA, has indicated that blasting at the quarry occurs approximately once a month and up to 11,000 lb of explosives are used in a blasting event (Reference [4]).

There are several types of explosives used in the mining and quarry industry and the type of explosive used is generally determined by the regional geology. PBM has been using ammonium nitrate/fuel oil (ANFO) as their blasting agent. ANFO has the added safety benefit of being shipped on the same truck as a binary explosive with the ammonium ntrate in a separate compartment from the fuel oil. The truck drives to each individual pre-drilled hole, where the specific weight of explosive is mixed and poured into the hole.

Trucks that deliver explosives to PBM are regulated by Department of Transportation regulations (23 CFR 658.17) that establish maximum gross vehicle weights at 80,000 lb resulting in a maximum cargo weight of under 50,000 lb. This is consistent with guidance from Regulatory Guide 1.91, "Evaluation of Explosions Postulated to Occur at Nearby Facilities and Transportation Routes Near Nuclear Power Plants," Revision 2, which recommends using 50,000 lb of equivalent weight TNT for a postulated accident involving a truck on a highway.

Based on the typical blasting activities and regulations precluding storage of explosives, the guidance in Regulatory Guide 1.91 provides a reasonable evaluation of the hazard associated with the PBM quarry to the CISF. This evaluation establishes that an acceptable safe distance for an explosion involving 50,000 lb of equivalent weight TNT is approximately 1,660 ft from the point of detonation, which is well short of the CISF.

Evaluating potential future quarry operations is problematic due to the unknown nature of future activities, potential new owners, or quarry expansion. Potential future activities will be limited by BATF regulation 27 CFR 555.218, "Table of Distances for Storage of Explosive Materials (High)." This table establishes that the minimum safe distance from an unbarricaded stockpile of 300,000 lbs of high explosives to inhabited buildings shall be 2,275 feet. This safe distance is well below the 4,000 feet between the CISF PA and the PBM property line providing assurance that future operations at the quarry will not impact the CISF.

References:

1. Regulatory Guide 1.91, "Evaluation of Explosions Postulated to Occur at Nearby Facilities and Transportation Routes Near Nuclear Power Plants," Revision 2.

2. 27 CFR Part 555, Commerce in Explosives, U.S. Bureau of Alcohol Tobacco and Firearms (BATF), U.S. Department of Justice.

3. 23 CFR Part 655, Traffic Operations, Federal Highway Administration, U.S. Department of Transportation.

4. Permian Basin Materials, Personal communications between M. Ulibari, Permian Basin Materials, D. Maggard, ORICA USA, C. Patterson, ORICA USA, A. Melton, ORICA USA, and B. Mason, Waste Control Specialists LLC, April 2019.

Impact:

SAR Sections 2.2, 12.2.2, and 12.3 have been revised as described in the response.

2.2 Nearby Industrial, Transportation and Military Facilities

The only industrial facilities located within five mile of the WCS CISF boundary are URENCO USA, Permian Basin Materials, the Lea County landfill, a future travel stop and Sundance Services, Inc. (Figure 2-3). URENCO USA is a uranium enrichment facility that uses centrifuge technology to provide uranium enrichment services. Waste Control Specialists operates several permitted and licensed facilities immediately south of the WCS CISF, including a RCRA landfill, a low-level radioactive waste facility and a byproduct materials landfill. The WCS Facilities include several fuel (diesel, gasoline, and propane) tanks used for fueling heavy equipment and facility operations. Tanks range in size from 350 gallons to 8,000 gallons. *These tanks are identified in Table 2-20.* RAI NP-12-4

RAI NP-12-3

Permian Basin Materials operates a quarry and crushing operation, wherein caliche, sand and gravel are mined, crushed and screened for commercial sales and used in making concrete (Permian, 2016[2-29]). *Occasional blasting is a normal part of quarry operations. Accident hazards associated with blasting activities are evaluated in SAR Chapter 12.* Sundance Services, Inc. provides oilfield waste disposal services. Sundance Services is authorized by the New Mexico Energy, Minerals and Natural Resources Department to operate the waste oil treating plant, and also manages produced water, solids and drilling muds. Sundance Services is also authorized to landfarm solids (Sundance, 2016[2-30]).

The Lea County (New Mexico) Municipal Landfill is located to the southwest and across New Mexico Highway 234 from WCS CISF. This landfill disposes of municipal solid waste for the Lea County Solid Waste Authority under New Mexico Environmental Department Permit Number SW-98-08(P). The landfill services Lea County and its municipalities. The Lea County Municipal Landfill does not generate or receive hazardous waste (Lea, 2016[2-16]).

Construction has started on a travel stop operated by Love's Travel Stops & Country Stores located at the intersection of New Mexico State Highway 18 and Hwy 176. This facility, which will provide fuel for highway vehicles, is located more than 3.5 miles from the WCS CISF.

DD Landfarm, a non-hazardous oilfield waste disposal facility that closed in August 2013 and is undergoing decommissioning and post-closure monitoring, is located approximately 4 km (2.5 miles) west of the proposed WCS CISF.

There are no military facilities within a mile of the WCS CISF. The closest military facility is Cannon Air Force Base is the closest at a distance of approximately 135 miles.

The Texas & New Mexico Railway at its closest point, is approximately 4.8 miles from the west OCA boundary of the WCS CISF. Using the methodology of Regulatory Guide 1.91, the maximum probable hazardous solid cargo for a single box car is 132,000 lbs, and detonation of this quantity of explosive could produce a 1 psi overpressure at a distance of approximately 2,300 ft (0.44 mile) from the detonation which does not approach the location of the WCS CISF. Considering for the possibility that multiple boxcars of explosive material are connected in a single train and multiple boxcars explode in the same event shows that ten completely full boxcars exploding in the same event produce 1 psi of overpressure at a distance of 5,000 feet from the detonation. This distance is much less than the distance to the WCS CISF. The weight of explosive material required to exceed 1 psi of overpressure at the WCS CISF makes the situation extremely unlikely under normal transportation conditions due to the configuration limitations (as the length of the train increases each successive rail car gets further away from the WCS CISF).

The Waste Control Specialists rail spur and loop exits the Texas & New Mexico Railway near Eunice, New Mexico as shown in updated SAR Figure 2-3. This spur continues east until it reaches the existing Waste Control Specialists facility where it forms a loop around the facility. The rail side track to the WCS CISF will begin by connecting to the northwest side of the existing loop and terminate by re-connecting at the north side of the loop. This rail line is completely controlled by ISP joint venture member Waste Control Specialists and limited to approved Waste Control Specialists waste shipments and transport casks. Railcars carrying contents with the potential to adversely affect the CISF will not be permitted on the Waste Control Specialists rail spur and loop. Fire and explosion precautions for the WCS CISF rail side track are discussed in Section 3.3.6 of the SAR.

The effects of explosions on the storage systems are discussed in the SAR Appendices, Sections A.12.2.5, B.12.2.5, C.12.2.5, D.12.2.5, E.12.1.2, E.12.2.2, F.12.1.2 and G.12.1.2, and it is determined that the canisters are protected from the effects of explosions. Overpressures of substantially greater than 1 psi would be required to cause damage to the cask storage systems.

Permian Basin Materials, LLC (PBM) operates an aggregates quarry and concrete ready mix facility in New Mexico near the CISF. PBM shares a property boundary with Waste Control Specialists and this boundary is approximately 4,000 feet from the CISF Protected Area. Actual blasting activities are further away but distances vary depending on exact locations.

All Indicated Changes are in response to RAI NP-12-3

PBM does not hold permits or licenses with the U.S. Bureau of Alcohol Tobacco and Firearms (BATF) or any other state or federal agency authorizing storage of explosives on their property. Blasting activities are conducted by PBM's blasting contractor, ORICA USA, who delivers the blasting agents to the quarry by truck. The blasting agents are delivered, placed, and detonated all in the same day so that no explosives are stored at the quarry. The fact that delivery, placement, and blasting must occur on the same day limits the amount of explosives that can be delivered in one day. The blasting contractor has indicated that blasting at the quarry occurs approximately once a month and up to 11,000 lbs of explosives are used in a typical single day blasting event. Any unused explosives are removed from the PBM site at the end of each day [12-8].

There are several types of explosives used in the mining and quarry industry and the type of explosive used is generally determined by the regional geology. PBM's contractor has been using Ammonium Nitrate/ Fuel Oil (ANFO) as their blasting agent. ANFO has the added safety benefit in that it is shipped on the same truck as a binary explosive with the Ammonium Nitrate in a separate compartment from the Fuel Oil. The truck drives to each individually pre-drilled hole, where the specific weight of explosive is mixed and poured into the hole.

Trucks that deliver explosives to PBM are regulated by U.S. Department of Transportation regulations [12-10] that establish maximum gross vehicle weights at 80,000 lbs resulting in a maximum cargo weight of under 50,000 lbs. This is consistent with guidance from Regulatory Guide 1.91 [12-11] which recommends using 50,000 lbs of equivalent weight TNT for a postulated accident involving a truck on a highway.

Based on the typical blasting activities and regulations precluding storage of explosives, the guidance in Regulatory Guide 1.91 provides a reasonable evaluation of the hazard associated with the PBM quarry to the CISF. This evaluation establishes that an acceptable safe distance for an explosion involving 50,000 lbs of equivalent weight TNT is approximately 1,660 feet from the point of detonation which is well short of the CISF.

If future operations require the storage of explosives on site, such storage will be limited by BATF regulation 27 CFR 555.218, "Table of Distances for Storage of Explosive Materials (High)" [12-9]. This table establishes that the minimum safe distance from an unbarricaded stockpile of 300,000 lbs of high explosives to inhabited buildings shall be 2,275 feet. This safe distance is well below the 4,000 feet between the CISF PA and the PBM property line providing assurance that future operations at the quarry will not impact the CISF.

All Indicated Changes are in response to RAI NP-12-3

12.3 References

12-1 NRC Regulatory Guide 3.48, "Standard Format and Content for the Safety Analysis Report for an Independent Spent Fuel Storage Installation or Monitored Retrievable Storage Installation (Dry Storage)," Rev. 1.

12-2 American National Standards Institute, American Nuclear Society, ANSI/ANS 57.9 1984, Design Criteria for an Independent Spent Fuel Storage Installation (Dry Storage Type).

12-3 Proposed SNM-1050, WCS Consolidated Interim Storage Facility Technical Specifications, Amendment 0.

12-4 *Emergency Response Guide 128, Emergency Response Guidebook (2016), U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration.*

12-5 NUREG-1567, "Standard Review Plan for Spent Fuel Dry Storage Facilities," Revision 0, U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, March 2000.

12-6 NUREG-1536, "Standard Review Plan for Spent Fuel Dry Storage Systems at a General License Facility," Revision 1, U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, July 2010.

12-7 ISP Calculation "Hazard Analysis of Gas Pipeline for WCS CISF," WCS01-0211, Revision 0.

RAI NP-12-3

12-8 Permian Basin Materials. Personal communications between M. Ulibari, Permian Basin Materials, D. Maggard, ORICA USA, C. Patterson, ORICA USA, A. Melton, ORICA USA, and B. Mason, Waste Control Specialists LLC, April 2019.

12-9 27 CFR Part 555, Commerce in Explosives, U.S. Bureau of Alcohol Tobacco and Firearms (BATF), U.S. Department of Justice.

12-10 23 CFR Part 655, Traffic Operations, Federal Highway Administration, U.S. Department of Transportation

12-11 Regulatory Guide 1.91, "Evaluation of Explosions Postulated to Occur at Nearby Facilities and Transportation Routes Near Nuclear Power Plants," Revision 2, Nuclear Regulatory Commission.

12-12 ISP Calculation "Fuel Tank Evaluation," WCS01-0212, Revision 0.

RAI NP-12-4

RAI NP-12-4:

Provide the following information for the gasoline, diesel, and propane tanks located on the Waste Control Specialists commercial waste disposal facility identified in WCS CISF SAR Section 12.2.2:

1. The distance between the proposed WCS CISF and the propane tanks and provide an analysis to support the conclusion that an accident involving these storage tanks would not impact the proposed WCS CISF. WCS CISF SAR Section 12.2.2 states that there are a number of gasoline, diesel and propane tanks located on the Waste Control Specialists commercial waste disposal facility. The location of each gasoline and diesel tank is provided and all gasoline and diesel tanks are greater than 1,660 feet from the proposed ISFSI and none of the locations have quantities that would create overpressures in excess of 1 psi at the CISF. The location of the propane storage tanks with respect to the CISF are not provided.
2. Indicate whether the analysis of the offsite accidents of the propane, gasoline and diesel storage tanks includes an assessment of the combined explosion overpressures of multiple storage tanks that are collocated at the Waste Control Specialists commercial waste disposal facility. WCS CISF SAR Section 12.2.2 states that there are a number of gasoline, diesel and propane tanks located on the Waste Control Specialists commercial waste disposal facility. The location of each gasoline and diesel tank is provided and all gasoline and diesel tanks are greater than 1660 feet from the proposed ISFSI and none of the locations have quantities that would create overpressures in excess of 1 psi at the CISF. However, it is not clear from the SAR whether the analysis considers the overpressure from a single tank explosion or the possible combined explosions of collocated tanks such as the 5,000 gallon gasoline tank and the 8,000 gallon diesel tank located 4,732 feet from the proposed CISF.

This information is needed to determine compliance with 10 CFR 72.122(b), (c) and (e).

Response to RAI NP-12-4:

Gasoline, diesel, and propane tanks located on the Waste Control Specialists commercial waste disposal facility and separation distances with the CISF consistent with the CISF Protected Area (PA) boundary are listed in Table NP-12-4-1.

In addition to the tanks listed in Table NP-12-4-1, there are three 475-gallon mobile diesel tanks. These tanks are mounted on truck trailers and are used to fill heavy equipment around the Waste Control Specialists facility.

The twelve tanks in Table NP-12-4-1 are shown on Figure NP-12-4-1 to this response to provide an overview of where tanks are in relation to each other and in relation to the CISF. Tanks identified as 3, 4, and 5, which consist of a combined total of 8,500 gallons of diesel fuel and 5,000 gallons of gasoline, are directly adjacent to each other, resulting in a total of 13,500 gallons of fuel in one location.

Regulatory Guide 1.91(Reference [1]) sets forth acceptable distances from explosions at which no significant damage would be expected. The guidance establishes the safe distance where the overpressure from the explosion is less than 1.0 psi.

The three collocated tanks were modeled as a vapor cloud using guidance from Regulatory Guide 1.91. The following assumptions were made in the model:

1. All three tanks consisting of 8,500 gallons of diesel fuel and 5,000 gallons of gasoline have a catastrophic failure (leak) resulting in immediate release of 100% of the fuel.
2. Waste Control Specialists is experiencing a maximum temperature of 115 °F (A conservative value that is higher than the maximum temperature recorded in the region).
3. Vaporization of diesel fuel is determined by the vapor pressure in equilibrium with liquid diesel fuel since the diesel fuel is still well below its boiling point. The amount of gasoline vapor produced is based on a distillation curve for standard gasoline since the maximum temperature (115 °F) is within the lower end of the boiling range for some gasoline components.
4. Vapor concentrations are assumed to be with the lower explosive limits and upper Explosive limit.
5. The diesel and gasoline vapors remain confined in a single cloud and do not disperse.
6. The vapor detonates soon after release.
7. The TNT equivalent mass for the three collocated tanks is the sum of the TNT equivalent masses for diesel and gasoline vapors.

Applying these assumptions and utilizing the guidance of Regulatory Guide 1.91 for vapor cloud explosions shows that the safe distance from this cluster of fuel tanks is 454 ft (Reference [2]). This distance is significantly less than the 4,400 ft that exists between the cluster of tanks and the CISF PA boundary.

The calculation (Reference [2]) models the potential vapor cloud explosion that could result from failure of the 5,000-gallon propane tank. Propane has a boiling point well below ambient temperatures and will completely vaporize as soon as it is no longer under pressure. The model shows that the safe distance from the propane tank is 1,010 ft. This distance is significantly less than the 4,340 ft that exists between the propane tank and the CISF PA boundary.

As indicated in Table NP-12-4-1, these evaluated cases bound all of the fixed diesel/gasoline tanks and the propane tanks at the existing Waste Control Specialists facility. As noted previously, there are three 475-gallon mobile diesel tanks. Applying the results from the evaluation of the three much larger collocated tanks, the Owner-Controlled Area boundary provides 660 feet of standoff distance from the Protected Area of the CISF. This is more than adequate to provide safe distance from an accident involving the mobile diesel tanks.

SAR Section 2.2 has been updated to indicate that the existing Waste Control Specialists facility has several fuel tanks used for facility operation. It has also been updated to point to new Table 2-20, "Waste Control Specialists Facility Fuel Tank Capacity and Proximity." SAR Section 12.2.2 has been updated to provide consistent distances from the Waste Control Specialists facility fuel tanks to the CISF Protective Area boundary. New safe distances based on the new calculation (Reference [2]) provided for the fuel tanks at Waste Control Specialists. Finally, Reference [2] has also been included as part of this submittal for information.

References:

1. Regulatory Guide 1.91, "Evaluation of Explosions Postulated to Occur at Nearby Facilities and Transportation Routes Near Nuclear Power Plants," Revision 2.

2. Calculation WCS01-0212, "Fuel Tank Evaluation," Revision 0.

Impact:

SAR Sections 2.2, 12.2.2, and 12.3 have been revised and SAR Table 2-20 has been added as described in the response.

Table NP-12-4-1 Gasoline, Diesel and Propane Tank Inventory

ID	Description	Capacity (gal)	Distance to CISF PA (ft)
1	TSDF Propane Tank	1,000	4,950
2	MWTF Propane Tank	5,000	4,340
3	MWTF Gasoline Tank	5,000	4,400
4	MWTF Diesel Tank (Red)	8,000	4,400
5	MWTF Diesel Tank (Green)	500	4,400
6	LLRW Diesel Tank	3,484	3,025
7	TSDF Fire Pump (Diesel)	850	5,000
8	LLRW Generator (Diesel)	310	2,970
9	LLRW Fire Pump (Diesel)	850	2,750
10	Security Generator (Diesel)	350	5,550
11	MWTF Generator (Diesel)	280	4,500
12	NOC Generator (Diesel)	350	4,500

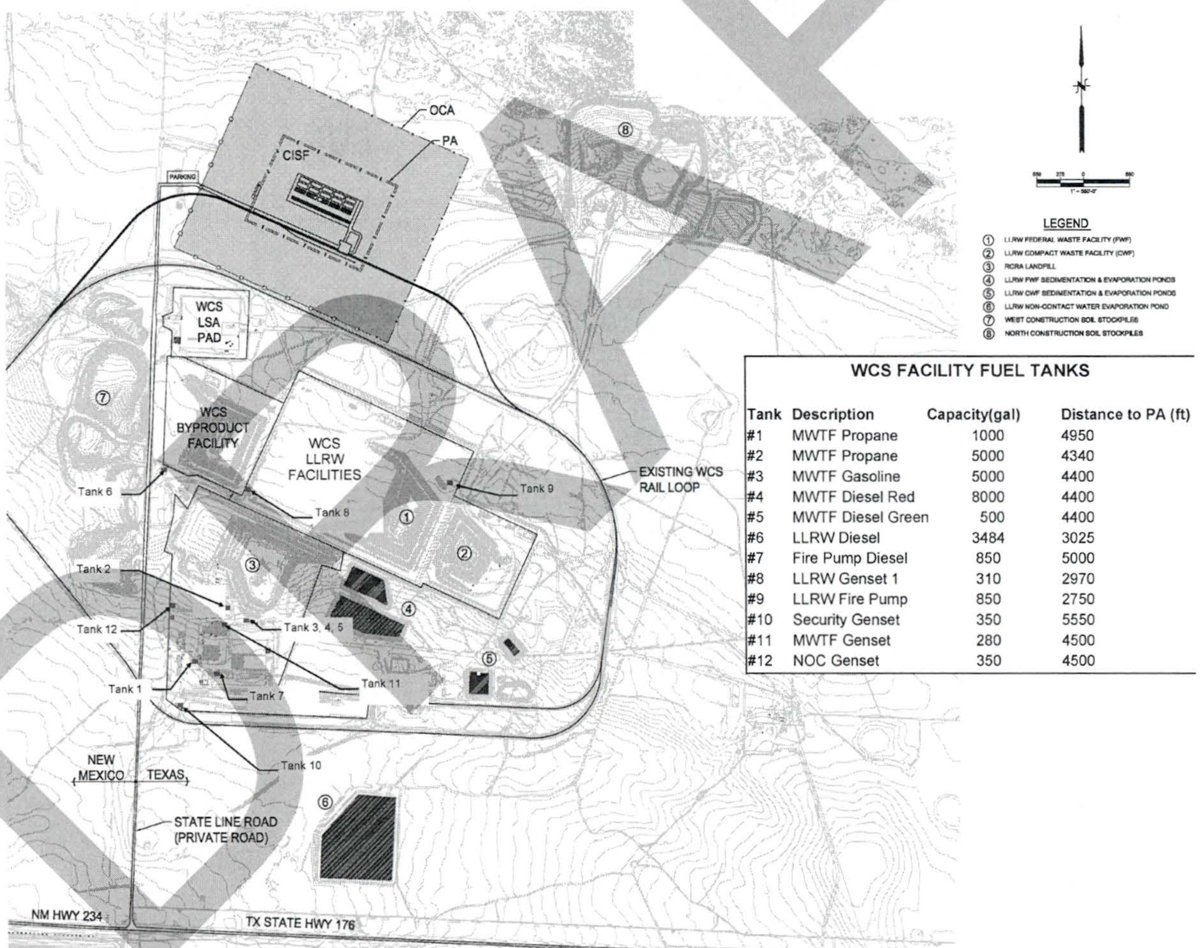


Figure NP-12-4-1 Gasoline, Diesel and Propane Tank Locations

2.2 Nearby Industrial, Transportation and Military Facilities

The only industrial facilities located within five mile of the WCS CISF boundary are URENCO USA, Permian Basin Materials, the Lea County landfill, a future travel stop and Sundance Services, Inc. (Figure 2-3). URENCO USA is a uranium enrichment facility that uses centrifuge technology to provide uranium enrichment services. Waste Control Specialists operates several permitted and licensed facilities immediately south of the WCS CISF, including a RCRA landfill, a low-level radioactive waste facility and a byproduct materials landfill. The WCS Facilities include several fuel (diesel, gasoline, and propane) tanks used for fueling heavy equipment and facility operations. Tanks range in size from 350 gallons to 8,000 gallons. *These tanks are identified in Table 2-20.* RAI NP-12-4

RAI NP-12-3

Permian Basin Materials operates a quarry and crushing operation, wherein caliche, sand and gravel are mined, crushed and screened for commercial sales and used in making concrete (Permian, 2016[2-29]). *Occasional blasting is a normal part of quarry operations. Accident hazards associated with blasting activities are evaluated in SAR Chapter 12.* Sundance Services, Inc. provides oilfield waste disposal services. Sundance Services is authorized by the New Mexico Energy, Minerals and Natural Resources Department to operate the waste oil treating plant, and also manages produced water, solids and drilling muds. Sundance Services is also authorized to landfarm solids (Sundance, 2016[2-30]).

The Lea County (New Mexico) Municipal Landfill is located to the southwest and across New Mexico Highway 234 from WCS CISF. This landfill disposes of municipal solid waste for the Lea County Solid Waste Authority under New Mexico Environmental Department Permit Number SW-98-08(P). The landfill services Lea County and its municipalities. The Lea County Municipal Landfill does not generate or receive hazardous waste (Lea, 2016[2-16]).

Construction has started on a travel stop operated by Love's Travel Stops & Country Stores located at the intersection of New Mexico State Highway 18 and Hwy 176. This facility, which will provide fuel for highway vehicles, is located more than 3.5 miles from the WCS CISF.

DD Landfarm, a non-hazardous oilfield waste disposal facility that closed in August 2013 and is undergoing decommissioning and post-closure monitoring, is located approximately 4 km (2.5 miles) west of the proposed WCS CISF.

There are no military facilities within a mile of the WCS CISF. The closest military facility is Cannon Air Force Base is the closest at a distance of approximately 135 miles.

Table 2-20
Waste Control Specialists Facility Fuel Tank Capacity and Proximity

Waste Control Specialists Facility Fuel Tank Description	*Capacity (gal)*	*Distance to CISF PA[1] (ft)*
Treatment Storage and Disposal Facility Propane Tank	*1,000*	*4,950*
Mixed Waste Treatment Facility Propane Tank	*5,000*	*4,340*
Mixed Waste Treatment Facility Gasoline Tank	*5,000*	*4,400*
Mixed Waste Treatment Facility Diesel Tank (Red)	*8,000*	*4,400*
Mixed Waste Treatment Facility Diesel Tank (Green)	*500*	*4,400*
Low-Level Radioactive Waste Facility Diesel Tank	*3,484*	*3,025*
Treatment Storage and Disposal Facility Fire Pump (Diesel)	*850*	*5,000*
Low-Level Radioactive Waste Facility Generator (Diesel)	*310*	*2,970*
Low-Level Radioactive Waste Facility Fire Pump (Diesel)	*850*	*2,750*
Security Generator (Diesel)	*350*	*5,550*
Mixed Waste Treatment Facility Generator (Diesel)	*280*	*4,500*
NOC Generator (Diesel)	*350*	*4,500*

Note 1: Protected Area (PA)

All Indicated Changes are in response to RAI NP-12-4

Immediately south of the proposed WCS CISF is the currently operating Waste Control Specialists commercial waste disposal facility. This site has 12 fixed fuel tanks (Table 2-20) ranging in size from under 300 gallons to 8,000 gallons in size containing either diesel fuel, gasoline, or propane. Three of the twelve tanks are collocated in a cluster. These three tanks are the MWTF Diesel Tank (red), the MWTF Diesel Tank (green), and the MWTF Gasoline Tank. These three tanks consist of a total of 8,500 gallons of diesel fuel and 5,000 gallons of gasoline.

Regulatory Guide 1.91 [12-11] was established to determine acceptable distances from explosions at which no significant damage would be expected. The guidance establishes the safe distance where the overpressure from the explosion is less than 1.0 psi.

Gasoline and diesel fuel are not explosive compounds and only have explosive potential if they are allowed to vaporize and mix with oxygen. Potential vaporization would only be the result of a tank leak or tank collapse allowing the liquid fuel to be released and then to vaporize.

Utilizing the guidance [12-11] for vapor cloud explosions, an evaluation of the collocated tanks [12-12] determines that the safe distance from the cluster of fuel tanks is 454 feet. This distance is significantly less than the 4,400 feet that exists between the cluster of tanks and the CISF Protected Area (PA) boundary.

In addition to the three collocated tanks, the evaluation [12-12] uses similar methodology to model the potential Vapor Cloud Explosion that could result from failure of the 5,000 gallon propane tank. The model shows that the safe distance from the propane tank is 1,010 feet. This distance is significantly less than the 4,340 feet that exists between the propane tank and the CISF PA boundary.

As indicated in Table 2-20, these evaluated cases bound all of the fixed diesel/gasoline tanks and the propane tanks at the existing Waste Control Specialists facility. In addition to the fixed tanks, Waste Control Specialists has three 475 gallon mobile diesel tanks used for fueling heavy equipment in the field. Applying the results from the evaluation of the larger collocated tanks [12-12], the Owner Controlled Area boundary provides 660 feet of standoff distance from the Protected Area of the CISF. This is more than adequate to provide safe distance from an accident involving the mobile diesel tanks.

Oil industry pipelines are located near the facility. *A natural gas pipeline owned by Energy Transfer LP (previously owned by Sid Richardson Energy Services Company) runs parallel to Texas State Hwy 176 within an easement on Waste Control Specialists property. An evaluation assessing the hazards to the WCS CISF due to a pipeline leak and subsequent vapor cloud explosion following the guidance of Regulatory Guide 1.91 determined that the distance between the pipeline and the WCS CISF is sufficient to preclude any adverse impacts to the facility [12-7].*

All Indicated Changes are in response to RAI NP-12-4

12.3 References

12-1 NRC Regulatory Guide 3.48, "Standard Format and Content for the Safety Analysis Report for an Independent Spent Fuel Storage Installation or Monitored Retrievable Storage Installation (Dry Storage)," Rev. 1.

12-2 American National Standards Institute, American Nuclear Society, ANSI/ANS 57.9 1984, Design Criteria for an Independent Spent Fuel Storage Installation (Dry Storage Type).

12-3 Proposed SNM-1050, WCS Consolidated Interim Storage Facility Technical Specifications, Amendment 0.

12-4 *Emergency Response Guide 128, Emergency Response Guidebook (2016), U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration.*

12-5 NUREG-1567, "Standard Review Plan for Spent Fuel Dry Storage Facilities," Revision 0, U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, March 2000.

12-6 NUREG-1536, "Standard Review Plan for Spent Fuel Dry Storage Systems at a General License Facility," Revision 1, U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards, July 2010.

RAI NP-12-3

12-7 ISP Calculation "Hazard Analysis of Gas Pipeline for WCS CISF," WCS01-0211, Revision 0.

12-8 Permian Basin Materials. Personal communications between M. Ulibari, Permian Basin Materials, D. Maggard, ORICA USA, C. Patterson, ORICA USA, A. Melton, ORICA USA, and B. Mason, Waste Control Specialists LLC, April 2019.

12-9 27 CFR Part 555, Commerce in Explosives, U.S. Bureau of Alcohol Tobacco and Firearms (BATF), U.S. Department of Justice.

12-10 23 CFR Part 655, Traffic Operations, Federal Highway Administration, U.S. Department of Transportation

12-11 Regulatory Guide 1.91, "Evaluation of Explosions Postulated to Occur at Nearby Facilities and Transportation Routes Near Nuclear Power Plants," Revision 2, Nuclear Regulatory Commission.

12-12 ISP Calculation "Fuel Tank Evaluation," WCS01-0212, Revision 0.

RAI NP-12-4

SAR Chapter 13, "Conduct of Operations"

RAI NP-13-2:

Provide an operating startup plan that identifies those specific operations involving the initial handling of radioactive material to be placed into storage.

WCS CISF SAR does not appear to include an operating startup plan. NUREG-1567 provides guidance on the elements that should be included in an operating startup plan. The operating startup plan should identify those specific operations involving the initial handling of radioactive material to be placed into storage. Although procedures to be used for normal operations or during steady-state conditions would not necessarily be included in the operating startup plan, the evaluation of the effectiveness of those procedures should be elements of the operating startup plan. For As Low As Reasonably Achievable (ALARA) considerations, as many of the operating startup actions as feasible should be performed during preoperational testing (i.e., before sources of exposure are present).

The operating startup plan should include the following elements:

- tests and confirmation of procedures and exposure times involving actual radioactive sources (e.g., radiation monitoring, in-pool operations);
- direct radiation monitoring of casks and shielding for radiation dose rates, streaming, and surface hot-spots;
- verification of effectiveness of heat removal features; and
- Documentation of results of tests and evaluations.

This information is needed to determine compliance with 10 CFR 72.24(p).

Response to RAI NP-13-2:

ISP has incorporated a new SAR Section 13.2.4, Operating Startup Plan, describing ISP's commitment to implement an operating startup plan at least 90 days prior to receipt and storage of canisterized spent nuclear fuel and greater than class C (GTCC) waste at the WCS CISF.

In addition, ISP has added the following new license condition (Condition 25) to the proposed Materials License:

> The licensee shall submit a Startup Plan to the NRC no later than 90 days prior to receipt and storage of canisterized spent nuclear fuel and GTCC waste at the WCS CISF.

Impact:

SAR Section 13.2.4 has been added as described in the response.

Material License Condition 25 has been added as described in the response.

LICENSE FOR INDEPENDENT STORAGE OF SPENT NUCLEAR FUEL AND HIGH-LEVEL RADIOACTIVE WASTE

SUPPLEMENTARY SHEET

19. The Licensee shall obtain onsite and offsite insurance coverage in the amounts committed to by ISP in the ISP license application.

20. The Licensee shall submit License Amendment(s) to this license to incorporate applicable portions of License Renewals listed below, within 120 days of the effective date of License Renewal Approval for each of the following:

    (1) Aging Management Program (AMP) for NUHOMS® Systems

    The Licensee shall commit to the AMPs committed to in the approved License Renewal of CoC 1004 for all NUHOMS® Spent Fuel Canisters and storage overpacks.

    (2) AMP for NAC Systems

    The Licensee shall commit to the AMPs committed to in the approved License Renewal of CoC 1015 AND 1025 AND 1031 for all applicable NAC Spent Fuel Canisters and storage overpacks.

RAI PLC-2

21. The Licensee shall submit a Startup Plan to the NRC at least 90 days prior to receipt and storage of the material identified in 6.A, 6.B, 7.A or 7.B at the facility.

22. *A Post-Transportation Verification shall include an evacuated volume helium leak test on 100% of the canisters that are received at the WCS CISF to ensure that the accessible portions of the confinement boundary are leak tight as defined in ANSI N 14-5 following transport to the site.*

23. Prior to commencement of operations, the Licensee shall have an executed contract with the U.S. Department of Energy (DOE) or other SNF Title Holder(s) stipulating that the DOE or the other SNF Title Holder(s) is/are responsible for funding operations required for storing the material identified in 6.A, 6.B, 7.A or 7.B at the CISF as licensed by the U.S. Nuclear Regulatory Commission.

24. Prior to receipt of the material identified in 6.A, 6.B, 7.A or 7.B, the Licensee shall have a financial assurance instrument required pursuant to 10 CFR 72.30 acceptable to the U.S. Nuclear Regulatory Commission.

25. *The licensee shall submit a Startup Plan to the NRC no later than 90 days prior to receipt and storage of canisterized spent nuclear fuel and GTCC waste at the WCS CISF.*

26. This license is effective as of the date of issuance shown below.

RAI NP-13-2

FOR THE NUCLEAR REGULATORY COMMISSION

John McKirgan, Chief
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material
Safety and Safeguards

Date of Issuance December XX, 20XX

Attachments: Appendix A –WCS Interim Storage Facility Technical Specifications

13.2.4 *Operating Startup Plan*

An operating startup plan will be prepared to implement the procedures necessary for the initial receipt of spent fuel and GTCC waste at the WCS CISF site, and the subsequent transfer of the spent fuel and GTCC waste to storage. The startup plan will be submitted to the NRC at 90 days prior to the initial receipt and storage of spent fuel and GTCC waste at WCS CISF. The plan will identify specific operations unique to the initial handling of spent fuel and GTCC waste to be placed into storage. The operating startup plan will also include reviews and tests of the operating procedures, confirmation of radiation exposure times and received doses, direct measurement of radiation dose rates from transportation and transfer casks and storage systems, evaluation of shielding methods, verification of heat removing features in accordance with the technical specifications, and notification to the NRC of the first loaded cask placed in storage.

The operating startup plan will be implemented for the initial receipt and transfer of spent fuel and GTCC waste and placement into storage. Upon completion of the plan, the effectiveness of procedures, actions, and equipment will be evaluated and documented to improve operations for subsequent spent fuel shipments.

SAR Appendix A, "NUHOMS-MP187 Cask System,"

RAI NP-A-1:

Provide the confinement calculations (e.g., Excel Spreadsheet), documented in WCS CISF SAR Section A.11, in order for the NRC staff to verify that the radionuclide inventory in WCS CISF SAR Table A.11.1, "SNF Assembly Activities," an analysis with 24 spent nuclear fuel assemblies per canister, and an analysis with 21 canisters, is bounding for all fuel and GTCC waste in FO-, FC-, and FF- DSCs.

The applicant provided a new confinement evaluation documented in Section A.11 of the WCS CISF SAR to include all of the isotopes required to meet current standards. The radioactive inventory was determined using the same design basis fuel assemblies that were demonstrated to be bounding in the Rancho Seco ISFSI FSAR, except that updated methods were used to calculate the radionuclide inventories.

The bounding assembly burnup and initial enrichment combinations used for the original analysis remain bounding for the radionuclide inventories regardless of the updated methods used to generate the source term. Therefore, assuming that all 21 canisters containing fuel under the SNM-2510 license are loaded with 24 fuel assemblies, each with the maximum radionuclide inventory for each assembly, the results bound the 21 canisters that are actually loaded.

The applicant should provide the confinement calculations (e.g., Excel Spreadsheet) for purposes of the staff's verification on the applicant's confinement evaluation.

This information is needed to determine compliance with 10 CFR 72.104(a) and 72.106(b).

Response to RAI NP-A-1:

Spreadsheet "WCS01-0502R0 - 0B PROPRIETARY.xls" from the confinement evaluation has been provided as requested.

Impact:

No change as a result of this RAI.

RAI NP-A-2:

Clarify whether the computed air leakage rates shown in WCS CISF SAR Section A.11.3.3, Appendix A, represent the allowable air leakage rate (cm^3/sec) or the reference leakage rate (ref-cm^3/sec)?

The applicant used the method described in ANSI N14.5 and assumed a leakage hole length to be the size of the weld length (3/16 inches) to compute a hole diameter of 4.7611×10^{-4} cm for a leakage rate of 1.0×10^{-5} std-cm^3/sec, as shown in SAR Section A.11.3.3. The computed air leakage rates, based on ANSI N14.5, are 4.4914×10^{-6}, 7.5892×10^{-6}, and 2.5413×10^{-5} cm^3/sec, respectively, under normal, off-normal, and accident conditions.

The applicant should either revise the unit of the leakage rate from "cm^3/sec" to "ref-cm^3/sec" or convert the allowable leakage rate to the reference leakage rate for clarification. The applicant should use the reference air leakage rate (medium: air; cavity pressure: 1 atm abs; ambient pressure: 0.01 atm abs; temperature 25°C) as the acceptance criterion for testing as recommended by ANSI N14.5.

This information is needed to determine compliance with 72.24(e).

Response to RAI NP-A-2:

The unit of the leakage rate is ref-cm^3/sec. SAR Sections A.11.1, A.11.2, A.11.3, and A.11.3.3 have been updated to clarify that specify the correct units (ref-cm^3/sec).

Impact:

SAR Sections A.11.1, A.11.2, A.11.3, and A.11.3.3 have been revised as described in the response.

A.11.1 Confinement Boundary

The confinement boundary for the FO-, FC- and FF-DSCs is documented in Section 3.3.2.1 of [A.11-1]. Reference [A.11-1] does not include a figure showing the confinement boundary for the FO-, FC- and FF-DSCs. However, Figure 7.1-1 of reference [A.11-12] provides a figures that shows the component and welds that make up the confinement boundary for the 24PT1-DSC which is also applicable to the FO-, FC-, and FF-DSCs with one exception, the FO-, FC-, and FF-DSCs do not have a "helium Leak Test Plug" in the Outer Top Cover Plate. Drawings for the canisters, including the confinement boundary are referenced in Section A.4.6.

The canisters will not release radioactive contents under all normal, off-normal, and accident conditions; see Section 3.3.2 and Section 8.2.2 of [A.11-1]. However, during fabrication and closure operations the confinement boundary was leak tested to 10^{-5} ref-std cm^3/sec in accordance with ANSI N14.5 [A.11-2]. Therefore, for these canister designs, a non-mechanistic release is postulated based on a leakage rate of 10^{-5} ref-std cm^3/sec. In addition, bounding evaluations in Section A.7.7 are performed to demonstrate that the confinement boundaries for the FO-, FC-, FF-DSCs do not exceed ASME B&PV Subsection NB Article NB-3200 (Level A allowables) during normal conditions of transport to provide reasonable assurance that the confinement boundary is not adversely impacted by transport to the WCS CISF.

Section 4.3, Codes and Standards, of the Technical Specifications for the Rancho Seco ISFSI [A.11-11] cites the applicable ASME Code for the MP187 FO-, FC-, and FF-DSCs.

Section 3.1, "DSC Integrity," of the Technical Specifications for the Rancho Seco ISFSI [A.11-11] includes limiting condition for operation (LCO) 3.1.1 for DSC vacuum pressure, LCO 3.1.2 for DSC helium leakage rate, and LCO 3.1.3 for DSC helium backfill pressure. These LCOs create dry, inert, leak tight atmosphere, which contributes to preventing the leakage of radioactive material.

A.11.2 Potential Release Source Term

As noted in Section A.11.1 the FO-, FC-, FF- DSCs, a non-mechanistic leakage rate of 10^{-5} ref-std cm^3/sec is postulated. The actinides and fission products for a B&W 15x15 fuel assembly are computed using SCALE6/ORIGEN-ARP. Two isotopic sets are considered, based on the design basis neutron and gamma sources. The design basis neutron source has a burnup of 38,268 MWd/MTU, enrichment of 3.18% U-235, and was discharged in 1983. The design basis gamma source has a burnup of 34,143 MWd/MTHM, enrichment of 3.21% U-235, and was discharged in 1989. The two source terms considered are decayed until June 2020, which corresponds to the placement of the first canisters at the WCS Consolidated Interim Storage Facility (WCS CISF). The reported source term in Table A.11-1 is the maximum value of the two isotopic sets considered. The design basis radioactive inventory for the confinement evaluation included in reference [A.11-1] was determined using these same bounding fuel assemblies as documented in Section 7.2.1 of Volume I of [A.11-1] (See also calculation 2069-0507, Revision 0 included in Volume IV of [A.11-1]).

The crud source is determined based on 140 $\mu Ci/cm^2$ Co-60 on the surfaces of the SNF rods at the time of discharge [A.11-3]. The design basis gamma assembly was discharged in 1989, or 31 years decay until loading. Therefore, the crud source term in Table A.11-1 is decayed 31 years.

A.11.3 Confinement Analysis

Per Section A.11.1 the FO-, FC-, FF- DSCs, a non-mechanistic leakage rate of 10^{-5} ref-std cm^3/sec is postulated. A confinement analysis is performed for normal, off-normal, and accident conditions to determine the dose to an individual due to inhalation and ingestion. There is no credible mechanism that would produce a leak of this magnitude through the confinement boundary of the canister. All welds in the canister shell are volumetrically examined, as is the weld between the inner bottom cover plate and the shell. Because it is not feasible to volumetrically examine the inner top cover plate weld, this weld is leak tested in accordance with the stated criteria. However, no credit is taken for the presence of the outer top cover plate, which is welded to the canister shell with a 0.5 inch weld that receives no fewer than three levels of dye-penetrant testing. The releases postulated in this analysis, therefore, are several orders of magnitude greater than any expected release.

A.11.3.1 Methodology

1. Calculate the specific activity (Ci/cm^3) in the canister cavity for each radioactive isotope based on the rod breakage fractions, release fractions, isotopic inventory, and cavity free volume. It is conservatively assumed that every SNF assembly in every canister has the same radiological source as the design basis SNF assembly. This assumption is conservative because many SNF assemblies will have less activity than the design basis source. Two sets of release fractions are considered: fuel-to-canister release fractions and Canister-to-Environment release fractions. The fuel-to-canister release fractions are the fraction of isotopes released from the interior of the SNF rod to the internal void region of the canister upon failure of the SNF rods. The fuel-to-canister release fractions used in this analysis are those specified in NUREG-1536 [A.11-4, Table 5-2] or NUREG-1567 [A.11-5, Table 9.2] and are summarized in Table A.11-2. The Canister-to-Environment release fractions are the fraction of isotopes released from the canister to the environment. As the radioactive materials from the SNF assembly will not be released directly to the environment, there will be some release retention in the canister. The fraction of radioactive materials released from the canister to the environment is justified and provided in [A.11-6, Table 3-5] and reproduced in Table A.11-3. These additional factors account for material that may condense, plate out or be filtered out before escaping the canister due to leakage hole size. This accounting of canister retention is also documented in other NRC documents [A.11-7, Section 7.3.8]. The two sets of release fractions are combined to create the fuel-to-environment release fractions in Table A.11-4. No credit is taken for retention of material released from the canister and potentially retained in the Horizontal Storage Module (HSM).

2. Using the as-tested leak rate and adjusting for normal, off-normal, and accident conditions in the canister cavity, determine the adjusted maximum canister leak rate for each set of conditions. The guidance of ANSI N14.5 [A.11-2] is used to calculate the adjusted leak rates.

All Indicated Changes are in response to RAI NP-A-2

3. Calculate the isotope specific leak rates by multiplying the specific activities by the seal leak rate for each condition.

4. Determine the dose to the whole body, thyroid, lens of the eye, skin, and other critical organs from inhalation and immersion exposures at the controlled area boundary. Atmospheric dispersion factors are determined using Regulatory Guide 1.145 [A.11-8] and dose conversion factors are taken from EPA Guidance Reports No. 11 [A.11-9] and No. 12 [A.11-10].

A.11.3.2 Specific Activities for Release

Specific activities for release are computed for the canister based on SNF assembly activities in Table A.11-1 and normal, off-normal, and accident release fractions in Table A.11-4. The specific activities are based on 24 SNF design basis assemblies per canister and a cavity free volume of 5,592,315 cm^3. The specific activities for release are provided in Table A.11-5. The maximum number of fuel assemblies in any canister is 24 SNF assemblies; therefore, this assumption bounds all of the loaded FO-, FC- and FF-DSCs.

A.11.3.3 Leakage Rates

A leak rate in the units *ref*-std·cm^3/sec corresponds to a leak of dry air at a temperature of 25°C from a pressure of 1 atm (absolute) to a pressure of 0.01 atm (absolute). Because the canister contains an atmosphere that is primarily helium at various temperatures and pressures, the specified standard leak rate must be adjusted for the change in gas, temperature, and pressure. The design basis conditions for the canisters are provided in Table 8-2a of [A.11-1]. Using the method from ANSI N14.5 [A.11-2] and a leakage hole length assumed to be the size of the weld length (3/16 inches), the hole diameter is computed to be 4.7611×10^{-4} cm for a leakage rate of 10^{-5} *ref*-std cm^3/sec.

Based on ANSI N14.5, the computed leakage rates for the three operating conditions are:

- Normal condition leakage rate $= 4.4914 \times 10^{-6}$ cm^3/sec
- Off-normal condition leakage rate $= 7.5892 \times 10^{-6}$ cm^3/sec
- Accident condition leakage rate $= 2.5413 \times 10^{-5}$ cm^3/sec

The isotope specific leak rates (Q_i - Ci/sec) used in the exposure calculations are equal to the number of canisters, multiplied by the specific activity, multiplied by the leakage rate, or:

$$Q_i = N \cdot S_i \cdot L$$

where: N is the number of canisters

S_i is the specific activity of nuclide i (Ci/cm^3)

RAI NP-A-3:

Provide a rationale for the statement in WCS CISF SAR Appendix A.7, "Structural Evaluation," p. A.7-1, that the canister confinement boundaries are evaluated for Normal Conditions of Transport (NCT) for the WCS CISF. On the basis of the rationale, also revise, as appropriate, the last paragraph of page A.7- 3 on the need for performing a bounding evaluation in WCS CISF SAR Section A.7.7, "Structural Evaluation of Canister Confinement Boundary under Normal conditions of Transport," to demonstrate that the canister confinement boundaries are not adversely impacted by transport to the WCS CISF.

The FO-, FC-, FF- Dry Shielded Canisters (DSCs) should all have been certified for transport as part of the Model NUHOMS MP-187 transportation package (Docket 71-9255) by meeting the 10 CFR Part 71.71 requirements for Normal Conditions of Transport. It is unclear why the canister confinement boundaries need to be re-evaluated for the so-called "Normal Conditions of Transport" for transport of spent nuclear fuel to the WCS CISF site. However, If the Normal Conditions of Transport are considered to address certain handling and transfer operations upon canister receipt at the site, specifics to these operations must be provided and justified in the SAR for their applicability.

(Note: This request applies similarly to the evaluations proposed in Appendix B, Section B.7.9, "Structural Evaluation of 24PT1-DSC Confinement boundary under Normal Conditions of Transport," Section C.7.8, "Structural Evaluation of 61BT-DSC Confinement Boundary under Normal Conditions of Transport, and Section D.7.8, "Structural Evaluation of 61BTH Type 1 DSC Confinement Boundary under Normal Conditions of Transport)

This information is needed to determine compliance with 10 CFR 72.24(c)(3), 72.24(d)(1) and (2) and 72.122(b)(1).

Response to RAI NP-A-3:

The rationale for evaluating the canister confinement boundaries for the FO-, FC-, FF- dry shielded canisters (DSCs) for normal conditions of transport (NCT) is to provide a method to ensure that canisters arriving at the WCS CISF are not adversely affected during normal transport. The evaluations are needed because the canister boundaries were not relied upon to verify containment for NCT in the Part 71 certification of the NUHOMS® MP-187 transportation package (Docket 71-9255). The evaluations are intended to show that the canisters themselves can maintain the required confinement boundary for storage when exposed to the loads generated during normal transport. While these evaluations are the primary method that ISP proposes to verify that canisters arriving at the WCS CISF are not adversely affected during normal transport, ISP is also proposing that an additional leak test be performed on every incoming canister to ensure that confinement has not been compromised.

Based on this rationale, ISP believes that the need to evaluate canister confinement boundaries for NCT is appropriately referenced in WCS CISF SAR Section A.7.7, "Structural Evaluation of Canister Confinement Boundary under Normal Conditions of Transport," and this represents a valid method to demonstrate that the canister confinement boundaries are not adversely impacted by transport to the WCS CISF.

A similar rationale applies to the 24PT1, 61BT, and 61BTH Type 1 DSCs.

The normal handling and transfer operations upon canister receipt at the site are described in Section 5.1.3 of the WCS CISF SAR.

Impact:

No change as a result of this RAI.

RAI NP-A-4:

Provide evaluations, as appropriate, to substantiate statements in SAR Section A.7.1, "Discussion". At the bottom of page A.7-2, the SAR states:

> "The evaluation of the MP187 cask as a transfer cask is based on Revision 13 of Drawing NUH-05-4001 (Cask Main Assembly) and Revision 8 of NUH- 05-4003 (Cask On-Site Transfer Arrangement), as shown in Volume IV of [A.7-4]. The current revision of NUH-05-4001 is Revision 15 as shown in Section 1.3.2 of [A.7-7]. There are no significant design differences in the cask main assembly configuration between these two revisions."

The broadbase statement of the above, "[T]here are no significant differences in the cask main assembly configuration between these two revisions," lacks clarity for the details through the process of incorporation by reference (IBR). The details addressed in individual revisions, including the design criteria on loads and load combinations and resulting changes in structural performance margins, should be properly summarized in the SAR for the NRC staff to evaluate the design differences as a basis for making a safety finding.

This information is needed to determine compliance with 10 CFR 72.24(c)(3), 72.24(d)(1) and (2) and 72.122(b)(1).

Response to RAI NP-A-4:

The table below lists the changes between Revision 13 and Revision 14 and Revision 14 and 15 of Drawing NUH-05-4001. A review of the changes shows that the changes do not affect design criteria on loads and load combinations and resulting changes in structural performance margins.

Changes between Revision 13 and 14	Changes between Revision 14 and 15
Revised –Amendment Application No. 7 Changes from Revision 13: Sheet 1 of 6 • Sheet 1- in Bill of Material (BOM) Item # 33 (hardened washer) revised – Item Quantity updated to "20" from "12" (revision 13) • Sheet 1-Note # 8 added to item # 32, 33, 34 and 44 in BOM. Note # 8 added "electroless nickle plated " Sheet 3 of 6 Section V and view J • Revised to chamfer and provide radius details at the bottom end closure	Changes from Revision 14 Title Block: • Changed company name to A TRANSNUCLEAR-(No other changes)

SAR Section A.7.1 has been updated to clearly state that that the changes between revisions do not affect design criteria related to loads and load combinations and do not impact structural performance margins.

Impact:

SAR Section A.7.1 has been revised as described in the response.

The MP187 cask is a multi-purpose cask designed and evaluated as a transfer cask for use in loading HSMs under 10 CFR Part 72 [A.7-1] [A.7-4] and as a transportation cask for off-site shipments under the provisions of 10 CFR Part 71 [A.7-2] [A.7-7]. The evaluation of the MP187 cask as a transfer cask is based on Revision 13 of drawing NUH-05-4001 (Cask Main Assembly) and Revision 8 of NUH-05-4003 (Cask On-Site Transfer Arrangement), as shown in Volume IV of [A.7-4]. The current revision of NUH-05-4001 is Revision 15 as shown in Section 1.3.2 of [A.7-7]. *The changes between Revisions 13 and 14 and 14 and 15 of Drawing NUH-05-4001 update Bill of Material Quantities for some washers; allow for electroless nickel coating for washers a cap head screw and a pin; add some chamfer and radius details at the bottom end closure; and update company name in title block. These changes do not impact the design criteria related to loads and load combinations and do not impact structural performance margins. Therefore there* are no significant design differences in the cask main assembly configuration between these two revisions.

Furthermore, as described in Chapter 3 the design criteria for the Rancho Seco ISFSI envelops the design criteria for the WCS CISF, except for the site-specific seismic criteria, which are reconciled in Section A.7.5. Therefore, the 10CFR Part 72 evaluations of the MP187 cask performed in [A.7-4] are applicable and the current configuration of the MP187 cask is acceptable for use as a transfer cask at the WCS CISF.

Finally, bounding evaluations in Section A.7.7 are performed to demonstrate that the confinement boundaries for the FO-, FC-, FF-DSCs do not exceed ASME B&PV Subsection NB Article NB-3200 (Level A allowables) during normal conditions of transport to provide reasonable assurance that the confinement boundary is not adversely impacted by transport to the WCS CISF.

All Indicated Changes are in response to RAI NP-A-4

SAR Appendix B, "Standardized Advanced NUHOMS® System"

RAI NP-B-1:

Revise the following statement in WCS CISF SAR Section B.3.3.3, "Seismic Design":

> "This system was designed for very high seismic regions, such as the west coast, and as such the design basis earthquake shown in Figures 2.2-1 and 2.2-2 of reference [B.3-1] for the AHSM easily envelops the enveloping acceleration response spectra at the concrete pad base and HSM center of gravity obtained by the WCS CISF soil-structure interaction (SSI) analysis at all frequencies as demonstrated in Sections B.7.5 and B.7.8. Due to the very low accelerations, the ties between the individual modules and the shear keys used to transfer vertical motions are not required at the WCS CISF."

The NRC staff notes that the AHSM arrays evaluated in WCS CISF SAR Section 7.6.4 are markedly different from those evaluated in the AHSM FSAR. For the previously approved AHSM, the analysis is performed for an assembly of three AHSM modules. For the analyzed assembly, the adjacent modules are tied to each other with module-to-module ties to prevent out-of-phase tipping and module-to-module separation. The analysis indicates that, for the high seismic region, the AHSM row assembly will need 10 feet of space around all sides to accommodate sliding and to facilitate retrievability of the 24PT1-DSC. For the AHSMs at the WCS CISF, where ties between the individual modules and shear keys are removed, the FSAR approved AHSMs (Docket No. 72-1029) are reconfigured. As such, the seismic stability description for the AHSM must be revised considering the site-specific analysis results presented in SAR Section 7.6.4, "Soil Structural Interaction of the NUHOMS NIT Storage Pad."

This information is needed to determine compliance with 10 CFR 72.24(c)(3), 72.24(d)(1) and (2) and 72.122(b)(1)(i).

Response to RAI NP-B-1:

The statement in WCS CISF SAR Section B.3.3.3 has been revised to clarify that advanced horizontal storage module (AHSM) row assemblies of greater than three modules side-by-side, and including configurations with modules back-to-back with this row, are bounded by the configuration in the evaluation in the AHSM FSAR. Section B.3.3.3 is also revised to remove the sentence stating: "Due to the very low accelerations, the ties between the individual modules and the shear keys used to transfer vertical motions are not required at the WCS CISF." Therefore, the AHSM assembly configuration and seismic accelerations as evaluated in the AHSM FSAR remain bounding for the configuration and accelerations evaluated in WCS CISF SAR Section 7.6.4.

Impact:

SAR Section B.3.3.3 has been revised as described in the response.

B.3.3 Design Criteria for Environmental Conditions and Natural Phenomena

B.3.3.1 Tornado Wind and Tornado Missiles

The design basis tornado wind and tornado missiles for the Standardized Advanced NUHOMS® Horizontal Modular Storage System AHSM are provided in Section 2.2.1 of reference [B.3-1] and for the NUHOMS®-MP187 cask in Section 3.2.1 of Volume 1 of reference [B.3-2]. The Standardized Advanced NUHOMS® Horizontal Modular Storage System components are designed and conservatively evaluated for the most severe tornado and missiles anywhere within the United States (Region I as defined in NRC Regulatory Guide 1.76 [B.3-9]) while the WCS CISF is in Region II, a less severe location with respect to tornado and tornado missiles.

The AHSM protects the DSC from adverse environmental effects and is the principal structure exposed to tornado wind and missile loads. Furthermore, all components of the AHSM (regardless of their safety classification) are designed to withstand tornadoes and tornado-based missiles. The MP187 cask protects the DSC during transit to the Storage Pad from adverse environmental effects such as tornado winds and missiles.

B.3.3.2 Water Level (Flood) Design

The 24PT1 DSCs and AHSMs are designed for an enveloping design basis flood, postulated to result from natural phenomena as specified by 10 CFR 72.122(b). The system is evaluated for a flood height of 50 feet with a water velocity of 15 fps.

The DSCs are subjected to an external hydrostatic pressure equivalent to the 50 feet head of water. The AHSM is evaluated for the effects of a water current of 15 fps impinging on the sides of a submerged AHSM. For the flood case that submerges the AHSM, the inside of the AHSM will rapidly fill with water through the AHSM vents.

As documented in Sections 2.4.2.2 and 3.2.2, the WCS CISF is not in a floodplain and is above the Probable Maximum Flood elevation and, therefore, will remain dry in the event of a flood.

B.3.3.3 Seismic Design

The seismic criteria for the Standardized Advanced NUHOMS® Horizontal Modular Storage System AHSM are provided in Section 2.2.3 of reference [B.3-1]. This system was designed for very high seismic regions, such as the west coast, and as such the design basis earthquake shown in Figures 2.2-1 and 2.2-2 of reference [B.3-1] for the AHSM easily envelops the enveloping acceleration response spectra at the concrete pad base and HSM center of gravity obtained by the WCS CISF soil-structure interaction (SSI) analysis at all frequencies as demonstrated in Sections B.7.5 and B.7.8. *As Section 11.2.1 of reference [B.3-1] indicates, tipping/rocking and module-to-module separation is negligible when the AHSM row assembly consists of a minimum of three modules side-by-side with shield walls; configurations with additional modules back-to-back with this row remain bounded by this analysis.*

RAI NP-B-2:

Revise the following statement on WCS CISF SAR page B.7-3, Section B.7.1, "Discussion" and make conforming changes to WCS CISF SAR Section B.7.8

> "The cask stability evaluations in [B.7-4] use the hypothetical case of the cask as a storage component, and hence in the vertical configuration, as bounding the horizontal configuration in the transfer mode."

The MP-187 in the transfer mode remains horizontal in the transfer trailer. As such, the cask stability and missile penetration evaluation of Section B.7.8 evaluation is the only evaluation that needs to be performed for the MP-187 transfer operation. The word, "alternate," of the section title, which also appears throughout, should be removed from Section B.7.8, "Alternate Cask Stability and Missile Penetration Evaluation of the MP187 Cask On-Site Transfer Configuration."

This information is needed to determine compliance with 10 CFR 72.24(c)(3), 72.24(d)(1) and (2) and 72.122(b)(1).

Response to RAI NP-B-2:

The statement on Revision 2 of WCS CISF SAR page B.7-3, Section B.7.1, "Discussion" has been revised to read:

> "The cask stability evaluations in [B.7-4] consider the MP187 cask in the transfer horizontal configuration, the only configuration for the MP187 cask."

The word "alternate" has been removed from Sections B.7.3 and B.7.8.

Impact:

The SAR Sections B.7.1, B.7.3, and B.7.8 have been revised as described in the response.

B.7.1 Discussion

As discussed in Chapter 1, the 24PT1 DSCs, currently stored inside AHSMs at the San Onofre Nuclear Generating Station (SONGS) ISFSI, will be transported to the WCS CISF utilizing the NUHOMS®-MP187 Transportation Cask. The canisters and the AHSM are Standardized Advanced NUHOMS® System components for the storage of SNF under NRC Certificate of Compliance No. 1029 [B.7-6] and are described in Chapter 1 of [B.7-1]. The MP187 transportation cask is licensed under NRC Certificate of Compliance (CoC) No. 9255 [B.7-3].

At the WCS CISF, the canisters will be stored inside newly fabricated AHSMs utilizing the MP187 cask for on-site transfer operations. The MP187 cask is a multi-purpose cask licensed as an on-site transfer cask [B.7-2] under 10 CFR Part 72 as described in [B.7-4].

As described in [B.7-1] the canister and the AHSM utilize the OS197 transfer cask for on-site transfer operations. The OS197 transfer cask is licensed under CoC No. 1004 and is described in the Standardized NUHOMS® UFSAR [B.7-7]. This appendix reconciles the design basis analyses of the 24PT1 DSC in the OS197 transfer cask (that will not be used at the WCS CISF) to justify use of the MP187 cask for transfer of the 24PT1 DSC at the WCS CISF.

The design basis seismic criteria for the canister and AHSM significantly exceed the seismic criteria for the WCS CISF (see Figure B.7-2). Hence, no reconciliation for seismic loads for the canister and AHSM need to be performed in this appendix.

The qualification of the MP187 cask for use as the on-site transfer cask at WCS CISF is based on the design basis analysis as documented in [B.7-4]. *The cask stability evaluations in [B.7-4] consider the MP187 cask in the transfer horizontal configuration, the only configuration for the MP187 cask.*

Finally, a bounding evaluation in Section B.7.9 is performed to demonstrate that the confinement boundaries for the 24PT1-DSC does not exceed ASME B&PV Subsection NB Article NB-3200 (Level A allowables) during normal conditions of transport to provide reasonable assurance that the confinement boundary is not adversely impacted by transport to the WCS CISF.

All Indicated Changes are in response to RAI NP-B-2

B.7.3 Structural Evaluation of MP187 Transfer Cask with Canister (Transfer Configuration at WCS CISF)

This section reconciles the use of the MP187 cask for transfer of the canister at the WCS CISF. This section also evaluates the 24PT1 DSC as a payload in the MP187 cask.

B.7.3.1 Evaluation of MP187 Cask Loaded with a Canister

The 10 CFR Part 71 evaluation of the canister in the MP187 cask is contained in Appendix A of the NUHOMS®-MP187 Multi-Purpose Transportation Package Safety Analysis Report (SAR) [B.7-5]. This section presents the evaluation of the canister in the MP187 cask for transfer operations under 10CFR Part 72. As in the 10 CFR Part 71 evaluations in Appendix A of [B.7-5], the evaluation presented herein is based on the design similarities between the FO- and FC- DSCs and the 24PT1 DSC.

As shown in Table A2.1-1 of [B.7-5], reproduced here as Table B.7-1, the 24PT1 DSC in [B.7-1] is the same as the FO DSC in [B.7-4], except that the 24PT1 DSC has a modified spacer disc spacing and support rod configuration. Sections A2.6.11.A and A2.6.11.B of [B.7-5] addressed these differences and concluded that the FO- and FC-DSCs configuration bounds the 24PT1 DSC configuration.

Table A2.2-1 of [B.7-5], reproduced here as Table B.7-2, shows that the 24PT1 DSC weight, center of gravity (cg) and weight moment of inertia (MOI) are bounded by those of the FO-, FC-, and FF- DSCs. As shown in this table, the 24PT1 DSC weight (78,400 lbs) is between the weight of the heaviest DSC (the FC- DSC with a weight of 81,120 lbs) and the lightest DSC (the FF- DSC with a weight of 74,900 lbs). This ensures that the effect of the lighter canister (increasing g-loads during postulated drop) and a heavier canister (higher stresses for non-drop loading conditions) envelop the 24PT1 DSC.

The total weight of the loaded MP187 cask (on-site transfer configuration) ranges from 239,700 lbs (with FC- DSC) to 233,500 lbs (with FF- DSC). This range bounds the total weight of 237,200 lbs (with 24PT1 DSC). Thus, the MP187 cask loaded with a FO- and FC- DSC configuration bounds the MP187 loaded with a 24PT1 DSC configuration [B.7-5, Table A2.2-2].

Section B.7.8 presents an evaluation of the MP187 cask in the transfer configuration at the WCS CISF.

Based on the evaluation above, the structural evaluation of the MP187 cask documented in [B.7-4] for the MP187 cask loaded with the FO- and FC- DSCs is applicable to the MP187 cask loaded with a 24PT DSC.

All Indicated Changes are in response to RAI NP-B-2

B.7.8 Cask Stability and Missile Penetration Evaluation of the MP187 Cask (On-Site Transfer Configuration)

This section presents a structural evaluation of the MP187 cask for tornado, seismic, and missile impact loads. The evaluation encompasses stability, stress, and missile penetration effects, as applicable.

The following evaluation considers the MP187 cask loaded with an FO-, FC-, FF-DSC. The MP187 cask with 24PT1 DSC configuration is bounded by the MP187 cask with an FO-, FC-, or FF-DSC (Section B.7.3).

B.7.8.1 Assumptions

1. The gust factor, G, value for wind loading of 0.85 is taken from Section 6.5.8.1 of ASCE 7-05 standard [B.7-8].
2. The stability calculations use a weight of the MP187 cask with transfer skid and transfer trailer of $W_c = 270$ kips. Per Table B.7-6, the minimum weight of the loaded cask for the analyzed configurations is 221.98 kips. The weight for the MP187 cask transfer trailer is 40 kips, and for the transfer skid is 21 kips. Therefore, the total weight of the cask with transfer trailer and skid is expected to be at minimum 221.98+40+21 = 282.98 kips. Thus, assuming a minimum weight of 270 kips to calculate the resisting moment is conservative.
3. The MP187 transfer trailer length, width, and height dimensions are 264 inches, 10.5 feet and 42 inches, respectively. The length, width, and height of the transfer skid are 186 inches, 10.5 feet, and 15 inches, respectively (refer to Figure B.7-3). These dimensions are representative dimensions for NUHOMS® Systems' transfer equipment.

B.7.8.2 Material Properties

Material properties of the cask outer shell, top cover plate, and ram access cover plate at 400 °F are taken from [B.7-5]. The material properties for the analyzed components are summarized in Table B.7-7.

B.7.8.3 Design Criteria

For stability analyses, the permissible angle of rotation is considered to be equal to one third of the critical angle of rotation – i.e. the angle of tilt at which the center of gravity of the configuration is directly over the configuration's edge (tip-over angle).

Stress allowables are based on ASME Code, Section III, Division 1, Appendix F, [B.7-9].

For missile penetration analyses, the required material thickness is calculated using Nelms' formula from [B.7-10] and the Ballistic Research Laboratory methodology contained in [B.7-11].

All Indicated Changes are in response to RAI NP-B-2

RAI NP-B-3:

Provide additional information for the WCS CISF SAR Section B.7.4, "Structural Analysis of AHSM with a Canister," seismic reconciliation analysis of the AHSM configured for WCS CISF. As a further clarification, also revise the last paragraph on page B.7-7, which states: "[T]he stress qualification for AHSM ties and concrete keys is provided in Table 3.3-21 of [B.7-1]"

The IBR evaluation of the AHSM uses the component design basis stress analysis results in UFSAR, Revision 6. The 1.5 g horizontal and 1.0 g vertical peak ground accelerations used are significantly higher than those of SAR Section 7.6.4, "Soil Structural Interaction of the NUHOMS NTS Storage Pad," which considers the design changes of removing the module-to-module ties and shear keys from the analyzed AHSM configuration. As such, the IBR stress results must clearly be delineated to address both the loading conditions and corresponding structural margins of safety for the AHSM storage system components.

This information is needed to determine compliance with 10 CFR 72.24(c)(3), 72.24(d)(1) and (2) and 72.122(b)(2)(i).

Response to RAI NP-B-3:

The incorporated by reference (IBR) evaluation of the advanced horizontal storage module (AHSM) uses the component design basis stress analysis results in the AHSM UFSAR, Revision 6. The 1.5 g horizontal and 1.0 g vertical peak ground accelerations used are significantly higher than those of the WCS CISF SAR Section 7.6.4, "Soil Structural Interaction of the NUHOMS NTS Storage Pad." Hence, design of the AHSM with a canister has significant margin and no reconciliation for seismic loads needs to be performed for these components in this configuration. SAR Section 7.6.4 *does not* consider the design change of removing the module-to-module ties and shear keys from the analyzed AHSM configuration; refer to the response to RAI NP-B-1 wherein the statement "Due to the very low accelerations, the ties between the individual modules and the shear keys used to transfer vertical motions are not required at the WCS CISF" has been removed. As discussed in WCS CISF SAR Section 7.6.4.3 and shown in Figures 7-33 through 7-35, Section 7.6.4 considers a simplified, lumped-mass model of an AHSM row assembly, for which module-to-module ties and shear keys are below the level of detail necessary for the analysis. As such, the structural margins of safety for the AHSM storage system components are adequately delineated in the IBR evaluation to Section B.7.4 of the WCS CISF SAR. The loading conditions are adequately delineated in the IBR evaluation to Section B.7.5. Additionally, no revision is required for the last paragraph on page B.7-7, which states: "[T]he stress qualification for AHSM ties and concrete keys is provided in Table 3.3-21 of [B.7-1]," as the design function of these components is retained.

Impact:

No change as a result of this RAI.

SAR Appendix C, "Standardized NUHOMS®-61BT System"

RAI NP-C-1:

Replace the acronym "PWR" to read "BWR" in WCS CISF SAR Section C.3.4.2, by noting that the NUHOMS-61BT1 storage system is designed for storing the BWR FAs.

This information is needed to determine compliance with 10 CFR 72.24(c)(3) and 72.24(d)(1) and (2).

Response to RAI NP-C-1:

The typos in Sections C.3.4.2 and D.3.4.2 of the WCS CISF SAR have been corrected to replace the acronym "PWR" with "BWR," as the NUHOMS®-61BT and NUHOMS®-61BTH Type 1 canisters are both designed for storing BWR fuel assemblies, not PWR fuel assemblies.

Impact:

SAR Sections C.3.4.2 and D.3.4.2 have been revised as described in the response.

C.3.4 Safety Protection Systems

The safety protection systems of the NUHOMS®-61BT System are discussed in Section K.2.3 of the "Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [C.3-1].

C.3.4.1 General

The NUHOMS®-61BT System is designed for safe confinement during dry storage of SFAs. The components, structures, and equipment that are designed to assure that this safety objective is met are summarized in Table C.3-2. The key elements of the NUHOMS®-61BT System and its operation at the WCS CISF that require special design consideration are:

1. Minimizing the contamination of the DSC exterior.
2. The double closure seal welds on the DSC shell to form a pressure retaining confinement boundary and to maintain a helium atmosphere.
3. Minimizing personnel radiation exposure during DSC transfer operations.
4. Design of the cask and DSC for postulated accidents.
5. Design of the HSM passive ventilation system for effective decay heat removal to ensure the integrity of the fuel cladding.
6. Design of the DSC basket assembly to ensure subcriticality.

RAI NP-C-2

C.3.4.2 Structural

The principal design criteria for the DSCs are presented in Sections *K.2.2.5.1, K.3.1.2, and* K.2.3.2 of the "Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [C.3-1]. The DSCs are designed to store intact and failed *BWR* FAs with or without channels. The fuel cladding integrity is assured by limiting fuel cladding temperature and maintaining a nonoxidizing environment in the DSC cavity.

RAI NP-C-1

The principal design criteria for the MP197HB cask are presented in Section 3.2.5.3 of the "NUHOMS®-MP197 Transportation Package Safety Analysis Report" [C.3-10]. The cask is designed to transfer the loaded DSCs to the HSM.

C.3.4.3 Thermal

The HSM relies on natural convection through the air space in the HSM to cool the DSC. This passive convective ventilation system is driven by the pressure difference due to the stack effect (ΔP_s) provided by the height difference between the bottom of the DSC and the HSM air outlet. This pressure difference is greater than the flow pressure drop (ΔP_f) at the design air inlet and outlet temperatures.

D.3.4 Safety Protection Systems

The safety protection systems of the NUHOMS®-61BTH Type 1 System are discussed in Section T.2.3 of the "Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [D.3-1].

D.3.4.1 General

The NUHOMS®-61BTH Type 1 System is designed for safe confinement during dry storage of SFAs. The components, structures, and equipment that are designed to assure that this safety objective is met are summarized in Table D.3-2. The key elements of the NUHOMS®-61BTH Type 1 System and its operation at the WCS CISF that require special design consideration are:

1. Minimizing the contamination of the DSC exterior.
2. The double closure seal welds on the DSC shell to form a pressure retaining confinement boundary and to maintain a helium atmosphere.
3. Minimizing personnel radiation exposure during DSC transfer operations.
4. Design of the cask and DSC for postulated accidents.
5. Design of the HSM passive ventilation system for effective decay heat removal to ensure the integrity of the fuel cladding.
6. Design of the DSC basket assembly to ensure subcriticality.

D.3.4.2 Structural

The principal design criteria for the DSCs are presented in Section T.2.5 of the "Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [D.3-1]. The DSCs are designed to store intact and failed BWR FAs with or without channels. The fuel cladding integrity is assured by limiting fuel cladding temperature and maintaining a nonoxidizing environment in the DSC cavity.

The principal design criteria for the MP197HB cask are presented in Section 3.2.5.3 of the "NUHOMS® -MP197 Transportation Package Safety Analysis Report" [D.3-10]. The cask is designed to transfer the loaded DSCs to the HSM.

D.3.4.3 Thermal

The HSM relies on natural convection through the air space in the HSM to cool the DSC. This passive convective ventilation system is driven by the pressure difference due to the stack effect (ΔP_s) provided by the height difference between the bottom of the DSC and the HSM air outlet. This pressure difference is greater than the flow pressure drop (ΔP_f) at the design air inlet and outlet temperatures.

All Indicated Changes are in response to RAI NP-C-1

RAI NP-C-2:

Confirm that the IBR citation, "Section K.2.3.2," is accurately identified in WCS CISF SAR Section C.3.4.2, "Structural," for presenting the principal design criteria for evaluating the DSC confinement structural performance. If it is not the correct citation, please provide appropriate IBR citation(s) to facilitate the staff review of the principal design criteria.

Section K.2.3.2 of the Standardized NUHOMS FSAR appears to address the confinement barrier leak testing only and there is no discussion regarding the confinement boundary structural design criteria.

This information is needed to determine compliance with 10 CFR 72.24(c)(3) and 72.24(d)(1) and (2).

Response to RAI NP-C-2:

As noted in the RAI the citation provided in SAR Section C.3.4.2 in incomplete only stating that the NUHOMS®-61BT DSC provides a leak-tight confinement. SAR Section C.3.4.2 has been updated to include references to Section K.2.2.5.1, "NUHOMS®-61BT DSC Structure Design Criteria and K.3.1.2 Design Criteria." Section K.3.1.2 includes subsections, K.3.1.2.1, "DSC Confinement Boundary and K.3.1.2.3 ASME Code-Exception for the 61BT DSC," providing complete incorporation by reference (IBR) citations for the DSC confinement structural performance.

Impact:

SAR Section C.3.4.2 has been revised as described in the response.

C.3.4 Safety Protection Systems

The safety protection systems of the NUHOMS®-61BT System are discussed in Section K.2.3 of the "Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [C.3-1].

C.3.4.1 General

The NUHOMS®-61BT System is designed for safe confinement during dry storage of SFAs. The components, structures, and equipment that are designed to assure that this safety objective is met are summarized in Table C.3-2. The key elements of the NUHOMS®-61BT System and its operation at the WCS CISF that require special design consideration are:

1. Minimizing the contamination of the DSC exterior.
2. The double closure seal welds on the DSC shell to form a pressure retaining confinement boundary and to maintain a helium atmosphere.
3. Minimizing personnel radiation exposure during DSC transfer operations.
4. Design of the cask and DSC for postulated accidents.
5. Design of the HSM passive ventilation system for effective decay heat removal to ensure the integrity of the fuel cladding.
6. Design of the DSC basket assembly to ensure subcriticality.

RAI NP-C-2

C.3.4.2 Structural

The principal design criteria for the DSCs are presented in Sections *K.2.2.5.1, K.3.1.2, and* K.2.3.2 of the "Standardized NUHOMS® Horizontal Modular Storage System Safety Analysis Report" [C.3-1]. The DSCs are designed to store intact and failed *BWR* FAs with or without channels. The fuel cladding integrity is assured by limiting fuel cladding temperature and maintaining a nonoxidizing environment in the DSC cavity.

RAI NP-C-1

The principal design criteria for the MP197HB cask are presented in Section 3.2.5.3 of the "NUHOMS®-MP197 Transportation Package Safety Analysis Report" [C.3-10]. The cask is designed to transfer the loaded DSCs to the HSM.

C.3.4.3 Thermal

The HSM relies on natural convection through the air space in the HSM to cool the DSC. This passive convective ventilation system is driven by the pressure difference due to the stack effect (ΔP_s) provided by the height difference between the bottom of the DSC and the HSM air outlet. This pressure difference is greater than the flow pressure drop (ΔP_f) at the design air inlet and outlet temperatures.

RAI NP-C-3:

With respect to the WCS CISF SAR Section C.7.7.3.1, Incorporated By Reference (IBR) use of the two FSARs (Rancho Seco, Revision 4 and TN Document NUH-003, Revision 14) to evaluate the MP197HB drop accident, provide an IBR list of the SAR sections, subsections, and paragraphs for identifying the specific analysis attributes and results to facilitate the staff safety review. In addition to Section C.7.7.3.1, "Loads," the list should also cover, as appropriate, other subject areas, including Section C.7.7.3.2, "Finite Element Analysis Models," Section C.7.7.3.3, "Boundary Conditions," and Section C.7.7.3.4, "Stress Analysis Methodology."

The proposed use of the two previously approved SARs covers multiple transfer cask models, including MP 187, OS187, OS197, OS197L, and OS197H. It is unclear how the DSC 61BT was evaluated against the previously approved transfer cask model(s). A detailed IBR list of information is needed to facilitate the staff review of the MP 197HB for transfer operation drop accidents.

This information is needed to determine compliance with 10 CFR 72.24(c)(3), 72.24(d)(1) and (2) and 72.122(b)(1).

Response to RAI NP-C-3:

WCS CISF Section C.7.7.3.1 uses the two FSARs (Rancho Seco, Revision 4, Reference [C.7-12], and TN Document NUH-003, Revision 14, Reference [C.7-13]) solely to justify that 75g load magnitude remains bounding for the MP197HB cask design in the cask accident drop evaluations. The conclusion that 75g static load remains highly conservative for the MP197HB design is derived only from the comparison of key design parameters of the MP197HB cask and casks already approved for that load magnitude.

These two IBRs are not used to evaluate MP197HB drop accidents. The boundary conditions, finite element model, stress analysis methodology and stress criteria presented in these two IBRs should not be considered as a basis for the MP197HB design approval. The Section C.7.7 information is based entirely on Reference [1] (Enclosure 1) performed specifically for 61BT DSC and MP197HB cask system transfer operations in WCS facility.

WCS CISF SAR Section C.7.5 reconciles MP197HB and OS197 cask designs and reviews the geometric parameters of the MP197HB and OS197 casks that may affect the 61 BT DSC structural analyses. Reference [1] reconciles the design differences. The major design parameters are: cask cavity inner diameter, cask rail locations, cask rail width, and cask rail thickness. Transport and transfer of the 61BT DSC in the MP197HB cask requires the use of a sleeve installed inside the MP197HB cask. Section C.7.5 compares the interface dimensions for the MP197HB cask with an internal spacer sleeve and for the OS197 transfer cask and determines that they are identical.

In consequence, stress analyses of the 61BT DSC transferred in the OS197 cask, documented in Reference [C.7-13] Appendix K, remain applicable for 61BT DSC when it is transferred in MP197HB cask. Specific IBR information to individual Appendix K sections is provided in WCS CISF SAR Section 7.7.

References:

1. TN Calculation WCS01-0201, “NUHOMS® MP197HB Cask Structural Qualification for Accident Conditions.”

Impact:

SAR Table C.7-9 has been revised as described in the response.

Table C.7-9
MP197HB, MP187 and OS197 Casks – Comparison of Basic Design Parameter

Parameter	MP197HB Cask	MP187 Cask	OS197 Cask
Outer Shell Thickness (*in*)	2.75	2.49	1.50
Inner Shell Thickness *(in)*	1.25	1.25	0.50
Bottom End Closure Thickness *(in)*	6.50	8.00	2.00
Top Lid Thickness (*in*)	4.50	6.50	5.25
Lead Gamma Shield Thickness *(in)*	3.00	4.00	3.56
Cask Body Outer Diameter (*in*)	84.50	83.50	79.12
Cask Cavity Diameter *(in)*	70.50	68.00	68.00
Overall Length of Cask Body (*in*)	210.25	201.50	207.20
Overall Length of Outer Shell *(in)*	190.25	183.50	183.35
Overall Length of Inner Shell *(in)*	185.25	173.75	191.25
Overall Length of Lead *(in)*	194.50	182.44	189.25
Cavity Length (*in*)	199.25	187.00	196.75
Cask Weight (Dry, Empty) (*kips*)	163.31	158.58	111.25
Cask Loaded (Dry, Loaded) (*kips*)	251.70	239.70	204.37

All Indicated Changes are in response to RAI NP-C-3

RAI NP-C-4:

In WCS CISF SAR Figure C.7-21, "Top End Drop Buckling," revise the erroneous abscissa labeling, "Time," to read, "Deceleration (g)," as appropriate to recognize that the canister end drop buckling capability is tracked against the load, in lieu of time increment.

This information is necessary to assure compliance with 10 CFR 72.24(c)(3) and 72.24(d)(1) and (2).

Response to RAI NP-C-4:

As described in Section C.7.7.3.5 of WCS CISF SAR, Figure C.7-21 represents the buckling deformation at the buckling location for the top end drop. The plot at the bottom of Figure C.7-21 was for information only, based on the ANSYS contour plot at the top this Figure. The plot has been taken out to avoid confusion, and the words "and radial displacement curve" under Section C.7.7.3.5 on Page C.7-26 have been removed.

Impact:

SAR Figure C.7-21 and Section C.7.7.3.5 have been revised as described in the response.

For the plastic analysis methodology, stress path evaluation in ANSYS brings the information about average stress intensity across the path, P_M, as well as maximum stress intensity at the path surface, labeled as $P_M + P_B$. Conservatively no distinction is made between paths located at gross or local discontinuities and areas remote from these discontinuities and all path averaged stresses (including general primary stress intensities, P_M, and local primary stress intensities, P_L) are classified and reported as P_M stresses and assessed against the P_M stress allowable.

Table C.7-10 lists the maximum values of reported results for the side drop load, while Table C.7-11 lists the maximum values of reported results for both the top and bottom end drop load.

The extent of lead slump in the MP197HB cask is assessed only for the vertical end drop scenario. The side drop induces only negligible amounts of slump in the lead shielding.

C.7.7.3.5 Summary of Results

The maximum stress intensity and the deformation plots for the 75g side drop are shown in Figure C.7-15 and Figure C.7-16, respectively. As shown in Table C.7-10 all stresses are within allowable limits for the side drop load.

The maximum stress intensity for the 75g top and bottom end drop are shown in Figure C.7-19 and Figure C.7-20, respectively. As shown in Table C.7-11 all stresses are within allowable limits for both the top and bottom end drop load.

The buckling analysis reveals commencement of buckling for the inner shell at 230g loads for both the bottom and top end drops. The buckling load for the MP197HB cask is well above the ASME Code required 3/2×75g = 112.5g load. An illustration of the top end drop buckling deformation at the buckling location is presented in Figure C.7-21.

At 75g there is a lead slump of 0.545 inches and 0.543 inches for the bottom and top end drops, respectively.

C.7.7.4 MP197HB Cask Stability and Missile Penetration Analyses

The MP197HB cask loaded with the 61BT or 61BTH DSCs is evaluated in this section for the effects of design basis tornado (DBT) wind pressure, tornado-generated missile impact, and seismic loads.

C.7.7.4.1 Assumptions

1. The gust factor, G, value for wind loading of 0.85 is taken from Section 6.5.8.1 of ASCE 7-05 standard [C.7-3].

All Indicated Changes are in response to RAI NP-C-4

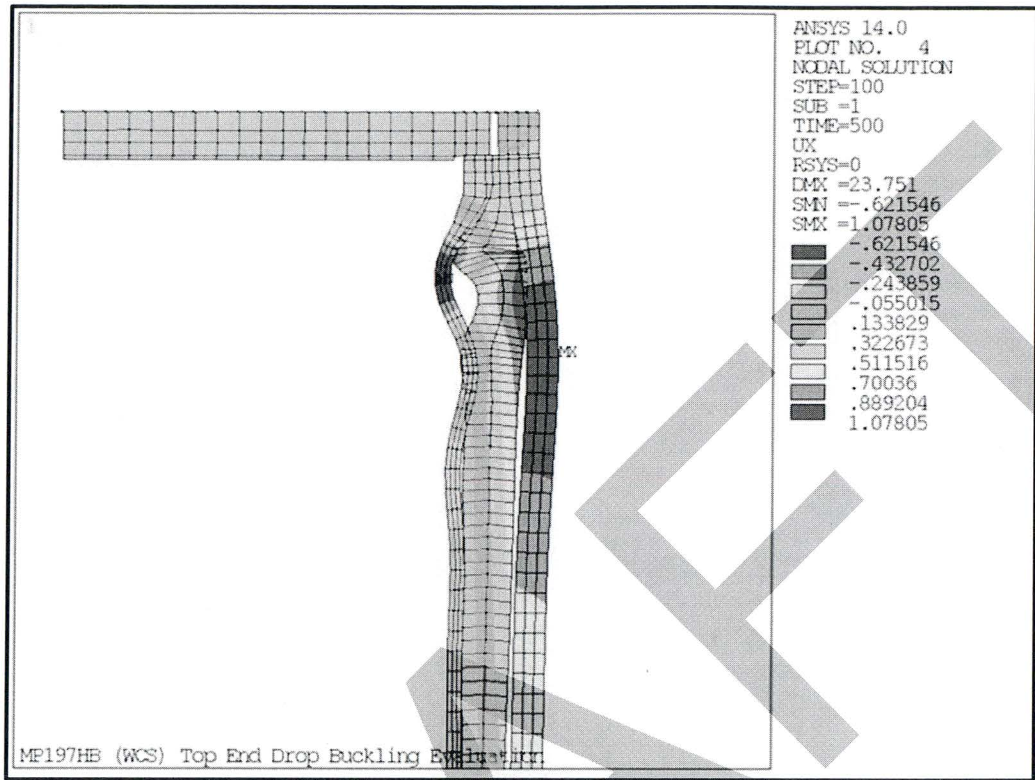


Figure C.7-21
Top End Drop Buckling

SAR Appendix D, "Standardized NUHOMS®-61BTH Type 1 System"

RAI NP-D-1:

Provide the calculation package(s) from which the summary discussions can be assessed and reviewed by the staff for the evaluation discussed in WCS CISF SAR Section D.7.3, "Seismic Reconciliation of the Canister HSM Model 102, MP197 Cask."

The WCS CISF SAR summary discussion lacks clarity in a number of areas essential for assessing the applicability of analysis assumptions and results. For example, WCS CISF SAR Section D.7.3.1.3 states: "[T]he forces and moments for each HSM subcomponent (roof slab, walls, floor slab) are determined for the WCS CISF spectra obtained from the SSI analysis, and then compared to their respective capacities, calculated as described in Section 8.1.1.5.E of [D.7-2]. The comparison is shown in Table D.7-1." It's unclear whether the noted SSI analysis is related to the site-specific analysis of SAR Section 7.6.4, where no HSM concrete subcomponents are explicitly modeled for extracting shear forces and bending moments for developing the data reported in Table D.7-1.

This information is needed to determine compliance with 10 CFR 72.24(c)(3), 72.24(d)(1) and (2) and 72.122(b)(2)(i).

Response to RAI NP-D-1:

The followings are the design basis calculations that support the evaluations discussed in WCS CISF SAR Section D.7.3:

- TN Americas LLC Calculation WCS01-0208, Rev. 0, "Evaluation of HSM 80/102 Modules for WCS SSI Loading."
- TN Americas LLC Calculation WCS01-0202, Rev. 1, "NUHOMS® MP197HB Cask Structural qualification for Normal/Off-Normal conditions."
- TN Americas LLC Calculation WCS01-0202, Rev. 0, "FO, FC, FF, 61BT, and 61BTH Type 1 DSC Seismic Reconciliation."

Contents from WCS01-0208 are summarized in UFSAR Section D.7.3.1 for the HSM Model 80 and Model 102. Similarly, contents from WCS01-0202 are summarized in UFSAR Section D.7.3.2 for the MP197HB Cask as On-Site Transfer Cask, and contents from WCS01-0202 are summarized in Section D.7.3.3 for the 61BTH Type 1 DSC.

Impact:

No change as a result of this RAI.

RAI NP-D-2:

Clarify the use of "stress ratio," cited in WCS CISF SAR Section D.7.3.1.5.2, "Evaluation of Heat Shield," for presenting the Heat Shield stud evaluation methodology and results. To facilitate NRC staff review, also provide calculation package(s) to substantiate the interaction ratio safety margins determination.

The NRC staff notes that the "interaction ratio" evaluation is generally required of the stud embedment strength qualification, when the studs are subject to concurrent axial, bending, and shear stresses. The use of stress in lieu of interaction ratios suggests that the combined effects of axial, bending, and shear stresses may not have been considered for evaluating the structural adequacy of the studs. The stress ratio criterion alone is insufficient and is also deviated from that of Section 8.1.1.7 of the FSAR, Revision 14, of Docket No. 1004.

This information is needed to determine compliance with 10 CFR 72.24(c)(3), 72.24(d)(1) and (2) and 72.122(b)(2)(i).

Response to RAI NP-D-2:

The WCS CISF SAR Section D.7.3.1.5.2 has been modified to be consistent with the description of Section 8.1.1.7 of the Docket Number 1004 FSAR, Revision 14, and to accurately represent the results documented in the substantiating calculation.

The results summarized in Section D.7.3.1.5.2 are taken from TN calculation WCS-0208 [1]. Section 8.6.5 of this document, covering heat shield design qualification, is provided as Enclosure X of this RAI transmittal. In the Enclosure document, the text substantiating results reported in Section D.7.3.1.5.2 is highlighted.

References:

1. TN Calculation, "Evaluation of HSM-80/102 Modules for WCS SSI Loading," WCS01-0208 Rev. 0, pages 55-58.

Impact:

WCS CISF SAR Section D.7.3.1.5.2 has been revised as described in the response.

D.7.3.1.5 Evaluation of Miscellaneous Components

D.7.3.1.5.1 Evaluation of the DSC Axial Retainer

The evaluation of the DSC axial retainer is described in Section 8.2.3.2(C)(iii) of [D.7-2]. The seismic load on the retainer is calculated below for the WCS CISF site-specific seismic loading.

[ ]

The maximum shear and bending stresses in the DSC axial retainer are 19.8 ksi and 25.8 ksi, respectively. The allowable shear and bending stresses are 23.5 ksi and 44.3 ksi, respectively. Therefore, the DSC axial retainer stresses are within allowable values.

D.7.3.1.5.2 Evaluation of the Heat Shields

The heat shield studs are evaluated for the axial, shear, and bending forces due to the WCS CISF site-specific loading.

[ ]

The stiffness of the 3/8" diameter studs is calculated and used to determine the natural frequency of the heat shield panels in the in-plane directions. The corresponding seismic accelerations are combined with deadweight loading to determine the maximum loads on the studs. The maximum axial and bending stresses in the studs are 1.59 ksi and 14.05 ksi, which give an interaction ratio of 0.43. The maximum shear stress in the studs is 0.40 ksi, which is less than the allowable shear stress of 18 ksi.

Therefore, the heat shield plates and studs are acceptable for the WCS CISF seismic loading.

D.7.3.1.6 Evaluation of HSM Seismic Stability and Sliding

The HSM is evaluated for seismic sliding and overturning stability due to the WCS CISF site-specific loading. The maximum sliding distance, rocking angle, and uplift height from the WCS CISF SSI analysis are 0.19", 0.05°, and 0.08", respectively. Therefore, the sliding and overturning stability characteristics of the HSM are acceptable for the WCS CISF seismic loading.

SAR Appendix E, "NAC-MPC"

RAI NP-E-2:

In WCS CISF SAR Section E.3.1.2, "Safety Protection Systems," in addition to those of the NAC-STC FSAR, add to the discussion of the other ITS SSCs to be considered for the WCS CISF safety evaluation. For the other ITS SSCs, also discuss the design description, design criteria, materials used for construction, and structural performance analysis in order to facilitate the staff safety review. [Note: This request applies also to WCS CISF SAR Section E.3.2.2 for the MPC- LACBWR storage system.]

The ITS SSCs listed in Tables 2.3-1 and 2.3-2 of the NAC-MPC FSAR are those associated primarily with the storage cask system, such as the transportable storage canister and basket, vertical concrete cask, and transfer cask. Safety classification for other ITS SSCs must also be evaluated for the WCS CISF discussed in Section E.4, "Operating Systems, NAC-MPC," including the ancillary equipment, adapter plate vertical cask transporter, rigging and slings, and storage pad used for receipt, handling, storage, and retrievability of the canisters.

This information is needed to determine compliance with 10 CFR 72.24(c)(3) and 72.24(d)(1) and (2).

Response to RAI NP-E-2:

The response and associated SAR Markup for RAI NP-E-4 include the information requested in the RAI.

Impact:

No change as a result of this RAI.

RAI NP-E-3:

Provide design details for the lifting yoke used for moving the transfer cask in WCS CISF SAR Section E.4.1.3, "Transfer Cask."

The lifting yoke as an ancillary component for transfer cask lifting is not part of the design approval review for the NAC-MPC SAR. As such, it must be evaluated for the WCS CISF site. [Note: This request applies also to Section E.4.2.3 for the MPC-LACBWR storage system.]

This information is necessary to assure compliance with 10 CFR 72.24(c)(3) and 72.24(d)(1) and (2).

Response to RAI NP-E-3:

SAR Sections E.4.1.3 and E.4.2.3 have been updated to clarify information relating to lifting yoke design and qualification criteria.

Impact:

SAR Sections E.4.1.3 and E.4.2.3 have been updated as described in the response.

The storage cask has an annular air passage to allow the natural circulation of air around the canister to remove the decay heat from the spent fuel. The decay heat is transferred from the fuel assemblies to the fuel tubes or damaged fuel can in the fuel basket and through the heat transfer disks to the canister wall. Heat flows by radiation and convection from the canister wall to the air circulating through the concrete cask annular air passage and is exhausted through the air outlet vents. This passive cooling system is designed to maintain the peak cladding temperature of both stainless steel and Zircaloy clad fuel well below acceptable limits during long-term storage. This design also maintains the bulk concrete temperature below 150°F and localized concrete temperatures below 200°F in normal operating conditions.

The top of the storage cask is closed by a shield plug and lid. The shield plug for the Yankee MPC is approximately 5 inches thick and incorporates carbon steel plate as gamma radiation shielding and NS-4-FR as neutron radiation shielding. A carbon steel lid that provides additional gamma radiation shielding is installed above the shield plug. For the CY-MPC, the shield plug is similar to the Yankee-MPC except the neutron shielding may be either NS-4-FR or NS-3. The shield plug and lid reduce skyshine radiation and provide a cover and seal to protect the canister from the environment and postulated tornado missiles. At the option of the user, a tamper-indicating seal may be installed on two of the concrete cask lid bolts.

To facility movement of the storage cask at the WCS CISF, embedded lift lugs are placed in the concrete. This provides a place for the vertical cask transporter to engage the storage cask in order to lift and subsequently move the storage cask whether there is a loaded TSC in it or not.

Existing Yankee-MPC and CY-MPC storage casks will not be used at the WCS CISF. New storage casks will be constructed on site at the WCS CISF. Fabrication of the storage cask involves no unique or unusual forming, concrete placement, or reinforcement requirements. The concrete portion of the storage cask is constructed by placing concrete between a reusable, exterior form and the inner metal liner. Reinforcing bars are placed near the inner and outer concrete surfaces to provide structural integrity. The inner liner and base of the storage cask are shop fabricated. An optional supplemental shielding fixture may be installed in the air inlets of the Yankee-MPC to reduce the radiation dose rate at the base of the cask. The principal fabrication specifications for the storage cask are shown in Table E.4-2.

E.4.1.3 Transfer Cask

The transfer cask, with its lifting yoke, is primarily a lifting device used to move the canister assembly. *The transfer cask is designed, fabricated, and tested to meet the requirements of ANSI N14.6 as a special lifting device. The transfer cask* provides biological shielding *and structural protection for a loaded TSC*. The transfer cask is used for the vertical transfer of the canister between work stations and the storage cask, or transport cask.

The general arrangement of the transfer cask and canister is shown in Figure E.4-4 and Figure E.4-5, and the arrangement of the transfer cask and concrete cask is shown in Figure E.4-6. The configuration of the transfer cask, canister and concrete cask during loading of the concrete cask is shown in Figure E.4-7.

Table 1.2-5 of Reference E.4-1 shows the principal design parameters of the transfer cask used for the Yankee-MPC and CY-MPC configurations. As shown, the basic design of the transfer cask is similar, with the CY-MPC transfer cask being approximately 30 inches longer and 2.5 inches larger in diameter than the Yankee-MPC transfer cask.

The transfer cask is a multiwall (steel/lead/NS-4-FR neutron shield/steel) design, which limits the average contact radiation dose rate to less than 300 mrem/hr. The transfer cask design incorporates a top retaining ring, which is bolted in place preventing a loaded canister from being inadvertently removed through the top of the transfer cask. The transfer cask has retractable bottom shield doors. During loading operations, the doors are closed and secured by lock bolts/lock pins, so they cannot inadvertently open. During unloading, the doors are retracted using hydraulic cylinders to allow the canister to be lowered into the storage or transport casks. The transfer cask is shown in Figure E.4-4.

To qualify the transfer cask as a heavy lifting device, it is designed, fabricated, and proof load tested to the requirements of NUREG-0612 and ANSI N14.6. Maintenance is to be performed in accordance with WCS CISF procedures that meet the requirements of NUREG-0612.

Lifting and handling of the transfer cask is performed using the Canister Transfer System (CTS), which is described in Section 7.5.1.

E.4.1.4 Ancillary Equipment

This section presents a brief description of the principal ancillary equipment needed to operate the NAC-MPC in accordance with its design.

E.4.1.4.1 Adapter Plate

The adapter plate is a carbon steel table that mates the transfer cask to either the vertical concrete (storage) cask or the NAC-STC transport cask. It has a large center hole that allows the transportable storage canister to be raised or lowered through the plate into or out of the transfer cask. Rails are incorporated in the adapter plate to guide and support the bottom shield doors of the transfer cask when they are in the open position. The adapter plate also supports the hydraulic system and the actuators that open and close the transfer cask bottom doors.

All Indicated Changes are in response to RAI NP-E-3

The top of the storage cask is closed by a lid with integral radiation shield. The radiation shield is approximately 8-inch thick concrete encased in a carbon steel shell extending into the cask cavity from the bottom surface of the 1.5-inch-thick carbon steel lid. The specification summary for the encased concrete is shown in Table E.4-3.

To facility movement of the storage cask at the WCS CISF, embedded lift lugs are placed in the concrete. This provides a place for the vertical cask transporter to engage the storage cask in order to lift and subsequently move the storage cask whether there is a loaded TSC in it or not.

Existing MPC-LACBWR storage casks will not be used at the WCS CISF. New storage casks will be constructed on site at the WCS CISF. Fabrication of the storage cask involves no unique or unusual forming, concrete placement, or reinforcement requirements. The concrete portion of the storage cask is constructed by placing concrete between a reusable, exterior form and the inner metal liner. Reinforcing bars are placed near the inner and outer concrete surfaces to provide structural integrity. The inner liner and base of the storage cask are shop fabricated. Radiation shielding is installed in the air inlets to reduce the radiation dose rates local to the air inlets at the base of the cask. The principal fabrication specifications for the storage cask are shown in Table E.4-2.

E.4.2.3 Transfer Cask

The transfer cask for the MPC-LACBWR is the same transfer cask used for the Yankee-MPC as described in WCS CISF SAR Appendix E, Section E.4.1.3. The transfer cask, with its lifting yoke, is primarily a lifting device used to move the canister assembly. *The transfer cask is designed, fabricated, and tested to meet the requirements of ANSI N14.6 as a special lifting device. The transfer cask* provides biological shielding *and structural protection for a loaded TSC*. The transfer cask is used for the vertical transfer of the canister between work stations and the storage cask, or transport cask.

The general arrangement of the transfer cask and canister is shown in Figure E.4-11 and Figure E.4-12, and the arrangement of the transfer cask and concrete cask is shown in Figure E.4-13. The configuration of the transfer cask, canister and concrete cask during loading of the concrete cask is shown in Figure E.4-14.

Table 1.A.2-5 of Reference E.4-1 shows the principal design parameters of the transfer cask used for the Yankee-MPC and MPC-LACBWR configurations.

All Indicated Changes are in response to RAI NP-E-3

The transfer cask is a multiwall (steel/lead/NS-4-FR neutron shield/steel) design, which limits the average contact radiation dose rate to less than 100 mrem/hr. The transfer cask design incorporates a top retaining ring, which is bolted in place preventing a loaded canister from being inadvertently removed through the top of the transfer cask. The transfer cask has retractable bottom shield doors. During loading operations, the doors are closed and secured by door stops, so they cannot inadvertently open. During unloading, the doors are retracted using hydraulic cylinders to allow the canister to be lowered into the storage or transport casks. The transfer cask is shown in Figure E.4-11.

To qualify the transfer cask as a heavy lifting device, it is designed, fabricated, and proof load tested to the requirements of NUREG-0612 and ANSI N14.6. Maintenance is to be performed in accordance with WCS CISF procedures that meet the requirements of NUREG-0612.

RAI NP-E-3

Lifting and handling of the transfer cask is performed using the Canister Transfer System (CTS), which is described in Section 7.5.1.

E.4.2.4 Ancillary Equipment

This section presents a brief description of the principal ancillary equipment needed to operate the MPC-LACBWR in accordance with its design.

E.4.2.4.1 Adapter Plate

The adapter plate is a carbon steel table that mates the transfer cask to either the vertical concrete (storage) cask or the NAC-STC transport cask. It has a large center hole that allows the transportable storage canister to be raised or lowered through the plate into or out of the transfer cask. Rails are incorporated in the adapter plate to guide and support the bottom shield doors of the transfer cask when they are in the open position. The adapter plate also supports the hydraulic system and the actuators that open and close the transfer cask bottom doors.

E.4.2.4.2 Vertical Cask Transporter

The vertical cask transporter is mobile lifting device that allows for the movement of the vertical concrete storage cask. The transporter engages the storage cask via the embedded lift lugs. After the transporter has engaged the storage cask, it can lift the storage cask and move it to the desired location. When the storage cask has a loaded TSC, the transporter shall not lift the storage higher than the allowed lift limit.

E.4.2.4.3 Rigging and Slings

RAI NP-E-5

Several lifting rig assemblies are required to handle various MPC-LACBWR components during transfer operations at the CISF. Each lifting rig assembly may consist of a combination of slings, shackles, swivel hoist rings, turnbuckles, master links, connecting links, and chains. The lifting rig assemblies are designed to meet the guidance of NUREG/CR-0612 with the following considerations made:

RAI NP-E-4:

Provide safety classifications of the SSCs discussed in WCS CISF SAR Section E.4.1.4, "Auxiliary Equipment," for the WCS CISF operation.

Section E.3.1.2, "Safety Protection Systems," presents safety classifications for the NAC-MPC storage system focusing only on the cask system components for the general license approval. Auxiliary equipment needed for the site-specific operation is not addressed. As such, safety classification must also be identified for the Auxiliary Equipment used at the WCS CISF site. [Note: The request also applies to Section E.4.2.4 for MPC-LACBWR.]

This information is needed to determine compliance with 10 CFR 72.24(c)(3) and 72.24(d)(1) and (2).

Response to RAI NP-E-4:

SAR Sections E.3.1.2.1 and E.3.2.2.1 have been updated to reference new Table E.3-2, which provides the generic safety classifications for the auxiliary equipment.

Impact:

SAR Section E.3.1.2.1 and E.3.2.2.1 have been revised as described in the response. Table E.3-2 has been added as described in the response.

E.3.1.2 Safety Protection Systems

The NAC-MPC relies upon passive systems to ensure the protection of public health and safety, except in the case of fire or explosion. As discussed in Section 2.3.6 of Reference E.3-1, fire and explosion events are effectively precluded by site administrative controls that prevent the introduction of flammable and explosive materials into areas where an explosion or fire could damage installed NAC-MPC systems. The use of passive systems provides protection from mechanical or equipment failure.

E.3.1.2.1 General

The NAC-MPC is designed for safe, long-term storage of spent nuclear fuel. The NAC-MPC will survive all of the evaluated normal, off-normal, and postulated accident conditions without release of radioactive material or excessive radiation exposure to workers or the general public. The major design considerations that have been incorporated in the NAC-MPC system to assure safe long-term fuel storage are:

1. Continued confinement in postulated accidents
2. Thick concrete and steel biological shield
3. Passive systems that ensure reliability
4. Inert atmosphere to provide corrosion protection for stored fuel cladding

Each NAC-MPC system storage component is classified with respect to its function and corresponding effect on public safety. In accordance with Regulatory Guide 7.10, each system component is assigned a safety classification into Category A, B or C, as shown in Tables 2.3-1 and 2.3-2 of Reference E.3-1. *Table E.3-2 provides the safety classifications for the Auxiliary Equipment referenced in Sections E.4.1.4 of this SAR.* The safety classification is based on review of each component's function and the assessment of the consequences of component failure following the guidelines of NUREG/CR-6407, "Classification of Transportation Packaging and Dry Spent Fuel Storage System Components According to Importance to Safety."

Category A - Components critical to safe operations whose failure or malfunction could directly result in conditions adverse to safe operations, integrity of spent fuel or public health and safety.

Category B - Components with major impact on safe operations whose failure or malfunction could indirectly result in conditions adverse to safe operations, integrity of spent fuel or public health and safety.

Category C - Components whose failure would not significantly reduce the packaging effectiveness and would not likely result in conditions adverse to safe operations, integrity of spent fuel, or public health and safety.

As discussed in Section 2.3 of Reference E.3-1, the NAC-MPC design incorporates features addressing the above design considerations to assure safe operation during fuel loading, handling, and storage. This section addresses the following:

All Indicated Changes are in response to RAI NP-E-4

E.3.2.2 Safety Protection Systems

The MPC-LACBWR relies upon passive systems to ensure the protection of public health and safety, except in the case of fire or explosion. As discussed in Section 2.3.6 of Reference E.3-1, fire and explosion events are effectively precluded by site administrative controls that prevent the introduction of flammable and explosive materials into areas where an explosion or fire could damage installed MPC-LACBWR systems. The use of passive systems provides protection from mechanical or equipment failure.

E.3.2.2.1 General

The MPC-LACBWR is designed for safe, long-term storage of spent nuclear fuel. The MPC-LACBWR will survive all of the evaluated normal, off-normal, and postulated accident conditions without release of radioactive material or excessive radiation exposure to workers or the general public. The major design considerations that have been incorporated in the MPC-LACBWR system to assure safe long-term fuel storage are:

6. Continued confinement in postulated accidents
7. Thick concrete and steel biological shield
8. Passive systems that ensure reliability
9. Inert atmosphere to provide corrosion protection for stored fuel cladding

Each MPC-LACBWR system storage component is classified with respect to its function and corresponding effect on public safety. In accordance with Regulatory Guide 7.10, each system component is assigned a safety classification into Category A, B or C, as shown in Table 2.A.3-1 of Reference E.3-1. *Table E.3-2 provides the safety classifications for the Auxiliary Equipment referenced in Sections E.4.2.4 of this SAR.* The safety classification is based on review of each component's function and the assessment of the consequences of component failure following the guidelines of NUREG/CR-6407, "Classification of Transportation Packaging and Dry Spent Fuel Storage System Components According to Importance to Safety."

Category A - Components critical to safe operations whose failure or malfunction could directly result in conditions adverse to safe operations, integrity of spent fuel or public health and safety.

Category B - Components with major impact on safe operations whose failure or malfunction could indirectly result in conditions adverse to safe operations, integrity of spent fuel or public health and safety.

Category C - Components whose failure would not significantly reduce the packaging effectiveness and would not likely result in conditions adverse to safe operations, integrity of spent fuel, or public health and safety.

All Indicated Changes are in response to RAI NP-E-4

Table E.3-2
Safety Classification of Auxiliary Equipment
(3 pages)

Assembly/ Component Name	*Safety Function/Description*	*Q-Category*
Auxiliary Equipment	*Systems and components not normally addressed or defined with cask system SARs that are normally utilized for the handling, loading, transfer, storage, and/or unloading multi-purpose, storage and transport cask system.*	*Itemized As Follows*
Cask Lifting Yoke (CLY) Assembly	*The lifting yoke assembly provides for the lifting and handling of a cask body (i.e., transfer cask, transport cask, etc.) by connection to lifting points/features on the cask during loading, unloading and/or transfer operations of radioactive materials at user facilities.*	*B*
- Lifting Yoke Load Bearing Components	*The load carrying components of the lifting yokes used to lift and handle transport and transfer casks during loading and unloading operations. Components include lift yoke arms, crossbeams, lift pins, etc., that transmit the load of the cask to the facility crane hook*	*B*
- Lifting Yoke Components for Non-Critical Lifts	*Load carrying components of the lifting yoke used for non-critical lifts only, allowing the use of reduced design factors of safety.*	*C*
- Lifting Yoke Operational Components	*The operational components provide operational support for the Yoke Assembly, including components that assist in the guiding or aligning of the yoke to the cask, arm actuation components, bolting, washers, screws, etc.*	*NQ*
- Lifting Yoke Auxiliary Components	*The Lifting Yoke Auxiliary Components, such as the yoke counterweight, are non-load bearing components utilized during normal operations to assist in the engagement of the lifting yoke to the lifting attachments on the cask.*	*B*
Cask Ancillary Systems (CAS)	*Cask ancillary systems are the various operational systems that are used at the loading and unloading facility to prepare TSCs, transport casks and other auxiliary equipment for storage and/or transport in accordance with the Certificate of Compliance (CoC). These systems do not provide a safety function for the cask performance. They provide operational support and monitor or modify operational conditions for final compliance with the CoC. These systems include H2 Monitoring, Vacuum Drying, Cask Cool Down, Cask Draining, etc. Failure of any of these systems would not have an adverse affect to cask final CoC condition.*	*NQ-OS*
Auxiliary Lifting Components for Critical Lifts	*The lifting slings and associated hardware, designed and tested to comply with the requirements of ASME B30.9 and ANSI N14.6 for use on critical lifts (e.g. lowering the loaded canister into the VCC).*	*B*

All Indicated Changes are in response to RAI NP-E-4

Table E.3-2
Safety Classification of Auxiliary Equipment
(3 pages)

Assembly/ Component Name	*Safety Function/Description*	*Q-Category*
Auxiliary Lifting Components for Non-Critical Lifts	*The lifting slings and associated hardware for use on non-critical lifts (e.g. lifting of an empty canister).*	*NQ*
Welding and Cutting Equipment	*Welding, cutting, and weld inspection systems required to perform the necessary canister field welds during loading or unloading operations.*	*NQ*
Weld Mock-up	*Weld mock-ups, representative of the canister certified design configuration, used to demonstrate and qualify the canister closure welding operation sequences and performance.*	*NQ-OS*
Ancillary Shielding	*Additional shielding components used during operational procedures to ensure doses to workers are maintained ALARA.*	*NQ*
Cask Maneuvering Equipment	*Systems used for the onsite transport of loaded concrete casks to the ISFSI pad*	*NQ-OS*
Auxiliary Transfer Equipment	*Components and systems designed to facilitate the loading, handling, testing, and/or other dry transfer operations during transfer from a facility to the shipping cask.*	*NQ*
Single Failure Proof Cask Lifting Systems	*Systems such as overhead gantry cranes or chain hoist systems designed to handle a critical load. These systems are designed and constructed with single failure proof features and are capable of retaining control of a critical load during and after a seismic event.*	*B*
Equipment Storage and Handling Systems	*Systems such as the Lift Yoke Stand designed to facilitate equipment handling and storage at the facility.*	*NQ*
Transfer Cask Leveling Pad	*A site-specific transfer cask leveling pad designed to ensure the proper levelness of the transfer cask during TSC insertion, welding and preparation for transfer in the decontamination/cask preparation area.*	*NQ-OS*
Personnel Barrier	*Components used as a physical barrier to prevent access to, or contact with, the package by persons during routine transport.*	*NQ-OS*

All Indicated Changes are in response to RAI NP-E-4

Table E.3-2
Safety Classification of Auxiliary Equipment
(3 pages)

Assembly/ Component Name	Safety Function/Description	Q-Category
Adapter Plate Components and Assembly	The Adapter Plate is utilized to appropriately position the loaded Transfer Cask (TFR) on the VCC Assembly for transfer of the loaded TSC assembly into or from the VCC, and to remotely open and close the TFR shield doors to access the TFR cavity. The Adapter Plate is also designed to interface with the appropriate Transport Cask for loading and unloading of the TSC Assembly.	NQ
Seismic Restraint System (SRS)	A structural assembly of components designed to limit the motion of the Transfer Cask, Concrete Cask, and/or Transport Cask during a seismic event.	B
- SRS Primary Structural Components	The primary structural components of the SRS include all components important to maintain the cask system in a safe condition during a seismic event (i.e. beam structures, foundations, bolted/welded connections, bracketry, struts, cables, etc. in the primary load path between the cask system and ground or other qualified structure).	B
- SRS Miscellaneous Components	The miscellaneous components of the SRS include items such as structural components used only for installation or operation of the Seismic Restraint System and non-structural components such as nameplates, coatings, etc. which are not relied upon to carry any load during a seismic event.	NQ

All Indicated Changes are in response to RAI NP-E-4

RAI NP-E-5:

Revise, as appropriate, the WCS CISF SAR Section E.4.1.4.2, "Rigging and Slings," description by identifying the specific rigging attachments and corresponding load paths rating criteria for which the ANSI N14.6, special lifting device, standard applies. [Note: The request also applies to Section E.4.2.4.3 for MPC-LACBWR.]

The staff notes that ANSI N14.6 and NUREG-0612 are cited as the standards for the ITS rigging attachments; however, the rigging attachments cited in the section appear to be of commercial "off the shelf" items. If the rigging attachments are configured as special lifting devices, they need to be designed, fabricated, operated, tested, inspected, and maintained per the ANSI N14.6 standard accordingly.

This information is necessary to assure compliance with 10 CFR 72.24(c)(3) and 72.24(d)(1) and (2).

Response to RAI NP-E-5:

SAR Sections E.4.1.4.3 and E.4.2.4.3 have been updated to provide more detail regarding lifting rig assemblies, including specific lifting components and the standards used in the design.

Impact:

SAR Sections E.4.1.4.3 and E.4.2.4.3 have been revised as described in the response.

E.4.1.4.2 Vertical Cask Transporter

The vertical cask transporter is mobile lifting device that allows for the movement of the vertical concrete storage cask. The transporter engages the storage cask via the embedded lift lugs. After the transporter has engaged the storage cask, it can lift the storage cask and move it to the desired location. When the storage cask has a loaded TSC, the transporter shall not lift the storage higher than the allowed lift limit.

E.4.1.4.3 Rigging and Slings

Several lifting rig assemblies are required to handle various NAC-MPC (Yankee-Rowe and Connecticut Yankee) components during transfer operations at the CISF. Each lifting rig assembly may consist of a combination of slings, shackles, swivel hoist rings, turnbuckles, master links, connecting links, and chains. The lifting rig assemblies are designed to meet the guidance of NUREG/CR-0612 with the following considerations made:

- *Lifting requirements consider dynamic loading (i.e., 1.1 dynamic load factor).*
- *Components meet the requirements of ASME B30 (i.e., ASME B30.9 – Slings, B30.10 – Hooks, and B30.26 – Rigging Hardware).*
- *Single-failure-proof lifting devices have enhanced safety features for handling critical loads without the need to consider drop conditions.*

Enhanced safety features include double the safety factor required for handling non-critical loads or redundant load paths, with each qualified to the safety factor required for handling non-critical loads. Note that handling of critical loads may be performed with non-single-failure proof rigging if drop conditions have been analyzed and shown to be acceptable.

Typical rigging and slings include a concrete cask lid sling, concrete cask shield plug sling, canister shield lid sling, loaded canister transfer sling (also used to handle the structural lid), and canister retaining ring sling.

E.4.1.4.4 Temperature Instrumentation

The concrete casks may be equipped with temperature-monitoring equipment to measure the outlet air temperature. The Technical Specification requires either daily temperature measurements or daily visual inspection for inlet and outlet screen blockage to ensure the cask heat removal system remains operable.

All Indicated Changes are in response to RAI NP-E-5

The transfer cask is a multiwall (steel/lead/NS-4-FR neutron shield/steel) design, which limits the average contact radiation dose rate to less than 100 mrem/hr. The transfer cask design incorporates a top retaining ring, which is bolted in place preventing a loaded canister from being inadvertently removed through the top of the transfer cask. The transfer cask has retractable bottom shield doors. During loading operations, the doors are closed and secured by door stops, so they cannot inadvertently open. During unloading, the doors are retracted using hydraulic cylinders to allow the canister to be lowered into the storage or transport casks. The transfer cask is shown in Figure E.4-11.

To qualify the transfer cask as a heavy lifting device, it is designed, fabricated, and proof load tested to the requirements of NUREG-0612 and ANSI N14.6. Maintenance is to be performed in accordance with WCS CISF procedures that meet the requirements of NUREG-0612.

RAI NP-E-3

Lifting and handling of the transfer cask is performed using the Canister Transfer System (CTS), which is described in Section 7.5.1.

E.4.2.4 Ancillary Equipment

This section presents a brief description of the principal ancillary equipment needed to operate the MPC-LACBWR in accordance with its design.

E.4.2.4.1 Adapter Plate

The adapter plate is a carbon steel table that mates the transfer cask to either the vertical concrete (storage) cask or the NAC-STC transport cask. It has a large center hole that allows the transportable storage canister to be raised or lowered through the plate into or out of the transfer cask. Rails are incorporated in the adapter plate to guide and support the bottom shield doors of the transfer cask when they are in the open position. The adapter plate also supports the hydraulic system and the actuators that open and close the transfer cask bottom doors.

E.4.2.4.2 Vertical Cask Transporter

The vertical cask transporter is mobile lifting device that allows for the movement of the vertical concrete storage cask. The transporter engages the storage cask via the embedded lift lugs. After the transporter has engaged the storage cask, it can lift the storage cask and move it to the desired location. When the storage cask has a loaded TSC, the transporter shall not lift the storage higher than the allowed lift limit.

E.4.2.4.3 Rigging and Slings

RAI NP-E-5

Several lifting rig assemblies are required to handle various MPC-LACBWR components during transfer operations at the CISF. Each lifting rig assembly may consist of a combination of slings, shackles, swivel hoist rings, turnbuckles, master links, connecting links, and chains. The lifting rig assemblies are designed to meet the guidance of NUREG/CR-0612 with the following considerations made:

- *Lifting requirements consider dynamic loading (i.e., 1.1 dynamic load factor).*
- *Components meet the requirements of ASME B30 (i.e., ASME B30.9 – Slings, B30.10 – Hooks, and B30.26 – Rigging Hardware).*
- *Single-failure-proof lifting devices have enhanced safety features for handling critical loads without the need to consider drop conditions.*

Enhanced safety features include double the safety factor required for handling non-critical loads or redundant load paths, with each qualified to the safety factor required for handling non-critical loads. Note that handling of critical loads may be performed with non-single-failure proof rigging if drop conditions have been analyzed and shown to be acceptable.

Typical rigging and slings include a concrete cask lid sling, concrete cask shield plug sling, canister shield lid sling, loaded canister transfer sling (also used to handle the structural lid), and canister retaining ring sling.

E.4.2.4.4 Temperature Instrumentation

The concrete casks may be equipped with temperature-monitoring equipment to measure the outlet air temperature. The Technical Specification requires either daily temperature measurements or daily visual inspection for inlet and outlet screen blockage to ensure the cask heat removal system remains operable.

E.4.2.5 Storage Pad

The MPC-LACBWR is designed for long-term storage at an ISFSI. At the ISFSI site, the loaded concrete storage casks are placed in the vertical position on a concrete pad in a linear array. The reinforced concrete foundation of the ISFSI pad is capable of sustaining the transient loads from the vertical cask transporter and the general loads of the stored casks. The pad design meets the NAC-MPC pad requirements listed in Reference E.4-1.

All Indicated Changes are in response to RAI NP-E-5

RAI NP-E-6:

Provide a rationale for the Section E.7.1, "Yankee Rowe MPC and Connecticut Yankee MPC," lead paragraph statement:

> "Finally, bounding evaluations in Section E.7.1.11 are referenced to demonstrate that the confinement boundaries for the Yankee-MPC and CY- MPC canisters do not exceed ASME B&PV Subsection NB Article NB-3200 (Level A allowables) during normal conditions of transport to provide reasonable assurance that the confinement boundary is not adversely impacted by transport to the WCS CISF."

The canister structural performance has already been certified by the NRC for the NCT under Docket 71-9235 and there appears no need to reevaluate the canister confinement boundary further for transport; however, if deemed necessary, revise, as appropriate, the evaluation in WCS CISF SAR Section E.7.1.11, "Structural Evaluation of Yankee-MPC and CY-MPC Canister Confinement Boundaries under Normal Conditions of Transport."

The NRC staff notes that WCS CISF SAR Section E.7.1.11 refers to the confinement boundary evaluation of the NAC-STC with canisters as contents. The NAC-STC package has been certified for meeting the 10 CFR Part 71.71 requirements for Normal Conditions of Transport (Docket 71-7235). As such, it's unclear why it is necessary to re-evaluate the canister confinement boundaries for transport of spent nuclear fuel to the WCS site. However, if the Normal Conditions of Transport are considered to address certain handling and transfer operations upon canister receipt at the site, specific descriptions must be provided in the SAR to justify their applicability. [Note: The request also applies to Section E.7.2 and Section E.7.2.11 for LACBWR-MPC.]

This information is needed to determine compliance with 10 CFR 72.24(c)(3) and 72.24(d)(1) and (2).

Response to RAI NP-E-6:

The observation is correct that the canister structural performance has already been certified by the NRC for the normal conditions of transport (NCT) under Docket 71-9235 and there is no need to reevaluate the canister confinement boundary. It is also a correct observation that the NAC-STC does meet the requirements of 10 CFR 71.71 for the NCT and is relied on as the confinement boundary during transport to the WCS CISF and does not need to be reevaluated. ISP included the descriptions and references to the supporting sections of the corresponding transportation SAR to demonstrate that during NCT that the confinement boundary is not adversely impacted by transport to the WCS CISF and that the confinement boundary will continue to perform its safety function when placed back into storage at the WCS CISF.

Impact:

No change as a result of this RAI.

RAI NP-E-7:

Provide for staff review NAC Calculation 30039-2010, Rev 0, "Concrete Cask Tip-Over Evaluation WCS," including any computer based analyses input/output files, for the site-specific non-mechanistic tip-over analysis.

The calculation and input/output files are necessary for reviewing the summary discussion of the cask tip-over modeling approach, its implementation, and calculated cask decelerations of Section E.12.1.3, "Concrete Cask Non- Mechanistic Tip-Over Analysis". [This request also applies to NAC Calculation 30039-2015, Rev 0, "Tip-Over DLF Calculation for WCS," as applied to Section E-12.2.3 for LACBWR MPC].

This information is needed to determine compliance with 10 CFR 72.24(c), 72.24(d)(1) and (2), and 72.122(b)(1).

Response to RAI NP-E-7:

NAC Calculation 30039-2010 has been included as Enclosure X of this RAI response package. The Input/Output files associated with Calculation 30039-2010 have been included in Enclosure Y of this RAI response package.

Impact:

No change as a result of this RAI.

SAR Appendix F, "NAC-UMS"

RAI NP-F-3:

Provide design details for the lifting yoke used for moving the transfer cask in WCS CISF SAR Section F.4.1.3, "Transfer Cask."

The lifting yoke as an ancillary component for transfer cask lifting is not part of the design approval review for the NAC-UMS SAR. As such, it must be evaluated for the WCS CISF site.

This information is needed to determine compliance with 10 CFR 72.24(c)(3) and 72.24(d)(1) and (2).

Response to RAI NP-F-3:

SAR Section F.4.1.4.3 has been updated to provide more detail regarding lifting rig assemblies, including specific lifting components and the standards used in the design.

Impact:

SAR Sections F.4.1.4.3 has been revised as described in the response.

F.4.1.4 Auxiliary Equipment

This section presents a brief description of the principal auxiliary equipment needed to operate the NAC-UMS Universal Storage System in accordance with its design.

F.4.1.4.1 Transfer Adapter

The transfer adapter is a carbon steel table that is positioned on the top of the vertical concrete cask or the transport cask and mates the transfer cask to either of those casks. It has a large center hole that allows the transportable storage canister to be raised or lowered through the plate into or out of the transfer cask. Rails are incorporated in the transfer adapter to guide and support the bottom shield doors of the transfer cask when they are in the open position. The transfer adapter also supports the hydraulic system and the actuators that open and close the bottom doors of the transfer cask.

F.4.1.4.2 Vertical Cask Transporter

The vertical cask transporter is a mobile lifting device that allows for the movement of the vertical concrete cask. The transporter engages the storage cask via the embedded lift lugs on the top of the cask. After the transporter has engaged the storage cask, it can lift the storage cask and move it to the desired location. When the storage cask has a loaded TSC, the transporter shall not lift the storage cask higher than the lift height limit in Table A5-1 of the NAC-UMS Technical Specifications, Reference F.4.2-2.

F.4.1.4.3 Rigging and Slings

Several lifting rig assemblies are required to handle various NAC-UMS components during transfer operations at the CISF. Each lifting rig assembly may consist of a combination of slings, shackles, swivel hoist rings, turnbuckles, master links, connecting links, and chains. The lifting rig assemblies are designed to meet the guidance of NUREG/CR-0612 with the following considerations made:

- *Lifting requirements consider dynamic loading (i.e., 1.1 dynamic load factor).*
- *Components meet the requirements of ASME B30 (i.e., ASME B30.9 – Slings, B30.10 – Hooks, and B30.26 – Rigging Hardware).*
- *Single-failure-proof lifting devices have enhanced safety features for handling critical loads without the need to consider drop conditions.*

Enhanced safety features include double the safety factor required for handling non-critical loads or redundant load paths, with each qualified to the safety factor required for handling non-critical loads. Note that handling of critical loads may be performed with non-single-failure proof rigging if drop conditions have been analyzed and shown to be acceptable.

Typical rigging and slings include a concrete cask lid sling, concrete cask shield plug sling, canister shield lid sling, loaded canister transfer sling (also used to handle the structural lid), and canister retaining ring sling.

All Indicated Changes are in response to RAI NP-F-3

RAI NP-F-4:

Provide safety classifications of the SSCs discussed in WCS CISF SAR Section F.4.1.4, "Auxiliary Equipment," for the WCS CISF operation.

Section F.3.1.2, "Safety Protection Systems," presents safety classifications for the NAC-UMS storage system focusing only on the cask system components for the general license approval. Auxiliary equipment needed for the site-specific operation is not addressed. As such, safety classification must also be identified for the Auxiliary Equipment used at the WCS CISF site.

This information is needed to determine compliance with 10 CFR 72.24(c)(3) and 72.24(d)(1) and (2).

Response to RAI NP-F-4:

SAR Section F.3.1.2.1 has been updated to reference Table E.3-2 (added in response to RAI NP-E-4), which provides the generic safety classifications for the auxiliary equipment.

Impact:

SAR Section F.3.1.2.1 has been revised as described in the response.

Each NAC-UMS component is classified with respect to its function and corresponding effect on public safety. In accordance with Regulatory Guide 7.10, each system component is assigned a safety classification into Category A, B or C, as shown in Table 2.3-1 of Reference F.3-1. *Table E.3-2 provides the safety classifications for the Auxiliary Equipment referenced in Sections F.4.1.4 of this SAR.* The safety classification is based on review of each component's function and the assessment of the consequences of component failure following the guidelines of NUREG/CR-6407, "Classification of Transportation Packaging and Dry Spent Fuel Storage System Components According to Importance to Safety." The safety classification categories are defined as follows:

Category A - Components critical to safe operations whose failure or malfunction could directly result in conditions adverse to safe operations, integrity of spent fuel or public health and safety.

Category B - Components with major impact on safe operations whose failure or malfunction could indirectly result in conditions adverse to safe operations, integrity of spent fuel or public health and safety.

Category C - Components whose failure would not significantly reduce the packaging effectiveness and would not likely result in conditions adverse to safe operations, integrity of spent fuel, or public health and safety.

As discussed in Section 2.3 of Reference F.3-1, the NAC-UMS design incorporates features addressing the above design considerations to assure safe operation during fuel loading, handling, and storage. The section addresses the following:

1. Protection by multiple confinement barriers and systems.
2. Protection by equipment and instrumentation selection
3. Nuclear criticality safety
4. Radiological protection
5. Fire and explosion protection
6. Ancillary Structure (Canister Handling Facility)

The confinement performance requirements for the NAC-UMS System are described in Chapter 7, Section 7.1.1.2 of Reference F.3-1 for storage conditions. In addition, "NAC-UMS Universal Transport Cask Safety Analysis Report" [F.3-2] demonstrates that the confinement boundary is not adversely affected by normal conditions of transport. Specifically, Chapter 2, Section 2.6.12 for the PWR canister. Therefore, transport to the WCS CISF will not adversely impacted confinement integrity of the NAC-UMS canister.

All Indicated Changes are in response to RAI NP-F-4

RAI NP-F-5:

Provide a rationale for the WCS CISF SAR Section F.7.1, "Maine Yankee," lead paragraph statement:

> "Finally, bounding evaluations in Section F.7.1.11 are referenced to demonstrate that the confinement boundaries for the NAC-UMS canisters do not exceed ASME B&PV Subsection NB Article NB-3200 (Level A allowables) during normal conditions of transport to provide reasonable assurance that the confinement boundary is not adversely impacted by transport to the WCS CISF."

The canister structural performance has already been certified by the NRC for NCT under Docket 71-9270 and there appears no need to reevaluate the canister confinement boundary further for transport; however, if deemed necessary, revise, as appropriate, the evaluation in Section F.7.1.11, "Structural Evaluation of NAC-UMS Canister Confinement Boundaries under Normal Conditions of Transport."

The staff notes that Section F.7.1.11 refers to the confinement boundaries evaluation of the NAC-UMS Transport cask canisters as contents. The NAC- UMS package has been certified for meeting the 10 CFR Part 71.71 requirements for Normal Conditions of Transport (Docket 71-7290). As such, it's unclear why it is necessary to evaluate the canister confinement boundaries for transport of spent nuclear fuel to the WCS site. However, if the Normal Conditions of Transport need to be considered to address certain handling and transfer operations upon canister receipt at the site, specific descriptions must be provided in the SAR to justify their applicability. [Note: The request is similar to that discussed previously for the NAC-MPC cask system]

This information is needed to determine compliance with 10 CFR 72.24(c)(3) and 72.24(d)(1) and (2).

Response to RAI NP-F-5:

The observation is correct that the canister structural performance has already been certified by the NRC for the Normal Conditions of Transport (NCT) under Docket 71-9270 and there is no need to reevaluate the canister confinement boundary. It is also a correct observation that the NAC-UMS Transport Cask meets the requirements of 10 CFR 71.71 for the NCT and is relied on as the confinement boundary during transport to the WCS CISF, and therefore does not need to be reevaluated. ISP included the descriptions and references to the supporting sections of the corresponding transportation SAR to demonstrate that during NCT that the confinement boundary is not adversely impacted by transport to the WCS CISF, and that the confinement boundary will continue to perform its safety function when placed back into storage at the WCS CISF.

Impact:

No change as a result of this RAI.

RAI NP-F-8:

Verify that the wording, "Reference 4," is correctly cited for the WCS CISF SAR page F.12-13 statement, "The acceleration used in the basket and canister evaluations for the UMS system in Reference 4 was 40g's."

"Reference 4" cannot be located in Section F.12.2, "References."

This information is needed to determine compliance with 10 CFR 72.24(c), 72.24(d)(1) and (2), and 72.122(b)(1).

Response to RAI NP-F-8:

The reference in Section F.12.1.3.12.2 (page F.12-13) is incorrect it should be Reference F.12.2-1. The WCS SAR has been updated to correct this error.

Impact:

SAR Section F.12.1.3.12.2 has been revised as described in the response.

Figure F.12-5
Deformed Shape of UMS VCC, Concrete Pad, Mudmat and Soil

The canister lid and attached canister shell peak acceleration is determined to be 26.6g, which would also correspond to the static acceleration to be applied to the model for the canister stress evaluation.

For the amplification of the accelerations during the short pulse, the maximum possible DLF for the triangular pulse is 1.52 regardless of the basket fundamental modal frequency and pulse duration. Likewise, for the accelerations during the long pulse, the maximum DLF for the sine pulse is 1.76. The Table F.12-3 shows the basket acceleration obtained from the analysis, the maximum DLF, and the amplified accelerations. The acceleration used in the basket and canister evaluations for the UMS system in Reference F.12.2-1 was 40g's. The peak basket amplified accelerations shown below is 37.7, which bounds the peak canister acceleration. Both accelerations are bounded by the design basis acceleration. Therefore, the basket and canister evaluations contained in Reference F.12.2-1 are bounding for the conditions at the CISF.

Table F.12-3
Peak Accelerations and DLF for UMS VCC Systems

Pulse	Peak Basket Analysis Acceleration (A_p) (g)	DLF	Amplified Acceleration (g) (A_p)×DLF
Short Pulse	24.8	1.52	37.7
Long Pulse	19.8	1.76	34.8

All Indicated Changes are in response to RAI NP-F-8

SAR Appendix G, "NAC-MAGNASTOR"

RAI NP-G-2:

Provide safety classifications of the SSCs discussed in WCS CISF SAR Section G.4.1.7, "Auxiliary Equipment," for the WCS CISF operation.

WCS CISF SAR Sections G.3.1.2, "Safety Protection Systems," presents safety classifications for the MAGNASTOR storage system focusing only on the cask system components for general license approval. Auxiliary equipment needed for the site-specific operation is not addressed. As such, safety classification must also be identified for the Auxiliary Equipment used at the WCS CISF site.

This information is needed to determine compliance with 10 CFR 72.24(c)(3) and 72.24(d)(1) and (2).

Response to RAI NP-G-2:

SAR Section G.3.1.2.1 has been updated to reference Table E.3-2 (added in response to RAI NP-E-4), which provides the Generic Safety Classifications for the Auxiliary Equipment.

Impact:

SAR Section G.3.1.2.1 has been revised as described in the response.

G.3.1.2 Safety Protection Systems

MAGNASTOR relies upon passive systems to ensure the protection of public health and safety, except in the case of fire or explosion. As previously discussed, fire and explosion events are effectively precluded by site administrative controls that prevent the introduction of flammable and explosive materials. The use of passive systems provides protection from mechanical or equipment failure.

G.3.1.2.1 General

MAGNASTOR is designed for safe, long-term storage of spent fuel. The system will withstand all of the evaluated normal conditions and off-normal and postulated accident events without release of radioactive material or excessive radiation exposure to workers or the general public. The major design considerations to assure safe, long-term fuel storage and retrievability for ultimate disposal by the Department of Energy in accordance with the requirements of 10 CFR 72 and ISG-2 are as follows.

- Continued radioactive material confinement in postulated accidents.
- Thick steel and concrete biological shield.
- Passive systems that ensure reliability.
- Pressurized inert helium atmosphere to provide corrosion protection for fuel cladding and enhanced heat transfer for the stored fuel.

Retrievability is defined as: "maintaining spent fuel in substantially the same physical condition as it was when originally loaded into the storage cask, which enables any future transportation, unloading and ultimate disposal activities to be performed using the same general type of equipment and procedures as were used for the initial loading."

Each major component of the system is classified with respect to its function and corresponding potential effect on public safety. In accordance with Regulatory Guide 7.10, each major system component is assigned a safety classification as shown in Table 2.4-1 or Reference G.3-1. *Table E.3-2 provides the safety classifications for the Auxiliary Equipment referenced in Sections G.4.1.7 of this SAR.* The safety classification is based on review of the component's function and the assessment of the consequences of its failure following the guidelines of NUREG/CR-6407. The safety classification categories are defined in the following list.

Category A - Components critical to safe operations whose failure or malfunction could directly result in conditions adverse to safe operations, integrity of spent fuel, or public health and safety.

Category B - Components with major impact on safe operations whose failure or malfunction could indirectly result in conditions adverse to safe operations, integrity of spent fuel, or public health and safety.

All Indicated Changes are in response to RAI NP-G-2

RAI NP-G-3:

Provide a rationale for the WCS CISF SAR Section G.7.1, "Undamaged and Damaged PWR Fuel," lead paragraph statement:

> "Finally, bounding evaluations in Section G.7.1.9 are referenced to demonstrate that the confinement boundaries for the NAC-UMS canisters do not exceed ASME B&PV Subsection NB Article NB-3200 (Level A allowables) during normal conditions of transport to provide reasonable assurance that the confinement boundary is not adversely impacted by transport to the WCS CISF."

The canister structural performance has already been certified by the NRC for NCT under Docket 71-9356 and there appears no need to reevaluate the canister confinement boundary further for transport; however, if deemed necessary, revise, as appropriate, the evaluation in Section G.7.1.9, "Structural Evaluation of NAC-MAGNASTOR Canister Confinement Boundaries under Normal Conditions of Transport."

The NRC staff notes that Section G.7.1.9 refers to the confinement boundaries evaluation of the NAC MAGNATRAN Transport cask canisters as content. The NAC-MAGNATRAN package has been certified for meeting the 10 CFR Part 71.71 requirements for Normal Conditions of Transport (Docket 71-9395). As such, it's unclear why it is necessary to evaluate the canister confinement boundaries for transport of spent nuclear fuel to the WCS site. However, if the Normal Conditions of Transport need to be considered to address certain handling and transfer operations upon canister receipt at the site, specific descriptions must be provided in the SAR to justify their applicability.

This information is needed to determine compliance with 10 CFR 72.24(c)(3) and 72.24(d)(1) and (2).

Response to RAI NP-G-3:

The observation is correct that the canister structural performance has already been certified by the NRC for the Normal Conditions of Transport (NCT) under Docket 71-9356 and there is no need to reevaluate the canister confinement boundary. The observation is also correct that the NAC-MAGNATRAN meets the requirements of 10 CFR 71.71 for the NCT and will be relied on as the confinement boundary during transport to the WCS CISF, and therefore does not need to be reevaluated. ISP included the descriptions and references to the supporting sections of the corresponding transportation SAR to demonstrate that during NCT that the confinement boundary is not adversely impacted by transport to the WCS CISF, and that the confinement boundary will continue to perform its safety function when placed back into storage at the WCS CISF.

Impact:

No change as a result of this RAI.

RAI NP-G-6:

Verify that the wording, “Reference 5,” is correctly cited for the WCS CISF SAR page F.12-14 statement, “The acceleration used in the basket and canister evaluations for the MAGNASTOR system in Reference 5 was 35g’s.”

“Reference 5” cannot be located in Section G.12.2, “References.”

This information is needed to determine compliance with 10 CFR 72.24(c), 72.24(d)(1) and (2), and 72.122(b)(1).

Response to RAI NP-G-6:

The reference in Section G.12.1.3.12.2 (page G.12-14) is incorrect it should be Reference G.12-1. The WCS SAR has been updated to correct this error.

Impact:

SAR Section G.12.1.3.12.2 has been revised as described in the response.

As indicated in Figure G.12-4, the acceleration time history shows two types of pulses. The DLF for the short pulse is based on a triangular shaped pulse. The DLF associated with the short pulse for the basket evaluation is dependent on the fundamental modal frequency of the MAGNASTOR basket and the time duration of the short pulse. Details of the modal analysis for the MAGNASTOR basket are contained in Reference G.12-3. The bounding DLF associated with the short pulse, which is dependent on basket orientation, is 1.05 resulting in an amplified acceleration for the short pulse of 29.2 g's. For the accelerations during the long pulse, the bounding DLF, for the sine pulse is 1.76, regardless of the fundamental modal frequency of the basket. The DLF of 1.76 for the sine pulse is conservatively applied to the peak transient analysis acceleration. The table below shows the basket acceleration obtained from the transient analysis, the maximum DLF, and the amplified accelerations. The acceleration used in the basket and canister evaluations for the MAGNASTOR system in Reference G.12-1 was 35g's. The peak amplified basket acceleration, which is shown below, is 33.1 and the peak canister acceleration of 28.8, and both of these accelerations are bounded by 35g. Therefore, the basket and canister evaluations contained in Reference G.12-1 are bounding for the conditions at the CISF.

All Indicated Changes are in response to RAI NP-G-6

SAR Appendix H, "Canisterized GTCC Waste," H.1., "Introduction and General Description of Installation"

RAI NP-H-1:

Revise WCS CISF SAR Appendix H.1 to address whether the confinement boundary of the GTCC canister does not exceed ASME B&PV Subsection NB Article NB-3200 (Level A allowables) during normal conditions of transport to provide reasonable assurance that the confinement boundary is not adversely impacted by transport to the WCS CISF.

The applicant made a similar statement in WCS CISF SAR Sections A.3.4.4, E.7.1, F.7.1 and G.7.1 to confirm that the canisters, received at WCS CISF, do not exceed ASME B&PV Subsection NB Article NB-3200 (Level A allowables) during normal conditions of transport to provide reasonable assurance that the confinement boundary is not adversely impacted by transport to the WCS CISF.

The applicant should add a similar statement (underlined above) in the WCS CISF SAR Appendix H if the confinement boundary of the GTCC canister does not exceed ASME B&PV Subsection NB Article NB-3200 (Level A allowables) during normal conditions of transport to provide reasonable assurance that the confinement boundary is not adversely impacted by transport to the WCS CISF.

This information is needed to determine compliance with 10 CFR 72.120(a).

Response to RAI NP-H-1:

ISP has added SAR Section H.8.3, "Structural Evaluation of Canister Confinement Boundary under Normal Conditions of Transport," to point to the evaluations demonstrating that the greater than Class C (GTCC) Waste canisters do not exceed American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Subsection NB Article NB-3200 (Level A allowables) during normal conditions of transport, which provides reasonable assurance that the confinement boundary is not adversely impacted by transport to the WCS CISF.

The addition of new SAR Section H.8.3 has caused the reference section for Appendix H.8.3 to become Section H.8.4.

Impact:

SAR Section H.8.3 has been added and Section H.8.4 has been revised as described in the response.

H.8.3 Structural Evaluation of Canister Confinement Boundary under Normal Conditions of Transport

The confinement boundaries for the canisters used to store GTCC waste are designed to meet ASME B&PV, Subsection NB, Article NB-3200 (Level A allowables) during normal conditions of transport in order to provide reasonable assurance that the confinement boundaries are not adversely impacted by transport to the WCS CISF. Since the structural design criteria for each of the GTCC waste canisters authorized for storage at the WCS CISF are the same as the structural design criteria used for the associated spent fuel canisters listed in Table 1-1, the structural evaluations of the spent fuel canister confinement boundaries under Normal Conditions of Transport also bound the corresponding GTCC waste canisters. These structural evaluations are presented in Appendix A.7.7 (NUHOMS®-MP187 Cask System); Appendix E.7.1.11, and Appendix E.1.2.11 (NAC-MPC); Appendix F.7.11 (NAC-UMS); and Appendix G.7.1.9 (NAC-MAGNASTOR).

All Indicated Changes are in response to RAI NP-H-1

Proprietary Information on Pages 91 through 109
Withheld Pursuant to 10 CFR 2.390

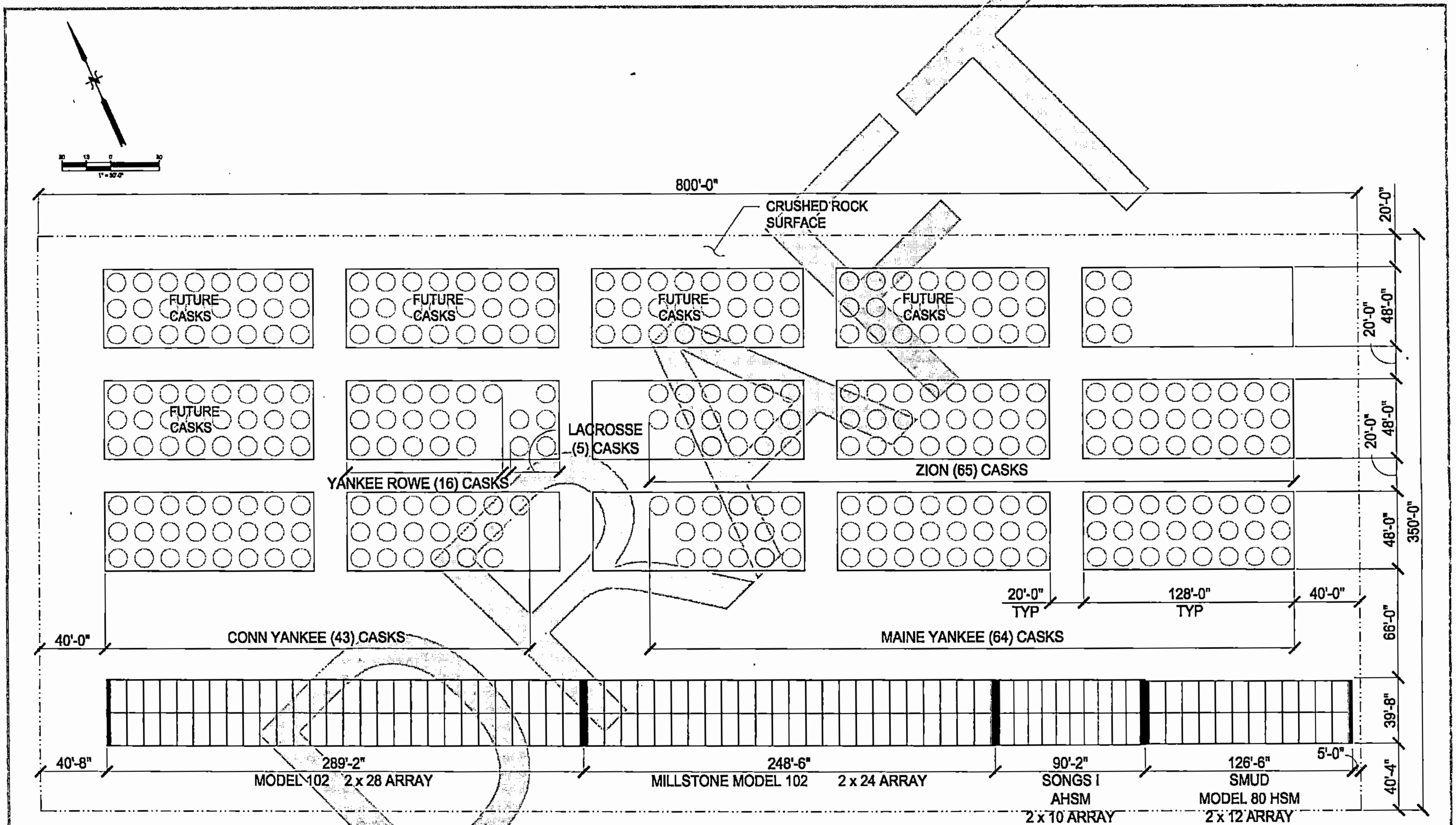


Figure 1-6
WCS CISF Storage Pad Layout