Enclosure 15 to E-51306

CoC 1004 Amendment 16, Revision 4

UFSAR Changed Pages

(Public Version)

The NUHOMS® system provides long-term interim storage for spent fuel assemblies which have been out of the reactor for a sufficient period of time and which comply with the criteria set forth in this UFSAR. The fuel assemblies are confined in a helium atmosphere by a canister containment pressure vessel. The canister is protected and shielded by a massive reinforced concrete module. Decay heat is removed from the canister and the concrete module by a passive natural draft convection ventilation system.

The canisterized spent fuel assemblies are transferred from the plant's spent fuel pool to the concrete storage modules located at the ISFSI in a transfer cask. The cask is aligned with the storage module and the canister is inserted into the module by means of a hydraulic ram. The NUHOMS® system is a totally passive installation that is designed to provide shielding and safe confinement of spent fuel for a range of postulated accident conditions and natural phenomena. As a condition of the USNRC Certificate of Compliance, temperature monitoring of the concrete module is required.

Revision 4A of this UFSAR consists of a revision to the previously submitted report and incorporates the conditions of use specified by the Certificate and US NRC's Safety Evaluation Report that were not included in earlier revisions, along with revisions to reflect design modifications and utility comments. *References to specific CoC conditions or TS requirements within UFSAR Revisions 3A and 4A apply to the Revision 0 CoC and TS.*

Revision 5 of this UFSAR incorporates all design modifications and supporting analysis implemented per Condition 9 of USNRC Certificate of Compliance (CoC) since issuance of Revision 4A. It also incorporates changes due to approval of Amendments 1 and 2 to the CoC. *References to specific CoC conditions or TS requirements within UFSAR Revision 5 refer to Amendments 1 and/or 2 CoC and TS, as appropriate, with no ambiguity.*

Revision 6 of this UFSAR incorporates all design modifications implemented per Condition 9 of CoC 1004 since issuance of UFSAR Revision 5. It also incorporates changes implemented under CoC Amendment No. 3. *References to specific CoC conditions or TS requirements within UFSAR Revision 6 apply to the Amendment 3 CoC and TS.*

Revision 7 of this UFSAR incorporates all design modifications implemented per 72.48 since the issuance of UFSAR Revision 6. It also incorporates changes implemented due to approval of Amendment No. 4 to CoC 1004. *References to specific CoC conditions or TS requirements within UFSAR Revision 7 apply to the Amendment 4 CoC and TS.*

Revision 8 of this UFSAR incorporates design modifications implemented per 72.48 since the issuance of UFSAR Revision 7. It also incorporates changes implemented due to approval of Amendments 5, 6 and 7 to CoC 1004. *References to specific CoC conditions or TS requirements within UFSAR Revision 8 refer to Amendments 5 and/or 6 and/or 7 CoC and TS, as appropriate, with no ambiguity.*

Revision 9 of this UFSAR incorporates design modifications implemented per 72.48 since the issuance of UFSAR Revision 8. It also incorporates changes implemented due to approval of Amendment 8 CoC 1004. *References to specific CoC conditions or TS requirements within UFSAR Revision 9 apply to the Amendment 8 CoC and TS.*

Revision 10 of this UFSAR incorporates design modifications implemented per 72.48 since the issuance of UFSAR Revision 9. It also incorporates changes implemented due to approval of Amendment 9 CoC 1004. *References to specific CoC conditions or TS requirements within UFSAR Revision 10 apply to the Amendment 9 CoC and TS.*

Revision 11 of this UFSAR incorporates design modifications implemented per 72.48 since the issuance of UFSAR Revision 10. It also incorporates changes implemented due to approval of Amendment 10 to CoC 1004. *References to specific CoC conditions or TS requirements within UFSAR Revision 11 apply to the Amendment 10 CoC and TS.* Revision 12 of this UFSAR incorporates design modifications implemented per 10 CFR 72.48 since the issuance of UFSAR Revision 11. *References to specific CoC conditions or TS requirements within UFSAR Revision 12 apply to the Amendment 10 CoC and TS.*

Revision 13 of this UFSAR incorporates design modifications implemented per 72.48 since the issuance of UFSAR Revision 12, including FCN 721004-951 that was approved prior to the issuance of Revision 12. It also incorporates changes implemented due to approval of Amendment 11 to CoC 1004. *References to specific CoC conditions or TS requirements within UFSAR Revision 13 apply to the Amendment 11 CoC and TS.*

Revision 14 of this UFSAR incorporates design modifications implemented per 72.48 since the issuance of UFSAR Revision 13. It also incorporates changes implemented due to approval of Amendment 13 to CoC 1004. *References to specific CoC conditions or TS requirements within UFSAR Revision 14 apply to the Amendment 13 CoC and TS.*

Revision 15 of this UFSAR incorporates design modifications implemented per 10 CFR 72.48 since the issuance of UFSAR Revision 14. *References to specific CoC conditions or TS requirements within UFSAR Revision 15 apply to the Amendment 13 CoC and TS.*

Revision 16 of this UFSAR incorporates design modifications implemented per 72.48 since the issuance of UFSAR Revision 15. It also incorporates changes implemented due to approval of Amendment 14 to CoC 1004. *References to specific CoC conditions or TS requirements within UFSAR Revision 16 apply to the Amendment 14 CoC and TS.*

Revision 17 of this UFSAR incorporates design modifications implemented per 10 CFR 72.48 since the issuance of UFSAR Revision 16. It also incorporates changes and CoC holder commitments resulting from the review and approval of the renewal of CoC 1004 (i.e., incorporation of aging management-related items). *References to specific CoC conditions or TS requirements within UFSAR Revision 17 apply to the Amendment 14 CoC and TS.*

Storage: After the DSC is inside the HSM, the hydraulic ram is disengaged from the DSC and withdrawn through the cask. The transfer trailer is pulled away, the DSC axial retainer is inserted and the HSM access door installed. The DSC is now in safe storage within the HSM.

Retrieval: For retrieval, the transfer cask is positioned and the DSC is transferred from the HSM to the cask. The hydraulic ram is used to pull the DSC into the cask. All transfer operations are performed in the same manner as previously described. Once back in the cask, the DSC with its SFAs is ready for return to the plant fuel pool or for direct off-site shipment to a repository or another storage location.

1.3.4 Arrangement of Storage Structures

The DSC, containing the SFAs, is transferred to, and stored in, the HSM in the horizontal position. Multiple HSMs are grouped together to form arrays whose size is determined to meet plant-specific needs. Arrays of HSMs are arranged within the ISFSI site on a concrete pad(s) with the entire area enclosed by a security fence. Individual HSMs are arranged adjacent to each other, spaced a small distance apart for ventilation (no spacing is needed for individual HSM-H/HSM-HS or Model 202 modules arranged adjacent to each other). The decay heat for each HSM is primarily removed by internal natural circulation flow and not by conduction through the HSM walls. Figure 1.3-11, Figure 1.3-12 and Figure 1.3-13 show typical layouts for NUHOMS® ISFSIs which are capable of modular expansion to any capacity. The parameters of interest in planning the installation layout are the configuration of the HSM array and an area in front of each HSM to provide adequate space for backing and aligning the transfer trailer.

There is no explicit requirement regarding the sequence of HSM loading. It is expected that all loading sequences will leave one or more HSMs vacant for a period of time prior to loading.

If using the HSM-HS module for storage at sites with high seismic levels, at least 3 modules are connected together as described in Appendix U.1 per the requirements of *CoC Condition II.2.a*.

Table 3.1-1
PWR Fuel Specifications for Fuel to be Stored in the Standardized NUHOMS®-24P DSC

PHYSICAL PARAMETERS	
Fuel	*Per TS Table 1-1a.*
Physical Parameters (without BPRAs)	
Maximum Assembly Length (unirradiated)	165.75 in (standard cavity) 171.71 in (long cavity)
Nominal Cross-Sectional Envelope	8.536 in
Maximum Assembly Weight	*Per TS Table 1-1a.*
Number of Assemblies per DSC	*Per TS Table 1-1a.*
Fuel Cladding	*Per TS Table 1-1a.*
Physical Parameters (with BPRAs)	
Maximum Assembly + BPRA Length (unirradiated)	
• With Burnup > 32,000 and ≤ 45,000 MWd/MTU	171.71 in (long cavity)
• With Burnup ≤ 32,000 MWd/MTU	171.96 in (long cavity)
Nominal Cross-Sectional Envelope	8.536 in
Maximum Assembly + BPRA Weight	*Per TS Table 1-1a.*
Number of Assemblies per DSC	*Per TS Table 1-1a.*
Number of BPRAs per DSC	*Per TS Table 1-1a.*
Fuel Cladding	*Per TS Table 1-1a.*
NUCLEAR PARAMETERS	
Maximum Planar Average Initial Fuel Enrichment	*Per TS Table 1-1a.*
Assembly Average Burnup, Initial Enrichment, and Cooling Time	*Per TS Table 1-1a.*
BPRA Cooling Time (Minimum)	*Per TS Table 1-1a.*
ALTERNATE NUCLEAR PARAMETERS	
Maximum Planar Average Initial Fuel Enrichment	*Per TS Table 1-1a.*
Assembly Average Burnup	*Per TS Table 1-1a.*
Decay Heat (Fuel + BPRA)	*Per TS Table 1-1a.*
Neutron Fuel Source	*Per TS Table 1-1a.*
Gamma (Fuel + BPRA) Source	*Per TS Table 1-1a.*

Table 3.1-2
BWR Fuel Specifications for Fuel to be Stored in the Standardized NUHOMS®-52B DSC

PHYSICAL PARAMETERS	
Fuel	*Per TS Table 1-1b.*
Physical Parameters	
Maximum Assembly Length (unirradiated)	176.16 in
Nominal Cross-Sectional Envelope*	5.454 in
Maximum Assembly Weight	*Per TS Table 1-1b.*
Number of Assemblies per DSC	*Per TS Table 1-1b.*
Fuel Cladding	*Per TS Table 1-1b.*
NUCLEAR PARAMETERS	
Maximum Lattice Average Initial Enrichment	*Per TS Table 1-1b.*
Assembly Average Burnup, Initial Enrichment, and Cooling Time	Per Table 3.1-8b
ALTERNATE NUCLEAR PARAMETERS	
Maximum Lattice Average Initial Enrichment	*Per TS Table 1-1b.*
Assembly Average Burnup	*Per TS Table 1-1b.*
Decay Heat	*Per TS Table 1-1b.*
Neutron Source	*Per TS Table 1-1b.*
Gamma Source	*Per TS Table 1-1b.*

* Cross-Sectional Envelope is the outside dimension of the fuel channel.

It should also be noted that a recent regulatory mandate [3.68 and 3.69] has required all U.S. utilities owning and operating nuclear plants to evaluate and protect their facility against the threat of sabotage by car or truck bomb. This evaluation has resulted in increased protection of the plant's vital areas through adoption of explosion-proof barriers and gates. Site specific ISFSI locations within the plant's protected area would be subject to the requirements of this mandate, thus requiring the applicants to ensure the same level of barrier protection for ISFSIs to safeguard against possible sabotage.

Licensees are required to verify that loadings resulting from potential fires and explosions are acceptable in accordance with 10CFR72.212(b)(2).

3.3.7 Materials Handling and Storage

3.3.7.1 Spent Fuel Handling and Storage

All spent fuel handling outside the plant's fuel pool is performed with the fuel assemblies contained in the DSC. Subcriticality during all phases of handling and storage is discussed in Section 3.3.4. The criterion for a safe configuration is an effective mean plus two-sigma neutron multiplication factor (k_{eff}) of 0.95. Section 3.3 calculations show that the expected k_{eff} value is below this limit.

Lift height restrictions are imposed on the TC and DSC with regard to their location and load temperatures. These restrictions are provided in Technical Specifications *4.4.1.*A and *4.4.1.B*.

3.3.7.1.1 Cladding Temperature Limits

Maximum allowable cladding temperature limits are determined for both BWR and PWR design basis fuel according to the methodology presented in Reference 3.21. The maximum allowable average cladding temperature for long term storage is based on the end of life hoop stress in the cladding and the cladding temperature at the beginning of dry storage. The method is estimated to calculate a storage temperature limit that will result in a probability of cladding breach of less than 0.5% in the peak rod during storage. Using this methodology produces cladding temperature limit of 381°C for design basis PWR fuel and 394 °C for the design basis BWR fuel cooled for five years or more. Appendix K addresses the cladding temperature limits for the BWR fuel in the NUHOMS®-61BT DSC and Appendix L addresses the cladding temperature limits for the PWR fuel in the NUHOMS®-24PT2 DSC. Since the damage mechanism in this methodology is thermal creep, the temperature limits are based on an average long term ambient temperature during storage of 70 °F.

381 °C (718 °F) and 394°C (741 °F) are the cladding temperature limits calculated for design basis 5-year cooled PWR and BWR fuel, respectively. Three steps were taken to extend the same methodology to the range of cooling times in the Fuel Qualification Table shown in 72-1004 CoC technical specifications. First, the same thermal computer

4.1.2 Principal Features

The principal features of a NUHOMS® ISFSI installation are described in Sections 1.2 and 1.3. The location of the ISFSI with respect to the plant site boundary and the associated emergency planning zone are site specific and are to be addressed by the licensee. The controlled access area for some typical NUHOMS® ISFSIs is illustrated in Figures 1.3-11 through 1.3-13. There are no utility systems, other than those potentially required for the temperature monitoring system*, required during storage conditions with a NUHOMS® ISFSI. Low voltage electrical power is needed to operate hydraulic pumps during DSC insertion and withdrawal operations, and for ISFSI lighting and security systems. The existing plant paging system may be extended to the ISFSI to provide telephone and paging information. There are no water or sewer systems necessary, nor are there any holding ponds, chemical and gas storage systems or open air tankage utilized for a NUHOMS® ISFSI. A NUHOMS® ISFSI has no stacks.

* A temperature monitoring system is only required if the licensee decides to use this approach for compliance with Technical Specification *3.1.4*.

4.3 Auxiliary Systems

The NUHOMS® ISFSI is a self-contained, passive storage facility which requires no auxiliary systems.

4.3.1 Ventilation Systems

Spent fuel confined in the NUHOMS® DSC is cooled by conduction and radiation within the DSC; and by conduction, convection and radiation from the DSC surface. Air inlets near the bottom of the HSM side walls and outlets near the HSM roof allow convective cooling by natural circulation. The driving force for this ventilation process is thermal buoyancy. The analysis of the HSM ventilation system is described in Section 8.1.3. No auxiliary ventilation is used or required at the ISFSI. Fuel loading/unloading and DSC closure/opening operations take place in the plant's fuel/reactor building which utilize the existing ventilation system in that facility.

4.3.1.1 Off-Gas Systems

There are no off-gas systems required for a NUHOMS® ISFSI. Any off-gas systems required during the DSC drying and backfilling operations utilize existing plant systems.

4.3.2 Electrical Systems

No electrical systems are required for the HSM or DSC during storage conditions other than for lighting and security system power except potentially for the HSM temperature monitoring*. Nonessential electrical power is used during DSC closure operations and during DSC transfer operations to the HSM. The required electrical power in the fuel/reactor building is obtained from existing plant systems. Power at the ISFSI is generally supplied from a retail source.

* A temperature monitoring system is only required if the licensee decides to use this approach for compliance with Technical Specification *3.1.4*.

4.3.3 Helium Supply System

A helium supply system may be used to force water from the DSC during closure operations.

4.3.4 Steam Supply and Distribution System

There are no steam systems utilized.

4.3.5 Water Supply System

The NUHOMS® system for loading of PWR fuel requires borated water for the DSC cavity compatible with the plant's existing fuel pool and technical specification limits.

5.1.1 Narrative Description

The following steps describe the recommended generic operating procedures for the standardized NUHOMS® system. Flowcharts of NUHOMS® system loading and retrieval operations are provided in Figure 5.1-1 and Figure 5.1-2, respectively.

5.1.1.1 Preparation of the Transfer Cask and DSC

1. Prior to placement in dry storage, the candidate fuel assemblies are to be visually examined to insure that no known or suspected gross cladding breaches exist. Pinholes and hairline cracks are acceptable. Verification of fuel integrity may also be accomplished using suitable existing plant records. The assemblies shall be evaluated (by plant records or other means) to verify that they meet the physical, thermal and radiological criteria specified in Technical Specification 2.1. Depending on the length of the authorized fuel assemblies to be loaded, fuel spacers may be placed within the DSC to reduce the fuel assembly/DSC cavity gap in consideration of Part 71 requirements. There are no requirements for fuel spacers under Part 72. Fuel spacers, if used, may be placed below the assembly, above the assembly, or both, and shall be evaluated for any adverse impact.
2. Prior to being placed in service, the transfer cask is to be cleaned or decontaminated as necessary to insure a surface contamination level of less than those specified in Technical Specification *3.3.1*.
3. Place the transfer cask in the vertical position in the cask decon area using the cask handling crane and the transfer cask lifting yoke.
4. Place scaffolding around the cask so that the top cover plate and surface of the cask are easily accessible to personnel.
5. Remove the transfer cask top cover plate and examine the cask cavity for any physical damage and ready the cask for service.
6. Examine the DSC for any physical damage which might have occurred since the receipt inspection was performed. The DSC is to be cleaned and any loose debris removed.
7. Using a crane, lower the DSC into the cask cavity by the internal lifting lugs and rotate the DSC to match the cask and DSC alignment marks.
8. Fill the cask-DSC annulus with clean, demineralized water. Place the inflatable seal into the upper cask liner recess and seal the cask-DSC annulus by pressurizing the seal with compressed air.
9. Fill the DSC cavity with water from the fuel pool or an equivalent source which meets the requirements of Technical Specification 3.2.1. For PWR fuel, the

4. Disengage the lifting yoke from the cask lifting trunnions and remove the yoke from the fuel pool. Spray the lifting yoke with clean demineralized water as it is raised out of the fuel pool.

5. Move a candidate fuel assembly from a fuel rack in accordance with the plant's 10CFR50 fuel handling procedures.

6. Prior to insertion of a spent fuel assembly into the DSC, the identity of the assembly is to be verified by two individuals using an underwater video camera or other means. Read and record the fuel assembly identification number from the fuel assembly and check this identification number against the DSC loading plan which indicates which fuel assemblies are acceptable for dry storage.

7. Position the fuel assembly for insertion into the selected DSC storage cell and load the fuel assembly. Repeat Steps 5 through 7 for each SFA loaded into the DSC. After the DSC has been fully loaded, check and record the identity and location of each fuel assembly in the DSC.

8. After all the SFAs have been placed into the DSC and their identities verified, reconnect the yoke to the previously staged DSC shield plug/cable assemblies and re-verify shield plug is level. Position the lifting yoke and the top shield plug above the fuel pool and lower the shield plug onto the DSC.

   CAUTION: Verify that all the lifting height restrictions as a function of temperature specified in Technical Specification *4.4.1.*A can be met in the following steps which involve lifting of the transfer cask.

9. Visually verify that the top shield plug is properly seated onto the DSC.

10. Position the lifting yoke with the cask trunnions and verify that it is properly engaged.

10a. From this point, until the DSC has been inserted into the HSM, the DSC will be inspected for damage after any TC drop of 15 inches or greater.

11. Raise the transfer cask to the pool surface. Prior to raising the top of the cask above the water surface, stop vertical movement.

12. Inspect the top shield plug to verify that it is properly seated onto the DSC. If not, lower the cask and reposition the top shield plug. Repeat Steps 11 and 12 as necessary.

13. Continue to raise the cask from the pool and spray the exposed portion of the cask with demineralized water until the top region of the cask is accessible.

14. Drain any excess water from the top of the DSC shield plug back to the fuel pool.

15. Lift the cask from the fuel pool. As the cask is raised from the pool, continue to spray the cask with demineralized water.

16. Move the transfer cask with loaded DSC to the cask decon area.

17. Install TC seismic restraints if required by *CoC Appendix A Inspections, Tests, and Evaluations Item 3.1.7* (required only on plant-specific basis).

18. Verify that the transfer cask dose rates are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

5.1.1.3 <u>DSC Drying and Backfilling</u>

1. Check the radiation levels along the perimeter of the cask. The cask exterior surface should be decontaminated as necessary in accordance with the limits specified in Technical Specification *3.3.1*. Temporary shielding may be installed as necessary to minimize personnel exposure. Fill neutron shield with demineralized water, if empty.

2. Place scaffolding around the cask so that any point on the surface of the cask is easily accessible to personnel.

3. Disengage the rigging cables from the top shield plug and remove the eyebolts. Disengage the lifting yoke from the trunnions and move it clear of the cask.

4. Decontaminate the exposed surfaces of the DSC shell perimeter and remove the inflatable cask/DSC annulus seal.

4a. In accordance with Technical Specification *4.3.2*, verify that the neutron shield (NS) is filled before the draining operation in Step 5 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

5. Connect the cask drain line to the cask, open the cask cavity drain port and allow water from the annulus to drain out until the water level is approximately twelve inches below the top edge of the DSC shell. Take swipes around the outer surface of the DSC shell and check for smearable contamination in accordance with the Technical Specification *3.3.1* limits.

6. Install the automated welding machine onto the inner top cover plate and place the inner top cover plate with the automated welding machine onto the DSC. Verify proper fit-up of the inner top cover plate with the DSC shell.

7. Check radiation levels along surface of the inner top cover plate. Temporary shielding may be installed as necessary to minimize personnel exposure.

7a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 8 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

8. Connect the vacuum drying system (VDS) to the DSC and use the liquid pump to drain approximately 60 gallons from the DSC to the fuel pool. Consistent with ISG-22 [5.8] guidance and Technical Specification 3.1.1, helium at 1-3 psig is used to backfill the DSC with an inert gas as water is being removed from the DSC. This will lower the water level about four inches below the bottom of the shield plug. Provisions should be made to assure that air will not enter the DSC cavity. This may be achieved by replenishing the helium in the DSC cavity during cask movement from the fuel pool to the decon area in case of a malfunction of equipment used for cask movement.

9. Disconnect the VDS from the DSC.

   CAUTION: An additional step is required to address Bulletin 96-04 concerns (5.5). This step provides for continuous hydrogen monitoring during the welding of the top inner cover plate as described in step 11 (5.4) and for compliance with Technical Specification *4.3.3*. Insert a ¼ inch tygon tubing of sufficient length through the vent port such that it terminates just below the DSC shield plug. Connect the tygon tubing to a hydrogen monitor to allow continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner cover plate. Optionally, other methods may be used for continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner top cover plate, to comply with the Technical Specification. Ensure that the DSC internal pressure remains atmospheric during welding of the inner top closure plate.

10. Cover the cask/DSC annulus to prevent debris and weld splatter from entering the annulus.

11. Ready the automated welding machine and tack weld the inner top cover plate to the DSC shell. Complete the inner top cover plate weldment and remove the automated welding machine.

   CAUTION: For DSCs with spacer discs coated with aluminum, continuously monitor the hydrogen concentration in the DSC cavity using the tygon tube arrangement described in step 9 during the inner top cover plate cutting/welding operations. Verify that the measured hydrogen concentration does not exceed a safety limit of 2.4% (5.4) (60% of flammability limit of 4.0%). If this limit is exceeded, stop all welding operations and purge the DSC cavity with 2-3 psig helium (or any other inert medium) via the ¼" tygon tubing to reduce the hydrogen concentration safely below the 2.4% limit. This step is optional for DSCs with spacer discs which have been coated with electroless nickel.

12. Perform dye penetrant weld examination of the inner top cover plate weld in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

13. Place the strongback so that it sits on the inner top cover plate and is oriented such that:
    - the DSC siphon and vent ports are accessible
    - the strongback stud holes line up with the TC lid bolt holes.

14. Lubricate the studs and, using a crossing pattern, adjust the strongback studs to snug tight ensuring approximately even pressure on the cover plate.

15. Connect the VDS to the DSC siphon and vent ports.

16. Install temporary shielding to minimize personnel exposure throughout the subsequent operations as required.

16a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 17 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

17. Engage the helium supply and open the valve on the vent port and allow helium gas to force the water from the DSC cavity through the siphon port. Use of helium is required per Technical Specification 3.1.1.

18. Once the water stops flowing from the DSC, close the DSC siphon port and disengage the gas source. Verify that the TC axial surface dose rates are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2* (Not required for the 24PHB DSC). The configuration for determining the TC axial dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

18a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 19 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

19. Open the cask drain port valve and remove the remaining water from the cask/DSC annulus. (This step may be performed after completion of the vacuum drying procedure or after the DSC sealing operations.)

20. Connect the hose from the vent port and the siphon port to the intake of the vacuum pump. Connect a hose from the discharge side of the VDS to the plant's radioactive waste system or spent fuel pool. Connect the VDS to a helium source.

    CAUTION: During the vacuum drying evolution, personnel should be in the area of loading operations, or in nearby low dose areas in order to take proper action in the event of a malfunction.

21. Open the valve on the suction side of the pump, start the VDS and draw a vacuum on the DSC cavity. The cavity pressure should be reduced in steps of approximately 100 torr, 50 torr, 25 torr, 15 torr, 10 torr, 5 torr, and 3 torr. After pumping down to each level, the pump is valved off and the cavity pressure monitored. The cavity pressure will rise as water and other volatiles in the cavity evaporate. When the cavity pressure stabilizes, the pump is valved in to complete the vacuum drying process. It may be necessary to repeat some steps, depending on the rate and extent of the pressure increase. Vacuum drying is complete when the pressure stabilizes for a minimum of 30 minutes at 3 torr or less as specified in Technical Specification 3.1.1.

    Note: The user shall ensure that the vacuum pump is isolated from the DSC cavity when demonstrating compliance with Technical Specification 3.1.1 requirements. Simply closing the valve between the DSC and the vacuum pump is not sufficient, as a faulty valve allows the vacuum pump to continue to draw a vacuum on the DSC. Turning off the pump, or opening the suction side of the pump to atmosphere are examples of ways to ensure that the pump is not continuing to draw a vacuum on the DSC.

22. Open the valve to the vent port and allow the helium to flow into the DSC cavity.

23. Pressurize the DSC with helium to about 24 psia not to exceed 34 psia.

24. Helium leak test the inner top cover plate weld for leakage in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1* limits.

25. If a leak is found, repair the weld, repressurize the DSC and repeat the helium leak test.

26. Once no leaks are detected, depressurize the DSC cavity by releasing the helium through the VDS to the plant's spent fuel pool or radioactive waste system.

27. Re-evacuate the DSC cavity using the VDS. The cavity pressure should be reduced in steps of approximately 10 torr, 5 torr, and 3 torr. After pumping down to each level, the pump is valved off and the cavity pressure is monitored. When the cavity pressure stabilizes, the pump is valved in to continue the vacuum drying process. Vacuum drying is complete when the pressure stabilizes for a minimum of 30 minutes at 3 torr or less in accordance with Technical Specification 3.1.1 limits.

    Note: The user shall ensure that the vacuum pump is isolated from the DSC cavity when demonstrating compliance with Technical Specification 3.1.1 requirements. Simply closing the valve between the DSC and the vacuum pump is not sufficient, as a faulty valve allows the vacuum pump to continue to draw a vacuum on the DSC. Turning off the pump, or opening the suction side of the pump to atmosphere are examples of ways to ensure that the pump is not continuing to draw a vacuum on the DSC.

28. Open the valve on the vent port and allow helium to flow into the DSC cavity to pressurize the DSC to 2.5 psig ± 2.5 psig in accordance with Technical Specification 3.1.2.a limits.

29. Close the valves on the helium source.

30. Remove the Strongback, decontaminate as necessary, and store.

5.1.1.4 <u>DSC Sealing Operations</u>

1. Disconnect the VDS from the DSC. Seal weld the prefabricated plugs over the vent and siphon ports and perform a dye penetrant weld examination in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

2. Install the automated welding machine onto the outer top cover plate and place the outer top cover plate with the automated welding system onto the DSC. Verify proper fit up of the outer top cover plate with the DSC shell.

3. Tack weld the outer top cover plate to the DSC shell. Complete the outer top cover plate weld root pass. Perform dye penetrant examination of the root pass weld. Weld out the outer top cover plate to the DSC shell and perform dye penetrant examination on the weld surface in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3*.

4. Remove the automated welding machine from the DSC. Rig the cask top cover plate and lower the cover plate onto the transfer cask.

5. Bolt the cask cover plate into place, tightening the bolts to the required torque in a star pattern. Verify that the TC radial dose rates measured at the surface of the transfer cask are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. The configuration for determining the TC radial surface dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

5.1.1.5 <u>Transfer Cask Downending and Transfer to ISFSI</u>

NOTE:

<u>Alternate Procedure for Downending of Transfer Cask</u>: Some plants have limited floor hatch openings above the cask/trailer/skid, which limit crane travel (within the hatch

CAUTION: Verify that the requirements of Technical Specification *4.4.1.B*, "TC/DSC Transfer Operations at High Ambient Temperatures" are met prior to next step.

3. Using a suitable heavy haul tractor, transfer the cask from the plant's fuel/reactor building to the ISFSI along the designated transfer route.

4. Once at the ISFSI, position the transfer trailer to within a few feet of the HSM.

5. Check the position of the trailer to ensure the centerline of the HSM and cask approximately coincide. If the trailer is not properly oriented, reposition the trailer, as necessary.

6. Back the cask to within a few inches of the HSM, set the trailer brakes and disengage the tractor. Drive the tractor clear of the trailer. Extend the transfer trailer vertical jacks.

7. Unbolt and remove the cask top cover plate.

8. Connect the skid positioning system hydraulic power unit to the positioning system via the hose connector panel on the trailer, and power it up. Remove the skid tie-down bolts and use the skid positioning system to bring the cask into approximate vertical and horizontal alignment with the HSM. Using optical survey equipment and the alignment marks on the cask and the HSM, adjust the position of the cask until it is properly aligned with the HSM.

9. Using the skid positioning system, fully insert the cask into the HSM access opening docking flange.

10. Secure the cask trunnions to the front wall embedments of the HSM using the cask restraints.

11. After the cask is docked with the HSM, verify the alignment of the transfer cask using the optical survey equipment.

12. Position the hydraulic ram behind the cask in approximate horizontal alignment with the cask and align the ram. Remove either the bottom ram access cover plate or the outer plug of the two-piece temporary shield plug. Power up the ram hydraulic power supply and extend the ram through the bottom cask opening into the DSC grapple ring.

13. Activate the hydraulic cylinder on the ram grapple and engage the grapple arms with the DSC grapple ring.

14. Recheck all alignment marks and ready all systems for DSC transfer. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

    If the alignment tolerance is exceeded, the following actions should be taken:

    a. Confirm that the transfer system is properly configured,

    b. Check and repair the alignment equipment, or

    c. Confirm the locations of the alignment targets on the TC and HSM.

15. Activate the hydraulic ram to initiate insertion of the DSC into the HSM. Stop the ram when the DSC reaches the support rail stops at the back of the module.

16. Disengage the ram grapple mechanism so that the grapple is retracted away from the DSC grapple ring.

17. Retract and disengage the hydraulic ram system from the cask and move it clear of the cask. Remove the cask restraints from the HSM.

18. Using the skid positioning system, disengage the cask from the HSM access opening. Insert DSC axial retainer.

19. The trailer may be moved as necessary to install the HSM door. Install the HSM door and secure it in place. Verify that the HSM dose rates are compliant with the limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Items 3.3.1 and 3.3.2*.

20. Replace the transfer cask top cover plate (optional, may be done later away from the ISFSI). Secure the skid to the trailer, retract the vertical jacks and disconnect the skid positioning system.

21. If this is the final loading, fully drain the liquid neutron shield.

22. Tow the trailer and cask to the designated equipment storage area. Return the remaining transfer equipment to the storage area.

23. Close and lock the ISFSI access gate and activate the ISFSI security measures.

5.1.1.7 Monitoring Operations

1. Perform routine security surveillance in accordance with the licensee's ISFSI security plan.

Note: Perform one of the two alternate surveillance activities listed below.

2a. Perform a daily visual surveillance of the HSM air inlets and outlets (end wall and roof birdscreens) to insure that no debris is obstructing the HSM vents in accordance with Technical Specification *3.1.4*.a requirements.

2b. Perform a temperature measurement of the thermal performance, for each HSM, on a daily basis in accordance with Technical Specification *3.1.4*.b requirements.

5.1.1.8 <u>DSC Retrieval from the HSM</u>

1. Ready the transfer cask, transfer trailer, and support skid for service and tow the trailer to the HSM.

2. Back the trailer as close to the HSM as compatible with HSM door removal, remove the cask top cover plate. Remove the HSM door. Remove the DSC axial retainer.

3. Using the skid positioning system align the cask with the HSM and position the skid until the cask is docked with the HSM access opening.

4. Using optical survey equipment verify alignment of the cask with respect to the HSM. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

   If the alignment tolerance is exceeded, the following actions should be taken:

   a. Confirm that the transfer system is properly configured,

   b. Check and repair the alignment equipment, or

   c. Confirm the locations of the alignment targets on the TC and HSM.

4a. Install the cask restraints.

5. Install and align the hydraulic ram with the cask.

6. Extend the ram through the cask into the HSM until it is inserted in the DSC grapple ring.

7. Activate the arms on the ram grapple mechanism with the DSC grapple ring.

7a. From this point, until fuel has been removed from the DSC or the DSC has been removed from the TC, the DSC will be inspected for damage after any TC drop of 15 inches or greater.

8. Retract ram and pull the DSC into the cask.

9. Retract the ram grapple arms.

10. Disengage the ram from the cask.

11. Remove the cask restraints.

12. Using the skid positioning system, disengage the cask from the HSM.

13. Install the cask top cover plate and ready the trailer for transfer.

14. Replace the door on the HSM.

5.1.1.9 Removal of Fuel from the DSC

When the DSC has been removed from the HSM, there are several potential options for off-site shipment of the fuel. It is preferred to ship the DSC intact to a reprocessing facility, monitored retrievable storage facility or permanent geologic repository in a compatible shipping cask licensed under 10CFR71.

If it becomes necessary to remove fuel from the DSC prior to off-site shipment, there are two basic options available at the ISFSI or reactor site. The fuel assemblies could be removed and reloaded into a shipping cask using dry transfer techniques, or if the applicant so desires, the initial fuel loading sequence could be reversed and the plant's spent fuel pool utilized. Procedures for unloading of the DSC in a fuel pool are presented here, however wet or dry procedures. This operation is to be performed under the site's standard health physics guidelines for welding, grinding, and handling of potentially highly contaminated equipment. These are to include the use of prudent housekeeping measures and monitoring of airborne particulates. Procedures may require personnel to perform the work using respirators or supplied air.

If fuel needs to be removed from the DSC, either at the end of service life or for inspection after an accident, precautions must be taken against the potential for the presence of damaged or oxidized fuel and to prevent radiological exposure to personnel during this operation. A sampling of the atmosphere within the DSC will be taken prior to inspection or removal of fuel.

This can be achieved with this design by the use of the purge and fill valves which permit a determination of the atmosphere within the DSC before the removal of the inner top cover and shield plugs, prior to filling the DSC cavity with water (borated water for the 24P). If the atmosphere within the DSC is helium and radioactivity check of the atmosphere in the DSC cavity did not detect the presence of any airborne radioactive particulates, then operations should proceed normally with fuel removal either via the TC or in the pool, if available. However, if air or airborne radioactive particulates are present within the DSC, then appropriate filters should be in place to preclude the uncontrolled release of any potential airborne radioactive particulate from the DSC via the purge-fill valves. This will protect both personnel and the operations area from potential contamination. For the accident case, personnel protection in the form of respirators or supplied air should be considered in accordance with licensee's Radiation Protection Program.

CAUTION: If unloading in a dry cell, provisions must be made to ensure that an inert helium gas atmosphere is provided during unloading operations for prevention of oxidation of the fuel rods in accordance with the requirements of ISG-22 [5.8]. In addition, consistent with the guidance provided in [5.8], the unloading procedure steps must be designed to minimize the time duration and the temperature of the environment to which the bare fuel is exposed during unloading in a dry cell.

If the work is performed outside the fuel/reactor building, a tent may be constructed over the work area which may be kept under a negative pressure to control airborne particulates. Any radioactive gas release will be Kr-85, which is not readily captured. Whether the krypton is vented through the plant stack or allowed to be released directly depends on the plant operating requirements.

Following opening of the DSC, the cask and DSC are filled with water prior to the placement in the fuel pool to prevent a sudden inrush of pool water. Cask placement into the pool is performed in the usual manner. Fuel unloading procedures will be governed by the plant operating license under 10CFR50. The generic procedures for these operations are as follows:

14. Locate the DSC siphon and vent port using the indications on the top cover plate. Place a portable drill press on the top of the DSC. Position the drill with the siphon port.

15. Place an exhaust hood or tent over the DSC, if necessary. The exhaust should be filtered or routed to the site radwaste system.

16. Drill hole(s) through the DSC top cover plate to expose the siphon and vent port quick connects.

17. Drill holes through the siphon and vent port cover plates to expose the siphon and vent port quick connects.

18. Obtain a sample of the DSC atmosphere, if necessary (e.g., at the end of service life). Fill the DSC with water from the fuel pool (and meeting the requirements of Technical Specification 3.2.1, if required) through the siphon port with the vent port open and routed to the plant's off-gas system.

CAUTION:

(a) The water fill rate must be regulated during this reflooding operation to ensure that the DSC vent pressure does not exceed 20.0 psig.

(b) To address Bulletin 96-04 concerns (5.5), and for compliance with Technical Specification *4.3.3*, provide for continuous hydrogen monitoring of the DSC cavity atmosphere (Reference step 5.1.1.3.9) during all subsequent cutting operations to ensure that a safety limit of 2.4% (60% of flammability limit of 4.0%) hydrogen concentration is not exceeded (5.4). Purge with 2-3 psig helium (or any other inert medium) as necessary to maintain the hydrogen concentration safely below this limit.

19. Place welding blankets around the cask and scaffolding.

20. Using plasma arc-gouging, a mechanical cutting system or other suitable means, remove the seal weld from the outer top cover plate and DSC shell. A fire watch should be placed on the scaffolding with the welder, as appropriate. The exhaust system should be operating at all times.

21. The material or waste from the cutting or grinding process should be treated and handled in accordance with the plant's low level waste procedures unless determined otherwise.

22. Remove the top of the tent, if necessary.

23. Remove the exhaust hood, if necessary.

24. Remove the DSC outer top cover plate.

25. Reinstall tent and temporary shielding, as required. Remove the seal weld from the inner top cover plate to the DSC shell in the same manner as the top cover plate. Remove the inner top cover plate. Remove any remaining excess material on the inside shell surface by grinding.

26. Clean the cask surface of dirt and any debris which may be on the cask surface as a result of the weld removal operation. Any other procedures which are required for the operation of the cask should take place at this point as necessary.

27. Engage the yoke onto the trunnions, install eyebolts into the top shield plug and connect the rigging cables to the eyebolts.

28. Visually inspect the lifting hooks or the yoke to insure that they are properly positioned on the trunnions.

5.4 Operation Support System

NUHOMS® is a self contained passive system and requires no effluent processing systems during storage conditions.

5.4.1 Instrumentation and Control System

There are no instrumentation and control systems used during storage conditions, except for potentially the HSM temperature monitoring required by NUHOMS® Technical Specification *3.1.4*.b. (A temperature monitoring system is only required if the licensee decides to use this approach for compliance with Technical Specification *3.1.4*.) The instrumentation and controls necessary during DSC loading, closure and transfer are described in Section 5.1.3.4.

5.4.2 System and Component Spares

Other than spares for the HSM temperature monitoring, there are no instrumentation or control systems used during storage conditions; thus, no other system and component spare parts are required.

7.3 Radiation Protection Design Features

7.3.1 Installation Design Features

The design considerations listed in Section 7.1.2 ensure that occupational exposures to radiation are ALARA and that a high degree of integrity is achieved through the confinement of radioactive materials inside the DSC. Applicable portions of Regulatory Position 2 of Regulatory Guide 8.8 (7.5) have been used as guidance.

A. Access control to radiation areas should utilize the licensee's existing plant procedures.

B. Radiation shielding substantially reduces the exposure of personnel during system operations and storage.

C. The NUHOMS® system is a passive storage system; no process instrumentation or controls are necessary during storage. The only required instrumentation is potentially the HSM temperature monitoring required by the Certificate conditions of use.*
*A temperature monitoring system is only required if the licensee decides to use this approach for compliance with Technical Specification *3.1.4*.

D. Airborne contaminants and gaseous radiation sources are confined by the high integrity double seal welded DSC assembly.

E. No crud is produced by the NUHOMS® system.

F. The necessity for decontamination is reduced by maintaining the cleanliness of the DSC and transfer cask during fuel loading and unloading operations (see Section 5.1); the DSC and transfer cask surfaces are smooth, nonporous, and are generally free of crevices, cracks, and sharp corners.

G. No radiation monitoring system is required during storage.

H. No resin or sludge is produced by the NUHOMS® system.

The NUHOMS® system is a passive storage system which uses ambient air for decay heat removal. Each HSM is capable of providing sufficient ventilation and natural circulation to assure adequate cooling of the DSC and its contents so that fuel cladding integrity is maintained. The convective cooling system is completely passive and requires no filtration system.

The off-normal thermal gradients and maximum temperatures are also developed for the DSC resting in the HSM, as described in Section 8.1.3.2. The maximum off-normal surface temperature calculated for the DSC shell is 382°F for an extreme ambient air temperature of 125°F.

There may be restrictions for onsite transfer and handling of the DSC under these extreme temperature conditions. Refer to Technical Specifications *4.4.1.A and 4.4.1.B* of the NUHOMS® COC.

C. Transfer Cask Off-Normal Thermal Stress Analysis

As described in Section 8.1.3.3 the maximum temperatures and associated through wall thermal gradients are calculated for a loaded on-site transfer cask for a maximum ambient temperature range of -40°F and 125°F. The temperature gradient for the 125°F ambient temperature case includes a sun screen that allows no solar heat flux on the cask. For the standardized cask the bounding 100°F case with solar insolation results in a maximum calculated temperature of 235°F on the exterior of the transfer cask and a maximum through wall temperature gradient of 61°F for the bounding postulated off-normal cases.

For the OS197 transfer cask, the maximum calculated temperature on the cask exterior is 251°F for the 125°F ambient temperature case with no solar heat flux.

The results of the off-normal thermal analyses shown in Table 8.1-10, Table 8.1-11, Table 8.1-21, and Table 8.1-21a and Table 8.1-21b for each of the NUHOMS® system components are combined with the appropriate results from other analyses for the associated load combinations. The resulting stresses and comparisons with allowable stresses are discussed in Section 8.2.10.

There may be restrictions for onsite handling of the transfer cask with a loaded DSC under these extreme temperature conditions. Refer to Technical Specifications *4.4.1.A and 4.4.1.B* of the NUHOMS® COC.

8.1.3 Thermal Hydraulic Analysis

This section of the SAR describes the thermal analysis of the NUHOMS® HSM, DSC and transfer cask. The analytical models of the HSM, the DSC and the transfer cask are described and the calculation results summarized. The thermophysical properties of the NUHOMS® system components used in the thermal analysis are listed in Table 8.1-8 and Table 8.1-9. The following evaluations are performed for the NUHOMS® system:

1. Thermal Analysis of the HSM

2. Thermal Analysis of the DSC in the HSM

3. Thermal Analysis of the DSC in the Transfer Cask

Table 8.1-17
Thermal Load Case Definitions for HSM Structural Analysis

Thermal Condition	Case No	Ambient Temp. (°F)	Maximum Inner Surface Temperature (°F)			Maximum Outer Surface Temperature (°F)			Maximum Thermal Gradient[3] (°F)		
			Roof	Wall	Floor	Roof	Wall	Floor[1]	Roof	Wall	Floor[1]
Normal Operating (T_o)	1 2 3[2]	70 100 0	164 201	137 172	139 172	114 142	118 152	125 155	50 59	29 32	14 17
Off-Normal (T_a)	1 2	125 -40	241 11	203 7	199 10	186 –26	181 –7	180 5	55 37	34 14	25 4
Accident (T_a)	1[4] 2	125 -40	441 250	414 237	479 295	240 54	312 138	361 174	201 196	102 99	118 121

---

1. The floor outside temperature and maximum gradient are reported for the one foot thick HSM floor.
2. The gradients are lower for the 70°F ambient case than the 100°F ambient case. These gradients will be even lower for the 0°F ambient case. Therefore, the 0°F is not considered further in this analysis for concrete.
3. Based on maximum gradient at any cross-section.
4. The reported value corresponds to an accident duration of 120 hours. This value bounds the analysis results corresponding to the licensing basis transient of 40 hours (COC Technical Specification *3.1.4.a*).
5. A description of the various thermal conditions follows.

Table 8.1-24
NUHOMS®-24P HSM Thermal Analysis Results Summary

Case	HSM Air Temperature (°F)		Maximum DSC Outer Surface Temperature (°F)			Maximum Concrete Temperature (°F)			
	In	Out	Bottom	Side	Top	Roof Inside	Roof Outside	Side Wall	Floor
1	70	165	248	311	345	164	114	137	139
2	100	200	273	339	374	201	142	172	172
3	125	230	295	362	399	241	186	203	199
4	N/A (All HSM vents plugged for 40 hours with outside air at 125°F)		485	599	640	441(1)	240(1)	414(1)	479(1)

(1) The reported value corresponds to an accident duration of 120 hours. This value bounds the analysis results corresponding to the licensing basis transient of 40 hours (CoC Technical Specification *3.1.4*.a).

Table 8.1-25
NUHOMS®-52B HSM Thermal Analysis Results Summary

Case	HSM Air Temperature (°F)		Maximum DSC Outer Surface Temperature (°F)			Maximum Concrete Temperature (°F)			
	In	Out	Bottom	Side	Top	Roof Inside	Roof Outside	Side Wall	Floor
1	70	151	214	270	300	150	112	127	128
2	100	186	239	297	328	185	140	161	160
3	125	215	261	320	352	224	184	192	187
4	N/A(All vents plugged for 40 hours with outside airat 125°F)		485	599	640	441(1)	240(1)	414(1)	479(1)

1. The reported value corresponds to an accident duration of 120 hours. This value bounds the analysis results corresponding to the licensing basis transient of 40 hours (CoC Technical Specification *3.1.4*.a).

Table 8.1-26
NUHOMS®-24P DSC Thermal Analysis Results Summary

Case	HSM Vent Air Inlet Temperature (°F)	Max. DSC Shell Temperature (°F)	Max. Fuel Cladding Temperature (°F/°C)	Average Helium Temperature (°F)	Fuel Cladding Acceptance Criteria (°F/°C)
1	70	345	700/371	420	724/384
2	100	374	711/377	435	1058/570
3	125	399	720/382	447	1058/570
4	N/A (HSM Vents plugged for 40 hours with ambient air at 125°F)	640	871/466[(1)]	667[(1)]	1058/570[(1)]
5	N/A (DSC in cask with internal vacuum)	<399[(2)]	<720/382[(2)]	N/A	1058/570

1. The reported value corresponds to an accident duration of 120 hours. This value bounds the analysis results corresponding to the licensing basis transient of 40 hours (CoC Technical Specification *3.1.4*.a).
2. The off-normal thermal analysis (Case 3) bounds the vacuum drying case (Case 5) because of the use of helium for blowdown.

Table 8.1-27
NUHOMS®-52B DSC Thermal Analysis Results

Case	HSM Vent Air Inlet Temperature (°F)	Max. DSC Shell Temperature (°F)	Max. Fuel Cladding Temperature (°F/°C)	Average Helium Temperature (°F)	Fuel Cladding Acceptance Criteria (°F/°C)
1	70	300	725/385	481	790/421
2	100	328	735/391	492	790/421
3	125	352	743/395	502	1058/570
4	N/A (HSM Vents plugged for 40 hours with ambient air at 125°F)	640	905/495(1)	719(1)	1058/570(1)
5	N/A (DSC in cask with internal vacuum)	<352(2)	<743/395(2)	N/A	1058/570

1. The reported value corresponds to an accident duration of 120 hours. This value bounds the analysis results corresponding to the licensing basis transient of 40 hours (CoC Technical Specification *3.1.4*.a).
2. The off-normal thermal analysis (Case 3) bounds the vacuum drying case (Case 5) because of the use of helium for blowdown.

temperatures are limited by the heat up of the total quantity of concrete behind the surface. Therefore, applying a constant heat flux to the HSM concrete and calculating the time dependent temperature distributions through the concrete, the surface temperature of the concrete as a function of time is obtained. Using the calculated HSM surface temperatures, the maximum DSC and fuel cladding temperatures are determined.

A thermal transient analysis of the HSM for the blocked vent condition is performed using a control volume model of the HSM internal air space and the surrounding concrete walls, roof, and floor. The first law of thermodynamics is used to obtain an energy balance equation that is solved using a forward finite differencing scheme with a sufficiently small time step to ensure the accuracy of the solution. The initial conditions for the analysis correspond to the steady state temperatures calculated for the off-normal analysis cases with an ambient temperature of 125 °F. The heat source included in the analysis is the 24 kW decay heat rejected from the surface of the DSC. Technical Specification *3.1.4*.a of CoC 1004 requires surveillance to ensure that HSM vents are not blocked for periods longer than that assumed in the safety analysis (40 hours). At the end of 40 hours, it is assumed that corrective actions would be completed and natural circulation air flow restored to the HSM. However, to be conservative, the solution is carried out to five days. The change in temperature with time after vent opening blockage for the HSM roof interior surface is shown in Figure 8.2-16.

At the end of the five days, the maximum HSM inside surface is 479 °F. The concrete temperature transient results are used to calculate the DSC shell transient temperatures. The same model of the DSC in HSM cases described in Section 8.1.3 is used. All the convection boundary conditions on the interior of HSM are deleted to simulate complete blockage of all inlet and outlet vents. The conductivity of the basket material is conservatively assumed to be that of fuel. The effective density and specific heat of the homogenized basket material and fuel are used. The maximum DSC surface temperature is 640 °F at the end of 40 hours in the blocked vent transient. Using the HEATING7 models of the DSC and its internals described in Section 8.1.3, the maximum fuel cladding temperatures for this case are calculated to be 871 °F (466 °C) for the PWR fuel and 905 °F (485 °C) for the BWR fuel. The fuel clad temperature at the start of the blocked vent transient for the 125°F extreme ambient temperature case are calculated to be less than 720 °F (382 °C) for the PWR fuel and 743 °F (395 °C) for the BWR fuel. The maximum fuel clad temperature as a function of time is expected to vary linearly between these two temperature values. The resulting temperatures are well below the fuel cladding short term temperature limit of 570 °C.

These temperatures are below the levels that safety impairing damage would occur to the HSM or DSC. ACI 349 (8.20) imposes a maximum upper limit of 350°F for concrete temperatures for accident or other short term conditions. As shown in Figure 8.2-16, the HSM concrete temperatures exceed 350 °F sometime after 40 hours for a blocked vent transient. Hence, the NUHOMS® Technical Specification *3.1.4* requires a daily visual inspection of the HSM air inlets and outlets or daily monitoring of the HSM thermal performance. The short time exposure of the DSC and the spent fuel assemblies to the elevated temperatures will not cause any damage or result in the release of radioactivity. The maximum DSC internal pressure during this event is 12.1 psig for the PWR fuel and 10.0 psig for the BWR fuel (assuming that no fission and fill gas is released).

9.3 Training Program

All personnel working at the ISFSI should receive training and indoctrination aimed at providing and maintaining a well-qualified work force for safe and efficient operation of the ISFSI. The licensee may utilize the existing plant training program to provide this training and indoctrination. Additional sections to the program should be added to include information specific to the ISFSI.

9.3.1 Program Description

9.3.1.1 Training for Operations Personnel

Generalized training should be provided to plant operations personnel in the applicable regulations and standards and in the engineering principles of passive cooling, radiological shielding, and structural characteristics of the ISFSI. Detailed operator training should be provided for DSC preparation and handling, fuel loading, transfer cask preparation and handling, and transfer trailer loading.

9.3.1.2 Training for Maintenance Personnel

Generalized training should be provided to plant maintenance personnel on the applicable regulations and standards and in the engineering principles of passive cooling, radiological shielding, and structural characteristics of the ISFSI. Specific training should be provided for use of the DSC vacuum drying system; the automated welding equipment for DSC closure; operation of the transfer trailer; alignment of the cask skid with the HSM; assembly of the hydraulic ram system; and normal and off-normal operation of the hydraulic ram. Specific training should also be provided for cleaning of the HSM air inlets and outlets.

9.3.1.3 Training for Health Physics Personnel

Generalized training should be provided to plant health physics personnel on the applicable regulations and standards and in the engineering principles of passive cooling, radiological shielding, and structural characteristics of the ISFSI. Specific training should be provided in radiological shielding design of the system, particularly the DSC top shield plug, the transfer cask and the HSM.

9.3.1.4 Training for Security Personnel

Details of the training program for security personnel are provided in the Security Plan to be maintained by the licensee, which is to be withheld from public disclosure in accordance with 10CFR2.790(d) and 10CFR73.21.

9.3.1.5 Specific Training Module Elements

The training modules shall include the following elements, at a minimum:

- *Standardized NUHOMS® System design (overview)*

- *ISFSI Facility design (overview)*
- *Structures, Systems, and Components Important to Safety (overview)*
- *NUHOMS® System UFSAR (overview)*
- *NRC Safety Evaluation Report (overview)*
- *Certificate of Compliance conditions (overview)*
- *NUHOMS® System Technical Specifications*
- *Applicable Regulatory Requirements (e.g., 10 CFR Part 72, Subpart K, 10 CFR Part 20, 10 CFR Part 73, 10 CFR Part 50)*
- *Required Instrumentation and Use*
- *Operating Experience Reviews*
- *NUHOMS® System and Maintenance procedures, including:*
  - *Fuel qualification and loading,*
  - *Rigging and handling,*
  - *Applicable LOADING OPERATIONS as described in Chapters 5, K.8, M.8, N.8, P.8, R.8, T.8, U. 8, W.8, Y.8, and Z.8 of the UFSAR,*
  - *UNLOADING OPERATIONS including reflooding,*
  - *Auxiliary equipment operations and maintenance (i.e., welding operations, vacuum drying, helium backfilling and leak testing, reflooding),*
  - *TRANSFER OPERATIONS including loading and unloading of the Transfer Vehicle,*
  - *ISFSI Surveillance operations,*
  - *Radiation Protection,*
  - *Maintenance, as described in the UFSAR,*
  - *Security, and*
  - *Off-normal and accident conditions, responses and corrective actions.*

10. OPERATING CONTROLS AND LIMITS

At the time of approval of the initial licensing, the information originally presented in SAR Chapter 10, Operating Controls and Limits, was moved to the Technical Specifications of NUHOMS® CoC 1004, including the Technical Specifications Bases. With Amendment 11 to CoC 1004, the Technical Specifications *were* converted to the NUREG-1745 format. Therefore, the Bases *were* returned to this chapter. The Bases follow Tables 10-1*, 10-2,* and 10-*3*, which are discussed below.

Original SAR Chapter 10 requirements are currently referenced in various TN documents. Table 10-1 provides a cross-reference index of the original Technical Specifications against the corresponding sections in the original SAR Chapter 10 requirements.

A cross-reference table showing the relationship between the Amendment 10 Technical Specification sections and their corresponding Amendment 11 Technical Specifications is provided as Table 10-2. Certain CoC conditions and NRC commitments are also discussed in Table 10-2.

Table 10-2 also includes the current location of the Bases statements from the Amendment 10 Technical Specifications.

CoC 1004 Amendment 16 created new CoC appendices, such as the Appendix A Inspections, Tests, and Evaluations (ITE), and rearranged the CoC conditions and the Technical Specifications (TS), as as part of an industry initiative for a graded approach to 10 CFR Part 72 licensing. Table 10-3 provides a cross reference of the CoC 1004 Amendment 15 CoC conditions and TS to their corresponding Amendment 16 licensing basis document location.

Table 10-1
Index of CoC Requirements v/s Historical SAR References

CoC Section No.[1]	Title of CoC Requirements	Historical **SAR** Reference
1.2	**Technical Specifications, Functional and Operating Limits**	**10.3**
1.2.1	Fuel Specification	10.3.1
1.2.2	DSC Vacuum Pressure During Drying	10.3.2
1.2.3	DSC Helium Backfill Pressure	10.3.3
1.2.4	DSC Helium Leak Rate of Inner Seal Weld	10.3.4
1.2.5	DSC Dye Penetrant Test of Closure Welds	10.3.5
1.2.6	Deleted	10.3.6
1.2.7	HSM Dose Rates	10.3.7
1.2.8	HSM Maximum Air Exit Temperature	10.3.8
1.2.9	Transfer Cask Alignment with HSM	10.3.9
1.2.10	DSC Handling Height Outside the Spent Fuel Pool Building	10.3.10
1.2.11	Transfer Cask Dose Rates	10.3.11
1.2.12	Maximum DSC Removable Surface Contamination	10.3.12
1.2.13	TC/DSC Lifting Heights as a Function of Low Temperature and Location	10.3.13
1.2.14	TC/DSC Transfer Operations at High Ambient Temperatures	10.3.14
1.2.15	Boron Concentration in the DSC Cavity Water (24-P Design Only)	10.3.15
1.2.16	Provision of TC Seismic Restraint Inside the Spent Fuel Building as a function of Horizontal Acceleration and Loaded Cask Weight	10.3.16
Table 1-1a	PWR Fuel Specifications of Fuel to be Stored in the Standardized NUHOMS®-24P DSC	Table 10.3-1
Table 1-1b	BWR Fuel Specifications of Fuel to be Stored in the Standardized NUHOMS® 52B DSC	Table 10.3-2
Figure 1.1	PWR Fuel Criticality Acceptance Curve	Figure 10.3.1
1.3	**Surveillance and Monitoring**	**10.4**
1.3.1	Visual Inspection of HSM Air Inlets and Outlets (Front Wall and Roof Birdscreen)	10.4.1
1.3.2	HSM Thermal Performance	10.4.2
Table 1.3.1	Summary of Surveillance and Monitoring Requirements	Table 10.4-1

Note 1 – These section numbers reflect the CoC prior to Amendment 11; Table 10-2 below provides a cross reference *between Amendments 10 and 11. Table 10-3 provides a cross-reference of the CoC conditions and TS between Amendments 15 and 16.*

Table 10-2
Technical Specification
Cross Reference Table between Amendment 10 and Amendment 11

Amendment 10 Tech Spec	Amendment 11 Tech Spec	Location of Amendment 10 Bases
1.1.1 Regulatory Requirement of General License	4.2.1 Horizontal Storage Module, and 4.3.3 Site Specific Parameters and Analyses	N/A
1.1.2 Operating Procedures	5.1 Procedures	N/A
1.1.3 Quality Assurance	Part of CoC	N/A
1.1.4 Heavy Loads	Part of CoC	N/A
1.1.5 Training Module	5.2.2 Training Program	N/A
1.1.6 Pre-Operational Testing and Training Exercise	Part of CoC	N/A
1.1.7 Special Requirements for First System in Place	Not in STS	N/A
1.1.8 Surveillance Requirements Applicability	3.0 Limiting Condition for Operation (LCO) and Surveillance Requirements (SR) Applicability	N/A
1.1.9 Supplement Shielding	4.3.3 Site Specific Parameters and Analyses	N/A
1.1.10 HSM-H Storage Configuration	4.3.1 Storage Configuration	N/A
1.1.11 Hydrogen Gas Monitoring for 61BTH and 32PTH1 DSCs	5.2.6 Hydrogen Gas Monitoring for 24P, 52B, 24PHB, 61BT, 32PT, 24PTH, 61BTH and 32PTH1 DSCs	N/A
1.1.12 Codes and Standards	4.2 Codes and Standards	N/A
1.2.1 Fuel Specifications	2.1 Fuel to be stored in the standardized NUHOMS® System and 4.1-Canister Criticality control	B 10.2
1.2.2 DSC Vacuum Pressure During Drying	3.1.1 DSC Bulk Water Removal Medium and Vacuum Drying Pressure	B 10.3.1.1
1.2.3, 1.2.3a DSC Helium Backfill Pressure for Various DSCs	3.1.2 DSC Helium Backfill Pressure for various DSCs	B 10.3.1.2
1.2.4, 1.2.4a DSC Helium Leak Rate of Inner Seal Weld for Various DSCs	5.2.4.c	B 10.5.2.4.c
1.2.5 DSC Dye Penetrant Test of Closure Welds	5.2.4.b	B 10.5.2.4.b
1.2.6 Deleted	N/A	N/A
1.2.7, 1.2.7a, 1.2.7b, 1.2.7c, 1.2.7d, 1.2.7e, 1.2.7f, 1.2.7g HSM Dose Rates with Various Loaded DSCs	5.4 HSM or HSM-H Dose Rate Evaluation Program	B 10.5.4
1.2.8, 1.2.8a, 1.2.8b, 1.2.8c HSM Maximum Exit Air Temperature with Various Loaded DSCs	3.1.4 HSM Maximum Air Exit Temperature with a Loaded DSC	B 10.3.1.4
1.2.9 Transfer Cask Alignment with HSM or HSM-H	5.3.3 Transfer Cask Alignment with HSM or HSM-H	B 10.5.3.3
1.2.10, 1.2.13, 1.2.14 and 1.2.14a TC/DSC Handling/Lifting Heights and Ambient Temperatures for Various DSCs	5.3.1 TC/DSC Lifting/Handling Height Limits	B 10.5.3.1
1.2.11, 1.2.11a through e TC Dose Rates with Various Loaded DSCs	5.2.4.e	B 10.5.2.4.e
1.2.12 Maximum DSC Removable Surface Contamination	5.2.4.d	B 10.5.2.4.d

Table 10-2
Technical Specification
Cross Reference Table between Amendment 10 and Amendment 11
(concluded)

Amendment 10 Tech Spec	Amendment 11 Tech Spec	Location of Amendment 10 Bases
1.2.13 See line above for 1.2.10, which includes 1.2.13	—	—
1.2.14 See line above for 1.2.10, which includes 1.2.14 and 14a	—	—
1.2.15, 1.2.15a, 1.2.15b, 1.2.15c, 1.2.15d Boron Concentration in the DSC Cavity Water for Various DSCs	3.2 Cask Criticality Control	B 10.3.2
1.2.16 Provision of TC Seismic Restraint Inside the Spent Fuel Pool Building as a Function of Horizontal Acceleration and Loaded Cask Weight	4.3.3 Site Specific Parameters and Analyses	B 10.4.3.3.7
1.2.17, 1.2.17a, 1.2.17b, 1.2.17c Vacuum Drying Duration Limits for Various DSCs	Deleted due to use of Helium	N/A
1.2.18, 1.2.18a, 1.2.18b Time Limit for Completion of 24PTH, 61BTH Type 2 or 32PTH1 DSC Transfer Operations	3.1.3 Time Limit for Completion of TRANSFER OPERATIONS (24PTH, 61BTH Type 2 or 32PTH1 DSC Only)	B 10.3.1.3
1.2.19 61BTH and 32PTH1 DSC Bulkwater Removal Medium	3.1.1 DSC Bulkwater Removal Medium and Vacuum Drying Pressure	B 10.3.1.1
1.3.1 Visual Inspection of HSM or HSM-H Air Inlets and Outlets (Front Wall and Roof Birdscreen)	5.2.5a Daily visual inspection of HSM or HSM-H Air Inlets and Outlets (front wall and roof bird screens)	B 10.5.2.5
1.3.2 HSM or HSM-H Thermal Performance	5.2.5b Daily HSM or HSM-H Temperature Measurement	B 10.5.2.5
From CoC condition 7, concrete testing for HSM-H	5.5 Concrete testing for HSM-H	N/A
From CoC condition 8, HSM-H configuration changes	5.6 HSM-H configuration changes	N/A
NRC Request: supplement shielding shall be used with OS197L cask	Included in new Section 4.4.1	N/A
NRC Request: modify TN's proposed wording on "Contingency Planning" for abnormal events, eliminate terms contingency planning, abnormal events, high dose rates	Added to Section 5.2.4 "Radiation Protection Program"	N/A
NRC Request: include a requirement for user to perform dose assessment ahead of time and augment Part 20 program and address recovery from a potential malfunction of a remote handling device	Added to Section 5.2.4 "Radiation Protection Program" and also modified Appendix W.10 Occupational Exposure Section to include exposure due to recovery operations from a potential malfunction of a remote handling device (Crane failure)	N/A
NRC Request: include the requirement of dose assessment for cases when Transfer cask requires use of remote operations.	Added to Section 5.2.4 "Radiation Protection Program"	N/A

Table 10-3
CoC Conditions and Technical Specifications
Cross Reference Table between Amendment 15 and Amendment 16
(2 Pages)

Amendment 15 CoC Condition or Technical Specification (TS)	Location in Amendment 16 Licensing Basis Documents
CoC Condition 1	Still a CoC condition, but re-worded
CoC Condition 2	Removed from the licensing basis
CoC Condition 3a	CoC Condition I
CoC Condition 3b	CoC Condition I CoC Condition II.3.a
CoC Condition 3c	Already included in UFSAR
CoC Condition 3d	Already included in UFSAR
CoC Condition 4	Removed from the licensing basis
CoC Condition 5	Removed from the licensing basis
CoC Condition 6	Removed from the licensing basis
CoC Condition 7	CoC Appendix B TS 4.3.4
CoC Condition 8	CoC Appendix B TS 4.3.5
TS 1.1	Unchanged
TS 1.2	Unchanged
TS 1.3	Unchanged
TS 1.4	Unchanged
TS 2.1	Unchanged
TS 2.1.1	Unchanged
TS 2.2.1	Unchanged
TS 2.2.2	CoC Appendix B TS 4.1.1
TS 2.2.3	CoC Appendix B TS 4.1.2
TS 3.0	Unchanged
TS 3.1.1	Unchanged
TS 3.1.2	Unchanged
TS 3.1.3	Unchanged
TS 3.1.4	CoC Appendix A Inspections, Tests, and Evaluations (ITE) 4.4
TS 3.2.1	Unchanged
TS 4.0	Removed from the licensing basis
TS 4.1 (first paragraph)	Removed from the licensing basis
TS 4.1 (table),	CoC Appendix A ITE 2.0
TS 4.1 (Notes)	Condensed neutron poison acceptance testing in CoC Appendix A ITE 2.1, 2.2, 2.3 and 2.4
TS 4.1 (proposed alternatives provision)	Removed from the TS
TS 4.2.1	CoC Condition II.1.a
TS 4.2.2	CoC Condition II.1.b
TS 4.2.3	CoC Condition II.1.c
TS 4.2.4	CoC Condition II.1.d, CoC Appendix C - ASME Code Alternatives

Table 10-3
CoC Conditions and Technical Specifications
Cross Reference Table between Amendment 15 and Amendment 16

(2 Pages)

Amendment 15 CoC Condition or Technical Specification (TS)	***Location in Amendment 16 Licensing Basis Documents***
TS 4.3	*CoC Condition II.2*
TS 4.3.1	*CoC Condition II.2.a*
TS 4.3.2	*Already included in UFSAR*
TS 4.3.3-1 through 11	*CoC Appendix A ITE 3.1*
TS 4.4	*CoC Condition II.3.b*
TS 4.4.1	*CoC Condition II.3.b, and II.3.b(1)*
TS 4.4.2	*CoC Condition II.3.b, and II.3.b(2)*
TS 4.4.3	*CoC Condition II.3.b, and II.3.b(3)*
TS 4.4.4	*CoC Condition II.3.b, and II.3.b(4)*
TS 4.5	*CoC Appendix A ITE 4.1*
TS 5.1	*CoC Appendix B TS 4.2*
TS 5.1.1	*Removed from the licensing basis*
TS 5.1.2	*TS 5.1.2.1 and TS 5.1.2.3 are removed from the licensing basis. TS 5.1.2.2 is now CoC Appendix B TS 4.4.1.C*
TS 5.2 (introduction)	*CoC Appendix B TS 4.3*
TS 5.2.1	*Removed from the licensing basis*
TS 5.2.2	*Moved to UFSAR*
TS 5.2.3	*CoC Appendix B TS 4.3.1*
TS 5.2.4 (introduction)	*Removed from the licensing basis*
TS 5.2.4.a	*CoC Appendix B TS 4.3.2*
TS 5.2.4.b	*CoC Appendix A ITE 4.3*
TS 5.2.4.c	*CoC Appendix A ITE 4.1*
TS 5.2.4.d	*CoC Appendix B TS 3.3.1*
TS 5.2.4.e	*CoC Appendix A ITE 3.2*
TS 5.2.5	*CoC Appendix B TS 3.1.4*
TS 5.2.6	*CoC Appendix B TS 4.3.3*
TS 5.3.1	*CoC Appendix B TS 4.4.1*
TS 5.3.2	*Moved to UFSAR*
TS 5.3.3	*Moved to UFSAR*
TS 5.3.4	*CoC Appendix B TS 4.4.2*
TS 5.4	*CoC Appendix A ITE 3.3*
TS 5.5	*CoC Appendix A ITE 4.2*
TS 5.6	*CoC Appendix B TS 4.5*
TS Tables	*TS Tables 1-1d, 1-1f, 1-1m, 1-1u, 1-1bb, 1-1ii, and 1-1nn are no longer in the Technical Specifications in Amendment 16 (Note: The fuel qualifications tables are still under discussion.)*
All TS Figures	*Unchanged*

NUHOMS® COC 1004 TECHNICAL SPECIFICATION BASES

As discussed on page 10-1, with Amendment 11 to CoC 1004, the Technical Specifications (TS) *were* converted to the NUREG-1745 format and the TS bases *were* returned to this chapter. The numbering scheme for the TS changed a great deal as the TS were converted to the NUREG-1745 format. *Additionally, as also discussed on Page 10-1, Amendment 16 further changed the numbering scheme for the licensing basis documents.* Therefore there is not a documented basis for each *CoC condition, ITE item, or* TS and therefore the numbering scheme of this chapter, as reflected in the table of contents below, is not comprehensive.

TABLE OF CONTENTS

B 10 *ITE 3.1* Site Specific Parameters and Analyses

BASES

B 10 *ITE 3.1*-1 The basis for this *ITE item* is UFSAR Section 3.2.2, “Water Level (Flood) Design.”

B 10 *ITE 3.1*-2 The basis for this *ITE item* is UFSAR Section 3.2.4, “Snow and Ice Loads.”

B 10 *ITE 3.1*-3 The bases for this *ITE item* are the decay heat removal related UFSAR sections shown below, for the indicated DSC types:

Section 1.2.2 – 24P	Section N.4.4 – 24PHB
Section 1.2.2 – 52B	Section P.4.4 – 24PTH
Section K.4.4 – 61BT	Section T.4.4 – 61BTH
Section M.4.4 – 32PT	Section U.4.4 – 32PTH1
Section Y.4.4 – 69BTH	Section Z.4.4 - 37PTH

B 10 *ITE 3.1*-4 The bases for this *ITE item* are the decay heat removal related UFSAR sections shown below, for the indicated DSC types:

Section 1.2.2 – 24P	Section N.4.5 – 24PHB
Section 1.2.2 – 52B	Section P.4.4 – 24PTH
Section K.4.5 – 61BT	Section T.4.4 – 61BTH
Section M.4.5 – 32PT	Section U.4.4 – 32PTH1
Section Y.4.4 – 69BTH	Section Z.4.4 - 37PTH

B 10 *ITE 3.1*-5 The basis for this *ITE item* is UFSAR Section 3.3.6, “Fire and Explosion Protection.”

B 10 *ITE 3.1*-6 The basis for this *ITE item* is NUREG-1536, Rev. 1, definition of, “Real Individual.”

B 10 *ITE 3.1*-7 The basis for this *ITE item* is UFSAR Section 8.2.3.2-D, “Transfer Cask Seismic Evaluation.”

B 10 *ITE 3.1*-8 The bases for this *ITE item* are UFSAR Sections 3.2.3, “Seismic Design Criteria,” P.2.2.3, “Seismic Design,” T.2.2.3, “Seismic Design,” and U.2.2.3, “Seismic Design,” Y.2.2.3, “Seismic Design,” and Z.2.2.3, “Seismic Design.”

B 10 *ITE 3.1*-9 The basis for this *ITE item* is 10 CFR 72.212(b)(2)(i)(B).

B 10 *ITE 3.1*-10 The basis for this *ITE item* is 10 CFR 72.212(b)(3).

B 10 *ITE 3.1*-11 The basis for this *ITE item* is 10 CFR 72.212(b)(2)(i)(B).

B 10 *ITE 3.2* Transfer Cask Dose Rates

BASES

These dose rates are based on the shielding analysis for the various DSCs included in the UFSAR Chapter 7 and Appendices J, K, M, N, P, T, U, Y, Z, and W, with some added margin for uncertainty. The cross references to these appendices are shown in the following table.

DSC	**Transfer Cask Axial Surface Dose Rate Configuration in UFSAR**	**Transfer Cask Radial Surface Dose Rate Configuration in UFSAR**
24P	Table J.5-3, Shield Plug	Table 7.3-2, TRANSFER
52B	Bounded by 24P	Bounded by 24P
61BT	Inner Cover Welding, Figure K.5-14	Table K.5-2, TRANSFER
32PT	Inner Cover Welding, Figure M.5-27	Table M.5-5, TRANSFER
24PHB	Inner Cover Welding, Figure N.5-14 (neutron), Figure N.5-17 (gamma)	Table N.5-3, TRANSFER
24PTH(1)	Welding, Table P.5-4	Table P.5-3, TRANSFER
24PTH-S-LC	Bounded by 24PTH	Table P.5-5, TRANSFER
61BTH	Welding, Table T.5-5	Table T.5-4, TRANSFER
32PTH1	Welding, Table U.5-3	Table U.5-2, TRANSFER
69BTH	Welding, Table Y.5-4	Table Y.5-3 TRANSFER
37PTH	Welding, Table Z.5-3	Table Z.5-2 TRANSFER
61BT(2)	Inner Cover Welding, Figure K.5-14	Figure W.5-2 (Maximum)
32PT(2)	Inner Cover Welding, Figure M.5-27	Figure W.5-2 (Maximum)

(1) Does not apply to the 24PTH-S-LC
(2) Applicable only to the OS197L TC

B 10 *ITE 3.3* HSM or HSM-H Dose Rate Evaluation Program

BASES

The specified dose rates provide as-low-as-is-reasonably- achievable on-site and off-site doses in accordance with 10 CFR Part 20 and 10 CFR 72.104(a).

These dose rates are based on the shielding analysis for the various DSCs included in the UFSAR Chapter 7 and Appendices J, K, M, N, P, T, U, W, Y, and Z with some added margin for uncertainty.

The cross references to these appendices are shown in the following table.

DSC	**HSM**	**HSM Door Outer Surface Dose Rate Configuration in UFSAR**	**HSM Front Surface Dose Rate Configuration in UFSAR**	**HSM Front Bird Screen Surface Dose Rate Configuration in UFSAR**
24P	Standardized HSM	Table 7.3-2	Table 7.3-2	Table 7.3-2
52B	Standardized HSM	Bounded by 24P	Bounded by 24P	Bounded by 24P
61BT	Standardized HSM	Table K.5-2	Table K.5-3	Table K.5-2
32PT	Standardized HSM	Table M.5-3	Table M.5-4	Table M.5-3
24PHB	Standardized HSM	Table N.5-3	Table N.5-4	Table N.5-4
24PTH-S-LC	Standardized HSM	Table P.5-2	Table P.5-2	Table P.5-2
61BTH	Standardized HSM	Table T.5-3	Table T.5-3	Table T.5-3
24PTH	HSM-H	Table P.5-1	Table P.5-1	Table P.5-1
61BTH	HSM-H	Table T.5-1	Table T.5-1	Table T.5-1
32PTH1	HSM-H	Table U.5-1	Table U.5-1	Table U.5-1
69BTH	HSM-H	Table Y.5-1	Table Y.5-1	Table Y.5-1
37PTH	HSM-H	Table Z.5-1	Table Z.5-1	Table Z.5-1

B 10 *ITE 4.1*   Leak Test

BASES

If the DSC leaked at the maximum acceptable rate of 1.0×10^{-4} atm cm^3/s for a period of 60 years, about 189,600 cc of helium would escape from the DSC. This is about 3.25% of the 5.83×10^6 cm^3 of helium initially introduced in the DSC. This conservatively assumes no reduction of internal gas temperature and pressure. Considering reduction of internal gas temperature and pressure the total helium loss over the period of extended operation (60 years) is calculated as 59,800 cm^3 or 1.03% of the initial helium inventory.

The 61BT, 32PT, 24PHB, 24PTH, 61BTH, 32PTH1, 69BTH and 37PTH DSC will maintain an inert atmosphere around the fuel and radiological consequences will be negligible, since it is designed and tested to be leak tight.

B 10 *ITE 4.3*   DSC Dye Penetrant Test of Closure Welds

BASES

Article NB-5000 Examination, ASME Boiler and Pressure Vessel Code, Section III, Division 1, Sub-Section NB.

BASES

Following initial DSC transfer to the HSM, air temperature increase between the HSM inlet vents and outlet vents is monitored until equilibrium conditions are achieved. For a DSC with a heat load less than the design basis, the methodology, level of conservationism, and margins used in the UFSAR is used to predict the temperature increase corresponding to a design basis DSC heat load.

Long-term integrity of the fuel cladding depends on storage in an inert atmosphere and maintaining fuel cladding temperature below an acceptable limit. The thermal analysis provided in the UFSAR (see referenced UFSAR Chapters below) evaluates the maximum HSM air exit temperatures and HSM concrete temperatures with a design basis heat load DSC under normal, off-normal, and accident conditions.

The HSM air temperature rise is monitored to ensure that the temperatures of the fuel cladding and the HSM concrete do not exceed the values calculated in the UFSAR thermal analysis for a given heat load.

This specification is applicable to a HSM or a HSM-H or high seismic option for HSM-H (HSM-HS) following an initial transfer of a loaded DSC (24P, 52B, 61BT, 32PT, 24PHB, 24PTH, 61BTH, 32PTH1, 69BTH or 37PTH) into them or the occurrence of an accident condition.

The actions are associated with checking HSM or HSM-H or HSM-HS inlet and outlet vents for any blockages and for ensuring that the excessive temperature rise is not due to environmental factors. If the temperatures cannot be controlled to within acceptable limits, the cask must be unloaded within the time period as determined by the analysis to ensure that the fuel cladding does not exceed the regulatory limit during storage.

The air temperature rise of greater than the specified amount can occur if the inlet and/or outlet vents are blocked. The blocked vent analysis documented in various thermal analysis sections of the UFSAR for the various canisters show that concrete and fuel cladding temperatures are below the analyzed limits if the surveillance frequency of once per day (daily) is used to inspect for the blockage.

A completion time of 30 days to perform the analysis is selected because with the vents open, there is significant margin to the accident condition temperature limits on the concrete and fuel cladding temperatures.

The HSM or HSM-H or HSM-HS air temperature rise is measured 24 hours after the DSC is inserted into the HSM or HSM-H or HSM-HS and repeated every 24 hours until an equilibrium condition is achieved. The measured thermal performance of the cask is then compared against that predicted by the UFSAR thermal analysis for the same heat load to ensure that the system is performing as designed.

REFERENCES

HSM	DSC Model	Applicable UFSAR References
Standardized HSM	24P and 52B	Chapter 8
Standardized HSM/HSM-HS	61BT	Appendix K.4
Standardized HSM/HSM-HS	32PT	Appendix M.4
Standardized HSM	24PHB	Appendix N.4
Standardized HSM/HSM-H/HSM-HS	24PTH-S-LC or 24PTH-S or 24PTH-L	Appendix P.4
Standardized HSM/HSM-H/HSM-HS	61BTH Type 1 or Type 2	Appendix T.4
Standardized HSM-H/HSM-HS	32PTH1	Appendix U.4
HSM-H/HSM-HS	69BTH	Appendix Y.4
HSM-H/HSM-HS	37PTH	Appendix Z.4

B 10 *TS* 2 FUNCTIONAL AND OPERATING LIMITS

Note: The Limiting Conditions for Operation (LCOs), Actions, Surveillance Requirements (SRs), etc. discussed herein are found in the NUHOMS® COC 1004 Technical Specifications.

BASES

BACKGROUND

The Standardized NUHOMS® DSC design (Models 24P, 52B, 61BT, 32PT, 24PHB, 24PTH, 61BTH and 32PTH1, 69BTH, and 37PTH) requires certain limits on the spent fuel parameters, including fuel type, maximum allowable enrichment prior to irradiation, maximum burnup, minimum acceptable cooling time prior to storage in the NUHOMS® System, and physical condition of the spent fuel (i.e., intact, damaged, or failed fuel assemblies). Other important limitations are the radiological source terms from Control Components associated with the fuel assemblies to be stored. These limitations are included in the thermal, structural, radiological, and criticality evaluations performed for these DSC designs.

APPLICABLE SAFETY ANALYSIS

Various analyses have been performed that use these fuel parameters as assumptions. These assumptions are included in the thermal, criticality, structural, shielding and confinement analyses provided in the referenced UFSAR chapters below and as discussed further here.

The specification is based on consideration of the design basis parameters included in the UFSAR and limitations imposed as a result of the staff review. Such parameters stem from the type of fuel analyzed, structural limitations, criteria for criticality safety, criteria for heat removal, and criteria for radiological protection. The Standardized NUHOMS® System is designed for dry, horizontal storage of irradiated light water reactor (LWR) fuel. The principal design parameters of the fuel to be stored can accommodate standard PWR fuel designs manufactured by Babcock and Wilcox (B&W), Combustion Engineering (CE), and Westinghouse (WE), AREVA, and standard BWR fuel manufactured by General Electric (GE), Exxon/ANF, and Framatome ANP, ABB, and AREVA. The NUHOMS®-24P and 52B systems are limited for use to these standard designs and to reload designs by other manufacturers as listed in Chapter 3 of the UFSAR. The analyses presented in the UFSAR are based on non-consolidated, zirconium-alloy clad fuel with no known or suspected gross breaches.

The NUHOMS®-61BT, 32PT, 24PHB, 24PTH, 61BTH, 32PTH1, 69BTH, and 37PTH Systems are limited for use to these standard designs and to reload designs by other manufacturers as listed in Tables 1-1d, 1-1f, 1-1i, 1-1j, 1-1m, 1-1u, 1-1bb, 1-1ii, and 1-1nn. The corresponding analyses for these systems are presented in Appendix K, M, N, P, T, U, Y, and Z, respectively, of the UFSAR.

The physical parameters that define the mechanical and structural design of the HSM and DSC are the fuel assembly dimensions and weight. The calculated stresses given in the UFSAR are based on the physical parameters given in Tables 1-1a, 1-1b, 1-1c, 1-1d, 1-1e, 1-1f, 1-1i, 1-1j, 1-1l, 1-1m, 1-1t, 1-1u, 1-1aa, 1-1bb, 1-1gg, 1-1ii,, 1-1ll, and 1-1nn which represent the upper bound.

The design basis fuel assemblies for nuclear criticality safety are Babcock and Wilcox 15x15 fuel assemblies for the NUHOMS®-24P and 24PHB, General Electric 7x7 fuel assemblies for the NUHOMS®-52B and General Electric 10x10 fuel assemblies for the NUHOMS®-61BT, 61BTH and 69BTH designs. The nuclear criticality safety for the NUHOMS®-32PT, NUHOMS®-24PTH, NUHOMS® -32PTH1 and 37PTH designs is based on an evaluation of individual fuel assembly class as listed in Table 1-1e, Table 1-1l, Table 1-1aa and Table 1-1ll, respectively.

The NUHOMS®-24P Long Cavity DSC is designed for use with standard Burnable Poison Rod Assembly (BPRA) designs for the B&W 15x15 and Westinghouse 17x17 fuel types as listed in Appendix J of the UFSAR. The NUHOMS®-24PHB Long Cavity DSC is designed for use with standard BPRA designs for the B&W 15x15 fuel types listed in Appendix N of the UFSAR.

The design basis PWR BPRA for shielding source terms and thermal decay heat load is the Westinghouse 17x17 Pyrex Burnable Absorber, while the DSC internal pressure analysis is limited by B&W 15x15 BPRAs. In addition, BPRAs with cladding failures were determined to be acceptable for loading into NUHOMS®-24P Long Cavity DSC as evaluated in Appendix J of the UFSAR. The acceptability of loading BPRAs, including damaged BPRAs into the long cavity versions of the 32PT and 24PTH DSC configurations is provided in Appendix M and Appendix P respectively of the UFSAR.

Control Components (CCs), as listed in Table 1-1e, Table 1-1i, Table 1-1l, Table 1-1aa and Table 1-1ii are authorized for storage in the NUHOMS®-32PT DSC, NUHOMS®-24PHB DSC, NUHOMS®-24PTH DSC and NUHOMS®-32PTH1 DSC, and NUHOMS® -37PTH DSC, respectively. For these DSCs, BPRAs are considered as being representative of all CCs. Materials that are positioned or operated within the envelope of the fuel assembly during reactor operation are also considered as CCs. The thermal and radiological limits for CCs that extend into the active fuel such as (but not limited to) BPRAs, NSAs, and CRAs and for CCs that do not extend into the active fuel such as (but not limited to) TPAs, and ORAs are specified separately. Table 1-1n specifies these limits for the NUHOMS®-24PHB DSC and the NUHOMS®-24PTH DSC. Table 1-1ee specifies these limits for the NUHOMS®-32PT DSC and the NUHOMS®-32PTH1 DSC. Table 1-1qq specifies these limits for the NUHOMS®-37PTH DSC. The source term limits specified in these tables corresponds to the Co-60 spectrum as presented in Appendix J of the UFSAR. The acceptability of loading CCs into the NUHOMS®-32PT, NUHOMS®-24PHB, , NUHOMS®-24PTH, NUHOMS®-32PTH1, and NUHOMS® -37PTH DSCs is provided in Appendix M, N, P, U, and Z of the UFSAR, respectively.

The boron concentration of the spent fuel pool water and the water added to the cavity of the loaded 24P, 32PT, 24PHB, 24PTH, 32PTH1, or 37PTH DSC for criticality control is defined in Technical Specification 3.2. Fixed poison is required for criticality control for the 61BT, 61BTH, 32PT, 24PTH, 32PTH1, 69BTH and 37PTH DSCs. Three alternate poison materials are allowed: (a) borated aluminum alloy, or (b) a boron carbide/aluminum metal matrix composite (MMC), or (c) Boral®.

The NUHOMS®-24P is designed for unirradiated fuel with an initial fuel enrichment of up to 4.0 wt. % U-235, taking credit for soluble boron in the DSC cavity water during loading operations. In addition, the fuel assemblies qualified for storage in NUH OMS®-24P DSC have an equivalent unirradiated enrichment of less than or equal to 1.45 wt. % U-235. Figure 1-1 defines the required burnup as a function of initial enrichment. The NUHOMS®-52B is designed for unirradiated fuel with an initial enrichment of less than or equal to 4.0 wt. % U-235.

The NUHOMS®-61BT has three basket configurations, based on the boron content in the poison plates as listed in Table 1-1k. The maximum lattice average enrichment authorized for NUHOMS®-61BT DSC is 4.4 wt. % U-235 , as shown in Table 1-1c for intact fuel and 4.0 wt. % U-235 as shown in Table 1-1j for damaged fuel.

For the 61BT DSC, borated aluminum, MMC, or Boral® shall be supplied in accordance with UFSAR Sections K.9.1.7.1, K.9.1.7.2, K.9.1.7.3, K.9.1.7.4, portions of Section K.9.1.7.7, portions of Section K.9.1.7.8.4, and all of Sections K.9.1.7.8.5, K.9.1.7.9.1, and K.9.1.7.9.2,, with the minimum B10 areal density specified in Table 1-1k. These sections of the UFSAR are hereby incorporated into the NUHOMS® 1004 CoC.

The NUHOMS®-61BTH DSC is designed for unirradiated fuel with a maximum lattice average enrichment of 5.0 wt. % U-235 as shown in Table 1-1t, taking credit for the boron content in the poison plates of the DSC basket, as shown in Table 1-1v for intact fuel, Table 1-1w and for damaged fuel, and Table 1-1w1 for failed fuel. The NUHOMS®-61BTH DSC (similar to 61BT DSC) is designated as Type 1 and Type 2 depending upon the rails used in the basket.

Each 61BTH DSC type is provided with six alternate basket configurations, based on the boron content in the poison plates, as listed in Table 1-1v or Table 1-1w or Table 1-1w1 (designated as "A" for the lowest B-10 loading to "F" for the highest B-10 loading).

For the 61BTH DSC, borated aluminum, MMC, or Boral® shall be supplied in accordance with UFSAR Sections T.9.1.7.1, T.9.1.7.2, T.9.1.7.3, T.9.1.7.4, portions of Section T.9.1.7.7, portions of Section T.9.1.7.8.4, and all of Sections T.9.1.7.8.5, T.9.1.7.9.1, and T.9.1.7.9.2, with the minimum B-10 areal density specified in Table 1-1v or Table 1-1w. These sections of the UFSAR are hereby incorporated into the NUHOMS® 1004 CoC.

The NUHOMS®-69BTH DSC is designed for unirradiated fuel with a maximum lattice average enrichment of 5.0 wt. % U-235 as shown in Table 1-1gg. Credit is taken for the boron content in the poison plates of the DSC basket, as shown in Table 1-1jj for intact and Table 1-1kk for damaged fuel. The NUHOMS®-69BTH DSC is provided with six alternate basket configurations, based on the boron content in the poison plates, as listed in Table 1-1jj or Table 1-1kk (designated as "A" for the lowest B-10 loading to "F" for the highest B-10 loading).

For the 69BTH DSC, borated aluminum, MMC, or Boral® shall be supplied in accordance with UFSAR Sections Y.9.1.7.1, Y.9.1.7.2, Y.9.1.7.3, Y.9.1.7.4, portions of Section Y.9.1.7.7, portions of Section Y.9.1.7.8.4, and all of Sections Y.9.1.7.8.5, Y.9.1.7.9.1, and Y.9.1.7.9.2, with the minimum B-10 areal density specified in Table 1-1jj or Table 1-1kk. These sections of the UFSAR are hereby incorporated into the NUHOMS® 1004 CoC.

The NUHOMS®-32PT is designed for unirradiated fuel with an initial fuel enrichment of up to 5.0 wt. % U-235 as shown in Table 1-1g and 1-1g1, taking credit for poison rod assemblies (PRAs), poison plates, and soluble boron in the DSC cavity water during loading operations. The required PRA locations are per Figures 1-5, or 1-6 or 1-7. A 32PT DSC basket may contain 0,4,8 or 16 PRAs and is designated a Type A, Type B, Type C or Type D basket, respectively. AMD 15

Each basket type is designed with up to two alternate configurations depending on the configuration of poison plates provided (16 or 24) as shown in Table 1-1g. In addition, two additional basket types - A1 and A2 with no PRAs, are designed for the 24-poison plate configuration as shown in Table 1-1g1. Table 1-1h specifies the number of PRAs and the minimum B-10 content for poison plates.

AMD 15

For the 32PT DSC, borated aluminum or MMC shall be supplied in accordance with UFSAR Sections M.9.1.7.1, M.9.1.7.2, U.9.1.7.4, portions of Section U.9.1.7.7, portions of Section U.9.1.7.8.4, and all of Sections U.9.1.7.8.5, U.9.1.7.9.1, and U.9.1.7.9.2,, with the minimum B10 areal density specified in Table 1-1h. These sections of the UFSAR are hereby incorporated into the NUHOMS® 1004 CoC.

The NUHOMS®-24PHB is designed for unirradiated fuel with an assembly average initial enrichment of less than or equal to 4.5 wt. % U-235 as shown in Table 1-1i, taking credit for soluble boron in the DSC cavity water during loading operations.

The NUHOMS®-24PTH is designed for unirradiated fuel with an assembly average initial enrichment of less than or equal to 5.0 wt. % U-235, as shown in Table 1-1l, taking credit for soluble boron in the DSC cavity water during loading operations and the boron content in the poison plates of the DSC basket, as shown in Table 1-1p for intact fuel, Table 1-1q for damaged fuel and Table 1-1q1 for damaged or failed fuel. The 24PTH DSC basket is designated as Type 1, if it is provided with aluminum inserts and Type 2 if it does not contain the aluminum inserts. Each basket type is designed with three alternate configurations, based on the boron content in the poison plates, as listed in Table 1-1r.

For the 24PTH DSC, borated aluminum, MMC, or Boral® shall be supplied in accordance with UFSAR Sections P.9.1.7.1, P.9.1.7.2, P.9.1.7.4, portions of Section P.9.1.7.7, portions of Section P.9.1.7.8.4, and all of Sections P.9.1.7.8.5, P.9.1.7.9.1, and P.9.1.7.9.2, with the minimum B-10 areal density specified in Table 1-1r. These sections of the UFSAR are hereby incorporated into the NUHOMS® 1004 CoC.

The NUHOMS®-32PTH1 is designed for unirradiated fuel with an assembly average initial enrichment of less than or equal to 5.0 wt. % U-235, as shown in Table 1-1aa, taking credit for soluble boron in the DSC cavity water during loading operations and the boron content in the poison plates of the DSC basket, as shown in Table 1-1cc for intact fuel and Table 1-1dd for damaged or failed fuel. The 32PTH1 DSC basket is designated as Type 1 or Type 2, depending upon the rails used in the basket. Each basket type is designed with five alternate configurations, based on the boron content in the poison plates, as listed in Table 1-1ff.

For the 32PTH1 DSC, borated aluminum, MMC, or Boral® shall be supplied in accordance with UFSAR Sections U.9.1.7.1, U.9.1.7.2, U.9.1.7.3, U.9.1.7.4, portions of Section U.9.1.7.7, portions of Section U.9.1.7.8.4, and all of Sections U.9.1.7.8.5, U.9.1.7.9.1, and U.9.1.7.9.2, with the minimum B-10 areal density specified in Table 1-1ff. These sections of the UFSAR are hereby incorporated into the NUHOMS® 1004 CoC.

The NUHOMS®-37PTH is designed for unirradiated fuel with an assembly average initial enrichment of less than or equal to 5.0 wt. % U-235, as shown in Table 1-1ll. Credit is taken for soluble boron in the DSC cavity water during loading operations and the boron content in the poison plates of the DSC basket, as shown in Table 1-1oo for intact and damaged fuel, and in Table 1-1pp for intact and damaged fuel with poison rod assemblies. The required PRA locations are per Figures 1-41 and 1-42. A 37PTH basket may contain five or nine PRAs. The NUHOMS®-37PTH DSC basket is designed with a single boron loading in the poison plates, as listed in Table 1-1rr.

For the 37PTH DSC, borated aluminum, MMC, or Boral® shall be supplied in accordance with UFSAR Sections Z.9.1.7.1, Z.9.1.7.2, Z.9.1.7.3, Z.9.1.7.4, portions of Section Z.9.1.7.7, portions of Section Z.9.1.7.8.4, and all of Sections Z.9.1.7.8.5, Z.9.1.7.9.1, and Z.9.1.7.9.2, with the minimum B-10 areal density specified in Table 1-1rr. These sections of the UFSAR are hereby incorporated into the NUHOMS® 1004 CoC.

The thermal design criterion of the fuel to be stored is that the total maximum heat generation rate per assembly and BPRA or control components be such that the fuel cladding temperature is maintained within established limits during normal and off-normal conditions. For the NUHOMS®-24P, 52B and 61BT Systems, fuel cladding temperature limits were established based on methodology in PNL-6189 and PNL-4835. For the NUHOMS®-32PT, 24PHB and 24PTH Systems, fuel cladding limits are based on ISG-11, Rev. 2. For the NUHOMS®-61BTH System, NUHOMS®-61BT System with Framatome-ANP 9x9 Version 9x9-2 (FANP9 9x9-2) fuel assemblies, and the NUHOMS®-32PTH1 System, fuel cladding limits are based on ISG-11, Rev. 3. For the NUHOMS®-69BTH and 37PTH Systems, the fuel cladding limits are based on NUREG-1536, Revision 1.

The radiological design criterion is that fuel stored in the NUHOMS® system must not increase the average calculated Standardized HSM or HSM-H or HSM-HS or transfer cask dose rates beyond those calculated for the 24P, 24PHB, 52B, 61BT, 32PT, 24PTH, 61BTH, or 32PTH1, 69BTH, or 37PTH canister full of design basis fuel assemblies with or without CCs.

Technical Specification 1.1 defines INTACT FUEL ASSEMBLY as an assembly containing fuel rods with no known or suspected cladding defects greater than hairline cracks or pin hole leaks. Non-cladding material damage is acceptable to the extent that the fuel assembly can be handled by normal means and the fuel assembly is retrievable after all normal and off-normal conditions. This is applicable to fuel assemblies to be loaded in the 24P, 24PHB, 52B, 61BT, 32PT, 24PTH, 61BTH, 32PTH1, 69BTH or 37PTH DSCs. The bases for this definition is that the criticality and confinement functions are maintained under normal, off-normal and accident conditions of storage. The criticality analyses documented for these DSCs considers that the fuel assembly geometry remains unchanged under accident conditions and sub-criticality is assured. AMD 15

Technical Specification Table 1-1a, Table 1-1b, Table 1-1c, Table 1-1j, Table 1-1e, Table 1-1i, Table 1-1l, Table 1-1t, Table 1-1aa ,Table 1-1gg, and Table 1-1ll provide the key fuel parameters that require confirmation prior to loading fuel assemblies within a specific standardized DSC model. Each of these Technical Specification Tables lists additional Technical Specification Tables and Figures which provide requirements which also must be met prior to loading.

FUNCTIONAL AND OPERATING LIMITS VIOLATIONS

If Functional and Operating Limits are violated, the limitations on the fuel assemblies in the canister have not been met. Actions must be taken to place the affected fuel assemblies in a safe condition. This safe condition may be established by returning the affected fuel assemblies to the spent fuel pool. However, it is acceptable for the affected fuel assemblies to remain in the canister if that is determined to be a safe condition.

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

REFERENCES

DSC Model	Applicable UFSAR References
24P and 52B	Chapters 3, 7, and 8
61BT	Appendix K.2, K.3, K.4, K.5, K.6, K.7 and K.11
32PT	Appendix M.2, M.3, M.4, M.5, M.6, M.7 and M.11
24PHB	Appendix N.2, N.3, N.4, N.5, N.6, N.7 and N.11
24PTH	Appendix P.2, P.3, P.4, P.5, P.6, P.7 and P.11
61BTH	Appendix T.2, T.3, T.4, T.5, T.6, T.7 and T.11
32PTH1	Appendix U.2, U.3, U.4, U.5, U.6, U.7 and U.11
69BTH	Appendix Y.2, Y.3, Y.4, Y.5, Y.6, Y.7, and Y.11
37PTH	Appendix Z.2, Z.3, Z.4, Z.5, Z.6, Z.7, and Z.11

LCOs — LCO 3.0.1, 3.0.2, 3.0.4 and 3.0.5 establish the general requirements applicable to all Specifications and apply at all times, unless otherwise stated.

LCO 3.0.1 — LCO 3.0.2 establishes the Applicability statement within each individual Specification as the requirement for when the LCO is required to be met (i.e., when the canister is in the specified conditions of the Applicability statement of each Specification).

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

a. Completion of the Required Actions within the specified Completion Times constitutes compliance with a Specification; and

b. Completion of the Required Actions is not required when an LCO is met within the specified Completion Time, unless otherwise specified.

There are two basic types of Required Actions. The first type of Required Action specifies a time limit in which the LCO must be met. This time limit is the Completion Time to restore a system or component or to restore variables to within specified limits. If this type of Required Action is not completed within the specified Completion Time, the canister may have to be placed in the spent fuel pool and unloaded. (Whether stated as a Required Action or not, correction of the entered Condition is an action that may always be considered upon entering ACTIONS.) The second type of Required Action specifies the remedial measures that permit continued operation of the unit that is not further restricted by the Completion Time. In this case, compliance with the Required Actions provides an acceptable level of safety for continued operation.

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

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

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

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

LCO 3.0.3

This specification is not applicable to the Standardized NUHOMS® System. The placeholder is retained for consistency with the power reactor technical specifications.

LCO 3.0.4

LCO 3.0.4 establishes limitations on changes in specified conditions in the Applicability when an LCO is not met. It precludes placing the Standardized NUHOMS® System in a specified condition stated in that Applicability (e.g., Applicability desired to be entered) when the following exist:

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

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

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

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

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

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

LCO 3.0.5 This specification is not applicable to the Standardized NUHOMS® System. The placeholder is retained for consistency with the power reactor technical specifications.

BASES

SRs	SR 3.0.1 through SR 3.0.4 establish the general requirements applicable to all Specifications in Sections 3.1, 3.2, 3.3, and 3.4 of the Technical Specification and apply at all times, unless otherwise stated.

SR 3.0.1

SR 3.0.1 establishes the requirement that SRs must be met during the specified conditions in the Applicability for which the requirements of the LCO apply, unless otherwise specified in the individual SRs. This Specification is to ensure that Surveillances are performed to verify systems and components, and that variables are within specified limits. Failure to meet Surveillance within the specified Frequency, in accordance with SR 3.0.2, constitutes a failure to meet an LCO.

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

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

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

Surveillances do not have to be performed when the equipment is in a specified condition for which the requirements of the associated LCO are not applicable, unless otherwise specified.

Surveillances, including Surveillances invoked by Required Actions, do not have to be performed on equipment that has been determined to not meet the LCO because the ACTIONS define the remedial measures that apply. Surveillances have to be met and performed in accordance with SR 3.0.2, prior to returning equipment to service.

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

This will allow operation to proceed to a specified condition where other necessary post maintenance tests can be completed.

SR 3.0.2

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

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

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

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

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

SR 3.0.3

SR 3.0.3 establishes the flexibility to defer declaring affected equipment as not meeting the LCO or an affected variable outside the specified limits when a Surveillance has not been completed within the specified Frequency. A delay period of up to 24 hours or up to the limit of the specified Frequency, whichever is less, applies from the point in time that it is discovered that the

Surveillance has not been performed in accordance with SR 3.0.2, and not at the time that the specified Frequency was not met.

This delay period provides adequate time to complete Surveillances that have been missed. This delay period permits the completion of a surveillance before complying with Required Actions or other remedial measures that might preclude completion of the Surveillance. The basis for this delay period includes consideration of unit conditions, adequate planning, availability of personnel, the time required to perform the Surveillance, the safety significance of the delay in completing the required Surveillance, and the recognition that the most probable result of any particular Surveillance being performed is the verification of conformance with the requirements.

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

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

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

If a Surveillance is not completed within the allowed delay period, then the equipment is considered not in service or the variable is considered outside the specified limits and the Completion Times of the Required Actions for the applicable LCO Conditions begin immediately upon expiration of the delay period. If a Surveillance is failed within the delay period, then the equipment is not in service, or the variable is outside the specified limits and the Completion Times of the Required Actions for the applicable LCO Conditions begin immediately upon the failure of the Surveillance. Completion of the Surveillance within the delay period allowed by this Specification, or within the Completion Time of the ACTIONS, restores compliance with SR 3.0.1.

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

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

The provisions of this Specification should not be interpreted as endorsing the failure to exercise the good practice of restoring systems or components to an appropriate status before entering an associated specified condition in the Applicability. However, in certain circumstances, failing to meet an SR will not result in SR 3.0.4 restricting a change in specified condition. When a system, subsystem, division, component, device, or variable is outside its specified limits, the associated SR(s) are not required to be performed, per SR 3.0.1, which states that Surveillances do not have to be performed on such equipment. When equipment does not meet the LCO, SR 3.0.4 does not apply to the associated SR(s) since the requirement for the SR(s) to be performed is removed. Therefore, failing to perform the Surveillance(s) within the specified Frequency does not result in an SR 3.0.4 restriction to changing specified conditions of the Applicability. However, since the LCO is not met in this instance, LCO 3.0.4 will govern any restrictions that may (or may not) apply to specified condition changes.

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

The precise requirements for performance of SRs are specified such that exceptions to SR 3.0.4 are not necessary. The specific time frames and conditions necessary for meeting the SRs are specified in the Frequency, in the Surveillance, or both. This allows performance of Surveillances when the prerequisite condition(s) specified in a Surveillance procedure require entry into the specified condition in the Applicability of the associated LCO prior to the performance or completion of a Surveillance. A Surveillance that could not be performed until after entering the LCO Applicability would have its Frequency specified such that it is not "due" until the specific conditions needed are met. Alternatively, the Surveillance may be stated in the form of a Note as not required (to be met or performed) until a particular event, condition, or time has been reached. Further discussion of the specific formats of SR annotation is found in Section 10.1.4, operation to proceed to a specified condition where other necessary post maintenance tests can be completed.

B 10 *TS* 3.1 DSC FUEL INTEGRITY

B 10 *TS* 3.1.1 DSC Bulkwater Removal Medium and Vacuum Drying Pressure

BASES

BACKGROUND

A DSC (all NUHOMS® Models) is placed in the spent fuel pool and loaded with fuel assemblies meeting the requirements of the Functional and Operating Limits. A shield plug is then placed on the DSC. Subsequent operations involve moving the DSC to the decontamination area and draining bulk water from the DSC using helium. After welding/NDE of the DSC inner top cover/top shield plug assembly, vacuum drying of the DSC is performed, and the DSC is backfilled with helium.

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

APPLICABLE SAFETY ANALYSIS

The confinement of radioactivity during the storage of spent fuel in a DSC is ensured by the use of multiple confinement barriers and systems. The barriers relied upon are the fuel pellet matrix, the fuel cladding tubes in which the fuel pellets are contained, and the DSC in which the fuel assemblies are stored. Long-term integrity of the fuel cladding depends on storage in an inert atmosphere. This protective environment is accomplished by vacuum drying the DSC and backfilling it with helium. The removal of water is necessary to prevent phase change–related pressure increase upon heatup. No time limits apply for vacuum drying a DSC when helium is used as a blowdown medium. The FSAR analysis (see Referenced FSAR Chapters below) evaluates that for each of the DSC Models, the confinement boundary is not compromised due to any normal, off-normal or accident condition postulated and the fuel clad temperature remains below allowable values.

The potential exists for oxidation of fuel pellets if they are exposed to air for sufficient duration at high temperature. Use of helium for blowdown or draindown operations will help prevent oxidation of fuel pellets due to air by replacing air with helium which is an inert gas.

LCO

A stable vacuum pressure of $\leq$ 3 Torr further ensures that all liquid water has evaporated in the DSC cavity, and that the resulting inventory of oxidizing gases in the DSC is below 0.25 volume %.

APPLICABILITY

This is applicable to all DSC Models.

ACTIONS

The actions specified require restoring the vacuum drying system to an operable status or ensuring the integrity of the DSC/ITCP weld or the establishment of a helium pressure of at least 1.0 atmosphere within the DSC or flooding the DSC to submerge the fuel assemblies, within 30 days. The specified value of helium atmosphere allows the transfer of decay heat from the DSC while allowing implementation of corrective actions to return the DSC to an analyzed condition. The 15 psig limit in the Action section is conservatively below the maximum analyzed blowdown pressure. The basis for 30 days is as follows: LCO 3.1.1 requires the use of helium for all water removal from the DSC before vacuum drying. Therefore, vacuum drying operations are carried out with water replaced by helium. The UFSAR thermal analysis demonstrates that if helium is used as a cover gas for water removal the conductivity of helium during vacuum drying operations assures that cladding temperatures remain below the cladding temperature limit. The DSC/TC annulus also contains water during the vacuum drying process. Because the cladding temperatures are below the cladding temperature limits, the criterion of 30 days is used as a reasonable time period for identifying and repairing vacuum drying system or seal welds.

SURVEILLANCE REQUIREMENTS

Ensure that vacuum pressure remains sufficiently low for a sufficient timeframe, to ensure that the DSC is dry.

REFERENCES

DSC Model	Applicable UFSAR References
24P and 52B	Chapter 8
61BT	Appendix K.3 and K.4
32PT	Appendix M.3 and M.4
24PHB	Appendix N.3 and N.4
24PTH	Appendix P.3 and P.4
61BTH	Appendix T.3 and T.4
32PTH1	Appendix U.3 and U.4
69BTH	Appendix Y.3 and Y.4
37PTH	Appendix Z.3 and Z.4

U.S. Nuclear Regulatory Commission (USNRC) Interim Staff Guidance (ISG) No. 11, Revision 3, “Cladding Considerations for the Transportation and Storage of Spent Fuel.”

NUREG 1536, Revision 1, “Standard Review Plan for Spent Fuel Dry Storage Systems at a General License Facility-Final Report.”

B 10 *TS* 3.1 DSC FUEL INTEGRITY

B 10 *TS* 3.1.2 DSC Helium Backfill Pressure

BASES

BACKGROUND

After welding/NDE of the DSC inner top cover/top shield plug assembly, vacuum drying of the DSC is performed, and the DSC is backfilled with helium. During normal storage conditions, the fuel assemblies are stored in the DSC with an inert helium atmosphere. Helium is a better conductor of heat than nitrogen or vacuum, and thus results in lower fuel clad temperatures. In addition, it provides an inert atmosphere during storage conditions. The inert helium environment protects the fuel from potential oxidizing environments. A helium purity of $\geq$ 99.99% is recommended for this application.

APPLICABLE SAFETY ANALYSIS

Long-term integrity of the fuel cladding depends on storage in an inert atmosphere. FSAR analysis (see Referenced FSAR Chapters below) evaluates the effect of accidents and short term temperature transients on fuel cladding integrity. Credit for the helium backfill pressure is taken to limit the potential for corrosion of the fuel cladding. FSAR thermal analysis evaluates the DSC maximum pressure under normal, off-normal, and accident conditions.

LCO

DSC backpressure is maintained within a range of pressure during initial backfill to ensure maintenance of the helium backfill pressure over time and will not result in excessive DSC pressure in normal, off-normal and accident conditions.

APPLICABILITY

This specification is applicable to all DSC Models.

ACTIONS

The actions required and associated completion times are associated with ensuring that the DSC remains in a safe condition and within its design pressure limits and time limits established in the UFSAR. These limits are imposed to ensure that the DSC confinement integrity is maintained. With a helium atmosphere in the DSC cavity, the UFSAR thermal analysis demonstrates that the cladding temperatures remain below the cladding temperature limit. Note that no credit is taken for any convection of helium in the DSC cavity. Because the cladding temperatures are below the cladding temperature limit, the criterion of 14 days is used as a reasonable time period for identifying and repairing vacuum drying system or seal welds.

SURVEILLANCE REQUIREMENTS

The DSC backfill pressure is monitored during the initial DSC loading to ensure that (1) the atmosphere surrounding the irradiated fuel is a non-oxidizing inert helium gas and (2) filled to a pressure level that is consistent with the UFSAR thermal analysis.

REFERENCES

DSC Model	Applicable UFSAR References
24P and 52B	Chapter 8
61BT	Appendix K.3 and K.4
32PT	Appendix M.3 and M.4
24PHB	Appendix N.3 and N.4
24PTH	Appendix P.3 and P.4
61BTH	Appendix T.3 and T.4
32PTH1	Appendix U.3 and U.4
69BTH	Appendix Y.3 and Y.4
37PTH	Appendix Z.3 and Z.4

B 10 *TS* 3.1 DSC FUEL INTEGRITY

B 10 *TS* 3.1.3 Time Limit for Completion of Transfer Operations (24PTH, 61BTH Type 2 or 32PTH1, 69BTH or 37PTH DSC Only)

BASES

BACKGROUND

After a high heat load DSC (NUHOMS®-24PTH-S, 24PTH-L, 61BTH Type 2, or 32PTH1, 69BTH or 37PTH DSC Only) has been loaded with fuel assemblies, vacuum dried and sealed, it is ready for transfer to the ISFSI. The design of a loaded NUHOMS® TC/DSC system provides sufficient passive heat rejection capacity to ensure that the integrity of the fuel cladding is maintained provided the specified time limits for completion of the transfer are met.

APPLICABLE SAFETY ANALYSIS

Long-term integrity of the fuel cladding depends on storage in an inert atmosphere and maintaining fuel cladding temperature below an acceptable limit. The TC/DSC transient thermal analysis provided in the UFSAR (see Referenced UFSAR Chapters below) evaluates the fuel cladding temperatures under normal, off-normal, and accident conditions during the transfer of a loaded TC/DSC.

LCO

The time to complete the transfer of a loaded TC/DSC is monitored to ensure that the fuel cladding does not exceed the ISG-11 or NUREG-1536, Revision 1, limit of 752°F during transfer.

APPLICABILITY

This specification is applicable to a loaded NUHOMS®-24PTH-S, 24PTH-L DSC or a 61BTH Type 2 DSC, 32PTH1 DSC, 69BTH DSC or a 37PTH DSC when transferred in an OS197FC, OS197FC-B or an OS200FC TC as applicable.

This technical specification does not apply to the 24P, 52B, 61BT, 61BTH Type 1, 32PT or 24PHB DSC. These DSCs are only authorized for a maximum heat load of 24 kW/DSC. The thermal analysis performed for these DSCs as documented in UFSAR demonstrate that the steady state cladding temperatures during TRANSFER OPERATIONS are below the cladding temperature limit. Therefore, there is no time limit for completion of DSC transfer.

ACTIONS

The actions required and the specified completion time of 2 hours are associated with ensuring that the fuel cladding does not exceed 752 degrees F during transfer.

SURVEILLANCE REQUIREMENTS

The specified monitoring of the time duration for the completion of the transfer step ensures that the fuel cladding temperatures remain below the regulatory limit of 752 degrees F during this operation.

REFERENCES

DSC Model	Applicable UFSAR References
24PTH	Appendix P.4
61BTH	Appendix T.4
32PTH1	Appendix U.4
69BTH	Appendix Y.4
37PTH	Appendix Z.4

BASES

BACKGROUND

After the DSC is loaded into the HSM and STORAGE OPERATIONS begin, the HSMs are monitored to ensure that the thermal design function

APPICABLE SAFETY ANALYSIS

For Visual Inspection of HSM or HSM-H Air Inlets and Outlets (Front Wall and Roof Birdscreen), the concrete temperature could exceed 350 °F in the accident circumstances of complete blockage of all vents. Concrete temperatures over 350 °F in accidents (without the presence of water or steam) can have uncertain impact on concrete strength and durability. A conservative analysis (adiabatic heat case) of complete blockage of all air inlets or outlets indicates that the concrete can reach the accident temperature limit of 350 °F in the time periods specified for HSM. For HSM-H*/HSM-HS*, the time period specified ensures that blockage will not exist for periods longer than that assumed in the safety analysis presented in Appendix P, Appendix T*,* Appendix U*, Appendix Y, and Appendix Z* of the *U*FSAR. At the analyzed time limit, the fuel cladding temperature remains well below the accident limit of 1058 °F.

LCO

The optional visual inspections or temperature measurements ensures that conditions do not persist which could cause HSM concrete temperatures and/or fuel cladding temperatures to approach accident limits.

APPLICABILITY

This specification is applicable during STORAGE OPERATIONS for any DSC loaded in any HSM or HSM-H.

ACTIONS

The actions required and the specified completion times for the required actions will ensure the correction of off-normal thermal conditions that could lead to exceeding the concrete and fuel clad temperature criteria. A COMPLETION TIME for REQUIRED ACTION D of 30 days to perform the analysis is selected because with the vents open, there is significant margin to the accident condition temperature limits on the concrete and fuel cladding temperatures.

SURVEILLANCE REQUIREMENTS

The daily surveillances are timely enough and detailed enough to provide the licensee with a positive means to identify conditions which threaten to approach temperature criteria for proper HSM or HSM-H operation.

REFERENCES

HSM	***DSC Model***	***Applicable UFSAR References***
Standardized HSM	*24P and 52B*	*Chapter 8*
Standardized HSM/HSM-HS	*61BT*	*Appendix K.4*
Standardized HSM/HSM-HS	*32PT*	*Appendix M.4*
Standardized HSM	*24PHB*	*Appendix N.4*
Standardized HSM/HSM-H/HSM-HS	*24PTH-S-LC or 24PTH-S or 24PTH-L*	*Appendix P.4*
Standardized HSM/HSM-H/HSM-HS	*61BTH Type 1 or Type 2*	*Appendix T.4*
Standardized HSM-H/HSM-HS	*32PTH1*	*Appendix U.4*
HSM-H/HSM-HS	*69BTH*	*Appendix Y.4*
HSM-H/HSM-HS	*37PTH*	*Appendix Z.4*

BASES

BACKGROUND

During loading and unloading of a 24P, 32PT, 24PHB, 24PTH, 32PTH1 or 37PTH DSC, the DSC cavity is filled with borated water having a minimum boron concentration which is a function of the DSC basket type, fuel assembly class, maximum assembly average enrichment and the condition of fuel (Intact or Damaged or Failed). This specification ensures that a subcritical configuration is maintained in the event of an accidental loading of a DSC with unirradiated fuel.

APPLICABLE SAFETY ANALYSIS

The 24P, 32PT, 24PHB, 24PTH or 32PTH1 or 37PTH DSCs have been designed for unirradiated fuel with a specified maximum assembly average initial enrichment while taking credit for the soluble boron concentration in the DSC cavity water. *The boron content in the neutron absorber plates is also credited in the 32PT, 24PTH, 32PTH1, and 37PTH DSC analyses.* The criticality analysis provided in the UFSAR (see Referenced UFSAR Chapters below) evaluates the various DSCs to ensure that a subcritical configuration is maintained.

LCO

The minimum boron concentration limits of the water in the DSC cavity as specified in the LCO to ensure that a subcritical configuration is maintained in the event of an accidental loading of a DSC with unirradiated fuel.

APPLICABILITY

This specification is applicable to 24P, 32PT, 24PHB, 24PTH, 32PTH1, or a 37PTH DSC during loading and unloading operations.

ACTIONS

The actions required and the specified completion times for the required actions are associated with ensuring that either the dissolved boron concentration is restored above the specified minimum or the fuel is removed from the DSC.

SURVEILLANCE REQUIREMENTS

Performance of two separate independent analysis of the water used to fill the DSC cavity (a) within 4 hours of initiation of loading/unloading operations and (b) subsequent analysis at intervals not exceeding 48 hours until the conclusion of such loading/unloading operations provides assurance that a subcritical DSC configuration is always maintained.

REFERENCES

DSC Model	Applicable UFSAR References
24P	Chapter 3
32PT	Appendix M.6
24PHB	Appendix N.6
24PTH	Appendix P.6
32PTH1	Appendix U.6
37PTH	Appendix Z.6

B 10 *TS 3.3.1* Maximum DSC Removable Surface Contamination

BASES

BACKGROUND

After the TC/DSC are removed from the spent fuel pool the DSC must be checked for contamination which may have occurred during fuel assembly loading.

APPLICABLE SAFETY ANALYSIS

This non-fixed contamination level is consistent with the requirements of 10 CFR 71.87(i)(1) and 49 CFR 173.443, which regulate the use of spent fuel shipping containers. Consequently, these contamination levels are considered acceptable for exposure to the general environment. This level will also ensure that contamination levels of the inner surfaces of the HSM and potential releases of radioactive material to the environment are minimized.

The use of an inflatable seal in the upper cask liner recess ensures that the TC/DSC annulus area below the seal remains clean during the subsequent fuel loading steps inside the spent fuel pool. Hence, the only area which needs to be checked for contamination is the top 1 foot of the DSC external surface. However, in the unlikely event that contamination is found that exceeds the specified levels, the entire length of the DSC surface needs to be decontaminated.

LCO

The LCO provides the appropriate contamination level limits.

APPLICABILITY

This specification is applicable to all DSC models.

ACTIONS

The actions required and the specified completion times for the required actions will ensure that the DSC surface contamination levels are within the limits, even to the extent that the fuel assemblies are removed from the DSC, the DSC removed from the TC, and the entire loading process repeated. A completion time of 30 days will allow time for proper ALARA assessment of the situation and planning, obtaining necessary supplies and equipment, and any necessary training.

SURVEILLANCE REQUIREMENTS

The surveillance requirement ensures that the contamination levels are met, either at the initial check, or after decontamination actions have been completed.

REFERENCES

10 CFR 71.87(i)(1)
49 CFR 173.443

B 10 *TS 4.3.2* RADIATION PROTECTION PROGRAM

ALARA Assessment

BASES

The basis for the ALARA assessment is 10 CFR 72.212 (b)(2)(i)(C).

B 10 *TS 4.3.3* Hydrogen Gas Monitoring for Specified DSCs

BASES

The basis for this technical specification is the safety concern of keeping the combustible mixture concentration below flammability limits while welding.

B 10 *TS 4.4* CASK TRANSFER CONTROLS

B 10 *TS 4.4.1* TC/DSC Lifting/Handling Height Limits

BASES

For the TC/DSC Handling Height Outside the Spent Fuel Pool Building, the NRC evaluation of the TC/DSC drop analysis concurred that drops up to 80 inches, of the DSC inside the TC, can be sustained without breaching the confinement boundary, preventing removal of spent fuel assemblies, or causing a criticality accident. This specification ensures that handling height limits will not be exceeded in transit to, or at the storage pad.

Acceptable damage may occur to the TC, DSC, and the fuel stored in the DSC, for drops of height greater than 15 inches. The specification requiring inspection of the DSC and fuel following a drop of 15 inches or greater ensures that the spent fuel will continue to meet the requirements for storage, the DSC will continue to provide confinement, and the TC will continue to provide its design functions of DSC transfer and shielding.

For the TC/DSC Lifting Heights as a Function of Low Temperature and Location, the basis for the low temperature and height limits is ANSI N14.6-1986 and -1993 paragraph 4.2.6, which requires at least 40 °F higher service temperature than nil ductility transition (NDT) temperature for the TC. In the case of the standardized TC, the test temperature is -40 °F; therefore, although the NDT temperature is not determined, the material will have the required 40 °F margin if the ambient temperature is 0 °F or higher. This assumes the material service temperature is equal to the ambient temperature.

The basis for the low temperature limit for the DSC is NUREG/CR-1815. The basis for the handling height limits is the NRC evaluation of the structural integrity of the DSC to drop heights of 80 inches and less.

For the NUHOMS®-24P, 52B and 61BT Systems, the basis for the high temperature limit is PNL-6189 for the fuel clad limit, the manufacturer's specification for neutron shield, and the design basis pressure of the TC internal cavity pressure. For the NUHOMS®-32PT, 24PHB and 24PTH Systems, the fuel cladding limits are based on ISG-11, Revision 2. For the NUHOMS®-61BTH System and the NUHOMS®-61BT System with FANP 9x9-2 fuel assemblies, the fuel cladding limits are based on ISG-11 Revision 3.

For the NUHOMS®-69BTH and 37PTH Systems, the fuel cladding limits are based on NUREG-1536, Revision 1.

For the TC/DSC Transfer at High Ambient Temperatures (32PTH1 DSC Only), the fuel cladding limits are based on ISG-11 Revision 3 (Reference 4).

The basis for using a solar shield during transfer operations when ambient temperatures exceed 100 °F (106 °F for 32PTH1) is to prevent direct solar radiation on the exterior surface of the cask and to ensure that component temperatures remain below the allowable limits described in the UFSAR. With the solar shield in place, the temperatures on the exterior surface of the cask remain below those evaluated in the UFSAR.

The solar shield while not required for transfer operations with ambient temperatures below 100 °F (106 °F for 32PTH1) may also be used to protect the cask from rain or snow or other ambient conditions.

B 10 *TS 4.4.2* Supplemental Shielding Drop onto OS197L TC

BASES

The bases for the consequences of an accidental drop of the outer trailer shielding onto the inner trailer shielding of the OS197L TC are provided in Section W.11.1.5 of the UFSAR. The lifting of the outer shielding, is restricted such that the bottom most part of the body of this shield is less than 4” above the inner shielding.

Table K.2-1
BWR Fuel Specifications for Fuel to be Stored in the Standardized NUHOMS®-61BT DSC

PHYSICAL PARAMETERS	
Fuel Design	*Per TS Table 1-1c.*
Cladding Material	*Per TS Table 1-1c.*
Fuel Damage	*Per TS Table 1-1c.*
Channels	*Per TS Table 1-1c.*
Maximum Assembly Length	176.2 in
Nominal Assembly Width (excluding channels)	5.44 in
Maximum Assembly Weight	*Per TS Table 1-1c.*
RADIOLOGICAL PARAMETERS[(1)]: No interpolation of Radiological Parameters is permitted between Groups.	
Group 1	
Maximum Burnup	*Per TS Table 1-1c.*
Minimum Cooling Time	*Per TS Table 1-1c.*
Maximum Lattice Average Initial Enrichment	*Per TS Table 1-1c.*
Minimum Initial Assembly Average Enrichment	*Per TS Table 1-1c.*
Maximum Initial Uranium Content	198 kg/assembly
Maximum Decay Heat	*Per TS Table 1-1c.*
Group 2	
Maximum Burnup	*Per TS Table 1-1c.*
Minimum Cooling Time	*Per TS Table 1-1c.*
Maximum Lattice Average Initial Enrichment	*Per TS Table 1-1c.*
Minimum Initial Assembly Average Enrichment	*Per TS Table 1-1c.*
Maximum Initial Uranium Content	198 kg/assembly
Maximum Decay Heat	*Per TS Table 1-1c.*
Group 3	
Maximum Burnup	*Per TS Table 1-1c.*
Minimum Cooling Time	*Per TS Table 1-1c.*
Maximum Lattice Average Initial Enrichment	*Per TS Table 1-1c.*
Minimum Initial Assembly Average Enrichment	*Per TS Table 1-1c.*
Maximum Initial Uranium Content	198 kg/assembly
Maximum Decay Heat	*Per TS Table 1-1c.*
Group 4	
Maximum Burnup	*Per TS Table 1-1c.*
Minimum Cooling Time	*Per TS Table 1-1c.*
Maximum Lattice Average Initial Enrichment	*Per TS Table 1-1c.*
Minimum Initial Assembly Average Enrichment	*Per TS Table 1-1c.*
Maximum Initial Uranium Content	198 kg/assembly
Maximum Decay Heat	*Per TS Table 1-1c.*
MINIMUM BORON LOADING	
Maximum Lattice Average Enrichment (wt. % U-235)	Minimum B10 Content in Poison Plates (Basket Type)
4.4	*Per TS Table 1-1c.*
4.1	*Per TS Table 1-1c.*
3.7	*Per TS Table 1-1c.*
ALTERNATE RADIOLOGICAL PARAMETERS:	
Maximum Initial Enrichment:	See Minimum Boron Loading above
Fuel Burnup, Initial Assembly Average Enrichment, and Cooling Time[(2)]:	See Table K.2-11, except that for a 61BT DSC contained in an OS197L TC, see Chapter W2, Tables W.2-4 and W.2-5, and Figure W.2-1.
Maximum Initial Uranium Content:	198 kg/assembly
Maximum Decay Heat:	*Per TS Table 1-1c.*

(1) When the OS197L TC is employed, apply the requirements of Chapter W2, Tables W.2-4 and W.2-5, and Figure W.2-1.
(2) For fuel assemblies containing BLEU fuel pellets, add 3 years additional cooling time to the minimum values shown in this table.

Table K.2-2
BWR Fuel Specification of Damaged Fuel to be Stored in the Standardized NUHOMS®-61BT DSC

PHYSICAL PARAMETERS:	
Fuel Design:	*Per TS Table 1-1j.*
Cladding Material:	*Per TS Table 1-1j.*
Fuel Damage:	*Per TS Table 1-1j.*
Channels:	*Per TS Table 1-1c.*
Maximum Assembly Length (unirradiated)	176.2 in
Nominal Assembly Width (excluding channels)	5.44 in
Maximum Assembly Weight	*Per TS Table 1-1j.*
RADIOLOGICAL PARAMETERS(1):	No interpolation of Radiological Parameters is permitted between groups.
Group 1:	
Maximum Burnup:	*Per TS Table 1-1j.*
Minimum Cooling Time:	*Per TS Table 1-1j.*
Maximum Initial Lattice Average Enrichment:	*Per TS Table 1-1j.*
Maximum Pellet Enrichment:	*Per TS Table 1-1j.*
Minimum Initial Assembly Average Enrichment:	*Per TS Table 1-1j.*
Maximum Initial Uranium Content:	198 kg/assembly
Maximum Decay Heat:	*Per TS Table 1-1j.*
Group 2:	
Maximum Burnup:	*Per TS Table 1-1j.*
Minimum Cooling Time:	*Per TS Table 1-1j.*
Maximum Initial Lattice Average Enrichment:	*Per TS Table 1-1j.*
Maximum Pellet Enrichment:	*Per TS Table 1-1j.*
Minimum Initial Assembly Average Enrichment:	*Per TS Table 1-1j.*
Maximum Initial Uranium Content:	198 kg/assembly
Maximum Decay Heat:	*Per TS Table 1-1j.*
Group 3:	
Maximum Burnup:	*Per TS Table 1-1j.*
Minimum Cooling Time:	*Per TS Table 1-1j.*
Maximum Initial Lattice Average Enrichment:	*Per TS Table 1-1j.*
Maximum Pellet Enrichment:	*Per TS Table 1-1j.*
Minimum Initial Assembly Average Enrichment:	*Per TS Table 1-1j.*
Maximum Initial Uranium Content:	198 kg/assembly
Maximum Decay Heat:	*Per TS Table 1-1j.*

Table K.2-2
BWR Fuel Specification of Damaged Fuel to be Stored in the Standardized NUHOMS®-61BT DSC

(Concluded)

RADIOLOGICAL PARAMETERS[1]:	
Group 4:	
Maximum Burnup:	*Per TS Table 1-1j.*
Minimum Cooling Time:	*Per TS Table 1-1j.*
Maximum Initial Lattice Average Enrichment:	*Per TS Table 1-1j.*
Maximum Pellet Enrichment:	*Per TS Table 1-1j.*
Minimum Initial Assembly Average Enrichment:	*Per TS Table 1-1j.*
Maximum Initial Uranium Content:	198 kg/assembly
Maximum Decay Heat:	*Per TS Table 1-1j.*
ALTERNATE RADIOLOGICAL PARAMETERS:	
Maximum Initial Lattice Average Enrichment:	*Per TS Table 1-1j.*
Fuel Burnup, Initial Assembly Average Enrichment, and Cooling Time[2]:	See Table K.2-11, except that for a 61BT DSC contained in an OS197L TC, see Chapter W.2, Tables W.2-4 and W.2-5, and Figure W.2-1.
Maximum Pellet Enrichment:	*Per TS Table 1-1j.*
Maximum Initial Uranium Content:	198 kg/assembly
Maximum Decay Heat:	*Per TS Table 1-1j.*

(1) When the OS197L TC is employed, apply the requirements of Chapter W.2, Tables W.2-4 and W.2-5, and Figure W.2-1.

(2) For fuel assemblies containing BLEU fuel pellets, add 3 years additional cooling time to the minimum values shown in this table.

K.4.5 Thermal Evaluation for Off-Normal Conditions

The NUHOMS®-61BT system components are evaluated for the extreme ambient temperatures of –40 ^{o}F (winter) and 125 ^{o}F (summer). Should these extreme temperatures ever occur, they would be expected to last for a very short duration of time. Nevertheless, these ambient temperatures are conservatively assumed to occur for a significant duration to cause a steady-state temperature distribution in the NUHOMS®-61BT system components.

K.4.5.1 Off-Normal Maximum/Minimum Temperatures during Storage

The thermal performance of the NUHOMS®-61BT DSC within the HSM under the extreme minimum ambient temperature of –40 ^{o}F and no insolation is evaluated in Section K.4.4.3.

For the extreme maximum off-normal ambient temperature of 125 ^{o}F, a steady state thermal analysis is performed using the 90^{o} symmetric model developed in Section K.4.4.1, the maximum decay heat load of 0.300 kW per assembly (18.3 kW total per DSC), and the DSC temperature distribution shown in Figure K.4-3. A summary of the calculated DSC component temperatures is listed in Table K.4-1.

K.4.5.2 Off-Normal Maximum/Minimum Temperatures during Transfer

The thermal performance of the NUHOMS®-61BT DSC within the OS197 transfer cask under the extreme minimum ambient temperature of –40 ^{o}F and no insolation is evaluated in Section K.4.4.3. Administrative controls (NUHOMS®-61BT CoC Technical Specification *4.4.1*.B) prevent transfer operations of a loaded TC/DSC when ambient temperatures exceed 100 ^{o}F. For transfer operations when ambient temperatures exceed 100 ^{o}F up to 125 ^{o}F, a solar shield is to be used to minimize insolation. Since the thermal performance of the DSC without sunshade at an ambient temperature of 100 ^{o}F is limiting, the results presented in Table K.4-1 for the 100 ^{o}F ambient case envelope the maximum off-normal 125 ^{o}F case.

K.4.5.3 Off-Normal Maximum Internal Pressure during Storage/Transfer

Maximum Internal Pressures

During off-normal conditions, the internal pressure of the NUHOMS®-61BT DSC is calculated assuming the 10% of the fuel rods are failed. For determination of internal pressure within the DSC, it is assumed that 100% of the rod fill gas and 30% of the significant fission gases within the failed fuel rods are available for release into the DSC cavity [4.6]. Using the fuel rod data from Section K.4.4.4, the maximum pressures are calculated.

The average cavity gas temperature during off-normal conditions of storage and transfer are 426°F and 480°F (866 and 940 °R), respectively as shown in Table K.4-1 and Table K.4-2. With rupture of 10% of the fuel rods, the pressures within the DSC are calculated via the ideal gas law:

K.8.1 Procedures for Loading the Cask

Process flow diagrams for the NUHOMS® system operation are presented Figure K.8.1-1 and Figure K.8.2-1. The location of the various operations may vary with individual plant requirements. The following steps describe the recommended generic operating procedures for the standardized NUHOMS® system.

K.8.1.1 Preparation of the Transfer Cask and DSC

Notes:

- If using the OS200 TC for transfer of the NUHOMS®-61BT DSC, verify that it has been fitted with an internal aluminum sleeve (refer to Drawing NUH-08-8004-SAR provided in Section U.1.5). This step, if required, can be performed at any time prior to placing the DSC in the TC.

1. Prior to placement in dry storage, the candidate intact and damaged fuel assemblies shall be evaluated (by plant records or other means) to verify that they meet the physical, thermal and radiological criteria specified in Technical Specification 2.1.

2. Prior to being placed in service, the transfer cask is to be cleaned or decontaminated as necessary to insure a surface contamination level of less than those specified in Technical Specification *3.3.1*.

3. Place the transfer cask in the vertical position in the cask decon area using the cask handling crane and the transfer cask lifting yoke.

4. Place scaffolding around the cask so that the top cover plate and surface of the cask are easily accessible to personnel.

5. Remove the transfer cask top cover plate and examine the cask cavity for any physical damage and ready the cask for service.

5a. If using the OS200 TC to load, verify that a cask spacer of appropriate height (refer to Drawing NUH-08-8005-SAR provided in Appendix U, Section U.1.5) is placed at the bottom of the TC.

6. Examine the DSC for any physical damage which might have occurred since the receipt inspection was performed. The DSC is to be cleaned and any loose debris removed.

   CAUTION: If loading fuel assemblies through the basket hold down ring (HDR), verify that the lifting grapple will be able to release fuel assemblies while inside the HDR.

19. Prior to the cask being lifted into the fuel pool, the water level in the pool should be adjusted as necessary to accommodate the cask/DSC volume. If the water placed in the DSC cavity was obtained from the fuel pool, a level adjustment may not be necessary.

K.8.1.2 DSC Fuel Loading

1. Lift the cask/DSC and position it over the cask loading area of the spent fuel pool in accordance with the plant's 10CFR50 cask handling procedures.

2. Lower the cask into the fuel pool until the bottom of the cask is at the height of the fuel pool surface. As the cask is lowered into the pool, spray the exterior surface of the cask with demineralized water.

3. Place the cask in the location of the fuel pool designated as the cask loading area.

4. Disengage the lifting yoke from the cask lifting trunnions and move the yoke and the top shield plug clear of the cask. Spray the lifting yoke and top shield plug with clean demineralized water if it is raised out of the fuel pool.

5. Move a candidate fuel assembly from a fuel rack in accordance with the plant's 10CFR50 fuel handling procedures.

6. Prior to insertion of a spent fuel assembly into the DSC, the identity of the assembly is to be verified by two individuals using an underwater video camera or other means. Read and record the fuel assembly identification number from the fuel assembly and check this identification number against the DSC loading plan which indicates which fuel assemblies are acceptable for dry storage.

7. Position the fuel assembly for insertion into the selected DSC storage cell and load the fuel assembly. Repeat Steps 5 through 7 for each SFA loaded into the DSC. A maximum of 16 damaged fuel assemblies may be loaded into the 2x2 compartments of a Type C basket. After the DSC has been fully loaded, check and record the identity and location of each fuel assembly in the DSC. If loading damaged fuel assemblies, place top end caps over each damaged fuel assembly placed into the basket.

8. After all the SFAs have been placed into the DSC and their identities verified, place the hold down ring . Alternately, the hold down ring may be placed on the basket before loading SFAs. Position the lifting yoke and the top shield plug and lower the shield plug onto the DSC.

   CAUTION: Verify that all the lifting height restrictions as a function of temperature specified in Technical Specification *4.4.1.*A can be met in the following steps which involve lifting of the transfer cask.

9. Visually verify that the top shield plug is properly seated onto the DSC.

10. Position the lifting yoke with the cask trunnions and verify that it is properly engaged.

10a. From this point, until the DSC has been inserted into the HSM, the DSC will be inspected for damage after any TC drop of 15 inches or greater.

11. Raise the transfer cask to the pool surface. Prior to raising the top of the cask above the water surface, stop vertical movement.

12. Inspect the top shield plug to verify that it is properly seated onto the DSC. If not, lower the cask and reposition the top shield plug. Repeat Steps 11 and 12 as necessary.

13. Continue to raise the cask from the pool and spray the exposed portion of the cask with demineralized water until the top region of the cask is accessible.

14. Drain any excess water from the top of the DSC shield plug back to the fuel pool.

    CAUTION: The radiation dose rates around the surface of the transfer cask without water in the neutron shield and/or in the DSC cavity (through step K.8.1.1.18) are expected to be high. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

15. Drain approximately 1100 gallons of water (as indicated on the rotometer) from the DSC back into the fuel pool or other suitable location using the VDS or optional liquid pump.

16. Lift the cask from the fuel pool. As the cask is raised from the pool, continue to spray the cask with demineralized water.

17. Move the transfer cask with loaded DSC to the cask decon area.

18. Replace the approximate 1100 gallons of water removed (as indicated on the rotometer) from the DSC with demineralized water or spent fuel pool water. Fill the neutron shield with demineralized water.

19. Install TC seismic restraints if required by *CoC Appendix A Inspections, Tests, and Evaluations Item 3.1.7* (required only on plant specific basis).

K.8.1.3 <u>DSC Drying and Backfilling</u>

1. Check the radiation levels along the perimeter of the cask. The cask exterior surface should be decontaminated as necessary in accordance with the limits specified in Technical Specification *3.3.1*. Temporary shielding may be installed as necessary to minimize personnel exposure.

2. Place scaffolding around the cask so that any point on the surface of the cask is easily accessible to personnel.

3. Disengage the rigging cables from the top shield plug and remove the eyebolts. Disengage the lifting yoke from the trunnions and position it clear of the cask.

4. Decontaminate the exposed surfaces of the DSC shell perimeter and remove the inflatable cask/DSC annulus seal.

4a. In accordance with Technical Specification *4.3.2*, verify that the neutron shield (NS) is filled before the draining operation in Step 5 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

5. Connect the cask drain line to the cask, open the cask cavity drain port and allow water from the annulus to drain out until the water level is approximately twelve inches below the top edge of the DSC shell. Take swipes around the outer surface of the DSC shell and check for smearable contamination in accordance with the Technical Specification *3.3.1* limits.

5a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 6 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

6. Drain approximately 1100 gallons of water (as indicated on a rotometer) from the DSC back into the fuel pool or other suitable location using the VDS or an optional liquid pump. Consistent with ISG-22 [8.6] guidance and Technical Specification 3.1.1, helium at 1-3 psig is used to backfill the DSC with an inert gas as water is being removed from the DSC.

7. Disconnect hose from the DSC siphon port.

8. Install the automatic welding machine onto the inner top cover plate and place the inner top cover plate with the automatic welding machine onto the DSC. Verify proper fit-up of the inner top cover plate with the DSC shell.

9. Check radiation levels along surface of the inner top cover plate. Temporary shielding may be installed as necessary to minimize personnel exposure.

10. Insert a ¼ inch tygon tubing of sufficient length through the vent port such that it terminates just below the DSC shield plug. Connect the tygon tubing to a hydrogen monitor to allow continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner cover plate, in compliance with Technical Specification *4.3.3*. Optionally, other methods may be used for continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner top cover plate, to comply with the Technical Specification.

11. Cover the cask/DSC annulus to prevent debris and weld splatter from entering the annulus.

12. Ready the automatic welding machine and tack weld the inner top cover plate to the DSC shell. Install the inner top cover plate weldment and remove the automatic welding machine.

    CAUTION: Continuously monitor the hydrogen concentration in the DSC cavity using the tygon tube arrangement described in step 10 during the inner top cover plate cutting/welding operations. Verify that the measured hydrogen concentration does not exceed a safety limit of 2.4% (8.4) (60.0% of flammability limit of 4.0%). If this limit is exceeded, stop all welding operations and purge the DSC cavity with 2-3 psig helium (or any other inert medium) via the ¼” tygon tubing to reduce the hydrogen concentration safely below the 2.4% limit.

13. Perform dye penetrant weld examination of the inner top cover plate weld in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

14. Place the strongback so that it sits on the inner top cover plate and is oriented such that

    - the DSC siphon and vent ports are accessible;
    - the strongback stud holes line up with the TC lid bolt holes.

15. Lubricate the studs and, using a crossing pattern, adjust the strongback studs to snug tight ensuring approximately even pressure on the cover plate.

16. Connect the VDS to the DSC siphon and vent ports.

17. Install temporary shielding to minimize personnel exposure throughout the subsequent welding operations as required.

17a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 18 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

18. Engage the helium supply and open the valve on the vent port and allow helium to force the water from the DSC cavity through the siphon port. Use of helium is required per Technical Specification 3.1.1.

19. Once the water stops flowing from the DSC, close the DSC siphon port and disengage the gas source. Verify that the TC axial surface dose rates are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. The configuration for determining the TC axial dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

19a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 20 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled

31. Remove the Strongback, decontaminate as necessary, and store.

K.8.1.4 DSC Sealing Operations

1. Disconnect the VDS from the DSC. Seal weld the prefabricated plugs over the vent and siphon ports and perform a dye penetrant weld examination in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements. Use of an optional test head is acceptable to perform the helium leak test of the inner top cover plate and vent/siphon port welds in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1*. If an optional test head is not used, proceed to Step 2.

2. Install the automatic welding machine onto the outer top cover plate and place the outer top cover plate with the automatic welding system onto the DSC. Verify proper fit up of the outer top cover plate with the DSC shell.

3. Tack weld the outer top cover plate to the DSC shell. Place the outer top cover plate weld root pass.

4. Helium leak test the inner top cover plate and vent/siphon port plate welds using the leak test port in the outer top cover plate in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1* limits. Alternatively, this can be done with a test head in Step K.8.1.4.1.

5. If a leak is found, remove the outer cover plate root pass, the vent and siphon port plugs and repair the inner cover plate welds. Then install the Strongback and repeat procedure steps from K.8.1.3 step 22.

6. Perform dye penetrant examination of the root pass weld. Weld out the outer top cover plate to the DSC shell and perform dye penetrant examination on the weld surface in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

7. Seal weld the prefabricated plug over the outer cover plate test port and perform dye penetrant weld examinations in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

8. Remove the automatic welding machine from the DSC.

9. If using the OS200 TC to load, place a sleeve ring spacer at the top of the aluminum sleeve (refer to Drawing NUH-08-8004-SAR provided in Appendix U, Section U.1.5).

10. Rig the cask top cover plate and lower the cover plate onto the transfer cask.

11. Bolt the cask cover plate into place, tightening the bolts to the required torque in a star pattern.

12. Verify that the TC radial dose rates measured at the surface of the Transfer Cask are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. The configuration for determining the TC radial surface dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

frame on the bottom of the transfer cask. (The temporary shield plug and ram trunnion support frame are not required with integral ram/trailer.)

K.8.1.6 DSC Transfer to the HSM

Note: If using the HSM-HS module for storage of the NUHOMS®-61BT DSC at sites with high seismic levels, verify that at least 3 modules are connected together per the requirements of *CoC Condition II.2.a*.

1. Prior to transferring the cask to the ISFSI or prior to positioning the transfer cask at the HSM designated for storage, remove the HSM door, inspect the cavity of the HSM, removing any debris and ready the HSM to receive a DSC. The doors on adjacent HSMs should remain in place.

   Caution: The insides of empty modules have the potential for high dose rates due to adjacent loaded modules. Proper ALARA practices should be followed for operations inside these modules and in the areas outside these modules whenever the door from the empty HSM has been removed.

2. Inspect the HSM air inlet and outlets to ensure that they are clear of debris. Inspect the screens on the air inlet and outlets for damage.

   CAUTION: Verify that the requirements of Technical Specification *4.4.1*.B, "TC/DSC Transfer Operations at High Ambient Temperatures" are met prior to next step.

3. Using a suitable heavy haul tractor, transfer the cask from the plant's fuel/reactor building to the ISFSI along the designated transfer route.

4. Once at the ISFSI, position the transfer trailer to within a few feet of the HSM.

5. Check the position of the trailer to ensure the centerline of the HSM and cask approximately coincide. If the trailer is not properly oriented, reposition the trailer, as necessary.

6. Unbolt and remove the cask top cover plate.

6a. If using OS200 TC to load, remove the sleeve ring spacer at the top of the aluminum sleeve (refer to Drawing NUH-08-8004-SAR provided in Appendix U, Section U.1.5).

7. Back the cask to within a few inches of the HSM, set the trailer brakes and disengage the tractor. Drive the tractor clear of the trailer. Extend the transfer trailer vertical jacks.

8. Connect the skid positioning system hydraulic power unit to the positioning system via the hose connector panel on the trailer, and power it up. Remove the skid tie-down bolts and

use the skid positioning system to bring the cask into approximate vertical and horizontal alignment with the HSM. Using optical survey equipment and the alignment marks on the cask and the HSM, adjust the position of the cask until it is properly aligned with the HSM.

9. Using the skid positioning system, fully insert the cask into the HSM access opening docking collar.

10. Secure the cask trunnions to the front wall embedments of the HSM using the cask restraints.

11. After the cask is docked with the HSM, verify the alignment of the transfer cask using the optical survey equipment.

12. Position the hydraulic ram behind the cask in approximate horizontal alignment with the cask and level the ram. Remove either the bottom ram access cover plate or the outer plug of the two-piece temporary shield plug. Power up the ram hydraulic power supply and extend the ram through the bottom cask opening into the DSC grapple ring.

13. Activate the hydraulic cylinder on the ram grapple and engage the grapple arms with the DSC grapple ring.

14. Recheck all alignment marks and ready all systems for DSC transfer. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

If the alignment tolerance is exceeded, the following actions should be taken:

a. Confirm that the transfer system is properly configured,

b. Check and repair the alignment equipment, or

c. Confirm the locations of the alignment targets on the TC and HSM.

15. Activate the hydraulic ram to initiate insertion of the DSC into the HSM. Stop the ram when the DSC reaches the support rail stops at the back of the module.

16. Disengage the ram grapple mechanism so that the grapple is retracted away from the DSC grapple ring.

17. Retract and disengage the hydraulic ram system from the cask and move it clear of the cask. Remove the cask restraints from the HSM.

18. Using the skid positioning system, disengage the cask from the HSM access opening. Insert the inner tube of the DSC axial retainer.

19. The trailer may be moved as necessary to install the HSM door. Install the HSM door and secure it in place. Verify that the HSM dose rates are compliant with the limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.3.1 and 3.3.2*.

20. Replace the transfer cask top cover plate. Secure the skid to the trailer, retract the vertical jacks and disconnect the skid positioning system.

21. If this is the final loading, fully drain the liquid neutron shield.

22. Tow the trailer and cask to the designated equipment storage area. Return the remaining transfer equipment to the storage area.

23. Close and lock the ISFSI access gate and activate the ISFSI security measures.

K.8.1.7 Monitoring Operations

1. Perform routine security surveillance in accordance with the licensee's ISFSI security plan.

Note: Perform one of the two alternate surveillance activities listed below.

2a. Perform a daily visual surveillance of the HSM air inlets and outlets to insure that no debris is obstructing the HSM vents in accordance with Technical Specification *3.1.4*.a requirements.

2b. Perform a temperature measurement of the thermal performance, for each HSM, on a daily basis in accordance with Technical Specification *3.1.4*.b requirements.

K.8.2 Procedures for Unloading the Cask

K.8.2.1 DSC Retrieval from the HSM

1. Ready the transfer cask, transfer trailer, and support skid for service and tow the trailer to the HSM. If using the OS200 TC to unload, verify that it has been fitted with an internal aluminum sleeve and a cask spacer of appropriate height (refer to Drawings NUH-08-8004-SAR and NUH-08-8005-SAR provided in Appendix U, Section U.1.5).

2. Back the trailer as close to the HSM as compatible with HSM door removal, and remove the cask top cover plate.

3. Remove the HSM door. Remove the inner tube of the DSC axial retainer.

4. Using the skid positioning system, align the cask with the HSM and position the skid until the cask is docked with the HSM access opening.

5. Using optical survey equipment, verify alignment of the cask with respect to the HSM. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

   If the alignment tolerance is exceeded, the following actions should be taken:

   a. Confirm that the transfer system is properly configured,

   b. Check and repair the alignment equipment, or

   c. Confirm the locations of the alignment targets on the TC and HSM.

5a. Install the cask restraints.

6. Install and align the hydraulic ram with the cask.

7. Extend the ram through the cask into the HSM until it is inserted in the DSC grapple ring.

8. Activate the arms on the ram grapple mechanism with the DSC grapple ring.

8a. *From this point, until fuel has been removed from the DSC or the DSC has been removed from the TC, the DSC will be inspected for damage after any TC drop of 15 inches or greater.*

9. Retract ram and pull the DSC into the cask.

10. Retract the ram grapple arms.

11. Disengage the ram from the cask.

12. Remove the cask restraints.

13. Using the skid positioning system, disengage the cask from the HSM.

14. If using the OS200 TC to unload, place a sleeve ring spacer at the top of the aluminum sleeve (refer to Drawing NUH-08-8004-SAR provided in Appendix U, Section U.1.5).

15. Install the cask top cover plate and ready the trailer for transfer.

16. Replace the door on the HSM.

11. Place scaffolding around the cask so that any point on the surface of the cask is easily accessible to handling personnel.

12. Unbolt the cask top cover plate.

13. If using the OS200 TC to unload, remove the sleeve ring spacer at the top of the aluminum sleeve placed in Section K.8.2.1, step 14. Connect the rigging cables to the cask top cover plate and lift the cover plate from the cask. Set the cask cover plate aside and disconnect the lid lifting cables.

14. Install temporary shielding to reduce personnel exposure as required. Fill the cask/DSC annulus with clean demineralized water and seal the annulus.

The process of DSC unloading is similar to that used for DSC loading. DSC opening operations described below are to be carefully controlled in accordance with plant procedures. This operation is to be performed under the site's standard health physics guidelines for welding, grinding, and handling of potentially highly contaminated equipment. These are to include the use of prudent housekeeping measures and monitoring of airborne particulates. Procedures may require personnel to perform the work using respirators or supplied air.

If fuel needs to be removed from the DSC, either at the end of service life or for inspection after an accident, precautions must be taken against the potential for the presence of damaged or oxidized fuel and to prevent radiological exposure to personnel during this operation. A sampling of the atmosphere within the DSC will be taken prior to inspection or removal of fuel.

This can be achieved with this design by the use of the purge and fill valves which permit a determination of the atmosphere within the DSC before the removal of the inner top cover and shield plugs, prior to filling the DSC cavity with water. If the atmosphere within the DSC is helium and radioactivity check of the atmosphere in the DSC cavity did not detect the presence of any airborne radioactive particulates, then operations should proceed normally with fuel removal either via the TC or in the pool, if available. However, if air or airborne radioactive particulates are present within the DSC, then appropriate filters should be in place to preclude the uncontrolled release of any potential airborne radioactive particulate from the DSC via the purge-fill valves. This will protect both personnel and the operations area from potential contamination. For the accident case, personnel protection in the form of respirators or supplied air should be considered in accordance with licensee's Radiation Protection Program.

If the work is performed outside the fuel/reactor building, a tent may be constructed over the work area, which may be kept under a negative pressure to control airborne particulates. Any radioactive gas release will be Kr-85, which is not readily captured. Whether the krypton is vented through the plant stack or allowed to be released directly depends on the plant operating requirements.

Following opening of the DSC, the cask and DSC are filled with water prior to lowering the top of cask below the surface of the fuel pool to prevent a sudden inrush of pool water. Cask placement into the pool is performed in the usual manner. Fuel unloading procedures will be governed by the plant operating license under 10CFR50. The generic procedures for these operations are as follows:

15. Locate the DSC siphon and vent port using the indications on the top cover plate. Place a portable drill press on the top of the DSC. Position the drill with the siphon port.

16. Place an exhaust hood or tent over the DSC, if necessary. The exhaust should be filtered or routed to the site radwaste system.

17. Drill a hole through the DSC top cover plate to expose the siphon port quick connect.

18. Drill a second hole through the top cover plate to expose the vent port quick connect.

19. Obtain a sample of the DSC atmosphere, if necessary (e.g., at the end of service life). Fill the DSC with water from the fuel pool through the siphon port with the vent port open and routed to the plant's off-gas system.

    CAUTION:

    (a) The water fill rate must be regulated during this reflooding operation to ensure that the DSC vent pressure does not exceed 20.0 psig.

    (b) Provide for continuous hydrogen monitoring of the DSC cavity atmosphere during all subsequent cutting operations to ensure that a safety limit of 2.4% (60.0% of flammability limit of 4.0%) is not exceeded (8.4) and in compliance with Technical Specification *4.3.3*. Purge with 2-3 psig helium (or any other inert medium) as necessary to maintain the hydrogen concentration safely below this limit.

20. Place welding blankets around the cask and scaffolding.

21. Using plasma arc-gouging, a mechanical cutting system or other suitable means, remove the seal weld from the outer top cover plate and DSC shell. A fire watch should be placed on the scaffolding with the welder, as appropriate. The exhaust system should be operating at all times.

22. The material or waste from the cutting or grinding process should be treated and handled in accordance with the plant's low level waste procedures unless determined otherwise.

23. Remove the top of the tent, if necessary.

24. Remove the exhaust hood, if necessary.

25. Remove the DSC outer top cover plate.

26. Reinstall tent and temporary shielding, as required. Remove the seal weld from the inner top cover plate to the DSC shell in the same manner as the top cover plate. Remove the inner top cover plate. Remove any remaining excess material on the inside shell surface by grinding.

27. Clean the cask surface of dirt and any debris which may be on the cask surface as a result of the weld removal operation. Any other procedures which are required for the operation of the cask should take place at this point as necessary.

28. Engage the yoke onto the trunnions, install eyebolts into the top shield plug and connect the rigging cables to the eyebolts.

K.11.1.2 Extreme Temperatures

This event is described in Section 8.1.2.2.

K.11.1.2.1 Postulated Cause of Event

No change to Section 8.1.2.2.

K.11.1.2.2 Detection of Event

No change to Section 8.1.2.2.

K.11.1.2.3 Analysis of Effects and Consequences

The thermal evaluation of the NUHOMS®-61BT system for off-normal conditions is presented in Section K.4.5. Based on the thermal analysis presented in Section K.4.9, the evaluations for the 61BT in the OS197/OS197H in Section K.4.5 remain valid for transfer of 61BT DSC in the OS200 TC. The 100ºF normal condition with solar insolation bounds the 125ºF case without solar insolation for the DSC in the OS197 transfer cask. Therefore the normal condition maximum temperatures are bounding. The 125ºF case with the DSC in the HSM is not bounded by the normal conditions.

The structural evaluation of the HSM's, NUHOMS®-61BT DSC and the OS197 transfer cask for the off-normal temperature conditions are presented in Section K.3.6.2.2. The structural evaluation of the basket due to off-normal thermal conditions is presented in Section K.3.4.4.

As indicated in Section K.3.6, the structural evaluation of the HSM-HS and OS200 Transfer Cask, as presented in Chapter U.3, Section U.3.6.2.3 and Chapter U.3, Section U.3.6.2.4, respectively, remain applicable when these components are loaded with the 61BT DSC.

K.11.1.2.4 Corrective Actions

Restrictions for onsite handling of the transfer cask with a loaded DSC under extreme temperature conditions are presented in Technical Specifications *4.4.1*.A and *4.4.1*.B. There is no change to this requirement as a result of addition of the NUHOMS®-61BT DSC.

K.11.1.3 Off-Normal Releases of Radionuclides

The NUHOMS®-61BT DSC is designed and tested to the leak tight criteria of ANSI N14.5 [11.2]. Therefore the estimated quantity of radionuclides expected to be released annually to the environment due to normal or off-normal events is zero.

K.11.1.3.1 Postulated Cause of Event

In accordance with the Standard Review Plan, NUREG-1536 [11.3], for off-normal conditions, it is conservatively assumed that 10% of the fuel rods fail.

L.4.5 Thermal Evaluation for Off-Normal Conditions

The NUHOMS®-24PT2L and –24PT2S DSCs are evaluated for the same off-normal conditions as Chapter 8.

L.4.5.1 Off-Normal Maximum/Minimum Temperatures during Storage

The thermal performance of the NUHOMS®-24PT2L and 24PT2S DSCs within the HSM under the extreme minimum ambient temperature of –40 °F and no insolation is evaluated using the same models as in Section L.4.4.1.

A summary of the calculated DSC component temperatures is listed in Table L.4-11, L.4-12 and L.4-13.

L.4.5.2 Off-Normal Maximum/Minimum Temperatures during Transfer

The thermal performance of the NUHOMS®-24PT2L and 24PT2S DSCs within the transfer cask under the extreme minimum ambient temperature of –40 °F and no insolation is evaluated using the same models as in Section L.4.4.1. Administrative controls (NUHOMS® CoC Technical Specification *4.4.1*.B) prevent transfer operations of a loaded TC/DSC when ambient temperatures exceed 100 °F. For transfer operations when ambient temperatures exceed 100 °F up to 125 °F, a solar shield is to be used to minimize insolation. Since the thermal performance of the DSC without sunshade at an ambient temperature of 100 °F is limiting, the results for the 100 °F ambient case envelope the maximum off-normal 125 °F case.

L.4.5.3 Off-Normal Maximum Internal Pressure during Storage/Transfer

Off-normal maximum DSC internal pressures are calculated in Section L.4.4.4.8.

L.4.5.4 Maximum Thermal Stresses

The maximum thermal stresses during off-normal conditions of storage and transfer are calculated in Section L.3.

L.4.5.5 Evaluation of Cask Performance for Off-Normal Conditions

The temperatures in the NUHOMS® HSM and transfer cask with the 24PT2L and 24PT2S DSCs are the same as Section 8.1.3 because of the same maximum heat load as the NUHOMS®-24P DSC design. The NUHOMS®-24PT2L and 24PT2S DSC shell and baskets are evaluated for the calculated temperatures and pressures in Section L.3. The maximum fuel cladding temperatures are well below the allowable fuel temperature limit as shown in Table L.4-11. The pressure remains below 10.0 psig during off-normal conditions of storage and transfer. Based on the thermal analysis, it is concluded that the NUHOMS®-24PT2L and –24PT2S DSC designs meets all applicable thermal requirements.

L.4.6 Thermal Evaluation for Accident Conditions

L.4.6.1 Blocked Vent Accident Evaluation

For the blocked vent case, the following DSC shell temperatures shown in Table L.4-16 apply:

Table L.4-16
DSC Shell Temperatures During Blocked Vent Accident.

Time	T_{top} (°F)	T_{side} (°F)	T_{bot} (°F)
0 hours	399	361	294
4 hours	527	486	360
8 hours	594	545	386
12 hours	627	574	399
16 hours	645	588	408
20 hours	654	597	416
24 hours	660	603	422
28 hours	665	607	428
32 hours	669	611	434
36 hours	672	614	440
40 hours	675	618	445

These temperatures were derived by conservatively not considering any thermal mass within the DSC internal basket structure

The blocked vent case was modeled using a 180° model with a adiabatic boundary condition at x=0. The model is shown in Figure L.4-16. The 180°, symmetrical model adds slight conservatism because the radiation heat transfer across the symmetry boundary is not accounted for in ANSYS. The temperatures on the shell surface are used from Table L.4-16. The option of a ramped boundary condition is used so that ANSYS will linearly interpolate the DSC shell temperatures between the points which are defined. The densities and specific heats of the materials are used from Table L.4-1 and Chapter 8. The results are reported for 40 hours into the blocked vent accident, which is consistent with the NUHOMS® Technical Specification *3.1.4*.a [4.14].

L.11.1.2.1 Postulated Cause of Event

No change to Section 8.1.2.2.

L.11.1.2.2 Detection of Event

No change to Section 8.1.2.2.

L.11.1.2.3 Analysis of Effects and Consequences

The thermal evaluation of the NUHOMS®-24PT2 system for off-normal conditions is presented in Section L.4.5. The 100 °F normal condition with solar insolation bounds the 125 °F case without solar insolation for the DSC in the transfer cask. Therefore, the normal condition maximum temperatures are bounding.

The structural evaluation of the HSMs, NUHOMS®-24PT2 DSC and the OS-197 and Standardized transfer casks for the off-normal temperature conditions are presented in Section L.3.6.2.2. The structural evaluation of the basket due to off-normal thermal conditions is presented in Section L.3.6.2.2.

L.11.1.2.4 Corrective Actions

Restrictions for onsite handling of the transfer cask with a loaded DSC under extreme temperature conditions are presented in NUHOMS® Technical Specifications *4.4.1*.A and *4.4.1*.B [11.2]. There is no change to this requirement as a result of addition of the NUHOMS®-24PT2 DSC.

Table M.2-2
PWR Fuel Assembly Design Characteristics for the NUHOMS®-32PT DSC

Assembly Class	B&W 15x15	WE 17x17	CE 15x15[3], [4]	WE 15x15	CE 14x14	WE 14x14
DSC Configuration	**Maximum Unirradiated Length (in)**					
32PT-S100/32PT-S125	165.75[1]	165.75[1]	165.75	165.75[1]	165.75[1]	165.75[1]
32PT-L100/32PT-L125	171.71[1]	171.71[1]	171.71	171.71[1]	171.71[1]	171.71[1]
Fissile Material	UO_2	UO_2	UO_2	UO_2	UO_2	UO_2
Maximum MTU/assembly[2]	0.475	0.475	0.475	0.475	0.475	0.475
Maximum Number of Fuel Rods	208	264	216	204	176	179
Maximum Number of Guide/ Instrument Tubes	17	25	9	21	5	17

---

[1] Maximum Assembly + CC Length (unirradiated).
[2] The maximum MTU/assembly is based on the shielding analysis AMD 15
[3] CE 15x15 assemblies with stainless steel plugging clusters installed are acceptable.
[4] Control Components that extend into the active fuel region are not authorized for storage with CE 15x15 class assemblies.

Table M2-2a
Thermal and Radiological Characteristics for Control Components Stored in the NUHOMS®-32PT DSC

Parameter	*BPRAs, NSAs, CRAs, RCCAs, VSIs, Neutron Sources, and APSRAs*	*TPAs and ORAs*
Maximum Gamma Source (γ/sec/DSC)	*Per TS Table 1-1ee*	
Decay Heat (Watts/DSC)	*256*	*256*

Note: NSAs and Neutron Sources shall only be stored in the interior compartments of the basket. Interior compartments are those that are completely surrounded by other compartments, including the corners. There are twelve interior compartments in the 32PT DSC.

The HSM thermal model described above provide the surface temperatures that are applied to the DSC, basket and payload model.

M.4.5.2 Off-Normal Maximum/Minimum Temperatures during Transfer

The thermal performance of the NUHOMS®-32PT DSC during transfer under the extreme minimum ambient temperature of 0 °F with no insolation and 117 °F with maximum insolation, and decay heat load configurations 1, 2 and 3 are examined. For transfer operations when ambient temperatures exceed 100 °F up to 117 °F, a solar shield is used.

M.4.5.2.1 Boundary Conditions, Transfer

In accordance with Section M.4.4.1.6, analyses of a 32PT DSC within the TC are performed for the following ambient conditions:

- Maximum normal ambient temperature of 117 °F with solar shield in place, and
- Minimum off-normal extreme ambient temperature of 0 °F without insolation.

These analyses determine maximum DSC surface temperatures. The maximum calculated DSC temperatures are applied to the exterior surface of the DSC in the DSC/basket/payload finite element model.

M.4.5.3 Off-Normal Maximum and Minimum Temperatures During Storage/Transfer

According to the NUHOMS® CoC 1004, Technical Specification *4.4.1*.B, "TC/DSC Transfer Operations at High Ambient Temperatures" for transfer operations, when ambient temperatures exceed 100 °F up to 125 °F, a solar shield shall be used to provide protection against direct solar radiation.

The thermal performance of the DSC during transfer operations when the DSC is in the transfer cask without the sunshade at an ambient temperature of 100 °F is limiting and bounds the maximum off-normal 117 °F transfer case with sunshade. This is demonstrated by results provided in Table M.4-8 and Table M.4-2.

A comparison of the thermal analysis results for 32PT-DSC during transfer operations for the cases of 100 °F ambient temperature without sunshade and 117 °F ambient temperature with sunshade shows that the maximum fuel cladding temperatures are 720°F (Table M.4-2) and 715 °F (Table M.4-8), respectively.

M.4.5.3.1 Fuel Cladding

The results are reported in Table M.4-8 for heat load zoning configurations 1, 2 and 3 which yield the highest fuel cladding temperatures.

Table M.4-9
Off-Normal Event DSC Basket Assembly Maximum Component Temperatures; Configuration 1

Configuration	$T_{grid,max}$ (°F)	$T_{grid,min}$ (°F)	$T_{rail,max}$ (°F)	$T_{rail,min}$ (°F)	$T_{Al,max}$ (1) (°F)	$T_{DSC\ shell}$ (2) (°F)
DSC in HSM, -40 °F	536	200	266	197	536	237
DSC in HSM, 117 °F	643	322	402	318	643	382
DSC horizontal in cask, -40 °F(3)	-	-	-	-	-	-
DSC horizontal in cask with shade, 117 °F	700	404	463	401	700	433

(1) Includes aluminum and poison plates.
(2) Maximum temperature is at top of shell.
(3) Not evaluated for cask with liquid neutron shield (OS197/OS197H). Per Technical Specification *4.4.1*.A transfer operations outside the fuel handling building at basket temperatures (assumed conservatively equal to ambient temperature) below 0 °F are not permitted.

Table M.4-10
Off-Normal Event DSC Basket Assembly Maximum Component Temperatures; Configuration 2

Configuration	$T_{grid,max}$ (°F)	$T_{grid,min}$ (°F)	$T_{rail,max}$ (°F)	$T_{rail,min}$ (°F)	$T_{Al,max}$ [(1)] (°F)	$T_{DSC\ shell}$ [(2)] (°F)
DSC in HSM, -40 °F	520	200	268	196	520	237
DSC in HSM, 117 °F	629	322	404	317	628	382
DSC horizontal in cask, -40 °F[(3)]	-	-	-	-	-	-
DSC horizontal in cask with shade, 117 °F	686	405	464	400	686	433

(1) Includes aluminum and poison plates.
(2) Maximum temperature is at top of shell.
(3) Not evaluated for cask with liquid neutron shield (OS197/OS197H). Per Technical Specification *4.4.1.*A transfer operations outside the fuel handling building at basket temperatures (assumed conservatively equal to ambient temperature) below 0 °F are not permitted.

Table M.4-11
Off-Normal Event DSC Basket Assembly Maximum Component Temperatures; Configuration 3

Configuration	$T_{grid,max}$ (°F)	$T_{grid,min}$ (°F)	$T_{rail,max}$ (°F)	$T_{rail,min}$ (°F)	$T_{Al,max}$ [(1)] (°F)	$T_{DSC\ shell}$ [(2)] (°F)
DSC in HSM, -40 °F	538	187	252	185	538	224
DSC in HSM, 117 °F	645	310	388	307	644	368
DSC horizontal in cask, -40 °F[(3)]	-	-	-	-	-	-
DSC horizontal in cask with shade, 117 °F	699	389	447	386	698	418

(1) Includes aluminum and poison plates.
(2) Maximum temperature is at top of shell.
(3) Not evaluated for cask with liquid neutron shield (OS197/OS197H). Per Technical Specification *4.4.1.*A transfer operations outside the fuel handling building at basket temperatures (assumed conservatively equal to ambient temperature) below 0 °F are not permitted.

M.8.1 Procedures for Loading the Cask

Process flow diagrams for the NUHOMS® System operation are presented in Figure M.8-1 and Figure M.8-2. The location of the various operations may vary with individual plant requirements. The following steps describe the recommended generic operating procedures for the standardized NUHOMS® System.

M.8.1.1 Preparation of the TC and DSC

NOTE: If using the OS200 TC for transfer of the NUHOMS®-32PT DSC, verify that it has been fitted with an internal aluminum sleeve (refer to Drawing NUH-08-8004-SAR provided in Appendix U, Section U.1.5). This step, if required, can be performed at any time prior to placing the DSC in the TC.

1. Prior to placement in dry storage, the candidate intact and damaged and failed fuel assemblies shall be evaluated (by plant records or other means) to verify that they meet the physical, thermal and radiological criteria specified in Technical Specification 2.1. Depending on the length of the fuel assemblies to be loaded, fuel spacers may be placed within the DSC to reduce the fuel assembly/DSC cavity gap in consideration of Part 71requirements. There are no requirements for fuel spacers under Part 72. Fuel spacers, if used, may be placed below the assembly, above the assembly, or both, and shall be evaluated for any adverse impact. AMD 15

2. Prior to being placed in service, the TC is to be cleaned or decontaminated as necessary to insure a surface contamination level of less than those specified in Technical Specification *3.3.1*. Prior to being placed in service, the DSC should have the top shield plug, inner top cover and outer top cover test fitted and removed.

3. Place the TC in the vertical position in the cask decon area using the cask handling crane and the TC lifting yoke.

4. Place scaffolding around the cask so that the top cover plate and surface of the cask are easily accessible to personnel.

5. Remove the TC top cover plate and examine the cask cavity for any physical damage and ready the cask for service.

5a. If using the OS200 TC to load, verify that a cask spacer of appropriate height (refer to Drawing NUH-08-8005-SAR provided in Appendix U, Section U.1.5) is placed at the bottom of the TC.

6. Examine the DSC for any physical damage which might have occurred since the receipt inspection was performed. The DSC is to be cleaned and any loose debris removed.

7. Using a crane, lower the DSC into the cask cavity by the internal lifting lugs and rotate the DSC to match the cask and DSC alignment marks.

8. Fill the cask-DSC annulus with clean, demineralized water. Place the inflatable seal into the upper cask liner recess and seal the cask-DSC annulus by pressurizing the seal with compressed air.

8a. Place and verify that the bottom fuel assembly spacers, if required, are present in the fuel cells. Optionally, this step may be performed at any prior time.

- A fuel movement schedule is then written, verified and approved based upon the loading plan. All fuel movements from any rack location are performed under strict compliance of the fuel movement schedule.
- If loading damaged fuel assemblies, verify that the required number of bottom end caps are installed in appropriate fuel compartment tube locations. AMD 15
- If loading failed fuel, verify that the required number of failed fuel cans are installed in the appropriate locations, or, once loaded with fuel, are installed in the appropriate locations in the basket.

6. Prior to insertion of a spent fuel assembly (and BPRAs, if applicable) into the DSC, the identity of the assembly (and BPRAs, if applicable) is to be verified by two individuals using an underwater video camera or other means. Read and record the identification number from the fuel assembly (and BPRAs, if applicable) and check this identification number against the DSC loading plan which indicates which fuel assemblies (and BPRAs, if applicable) are acceptable for dry storage.

7. Position the fuel assembly for insertion into the selected DSC storage cell and load the fuel assembly. Repeat Step 6 for each SFA loaded into the DSC. Damaged fuel assemblies or failed fuel assemblies may be loaded into the basket per Technical Specifications. If applicable, insert the required number of PRAs at specific locations called out in the loading plan. After the DSC has been fully loaded, check and record the identity and location of each fuel assembly and BPRAs, if applicable, in the DSC. Also record the location of each PRA inserted in the DSC (if applicable). If loading damaged fuel assemblies, place top end caps over each damaged fuel assembly placed into the basket. If loading failed fuel, ensure that the failed fuel can lids are installed. AMD 15 AMD 15

8. After all the SFAs, BPRAs, and PRAs, if applicable, have been placed into the DSC and their identities verified, position the lifting yoke with the rigging cables connected to the top shield plug, adjust the rigging cables as needed to level the top shield plug and lower the shield plug onto the DSC.

   CAUTION: Verify that all the lifting height restrictions as a function of temperature specified in Technical Specification *4.4.1.A* can be met in the following steps which involve lifting of the TC.

9. Visually verify that the top shield plug is properly seated onto the DSC.

10. Position the lifting yoke with the TC trunnions and verify that it is properly engaged.

10a. From this point, until the DSC has been inserted into the HSM, the DSC will be inspected for damage after any TC drop of 15 inches or greater.

11. Raise the TC to the pool surface. Prior to raising the top of the cask above the water surface, stop vertical movement.

12. Inspect the top shield plug to verify that it is properly seated onto the DSC. If not, lower the cask and reposition the top shield plug. Repeat Steps 11 and 12 as necessary.

13. Continue to raise the TC from the pool and spray the exposed portion of the cask with demineralized water until the top region of the cask is accessible.

14. Drain any excess water from the top of the DSC shield plug back to the fuel pool.

CAUTION: The radiation dose rates around the surface of the transfer cask without water in the neutron shield and/or in the DSC cavity (if it was drained in step M.8.1.1.9) are expected to be high. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

17. Lift the TC from the fuel pool. As the cask is raised from the pool, continue to spray the cask with demineralized water.

18. Move the TC with loaded DSC to the cask decon area.

19. Replace the approximate 750 gallons of water removed in step 16 (as indicated on the flowmeter) from the DSC with spent fuel pool water. Fill the neutron shield with demineralized water if it was drained in Step M.8.1.1.9.

M.8.1.3 DSC Drying and Backfilling

1. Check the radiation levels along the perimeter of the cask. The cask exterior surface should be decontaminated as necessary in accordance with the limits specified in Technical Specification *3.3.1*. Temporary shielding may be installed as necessary to minimize personnel exposure.

2. Place scaffolding around the cask so that any point on the surface of the cask is easily accessible to personnel.

3. Disengage the rigging cables from the top shield plug and remove the eyebolts. Disengage the lifting yoke from the trunnions and position it clear of the cask.

4. Decontaminate the exposed surfaces of the DSC shell perimeter and remove the inflatable cask/DSC annulus seal.

4a. In accordance with Technical Specification *4.3.2*, verify that the neutron shield (NS) is filled before the draining operation in Step 5 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

5. Connect the cask drain line to the cask, open the cask cavity drain port and allow water from the annulus to drain out until the water level is approximately twelve inches below the top edge of the DSC shell. Take swipes around the outer surface of the DSC shell and check for smearable contamination in accordance with the Technical Specification *3.3.1* limits.

5a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 6 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

6. Drain approximately 750 gallons of water (as indicated on a flowmeter) from the DSC back into the fuel pool or other suitable location using the VDS or an optional liquid pump. Consistent with ISG-22 [8.7] guidance and Technical Specification 3.1.1, helium at 1-3 psig is used to backfill the DSC with an inert gas as water is being removed from the DSC.

7. Disconnect hose from the DSC siphon port.

8. Install the automatic welding machine onto the inner top cover plate and place the inner top cover plate with the automatic welding machine onto the DSC. Verify proper fit-up of the inner top cover plate with the DSC shell.

9. Check radiation levels along surface of the inner top cover plate. Temporary shielding may be installed as necessary to minimize personnel exposure.

   CAUTION: Insert a 1/4 inch tygon tubing of sufficient length through the vent port such that it terminates just below the DSC shield plug. Connect the tygon tubing to a hydrogen monitor to allow continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner cover plate, in compliance with Technical Specification *4.3.3*. Optionally, other methods may be used for continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner top cover plate, to comply with the Technical Specification.

10. Cover the cask/DSC annulus to prevent debris and weld splatter from entering the annulus.

11. Ready the automatic welding machine and tack weld the inner top cover plate to the DSC shell. Install the inner top cover plate weldment and remove the automatic welding machine.

   CAUTION: Continuously monitor the hydrogen concentration in the DSC cavity using the tygon tube arrangement described in step 9 during the inner top cover plate cutting/welding operations. Verify that the measured hydrogen concentration does not exceed a safety limit of 2.4% [8.4] (60% of flammability limit of 4.0%). If this limit is exceeded, stop all welding operations and purge the DSC cavity with 2-3 psig helium (or any other inert medium) via the 1/4 inch tygon tubing to reduce the hydrogen concentration safely below the 2.4% limit.

12. Perform dye penetrant weld examination of the inner top cover plate weld in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

13. Connect the VDS to the DSC siphon and vent ports.

14. Install temporary shielding to minimize personnel exposure throughout the subsequent welding operations as required.

14a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 15 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

15. Engage the helium supply and open the valve on the vent port and allow helium to force the water from the DSC cavity through the siphon port. Use of helium is required per Technical Specification 3.1.1.

16. Once the water stops flowing from the DSC, close the DSC siphon port and disengage the gas source.

16a. Verify that the TC axial surface dose rates are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. The configuration for determining the TC axial dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

17. Connect the hose from the vent port and the siphon port to the intake of the vacuum pump. Connect a hose from the discharge side of the VDS to the plant's radioactive waste system or spent fuel pool. Connect the VDS to a helium source.

    CAUTION: During the vacuum drying evolution, personnel should be in the area of loading operations, or in nearby low dose areas in order to take proper action in the event of a malfunction.

18. Open the valve on the suction side of the pump, start the VDS and draw a vacuum on the DSC cavity. The cavity pressure should be reduced in steps of approximately 100 mm Hg, 50 mm Hg, 25 mm Hg, 15 mm Hg, 10 mm Hg, 5 mm Hg, and 3 mm Hg. After pumping down to each level, the pump is valved off and the cavity pressure monitored. The cavity pressure will rise as water and other volatiles in the cavity evaporate. When the cavity pressure stabilizes, the pump is valved in to complete the vacuum drying process. It may be necessary to repeat some steps, depending on the rate and extent of the pressure increase. Vacuum drying is complete when the pressure stabilizes for a minimum of 30 minutes at 3 mm Hg absolute or less as specified in Technical Specification 3.1.1.

    Note: The user shall ensure that the vacuum pump is isolated from the DSC cavity when demonstrating compliance with Technical Specification 3.1.1 requirements. Simply closing the valve between the DSC and the vacuum pump is not sufficient, as a faulty valve allows the vacuum pump to continue to draw a vacuum on the DSC. Turning off the pump, or opening the suction side of the pump to atmosphere are examples of ways to ensure that the pump is not continuing to draw a vacuum on the DSC.

19. Open the valve to the vent port and allow the helium to flow into the DSC cavity.

20. Pressurize the DSC with helium to about 24 psia not to exceed 34 psia.

21. Helium leak test the inner top cover plate weld for leakage in accordance with ANSI N14.5 to a sensitivity of 1×10^{-5} atm-cm^3/sec. This test is optional.

22. If a leak is found, repair the weld, repressurize the DSC and repeat the helium leak test.

23. Once no leaks are detected, depressurize the DSC cavity by releasing the helium through the VDS to the plant's spent fuel pool or radioactive waste system.

24. Re-evacuate the DSC cavity using the VDS. The cavity pressure should be reduced in steps of approximately 10 mm Hg, 5 mm Hg, and 3 mm Hg. After pumping down to each level, the pump is valved off and the cavity pressure is monitored. When the cavity pressure stabilizes, the pump is valved in to continue the vacuum drying process. Vacuum drying is complete when the pressure stabilizes for a minimum of 30 minutes at 3 mm Hg absolute or less in accordance with Technical Specification 3.1.1 limits.

Note: The user shall ensure that the vacuum pump is isolated from the DSC cavity when demonstrating compliance with Technical Specification 3.1.1 requirements. Simply closing the valve between the DSC and the vacuum pump is not sufficient, as a faulty valve allows the vacuum pump to continue to draw a vacuum on the DSC. Turning off the pump, or opening the suction side of the pump to atmosphere are examples of ways to ensure that the pump is not continuing to draw a vacuum on the DSC.

25. Open the valve on the vent port and allow helium to flow into the DSC cavity to pressurize the DSC to 2.5 psig ± 1.0 psig in accordance with Technical Specification 3.1.2.b limits.

26. Close the valves on the helium source.

27. Decontaminate as necessary, and store.

M.8.1.4 DSC Sealing Operations

1. Disconnect the VDS from the DSC. Seal weld the prefabricated plugs over the vent and siphon ports, inject helium into blind space just prior to completing welding, and perform a dye penetrant weld examination in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements. Use of an optional test head is acceptable to perform the helium leak test of the inner top cover plate and vent/siphon port welds in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1*. If an optional test head is not used, proceed to Step 2.

1a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 2 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

2. Open the cask drain port valve and remove the remaining water from the cask/DSC annulus.

3. Install the automatic welding machine onto the outer top cover plate and place the outer top cover plate with the automatic welding system onto the DSC. Verify proper fit up of the outer top cover plate with the DSC shell.

4. Tack weld the outer top cover plate to the DSC shell. Place the outer top cover plate weld root pass.

5. Helium leak test the inner top cover plate and vent/siphon port plate welds using the leak test port in the outer top cover plate in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1* limits. Verify that the personnel performing the leak test are qualified in accordance with SNT-TC-1A [8.6]. Alternatively, this can be done with a test head in Step M.8.1.4.1.

6. If a leak is found, remove the outer cover plate root pass, the vent and siphon port plugs and repair the inner cover plate welds. Repeat procedure steps from M.8.1.3 step 18.

7. Perform dye penetrant examination of the root pass weld. Weld out the outer top cover plate to the DSC shell and perform dye penetrant examination on the weld surface in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

8. Seal weld the prefabricated plug over the outer cover plate test port and perform dye penetrant weld examinations.

9. Remove the automatic welding machine from the DSC.

10. If using the OS200 TC to load, place a sleeve ring spacer at the top of the aluminum sleeve (refer to Drawing NUH-08-8004-SAR provided in Appendix U, Section U.1.5). Rig the cask top cover plate and lower the cover plate onto the TC.

11. Bolt the cask cover plate into place, tightening the bolts to the required torque in a star pattern.

12. Verify that the TC radial dose rates measured at the surface of the Transfer Cask are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. The configuration for determining the TC radial surface dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

M.8.1.5 TC Downending and Transfer to ISFSI

1. If loading 32PT-S100 or 32PT-L100 DSC (qualified for 100-ton crane capacity), drain the neutron shield to an acceptable location.

   CAUTION: The radiation dose rates around the surface of the transfer cask without water in the neutron shield (through step M.8.1.5.10) are expected to be high. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

3. Move the scaffolding away from the cask as necessary. Engage the lifting yoke and lift the cask over the cask support skid on the transfer trailer.

4. The transfer trailer should be positioned so that cask support skid is accessible to the crane with the trailer supported on the vertical jacks.

5. Position the cask lower trunnions onto the transfer trailer support skid pillow blocks.

6. Move the crane forward while simultaneously lowering the cask until the cask upper trunnions are just above the support skid upper trunnion pillow blocks.

7. Inspect the positioning of the cask to insure that the cask and trunnion pillow blocks are properly aligned.

8. Lower the cask onto the skid until the weight of the cask is distributed to the trunnion pillow blocks.

9. Inspect the trunnions to insure that they are properly seated onto the skid. Install the trunnion tower closure plates (optional for the OS197 TC and the OS197H TC).

10. Fill the neutron shield with demineralized water, if it was drained in M.8.1.5 step 1.

11. Remove the bottom ram access cover plate from the cask. Install the two-piece temporary neutron/gamma shield plug to cover the bottom ram access. Install the ram trunnion support frame on the bottom of the TC. (The temporary shield plug and ram trunnion support frame are not required with integral ram/trailer.)

M.8.1.6 DSC Transfer to the HSM

NOTE: If using the HSM-HS module for storage of the NUHOMS®-32PT DSC at sites with high seismic levels, verify that at least 3 modules are connected together per the requirements of *CoC Condition II.2.a*.

1. Prior to transferring the cask to the ISFSI, remove the HSM door, inspect the cavity of the HSM, removing any debris and ready the HSM to receive a DSC. The doors on adjacent HSMs should remain in place.

   Caution: The insides of empty modules have the potential for high dose rates due to adjacent loaded modules. Proper ALARA practices should be follower for operations inside these modules and in the areas outside these modules whenever the door from the empty HSM has been removed.

2. Inspect the HSM air inlet and outlets to ensure that they are clear of debris. Inspect the screens on the air inlet and outlets for damage.

   CAUTION: Verify that the requirements of Technical Specification *4.4.1.B*, "TC/DSC Transfer Operations at High Ambient Temperatures" are met prior to next step.

3. Using a suitable heavy haul tractor, transfer the cask from the plant's fuel/reactor building to the ISFSI along the designated transfer route.

6. Unbolt and remove the cask top cover plate.

    6a. If using OS200 TC to load, remove the sleeve ring spacer at the top of the aluminum sleeve (refer to Drawing NUH-08-8004-SAR provided in Section U.1.5).

7. Back the cask to within a few inches of the HSM, set the trailer brakes and disengage the tractor. Drive the tractor clear of the trailer. Extend the transfer trailer vertical jacks.

8. Connect the skid positioning system hydraulic power unit to the positioning system via the hose connector panel on the trailer, and power it up. Remove the skid tie-down bracket fasteners and use the skid positioning system to bring the cask into approximate vertical and horizontal alignment with the HSM. Using optical survey equipment and the alignment marks on the cask and the HSM, adjust the position of the cask until it is properly aligned with the HSM.

9. Using the skid positioning system, fully insert the cask into the HSM access opening docking collar.

10. Secure the cask trunnions to the front wall embedments of the HSM using the cask restraints.

11. After the cask is docked with the HSM, verify the alignment of the TC using the optical survey equipment.

12. Position the hydraulic ram behind the cask in approximate horizontal alignment with the cask and level the ram. Remove either the bottom ram access cover plate or the outer plug of the two-piece temporary shield plug. Power up the ram hydraulic power supply and extend the ram through the bottom cask opening into the DSC grapple ring.

13. Activate the hydraulic cylinder on the ram grapple and engage the grapple arms with the DSC grapple ring.

14. Recheck all alignment marks and ready all systems for DSC transfer. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

    If the alignment tolerance is exceeded, the following actions should be taken:

    a. Confirm that the transfer system is properly configured,

    b. Check and repair the alignment equipment, or

    c. Confirm the locations of the alignment targets on the TC and HSM.

15. Activate the hydraulic ram to initiate insertion of the DSC into the HSM. Stop the ram when the DSC reaches the support rail stops at the back of the module.

16. Disengage the ram grapple mechanism so that the grapple is retracted away from the DSC grapple ring.

17. Retract and disengage the hydraulic ram system from the cask and move it clear of the cask. Remove the cask restraints from the HSM.

18. Using the skid positioning system, disengage the cask from the HSM access opening.

19. Install the DSC axial retainer through the HSM door opening.

20. The trailer may be moved as necessary to install the HSM door. Install the HSM door and secure it in place. Door may be welded for security. Verify that the HSM dose rates are compliant with the limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.3.1 and 3.3.2*.

21. Replace the TC top cover plate. Secure the skid to the trailer, retract the vertical jacks and disconnect the skid positioning system.

22. If this is the final loading, fully drain the liquid neutron shield.

23. Tow the trailer and cask to the designated equipment storage area. Return the remaining transfer equipment to the storage area.

24. Close and lock the ISFSI access gate and activate the ISFSI security measures.

M.8.1.7 Monitoring Operations

1. Perform routine security surveillance in accordance with the licensee's ISFSI security plan.

Note: Perform one of two alternative surveillance activities listed below.

2a. Perform a daily visual surveillance of the HSM air inlets and outlets to insure that no debris is obstructing the HSM vents in accordance with Technical Specification *3.1.4.a* requirements.

2b. Perform a temperature measurement of the thermal performance, for each HSM, on a daily basis in accordance with Technical Specification *3.1.4.b* requirements.

M.8.2 Procedures for Unloading the Cask

M.8.2.1 DSC Retrieval from the HSM

1. Ready the TC, transfer trailer, and support skid for service and tow the trailer to the HSM. If using the OS200 TC to unload, verify that it has been fitted with an internal aluminum sleeve and a cask spacer of appropriate height (refer to Drawings NUH-08-8004-SAR and NUH-08-8005-SAR provided in Section U.1.5).

2. Back the trailer as close to the HSM as compatible with HSM door removal, and remove the cask top cover plate.

3. Cut any welds from the door and remove the HSM door. Remove the DSC drop-in retainer.

4. Using the skid positioning system align the cask with the HSM and position the skid until the cask is docked with the HSM access opening.

5. Using optical survey equipment, verify alignment of the cask with respect to the HSM. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

   If the alignment tolerance is exceeded, the following actions should be taken:

   a. Confirm that the transfer system is properly configured,

   b. Check and repair the alignment equipment, or

   c. Confirm the locations of the alignment targets on the TC and HSM.

5a. Install the cask restraints.

6. Install and align the hydraulic ram with the cask.

7. Extend the ram through the cask into the HSM until it is inserted in the DSC grapple ring.

8. Activate the arms on the ram grapple mechanism with the DSC grapple ring.

8a. From this point, until fuel has been removed from the DSC or the DSC has been removed from the TC, the DSC will be inspected for damage after any TC drop of 15 inches or greater.

9. Retract ram and pull the DSC into the cask.

10. Retract the ram grapple arms.

11. Disengage the ram from the cask.

12. Remove the cask restraints.

13. Using the skid positioning system, disengage the cask from the HSM.

14. If using the OS200 TC to unload, place a sleeve ring spacer at the top of the aluminum sleeve (refer to Drawing NUH-08-8004-SAR provided in Section U.1.5).

15. Install the cask top cover plate and ready the trailer for transfer.

16. Replace the door on the HSM.

M.8.2.2 Removal of Fuel from the DSC

When the DSC has been removed from the HSM, there are several potential options for off-site shipment of the fuel. It is preferred to ship the DSC intact to a reprocessing facility, monitored retrievable storage facility or permanent geologic repository in a compatible shipping cask licensed under 10CFR71.

If it becomes necessary to remove fuel from the DSC prior to off-site shipment, there are two basic options available at the ISFSI or reactor site. The fuel assemblies could be removed and reloaded into a shipping cask using dry transfer techniques, or if the applicant so desires, the initial fuel loading sequence could be reversed and the plant's spent fuel pool utilized.

Procedures for

unloading the DSC in a fuel pool are presented here. However, wet or dry unloading procedures are essentially identical to those of DSC loading through the DSC weld removal (beginning of preparation to placement of the cask in the fuel pool). Prior to opening the DSC, the following operations are to be performed.

1. The cask may now be transferred to the cask handling area inside the plant's fuel/reactor building.

2. Position and ready the trailer for access by the crane and install the ram access penetration cover plate.

3. Attach the lifting yoke to the crane hook.

4. Engage the lifting yoke with the trunnions of the cask.

5. Visually inspect the yoke lifting hooks to insure that they are properly aligned and engaged onto the cask trunnions.

6. If unloading 32PT-S100 or 32PT-L100 DSC (qualified for 100-ton crane capacity), drain water from the neutron shield.

   CAUTION: The radiation dose rates around the surface of the transfer cask without water in the neutron shield (through step M.8.2.2.9) are expected to be high. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

7. Lift the cask approximately one inch off the trunnion supports. Visually inspect the yoke lifting hooks to insure that they are properly positioned on the trunnions.

8. Move the crane backward in a horizontal motion while simultaneously raising the crane hook vertically and lift the cask off the trailer. Move the cask to the cask decon area.

9. Lower the cask into the cask decon area in the vertical position. Fill the neutron shield with demineralized water if it was drained in Step M.8.2.2.6. Verify that the HSM dose rates are compliant with the limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.3.1 and 3.3.2*.

10. Wash the cask to remove any dirt which may have accumulated on the cask during the DSC loading and transfer operations.

11. Place scaffolding around the cask so that any point on the surface of the cask is easily accessible to handling personnel.

12. Unbolt the cask top cover plate.

13. Connect the rigging cables to the cask top cover plate and lift the cover plate from the cask. Set the cask cover plate aside and disconnect the lid lifting cables. If using the OS200 TC to unload, remove the sleeve ring spacer at the top of the aluminum sleeve placed in Section M.8.2.1, step 14.

14. Install temporary shielding to reduce personnel exposure as required. Fill the cask/DSC annulus with clean demineralized water and seal the annulus.

operation is to be performed under the site's standard health physics guidelines for welding, grinding, and handling of potentially highly contaminated equipment. These are to include the use of prudent housekeeping measures and monitoring of airborne particulates. Procedures may require personnel to perform the work using respirators or supplied air.

If fuel needs to be removed from the DSC, either at the end of service life or for inspection after an accident, precautions must be taken against the potential for the presence of damaged or oxidized fuel and to prevent radiological exposure to personnel during this operation. A sampling of the atmosphere within the DSC will be taken prior to inspection or removal of fuel.

This can be achieved with this design by the use of the purge and fill valves which permit a determination of the atmosphere within the DSC before the removal of the inner top cover and shield plugs, prior to filling the DSC cavity with water (borated water for the 32PT). If the atmosphere within the DSC is helium and radioactivity check of the atmosphere in the DSC cavity did not detect the presence of any airborne radioactive particulates, then operations should proceed normally with fuel removal either via the TC or in the pool, if available. However, if air or airborne radioactive particulates are present within the DSC, then appropriate filters should be in place to preclude the uncontrolled release of any potential airborne radioactive particulate from the DSC via the purge-fill valves. This will protect both personnel and the operations area from potential contamination. For the accident case, personnel protection in the form of respirators or supplied air should be considered in accordance with licensee's Radiation Protection Program.

If the work is performed outside the fuel/reactor building, a tent may be constructed over the work area, which may be kept under a negative pressure to control airborne particulates. Any radioactive gas release will be Kr-85, which is not readily captured. Whether the krypton is vented through the plant stack or allowed to be released directly depends on the plant operating requirements.

Following opening of the DSC, the cask and DSC are filled with water prior to lowering the top of cask below the surface of the fuel pool to prevent a sudden inrush of pool water. Cask placement into the pool is performed in the usual manner. Fuel unloading procedures will be governed by the plant operating license under 10CFR50. The generic procedures for these operations are as follows:

15. Locate the DSC siphon and vent port using the indications on the top cover plate. Place a portable drill press on the top of the DSC. Position the drill with the siphon port.

16. Place an exhaust hood or tent over the DSC, if necessary. The exhaust should be filtered or routed to the site radwaste system.

17. Drill a hole through the DSC top cover plate to expose the siphon port quick connect.

18. Drill a second hole through the top cover plate to expose the vent port quick connect.

19. Obtain a sample of the DSC atmosphere, if necessary (e.g., at the end of service life). Fill the DSC with water from the fuel pool (and meeting the requirements of Technical Specification 3.2.1, if required) through the siphon port with the vent port open and routed to the plant's off-gas system.

CAUTION:

(a) The water fill rate must be regulated during this reflooding operation to ensure that the DSC vent pressure does not exceed 20.0 psig.

(b) Provide for continuous hydrogen monitoring of the DSC cavity atmosphere during all subsequent cutting operations to ensure that a safety limit of 2.4% (60.0% of flammability limit of 4.0%) is not exceeded [8.4] and in compliance with Technical Specification *4.3.3*. Purge with 2-3 psig helium as necessary to maintain the hydrogen concentration safely below this limit.

20. Place welding blankets around the cask and scaffolding.

21. Using plasma arc-gouging, a mechanical cutting system or other suitable means, remove the seal weld from the outer top cover plate and DSC shell. A fire watch should be placed on the

M.11.1.2 Extreme Temperatures

No change. The off-normal maximum ambient temperature of 125°F is used in Chapter 8, Section 8.1.2.2. For the NUHOMS®-32PT system, a maximum ambient temperature of 117 °F is used. Therefore, the analyses in Section 8.1.2.2 bound the NUHOMS®-32PT system.

M.11.1.2.1 Postulated Cause of Event

No change. See Chapter 8, Section 8.1.2.2.

M.11.1.2.2 Detection of Event

No change. See Chapter 8, Section 8.1.2.2.

M.11.1.2.3 Analysis of Effects and Consequences

The thermal evaluation of the NUHOMS®-32PT system for off-normal conditions is presented in Section M.4.5. Based on discussions in Section M.4.9, the evaluations in Section M.4.5 remain valid for transfer of 32PT DSC in OS200 TC. The 100 ºF normal condition with insolation bounds the 117 ºF case without insolation for the DSC in the TC. Therefore the normal condition maximum temperatures are bounding. The 117 ºF case with the DSC in the HSM is not bounded by the normal conditions.

The structural evaluation of the 32PT DSC for off-normal temperature conditions is presented in Section M.3.6.2.2. The structural evaluation of the basket due to off-normal thermal conditions is presented in Section M.3.4.4.

As indicated in Section M.3.6, the structural evaluation of the HSM-HS and OS200 Transfer Cask, as presented in Appendix U.3, Section U.3.6.2.3 and Appendix U.3, Section U.3.6.2.4, respectively, are not affected when loaded with the 61BT DSC.

M.11.1.2.4 Corrective Actions

Restrictions for onsite handling of the TC with a loaded DSC under extreme temperature conditions are presented in Technical Specifications *4.4.1*.A and *4.4.1*.B. There is no change to this requirement as a result of addition of the NUHOMS®-32PT DSC.

M.11.1.3 Off-Normal Releases of Radionuclides

The NUHOMS®-32PT DSC is designed and tested to the leak tight criteria of ANSI N14.5 [11.2]. Therefore the estimated quantity of radionuclides expected to be released annually to the environment due to normal or off-normal events is zero.

M.11.1.3.1 Postulated Cause of Event

In accordance with the Standard Review Plan, NUREG-1536 [11.3] for off-normal conditions, it is conservatively assumed that 10% of the fuel rods fail.

Table N.2-1
PWR Fuel Specification for Fuel to be Stored in the Standardized NUHOMS®-24PHB DSC

PHYSICAL PARAMETERS	
Fuel Class	*Per TS Table 1-1i*
Maximum Number of Irradiated Stainless Steel Rods in Reconstituted Assemblies per DSC	*Per TS Table 1-1i*
Maximum Number of Irradiated Stainless Steel Rods per Reconstituted Assembly	*Per TS Table 1-1i*
Maximum Number of Reconstituted Assemblies per DSC with Low Enriched Uranium Oxide Rods	*Per TS Table 1-1i*
Fuel Damage	*Per TS Table 1-1i*
Control Components	*Per TS Table 1-1i*
Physical Parameters (without CCs)	
Maximum Assembly Length (unirradiated, intact assembly with Maximum Burnup ≤ 55 GWd/MTU)	*165.785 in (Standard Cavity)* *171.23 in (Long Cavity)*
Maximum Assembly Length (unirradiated, damaged assembly with Maximum Burnup ≤ 45 GWd/MTU)	*165.785 in (Standard Cavity)* *171.23 in (Long Cavity)*
Maximum Assembly Length (unirradiated, damaged assembly with Maximum Burnup> 45 GWd/MTU and ≤ 55 GWd/MTU)	*164.785 in (Standard Cavity)* *170.23 in (Long Cavity)*

Table N.2-1
PWR Fuel Specification for Fuel to be Stored in the Standardized NUHOMS®-24PHB DSC

(Continued)

Physical Parameters (with CCs)	
Maximum Assembly + CC Length (unirradiated, intact assembly with Maximum Burnup ≤ 55 GWd/MTU)	*171.23 in (Long Cavity)*
Maximum Assembly Length (unirradiated, damaged assembly with Maximum Burnup ≤ 45 GWd/MTU)	*171.23 in (Long Cavity)*
Maximum Assembly Length (unirradiated, damaged assembly with Maximum Burnup> 45 GWd/MTU and ≤ 55 GWd/MTU).	*170.23 in (Long Cavity)*
Fuel Cladding	*Per TS Table 1-1i*
Nominal Cross-Sectional Envelope	*8.536 in*
Number of Intact Assemblies	*Per TS Table 1-1i*
Number and Location of Damaged Assemblies	*Per TS Table 1-1i*
Maximum Assembly plus CC Weight	*Per TS Table 1-1i*
Nuclear Parameters	
Maximum Planar Average Initial Enrichment	*Per TS Table 1-1i*
Minimum Boron Loading	*Per TS Table 1-1i*
Maximum Initial Uranium loading per assembly	*0.490 MTU*
Allowable loading configurations for each 24PHB DSC	*Per TS Table 1-1i*
Burnup, Enrichment, and Minimum Cooling Time for Configuration 1 (Figure N.2-1)	*Table N.2-3 for Zone 1 fuel; Table N.2-4 for Zone 2 fuel; Table N.2-5 for Zone 3 fuel*
Burnup, Enrichment, and Minimum Cooling Time for Configuration 2 (Figure N.2-2)	*Table N.2-5 for Zone 3 fuel*
Minimum Cooling Time for CCs	*Per TS Table 1-1i*
Total Decay Heat per DSC	*Per TS Table 1-1i*
Decay Heat Limits for Zone 1, 2 and 3 Fuel	*Per TS Table 1-1i*

(1) Thermal and radiological characteristics for CCs listed in this table for 24PTH DSC are also applicable to 24PHB DSC.

Table N.2-2
PWR Fuel Assembly Design Characteristics

Assembly Class	B&W 15x15
Assembly Length	See Table N.2-1
Maximum Initial Enrichment	4.5 wt. %
Maximum Quantity of Stainless Steel Replacement Rods per Assembly	10
Maximum Quantity of Replacement zirconium-alloy clad lower enrichment UO_2 Rods per Assembly	208
Fuel Types	Mark B2, B3, B4, B4Z, BZ, B5, B5Z, B6, B7, B8, B9, B10, B11 and B11A
Fissile Material	UO_2
Maximum Nominal MTU/Assembly	0.49
Maximum Number of Fuel Rods	208
Maximum Number of Guide/Instrument Tubes	17

Table N.2-2a
Thermal and Radiological Characteristics for Control Components Stored in the NUHOMS®-24PHB DSC

Parameter	BPRAs, NSAs, CRAs, RCCAs, VSIs, APSRAs, and Neutron Sources	TPAs and ORAs
Maximum Gamma Source (γ/sec/DSC)	*Per TS Table 1-1n.*	*Per TS Table 1-1n.*
Decay Heat (Watts/DSC)	192.0	192.0

CAUTION: Verify that all the lifting height restrictions as a function of temperature specified in Technical Specification *4.4.1*.A can be met in the following steps which involve lifting of the TC.

N.8.1.3 24PHB DSC Drying and Backfilling

All operations are the same as described in Section 5.1.1.3, including Steps 4a, 7a, 16a, and 18a. Step 28 is revised to state that the DSC helium backfill pressure requirements of Technical Specification 3.1.2.b apply. Steps 6, 7, 9, 11, 12, 13, 24, and 30 are revised as follows:

6. Install the automated welding machine onto the inner top cover plate and place the inner top cover plate with the automated welding machine onto the DSC. Verify proper fit-up of the inner top cover plate with the DSC shell.

   For the optional 24PHBL "shifted shielding" configuration, install the automated welding machine onto the cover plate of the top shield plug assembly. Verify proper fit-up of the assembly with the DSC shell.

7. Check radiation levels along surface of the inner top cover plate or along the surface of the top shield plug assembly (for the optional 24PHBL "shifted shielding" configuration). Verify that the TC axial surface dose rates are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. The configuration for determining the TC axial dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. Temporary shielding may be installed as necessary to minimize personnel exposure.

9. Disconnect the VDS from the DSC.

   CAUTION: An additional step is required to address Bulletin 96-04 concerns (5.5). This step provides for continuous hydrogen monitoring during the welding of the top inner cover plate as described in step 11 (5.4) and for compliance with Technical Specification *4.3.3*. Insert a ¼ inch tygon tubing of sufficient length through the vent port such that it terminates just below the DSC shield plug. Connect the tygon tubing to a hydrogen monitor to allow continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner cover plate or the top shield plug assembly (for the optional 24PHBL "shifted shielding" configuration). Optionally, other methods may be used for continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner top cover plate, to comply with the Technical Specification. Ensure that the DSC internal pressure remains atmospheric during welding of the inner top closure plate or the top shield plug assembly (for the alternate 24PHBL "shifted shielding" configuration).

11. Ready the automated welding machine and tack weld the inner top cover plate or the top shield plug assembly (for the optional 24PHBL "shifted shielding" configuration) to the DSC shell. Complete the inner top cover plate weldment and remove the automated welding machine.

CAUTION: Continuously monitor the hydrogen concentration in the DSC cavity using the tygon tube arrangement described in step 9 during the inner top cover plate or the top shield plug assembly (for the optional 24PHBL "shifted shielding" configuration) welding operations. Verify that the measured hydrogen concentration does not exceed a safety limit of 2.4% (5.4) (60.0% of flammability limit of 4.0%) and in compliance with Technical Specification *4.3.3*. If this limit is exceeded, stop all welding operations and purge the DSC cavity with 2-3 psig helium (or any other inert medium) via the ¼" tygon tubing to reduce the hydrogen concentration safely below the 2.4% limit.

12. Perform dye penetrant weld examination of the inner top cover plate or the top shield plug assembly (for the optional 24PHBL "shifted shielding" configuration) weld in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

13. Place the strongback so that it sits on the inner top cover plate and is oriented such that:

    - the DSC siphon and vent ports are accessible
    - the strongback stud holes line up with the TC lid bolt holes.

    Steps 13 and 14 are optional for the optional 24PHBL "shifted shielding" configuration.

24. Helium leak test the inner top cover plate weld for leakage in accordance with ANSI N.14.5 to a sensitivity of $1x10^{-5}$ atm-cm^3/sec. This test is optional.

30. Remove the Strongback, if used. Decontaminate as necessary, and store.

N.8.1.4 24PHB DSC Sealing Operations

1. Disconnect the VDS from the DSC. Seal weld the prefabricated plugs over the vent and siphon ports, inject helium in blind space and perform a dye penetrant weld examination in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements. Use of an optional test head is acceptable to perform the helium leak test of the inner top cover plate and vent/siphon port welds in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1*. If an optional test head is not used, proceed to Step 2.

2. Install the welding machine onto the outer top cover plate and place the outer top cover plate with the welding system onto the DSC. Manual welding is also acceptable. Verify proper fit up of the outer top cover plate with the DSC shell.

3. Tack weld the outer top cover plate to the DSC shell. Place the outer top cover plate weld root pass.

4. Helium leak test the inner top cover plate and vent/siphon port plate welds using the leak test port in the outer top cover plate in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1* limits. Verify that the personnel performing the leak test are qualified in accordance with SNT-TC-1A [8.1]. Alternatively, this can be done with a test head in N.8.1.4 step 1.

5. If a leak is found, remove the outer cover plate root pass, the vent and siphon port plugs and repair the inner cover plate welds. Then install the Strongback and repeat procedure steps from Section 5.1.1.3, step 20.

6. Perform dye penetrant examination of the root pass weld. Weld out the outer top cover plate to the DSC shell and perform dye penetrant examination on the weld surface in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

7. Seal weld the prefabricated plug over the outer cover plate test port and perform dye penetrant weld examinations.

8. Open the cask drain port valve and drain the water from the cask/DSC annulus.

9. Rig the cask top cover plate and lower the cover plate onto the TC.

10. Bolt the cask cover plate into place, tightening the bolts to the required torque in a star pattern.

11. Verify that the TC radial dose rates measured at the surface of the Transfer Cask are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. The configuration for determining the TC radial surface dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

N.11.1.2.2 Detection of Event

No change. See Section 8.1.2.2.

N.11.1.2.3 Analysis of Effects and Consequences

The thermal evaluation of the NUHOMS®-24PHB System for off-normal conditions is presented in Section N.4.5. The 100ºF normal condition with insolation bounds the 117ºF case without insolation for the DSC in the TC. Therefore the normal condition maximum temperatures are bounding.

The structural evaluation of the 24PHB DSC for off-normal temperature conditions is presented in Section N.3.6.2.2.

N.11.1.2.4 Corrective Actions

Restrictions for onsite handling of the TC with a loaded DSC under extreme temperature conditions are presented in Technical Specifications *4.4.1*.A and *4.4.1*.B. There is no change to this requirement as a result of addition of the NUHOMS®-24PHB DSC.

N.11.1.3 Off-Normal Releases of Radionuclides

The NUHOMS®-24PHB DSC is designed and tested to the leak tight criteria of ANSI N14.5 [11.2]. Therefore the estimated quantity of radionuclides expected to be released annually to the environment due to normal or off-normal events is zero.

N.11.1.3.1 Postulated Cause of Event

In accordance with the Standard Review Plan, NUREG-1536 [11.3] and ISG-5 Rev. 1 [11.4] for off-normal conditions, it is conservatively assumed that 10% of the fuel rods fail.

N.11.1.3.2 Detection of Event

Failed fuel rods would go undetected, but are not a safety concern since the canister is designed and tested to leak tight criteria.

N.11.1.3.3 Analysis of Effects and Consequences

The bounding off-normal pressure for the NUHOMS®-24PHB DSC is calculated with the DSC in either the HSM or in the TC in Section N.4.5.4 as 15.2 psig which is below the 20 psig pressure used in the stress analyses. The NUHOMS®-24PHB DSC stresses due to these pressures are below the allowable stresses for off-normal conditions, as shown in Section N.3.6.2.2.

The NUHOMS®-24PHB DSC is designed and tested to the leak tight criteria of ANSI N14.5 [11.2]. Therefore the estimated quantity of radionuclides expected to be released annually to the environment due to normal or off-normal events is zero.

Table P.2-1
PWR Fuel Specification for the Fuel to be Stored in the NUHOMS®-24PTH DSC

PHYSICAL PARAMETERS: *Fuel Class*	*Per TS Table 1-1l*
Fuel Damage	*Per TS Table 1-1l*
Failed Fuel	*Per TS Table 1-1l*
Partial Length Shield Assemblies (PLSAs)	*Per TS Table 1-1l*
Reconstituted Fuel Assemblies: • *Maximum Number of Irradiated Stainless Steel Rods in Reconstituted Assemblies per DSC* • *Maximum Number of Irradiated Stainless Steel Rods per Reconstituted Fuel Assembly* • *Maximum Number of Reconstituted Assemblies per DSC with unlimited number of low enriched UO_2 rods and/or Unirradiated Stainless Steel Rods and/or Zr Rods or Zr Pellets*	*Per TS Table 1-1l*
Control Components (CCs)	*Per TS Table 1-1l*
Nominal Assembly Width for Intact and Damaged Fuel Only	*8.536 inches*
Number of Intact Assemblies	*Per TS Table 1-1l*
Number and Location of Damaged Assemblies	*Per TS Table 1-1l*
Number and Location of Failed Assemblies	*Per TS Table 1-1l*
Maximum Assembly plus CC Weight	*Per TS Table 1-1l*
THERMAL/RADIOLOGICAL PARAMETERS: *Allowable heat load zoning configurations Per TS Table 1-1l.*	*FQTs for applicable heat load zones are as follows:* *Table 1-3b for 0.6 kW,* *Table 1-3g for 1.0 kW,* *Table 1-3j for 1.3 kW,* *Table 1-3k for 1.5 kW,* *Table 1-3l for 1.7 kW,* *Table 1-3m for 2.0 kW,* *Table 1-3o for 2.5 kW, and* *Table 1-3p for 0.2 to 0.6 wt. % U-235.*
Maximum Planar Average Initial Fuel Enrichment	*Per TS Table 1-1l*
Decay Heat	*Per TS Table 1-1l*
Minimum Boron Loading	*Per TS Table 1-1l*

This page intentionally left blank.

Table P.2-2
Thermal and Radiological Characteristics for Control Components Stored in the NUHOMS®-24PTH DSC

Parameter	BPRAs, NSAs, CRAs, RCCAs, VSIs, Neutron Sources and APSRAs	TPAs and ORAs
Maximum Gamma Source (γ/sec/DSC)	*Per TS Table 1-1n.*	*Per TS Table 1-1n.*
Decay Heat (Watts/DSC)	192.0	192.0

Note: NSAs and Neutron Sources shall only be stored in the interior compartments of the basket. Interior compartments are those compartments that are completely surrounded by other compartments, including the corners. There are four interior compartments in the 24PTH DSC.

Table P.2-3
PWR Fuel Assembly Design Characteristics for the NUHOMS®-24PTH DSC

Assembly Class		***B&W 15x15***	***WE 17x17***	***CE 15x15***	***WE 15x15***	***CE 14x14***	***WE 14x14***
Maximum Unirradiated Length (in)[(1)]	*24PTH-S*	*165.75*	*165.75*	*165.75*	*165.75*	*165.75*	*165.75*
	24PTH-L	*171.93*	*171.93*	*171.93*	*171.93*	*171.93*	*171.93*
	24PTH-S-LC	*171.93*	*N/A*[(3)]	*N/A*[(3)]	*N/A*[(3)]	*N/A*[(3)]	*N/A*[(3)]
Fissile Material		UO_2	UO_2	UO_2	UO_2	UO_2	UO_2
Maximum MTU/Assembly[(2)]		*0.492*	*0.492*	*0.492*	*0.492*[(4)]	*0.492*	*0.492*
Maximum Number of Fuel Rods		*208*	*264*	*216*	*204*	*176*	*179*

(1) Maximum Assembly + Control Component Length (unirradiated)
(2) The maximum MTU/assembly is based on the shielding analysis.
(3) Not authorized for storage.
(4) The maximum MTU/assembly for WE 15x15 PLSA = 0.33.

P.4.6.6.4 Boundary Conditions, Off-Normal Transfer

In accordance with Section P.4.5, an analysis of a 24PTH DSC in the OS197FC cask and in the Standardized TC is performed for the following ambient conditions:

Maximum normal ambient temperature of 117 °F with solar shield in place in OS197FC cask,
Maximum normal ambient temperature of 117 °F with solar shield in place in Standardized cask.

These analyses determine maximum DSC shell surface temperatures. The maximum calculated DSC shell temperatures are applied to the exterior surface of the DSC shell in the DSC/basket/payload finite element model.

For Standardized TC, the DSC shell temperatures were calculated for 24 kW in Section 8.1.3. The results are summarized in Table P.4-39.

P.4.6.6.5 24PTH DSC Thermal Model Results for Off-Normal Conditions of Storage and Transfer

According to the NUHOMS® CoC 1004, Technical Specification *4.4.1*.B, "TC/DSC Transfer Operations at High Ambient Temperatures" for transfer operations, when ambient temperatures exceed 100 °F, a solar shield shall be used to provide protection against direct solar radiation.

Fuel Cladding Temperatures

The maximum fuel cladding temperatures during off-normal conditions of storage and transfer are evaluated for all HLZCs and compared with the corresponding fuel cladding temperature limits.

The results are reported in Table P.4-20 for HLZCs 1 (bounds HLZCs 2 and 3), 4 and 5.

DSC Basket Materials Component Temperatures

The maximum temperatures of the basket assembly for off-normal conditions of storage and transfer for HLZC 1 (bounds HLZCs 2 and 3), 4 and 5 are listed in Table P.4-21, Table P.4-22, and Table P.4-23, respectively.

P.4.6.6.6 Off-Normal 24PTH DSC Maximum Internal Pressure during Storage/Transfer

The maximum average helium backfill gas temperature for off-normal conditions of storage and transfer occurs when the 24PTH-S DSC with aluminum inserts, and a heat load of 31.2 kW (HLZC 4) is in OS197FC TC with an ambient temperature of 117 °F and sunshade. The average helium temperature is 513 °F (973 °R). Per NUREG 1536 [4.7], the percentage of fuel rods ruptured for off-normal cases is 10%.

A summary of the maximum off-normal operating pressures for the various 24PTH DSC configurations are presented in Table P.4-24.

P.8.1 Procedures for Loading the Cask

Process flow diagrams for the NUHOMS® System operations are presented Figure P.8-1 and Figure P.8-2. The location of the various operations may vary with individual plant requirements. The following steps describe the recommended generic operating procedures for the standardized NUHOMS® System.

P.8.1.1 Preparation of the TC and DSC

Notes:

- If using the OS200/OS200 FC TC for transfer of the NUHOMS®-24PTH DSC, verify that it has been fitted with an internal aluminum sleeve (refer to Drawing NUH-08-8004-SAR provided in Appendix U, Section U.1.5). This step, if required, can be performed at any time prior to placing the DSC in the TC.

1. Prior to placement in dry storage, the candidate intact and damaged and failed fuel assemblies shall be evaluated (by plant records or other means) to verify that they meet the physical, thermal and radiological criteria specified in Technical Specification 2.1.

2. Prior to being placed in service, the TC is to be cleaned or decontaminated as necessary to insure a surface contamination level of less than those specified in Technical Specification *3.3.1*.

3. Place the TC in the vertical position in the cask decon area using the cask handling crane and the TC lifting yoke.

4. Place scaffolding around the cask so that the top cover plate and surface of the cask are easily accessible to personnel.

5. Remove the TC top cover plate and examine the cask cavity for any physical damage and ready the cask for service. If required by the plant lifting crane capacity limit, drain the TC neutron shield water to an acceptable location.

5a. If using OS200/OS200FC TC to load, verify that a cask spacer of appropriate height (refer to Drawing NUH-08-8005-SAR provided in Appendix U, Section U.1.5) is placed at the bottom of the TC. If using OS197, OS197H or OS197FC TC to load, verify that it has the appropriate height spacer (see Figure P.4-18).

6. Examine the DSC for any physical damage which might have occurred since the receipt inspection was performed. The DSC is to be cleaned and any loose debris removed.

7. Verify that the DSC basket type (1A, 2A etc.) is appropriate for the specific fuel loading campaign.

8. Using a crane, lower the DSC into the cask cavity by the internal lifting lugs and rotate the DSC to match the cask and DSC alignment marks.

9. Fill the cask-DSC annulus with clean, demineralized water. Place the inflatable seal into the upper cask liner recess and seal the cask-DSC annulus by pressurizing the seal with compressed air.

CAUTION: Verify that all the lifting height restrictions as a function of temperature specified in Technical Specification *4.4.1*.A can be met in the following steps which involve lifting of the TC.

9. Visually verify that the top shield plug is properly seated onto the DSC.

10. Position the lifting yoke with the TC trunnions and verify that it is properly engaged.

10a. From this point, until the DSC has been inserted into the HSM, the DSC will be inspected for damage after any TC drop of fifteen inches or greater.

11. Raise the TC to the pool surface. Prior to raising the top of the cask above the water surface, stop vertical movement.

12. Inspect the top shield plug to verify that it is properly seated onto the DSC. If not, lower the cask and reposition the top shield plug. Repeat Steps 11 and 12 as necessary.

13. Continue to raise the TC from the pool and spray the exposed portion of the cask with demineralized water until the top region of the cask is accessible.

14. Drain any excess water from the top of the DSC shield plug back to the fuel pool.

15. Check the radiation levels at the center of the top shield plug and around the perimeter of the cask.

16. Drain water from the DSC as necessary to meet the plant lifting crane capacity limits. Consistent with ISG-22 [8.5] guidance and Technical Specification 3.1.1, helium at 1-3 psig is used to backfill the DSC with an inert gas as water is being removed from the DSC.

    CAUTION: The radiation dose rates around the surface of the transfer cask without water in the neutron shield and/or in the DSC cavity (through step P.8.1.2.19) are expected to be high. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

17. Lift the TC from the fuel pool. As the cask is raised from the pool, continue to spray the cask with demineralized water.

18. Move the TC with loaded DSC to the cask decon area.

19. If applicable to keep the occupational exposure ALARA, replace the water removed from the DSC in Step 16 with spent fuel pool water of the proper boron concentration. Fill the neutron shield with demineralized water if it was drained in Step P.8.1.1.5. Temporary shielding may be installed as necessary to minimize personnel exposure.

P.8.1.3 DSC Drying and Backfilling

CAUTION: During performance of steps listed in Section 8.1.3, monitor the Cask/DSC annulus water level and replenish as necessary to maintain cooling.

1. Check the radiation levels along the perimeter of the cask. The cask exterior surface should be decontaminated as necessary in accordance with the limits specified in Technical Specification *3.3.1* for the DSC surfaces. Temporary shielding may be installed as necessary to minimize personnel exposure.

2. Place scaffolding around the cask so that any point on the surface of the cask is easily accessible to personnel.

3. Disengage the rigging cables from the top shield plug and remove the eyebolts. Disengage the lifting yoke from the trunnions and position it clear of the cask.

4. Decontaminate the exposed surfaces of the DSC shell perimeter and remove the inflatable cask/DSC annulus seal.

4a. In accordance with Technical Specification *4.3.2*, verify that the neutron shield (NS) is filled before the draining operation in Step 5 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

5. Connect the cask drain line to the cask, open the cask cavity drain port and allow water from the annulus to drain out until the water level is approximately twelve inches below the top edge of the DSC shell. Take swipes around the outer surface of the DSC shell and check for smearable contamination in accordance with the Technical Specification *3.3.1* limits.

5a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 6 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

6. Prior to the start of welding operations, drain a minimum of 750 gallons of water from the DSC back into the fuel pool or other suitable location using the VDS or an optional liquid pump. Alternatively, all the water from the DSC may be drained if precautions are taken to keep the occupational exposure ALARA. Consistent with ISG-22 [8.5] guidance and Technical Specification 3.1.1, helium at 1-3 psig is used to backfill the DSC with an inert gas as water is being removed from the DSC.

7. Disconnect hose from the DSC siphon port.

8. Install the automatic welding machine onto the inner top cover plate and place the inner top cover plate with the automatic welding machine onto the DSC. Verify proper fit-up of the inner top cover plate with the DSC shell.

9. Check radiation levels along surface of the inner top cover plate. Temporary shielding may be installed as necessary to minimize personnel exposure.

   CAUTION: Insert a 1/4-inch flexible tubing of sufficient length and adequate temperature resistance through the vent port such that it terminates just below the DSC shield plug. Connect the flexible tubing to a hydrogen monitor to allow continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner cover plate, in compliance with Technical Specification *4.3.3*. Optionally, other methods may be used for continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner top cover plate, to comply with the Technical Specification.

10. Cover the cask/DSC annulus to prevent debris and weld splatter from entering the annulus.

11. Ready the automatic welding machine and tack weld the inner top cover plate to the DSC shell. Install the inner top cover plate weldment and remove the automatic welding machine.

CAUTION: Continuously monitor the hydrogen concentration in the DSC cavity using the flexible tube arrangement or other alternate methods described in Step 9 during the inner top cover plate cutting/welding operations. Verify that the measured hydrogen concentration does not exceed a safety limit of 2.4% [8.2 and 8.3] (60.0% of flammability limit of 4.0%). If this limit is exceeded, stop all welding operations and purge the DSC cavity with approximately 2-3 psig helium (or any other inert medium) via the 1/4 inch flexible tubing to reduce the hydrogen concentration safely below the 2.4% limit.

12. Perform dye penetrant weld examination of the inner top cover plate weld in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

13. Connect the VDS to the DSC siphon and vent ports.

14. Install temporary shielding to minimize personnel exposure throughout the subsequent welding operations as required.

14a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 15 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

15. Engage helium supply and open the valve on the vent port and allow helium to force the water from the DSC cavity through the siphon port. Use of helium is required per Technical Specification 3.1.1.

16. Once the water stops flowing from the DSC, close the DSC siphon port and disengage the gas source.

16a. Verify that the TC axial surface dose rates are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. The configuration for determining the TC axial dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

17. Connect the hose from the vent port and the siphon port to the intake of the vacuum pump. Connect a hose from the discharge side of the VDS to the plant's radioactive waste system or spent fuel pool. Connect the VDS to a helium source.

CAUTION: During the vacuum drying evolution, personnel should be in the area of loading operations, or in nearby low dose areas in order to take proper action in the event of a malfunction.

18. Open the valve on the suction side of the pump, start the VDS and draw a vacuum on the DSC cavity. The cavity pressure should be reduced in steps of approximately 100 mm Hg, 50 mm Hg, 25 mm Hg, 15 mm Hg, 10 mm Hg, 5 mm Hg, and 3 mm Hg. After pumping down to each level, the pump is valved off and the cavity pressure monitored. The cavity pressure will rise as water and other volatiles in the cavity evaporate. When the cavity pressure stabilizes, the pump is valved in to complete the vacuum drying process. It may be necessary to repeat some steps, depending on the rate and extent of the pressure increase. Vacuum drying is complete when the pressure stabilizes for a minimum of 30 minutes at 3 mm Hg absolute or less as specified in Technical Specification 3.1.1.

P.8.1.4 DSC Sealing Operations

CAUTION: During performance of steps listed in Section P.8.1.4, monitor the cask/DSC annulus water level and replenish as necessary to maintain cooling.

1. Disconnect the VDS from the DSC. Seal weld the prefabricated plugs over the vent and siphon ports, inject helium into blind space just prior to completing welding, and perform a dye penetrant weld examination in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements. Use of an optional test head is acceptable to perform the helium leak test of the inner top cover plate and vent/siphon port welds in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1*. If an optional test head is not used, proceed to Step 2.

2. Temporary shielding may be installed as necessary to minimize personnel exposure. Install the automatic welding machine onto the outer top cover plate and place the outer top cover plate with the automatic welding system onto the DSC. Verify proper fit up of the outer top cover plate with the DSC shell.

3. Tack weld the outer top cover plate to the DSC shell. Place the outer top cover plate weld root pass.

4. Helium leak test the inner top cover plate and vent/siphon port plate welds using the leak test port in the outer top cover plate in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1* limits. Verify that the personnel performing the leak test are qualified in accordance with SNT-TC-1A [8.4]. Alternatively this can be done with a test head in P.8.1.4 step 1.

5. If a leak is found, remove the outer cover plate root pass, the vent and siphon port plugs and repair the inner cover plate welds. Repeat procedure steps from P.8.1.3 Step 18.

6. Perform dye penetrant examination of the root pass weld. Weld out the outer top cover plate to the DSC shell and perform dye penetrant examination on the weld surface in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

7. Seal weld the prefabricated plug over the outer cover plate test port and perform dye penetrant weld examinations.

8. Remove the automatic welding machine from the DSC.

8a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 9 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

9. Open the cask drain port valve and drain the water from the cask/DSC annulus.

10. Rig the cask top cover plate and lower the cover plate onto the TC.

11. Bolt the cask cover plate into place, tightening the bolts to the required torque in a star pattern.

    CAUTION: Monitor the applicable time limits of Technical Specification 3.1.3 until the completion of DSC transfer Step 6 of Section P.8.1.6.

12. Verify that the TC radial dose rates measured at the surface of the Transfer Cask are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. The configuration for determining the TC radial surface dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

P.8.1.5 <u>TC Downending and Transfer to ISFSI</u>

1. If loading with OS197/OS197H/OS197FC TC, drain the TC neutron shield to an acceptable location as required to meet the plant lifting crane capacity limit.

   CAUTION: The radiation dose rates around the surface of the transfer cask without water in the neutron shield (through step P.8.1.5.10) are expected to be high. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

2. Re-attach the TC lifting yoke to the crane hook, as necessary. Ready the transfer trailer and cask support skid for service.

3. Move the scaffolding away from the cask as necessary. Engage the lifting yoke and lift the cask over the cask support skid on the transfer trailer.

4. The transfer trailer should be positioned so that cask support skid is accessible to the crane with the trailer supported on the vertical jacks.

5. Position the cask lower trunnions onto the transfer trailer support skid pillow blocks.

6. Move the crane forward while simultaneously lowering the cask until the cask upper trunnions are just above the support skid upper trunnion pillow blocks.

7. Inspect the positioning of the cask to insure that the cask and trunnion pillow blocks are properly aligned.

8. Lower the cask onto the skid until the weight of the cask is distributed to the trunnion pillow blocks.

9. Inspect the trunnions to ensure that they are properly seated onto the skid. Install the trunnion tower closure plates (optional for the OS197 TC or the OS197H or OS200 TC).

10. Fill the neutron shield with demineralized water, if it was drained in P.8.1.5.1 step 1, and verify that the NS is filled, in accordance with Technical Specification *4.3.2*.

11. Remove the bottom ram access cover plate from the cask. Install the two-piece temporary neutron/gamma shield plug to cover the bottom ram access. Install the ram trunnion support frame on the bottom of the TC. (The temporary shield plug and ram trunnion support frame are not required with integral ram/trailer).

P.8.1.6 <u>DSC Transfer to the HSM</u>

Note: If using the HSM-HS module for storage of the NUHOMS®-24PTH DSC at sites with high seismic levels, verify that at least 3 modules are connected together per the requirements of *CoC Condition II.2.a*.

1. Prior to transferring the cask to the ISFSI, remove the HSM door, inspect the cavity of the HSM, removing any debris and ready the HSM to receive a DSC. The doors on adjacent HSMs should remain in place.

   CAUTION: The insides of empty modules have the potential for high does rates due to adjacent loaded modules. Proper ALARA practices should be followed for operations inside these modules and in the areas outside these modules whenever the door from the empty HSM has been removed.

2. Inspect the HSM air inlet and outlets to ensure that they are clear of debris. Inspect the screens on the air inlet and outlets for damage.

   CAUTION: Verify that the requirements of Technical Specification *4.4.1*.B are met prior to next step.

3. Using a suitable vehicle, transfer the cask from the plant's fuel/reactor building to the ISFSI along the designated transfer route.

4. Once at the ISFSI, position the transfer trailer to within a few feet of the HSM.

5. Check the position of the trailer to ensure the centerline of the HSM and cask approximately coincide. If the trailer is not properly oriented, reposition the trailer, as necessary.

6. Unbolt and remove the cask top cover plate.

   CAUTION: Verify that the applicable time limits of Technical Specification 3.1.3 are met.

7. Back the cask to within a few inches of the HSM, set the trailer brakes and disengage the tractor. Extend the transfer trailer vertical jacks.

8. Connect the skid positioning system hydraulic power unit to the positioning system via the hose connector panel on the trailer, and power it up. Remove the skid tie-down bracket fasteners and use the skid positioning system to bring the cask into approximate vertical and horizontal alignment with the HSM. Using optical survey equipment and the alignment marks on the cask and the HSM, adjust the position of the cask until it is properly aligned with the HSM.

9. Using the skid positioning system, fully insert the cask into the HSM access opening docking collar.

10. Secure the cask trunnions to the front wall embedments of the HSM using the cask restraints.

11. After the cask is docked with the HSM, verify the alignment of the TC using the optical survey equipment.

12. Position the hydraulic ram behind the cask in approximate horizontal alignment with the cask and level the ram. Remove either the bottom ram access cover plate or the outer plug of the two-piece temporary shield plug. Power up the ram hydraulic power supply and extend the ram through the bottom cask opening into the DSC grapple ring.

13. Activate the hydraulic cylinder on the ram grapple and engage the grapple arms with the DSC grapple ring.

14. Recheck all alignment marks and ready all systems for DSC transfer. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

    If the alignment tolerance is exceeded, the following actions should be taken:

    a. Confirm that the transfer system is properly configured,

    b. Check and repair the alignment equipment, or

    c. Confirm the locations of the alignment targets on the TC and HSM.

15. Activate the hydraulic ram to initiate insertion of the DSC into the HSM. Stop the ram when the DSC reaches the support rail stops at the back of the module.

16. Disengage the ram grapple mechanism so that the grapple is retracted away from the DSC grapple ring.

17. Retract and disengage the hydraulic ram system from the cask and move it clear of the cask. Remove the cask restraints from the HSM.

18. Using the skid positioning system, disengage the cask from the HSM access opening.

19. Install the DSC drop-in retainer through the HSM door opening. The trailer may be moved as necessary to install the HSM door. Install the HSM door and secure it in place. Door may be welded for security. Verify that the HSM dose rates are compliant with the limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Items 3.3.1 and 3.3.2*.

20. Replace the TC top cover plate. Secure the skid to the trailer, retract the vertical jacks and disconnect the skid positioning system.

21. If this is the final loading, fully drain the liquid neutron shield.

22. Tow the trailer and cask to the designated equipment storage area. Return the remaining transfer equipment to the storage area.

23. Close and lock the ISFSI access gate and activate the ISFSI security measures.

P.8.1.7 Monitoring Operations

1. Perform routine security surveillance in accordance with the licensee's ISFSI security plan.

2. Perform a daily visual surveillance of the HSM air inlets and outlets to insure that no debris is obstructing the HSM vents in accordance with Technical Specification *3.1.4*.a requirements OR perform a temperature measurement of the thermal performance, for each HSM, on a daily basis in accordance with Technical Specification *3.1.4*.b requirements.

P.8.2 Procedures for Unloading the Cask

P.8.2.1 DSC Retrieval from the HSM

1. Ready the TC, transfer trailer, and support skid for service and tow the trailer to the HSM. If using the OS200/OS200FC TC to unload, verify that it has been fitted with an internal aluminum sleeve and cask spacer of appropriate height (refer to Drawings NUH-08-8004-SAR and NUH-08-8005-SAR provided in Appendix U.1, Section U.1.5). If using OS197, OS197H or OS197FC TC to unload, verify that it has the appropriate height spacer (see Figure P.4-18).

2. Back the trailer as close to the HSM as compatible with HSM door removal and remove the cask top cover plate.

3. Cut any welds from the door and remove the HSM door using a porta-crane. Remove the DSC drop-in retainer.

4. Using the skid positioning system align the cask with the HSM and position the skid until the cask is docked with the HSM access opening.

5. Using optical survey equipment, verify alignment of the cask with respect to the HSM. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

   If the alignment tolerance is exceeded, the following actions should be taken:

   a. Confirm that the transfer system is properly configured,

   b. Check and repair the alignment equipment, or

   c. Confirm the locations of the alignment targets on the TC and HSM.

5a. Install the cask restraints.

6. Install and align the hydraulic ram with the cask.

7. Extend the ram through the cask into the HSM until it is inserted in the DSC grapple ring.

8. Activate the arms on the ram grapple mechanism with the DSC grapple ring.

8a. From this point, until fuel has been removed from the DSC or the DSC has been removed from the TC, the DSC will be inspected for damage after any TC drop of fifteen inches or greater.

9. Retract ram and pull the DSC into the cask.

10. Retract the ram grapple arms.

11. Disengage the ram from the cask.

12. Remove the cask restraints.

13. Using the skid positioning system, disengage the cask from the HSM.

Note: If using the OS200/OS200FC TC to unload, place a sleeve ring spacer at the top of the aluminum sleeve (refer to Drawing NUH-08-8004-SAR provided in Appendix U.1, Section U.1.5).

14. Install the cask top cover plate and ready the trailer for transfer.

15. Replace the door on the HSM.

P.8.2.2 Removal of Fuel from the DSC

When the DSC has been removed from the HSM, there are several potential options for off-site shipment of the fuel. It is preferred to ship the DSC intact to a reprocessing facility, monitored retrievable storage facility or permanent geologic repository in a compatible shipping cask licensed under 10CFR71.

If it becomes necessary to remove fuel from the DSC prior to off-site shipment, there are two basic options available at the ISFSI or reactor site. The fuel assemblies could be removed and reloaded into a shipping cask using dry transfer techniques, or if the applicant so desires, the initial fuel loading sequence could be reversed and the plant's spent fuel pool utilized. Procedures for unloading the DSC in a fuel pool are presented here. However, wet or dry unloading procedures are essentially identical to those of DSC loading through the DSC weld removal (beginning of preparation to placement of the cask in the fuel pool). Prior to opening the DSC, the following operations are to be performed.

CAUTION: Verify that the applicable time limits of Technical Specification 3.1.3 are met until the completion of Step P.8.2.2.14.

1. The TC may now be transferred to the cask handling area inside the plant's fuel/reactor building.

2. Position and ready the trailer for access by the crane and install the ram access penetration cover plate.

3. Attach the lifting yoke to the crane hook.

4. Engage the lifting yoke with the trunnions of the TC.

5. Visually inspect the yoke lifting hooks to insure that they are properly aligned and engaged onto the TC trunnions.

6. If unloading with OS197/OS197FC TC, drain the TC water from the neutron shield to an acceptable location as required to meet the plant lifting crane capacity limit.

   CAUTION: The radiation dose rates around the surface of the transfer cask without water in the neutron shield (through step P.8.2.2.9) are expected to be high. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

7. Lift the TC approximately one inch off the trunnion supports. Visually inspect the yoke lifting hooks to insure that they are properly positioned on the trunnions.

8. Move the crane backward in a horizontal motion while simultaneously raising the crane hook vertically and lift the TC off the trailer. Move the TC to the cask decon area.

9. Lower the TC into the cask decon area in the vertical position. Fill the neutron shield with *demineralized* water if it was drained in Step P.8.2.2.6, and verify that the NS is filled, in accordance with Technical Specification *4.3.2*.

10. Wash the TC to remove any dirt which may have accumulated on the TC during the DSC loading and transfer operations.

11. Place scaffolding around the TC so that any point on the surface of the TC is easily accessible to handling personnel.

12. Unbolt the TC top cover plate.

13. If using the OS200/OS200FC TC to unload, remove the sleeve ring spacer at the top of the aluminum sleeve placed in Section P.8.2.1, step 13. Connect the rigging cables to the TC

14. Install temporary shielding to reduce personnel exposure as required. Fill the TC/DSC annulus with clean demineralized water and seal the annulus.

The process of DSC unloading is similar to that used for DSC loading. DSC opening operations described below are to be carefully controlled in accordance with plant procedures. This operation is to be performed under the site's standard health physics guidelines for welding, grinding, and handling of potentially highly contaminated equipment. These are to include the use of prudent housekeeping measures and monitoring of airborne particulates. Procedures may require personnel to perform the work using respirators or supplied air.

If fuel needs to be removed from the DSC, either at the end of service life or for inspection after an accident, precautions must be taken against the potential for the presence of damaged or oxidized fuel and to prevent radiological exposure to personnel during this operation. A sampling of the atmosphere within the DSC will be taken prior to inspection or removal of fuel.

This can be achieved with this design by the use of the purge and fill valves which permit a determination of the atmosphere within the DSC before the removal of the inner top cover and shield plugs, prior to filling the DSC cavity with water (borated water for the 24PTH). If the atmosphere within the DSC is helium and radioactivity check of the atmosphere in the DSC cavity did not detect the presence of any airborne radioactive particulates, then operations should proceed normally with fuel removal either via the TC or in the pool, if available. However, if air or airborne radioactive particulates are present within the DSC, then appropriate filters should be in place to preclude the uncontrolled release of any potential airborne radioactive particulate from the DSC via the purge-fill valves. This will protect both personnel and the operations area from potential contamination. For the accident case, personnel protection in the form of respirators or supplied air should be considered in accordance with licensee's Radiation Protection Program.

If the work is performed outside the fuel/reactor building, a tent may be constructed over the work area, which may be kept under a negative pressure to control airborne particulates. Any radioactive gas release will be Kr-85, which is not readily captured. Whether the krypton is vented through the plant stack or allowed to be released directly depends on the plant operating requirements.

Following opening of the DSC, the cask and DSC are filled with water prior to lowering the top of cask below the surface of the fuel pool to prevent a sudden inrush of pool water. Cask placement into the pool is performed in the usual manner. Fuel unloading procedures will be governed by the plant operating license under 10CFR50. The generic procedures for these operations are as follows:

15. Locate the DSC siphon and vent port using the indications on the top cover plate. Place a portable drill press on the top of the DSC. Position the drill with the siphon port.

16. Place an exhaust hood or tent over the DSC, if necessary. The exhaust should be filtered or routed to the site radwaste system.

17. Drill a hole through the DSC top cover plate to expose the siphon port quick connect.

18. Drill a second hole through the top cover plate to expose the vent port quick connect.

19. Obtain a sample of the DSC atmosphere, if necessary (e.g., at the end of service life). Fill the DSC with water from the fuel pool through the siphon port with the vent port open and routed to the plant's off-gas system.

    CAUTION:

    (a) The water fill rate must be regulated during this reflooding operation to ensure that the DSC vent pressure does not exceed 20.0 psig.

    (b) In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 19(c) is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

(c) Provide for continuous hydrogen monitoring of the DSC cavity atmosphere during all subsequent cutting operations to ensure that a safety limit of 2.4% (60.0% of flammability limit of 4.0%) is not exceeded [8.2 and 8.3] and in compliance with Technical Specification *4.3.3*. Drain appropriate amount of water from the DSC cavity before cutting operations to ensure that sufficient free volume exists in the DSC cavity for H_2 concentration limit. Purge with 2-3 psig helium (or any other inert medium) as necessary to maintain the hydrogen concentration safely below this limit.

20. Place welding blankets around the cask and scaffolding.

21. Using plasma arc-gouging, a mechanical cutting system or other suitable means, remove the seal weld from the outer top cover plate and DSC shell. A fire watch should be placed on the scaffolding with the welder, as appropriate. The exhaust system should be operating at all times.

22. The material or waste from the cutting or grinding process should be treated and handled in accordance with the plant's low level waste procedures unless determined otherwise.

23. Remove the top of the tent, if necessary.

24. Remove the exhaust hood, if necessary.

25. Remove the DSC outer top cover plate.

26. Reinstall tent and temporary shielding, as required. Remove the seal weld from the inner top cover plate to the DSC shell in the same manner as the top cover plate. Remove the inner top cover plate. Remove any remaining excess material on the inside shell surface by grinding.

27. Clean the cask surface of dirt and any debris which may be on the cask surface as a result of the weld removal operation. Any other procedures which are required for the operation of the cask should take place at this point as necessary.

28. Engage the yoke onto the trunnions, install eyebolts into the top shield plug and connect the rigging cables to the eyebolts.

29. Visually inspect the lifting hooks or the yoke to insure that they are properly positioned on the trunnions.

29a. If the neutron shield is to remain filled during Step 30, in accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 30 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

P.11.1.2 Extreme Temperatures

No change. The off-normal maximum ambient temperature of 125 °F is used in Section 8.1.2.2. For the NUHOMS®-24PTH system, a maximum ambient temperature of 117 °F is used. Therefore, the analyses in Section 8.1.2.2 bound TCs and HSM Model 102 used in the NUHOMS®-24PTH system.

P.11.1.2.1 Postulated Cause of Event

No change. See Section 8.1.2.2.

P.11.1.2.2 Detection of Event

No change to Section 8.1.2.2.

P.11.1.2.3 Analysis of Effects and Consequences

The thermal evaluation of the NUHOMS®-24PTH system for off-normal conditions is presented in Section P.4. The 100 ºF normal condition with insolation bounds the 117 ºF case without insolation for the DSC in the TC. Therefore the normal condition maximum temperatures are bounding. The 117 ºF case with the DSC in the HSM-H is not bounded by the normal conditions and therefore evaluated in Section P.4.

The NUHOMS® standardized TC and HSM Model 102 were evaluated for a maximum heat load of 24 kW and maximum off-normal ambient temperature of 125 ºF. The maximum heat load of the 24PTH-S-LC DSC in standardized TC or HSM Model 102 is limited to 24 kW. Therefore the evaluation presented in Section 8.1.2.2 is bounding for these components.

The structural evaluation of the 24PTH DSC for off-normal temperature conditions is presented in Section P.3.6.2.2. The structural evaluation of the basket due to off-normal thermal conditions is presented in Section P.3.6.1.3. The structural evaluation of HSM-H and OS197FC Transfer Cask for off-normal conditions with 24PTH DSC are presented in Section P.3.6.

As indicated in Section P.3.6, the structural evaluation of the HSM-HS and OS200/OS200FC Transfer Cask, as presented in Chapter U.3, Section U.3.6.2.3 and Chapter U.3, Section U.3.6.2.4, respectively, are not affected when loaded with the 24PTH DSC.

P.11.1.2.4 Corrective Actions

Restrictions for onsite handling of the TC with a loaded DSC under extreme temperature conditions are presented in Technical Specifications *4.4.1*.A and *4.4.1*.B. There is no change to this requirement as a result of addition of the NUHOMS®-24PTH DSC.

Table T.2-1
BWR Fuel Specification for the Fuel to be Stored in the NUHOMS®-61BTH DSC

PHYSICAL PARAMETERS: *Fuel Class*	*Per TS Table 1-1t*
Fuel Damage	*Per TS Table 1-1t*
Failed Fuel	*Per TS Table 1-1t*
RECONSTITUTED FUEL ASSEMBLIES: • *Maximum Number of Irradiated Stainless Steel Rods in Reconstituted Assemblies per DSC* • *Maximum Number of Irradiated Stainless Steel Rods per Reconstituted Fuel Assembly* • *Maximum Number of Reconstituted Assemblies per DSC with unlimited number of low enriched UO2 rods or Zr Rods or Zr Pellets or Unirradiated Stainless Steel Rods*	*Per TS Table 1-1t* *Per TS Table 1-1t* *Per TS Table 1-1t*
Number of Intact Assemblies	*Per TS Table 1-1t*
Number and Location of Damaged Assemblies	*Per TS Table 1-1t*
Number and Location of Failed Assemblies	*Per TS Table 1-1t*
Channels	*Per TS Table 1-1t*
Maximum Initial Uranium Content	*198 kg/assembly*
Maximum Assembly Weight with Channels	*Per TS Table 1-1t*
THERMAL/RADIOLOGICAL PARAMETERS: *Allowable Heat Load Zoning Configurations for each Type 1 61BTH DSC* *Allowable Heat Load Zoning Configurations for each Type 2 61BTH DSC:* *Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 1* *Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 2* *Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 3* *Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 4* *Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 5* *Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 6*	*Per TS Table 1-1t* *Per TS Table 1-1t* *Per Table 1-4c for Zone 3 fuel.* *Per Table 1-4b for Zone 2 fuel, Table 1-4d for Zone 4 fuel, and Table 1-4e for Zone 5 fuel.* *Per Table 1-4b for Zone 2 fuel.* *Per Table 1-4a for Zone 1 fuel, Table 1-4b for Zone 2 fuel, Table 1-4d for Zone 4 fuel, and Table 1-4e for Zone 5 fuel.* *Per Table 1-4b for Zone 2 fuel and Table 1-4e for Zone 5 fuel.* *Per Table 1-4a for Zone 1 fuel, Table 1-4d for Zone 4 fuel, Table 1-4e for Zone 5 fuel, and Table 1-4f for Zone 6 fuel.*

Table T.2-1
BWR Fuel Specification for the Fuel to be Stored in the NUHOMS®-61BTH DSC
(Concluded)

Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 7	*Per Table 1-4d for Zone 4 fuel and Table 1-4e for Zone 5 fuel.*
Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 8	*Per Table 1-4b for Zone 2 fuel, Table 1-4c for Zone 3 fuel, Table 1-4d for Zone 4 fuel, and Table 1-4e for Zone 5 fuel.*
Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 9	*Per Table 1-4c for Zone 1 fuel, Table 1-4d for Zone 2 fuel, Table 1-4b for Zone 3 and Zone 4 fuel.*
Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 10	*Per Table 1-4c for Zone 1 fuel, Table 1-4d for Zone 2 and Zone 4 fuel, and Table 1-4h for Zone 3 fuel if the maximum decay heat per FA in Zone 3 is less than or equal to 0.9 kW* *Or* *Per Table 1-4c for Zone 1, Zone 2 and Zone 4 fuel, Table 1-4i for Zone 3 fuel if the maximum decay heat per FA in Zone 3 is greater than 0.9 kW.*
Burnup, Enrichment, and Minimum Cooling Time for fuel with ≤ 20 GWd/MTU and 0.5 to 0.9 wt. % in all Heat Load Zoning Configurations	*Per Table 1-4g for zone 1, 2, 3, 4, 5, and 6 fuel.*
Maximum Lattice Average Initial Enrichment	*Per TS Table 1-1t*
Maximum Pellet Enrichment	*Per TS Table 1-1t*
Maximum Decay Heat Limits for Zones 1, 2, 3, 4, 5 and 6 Fuel	*Per TS Table 1-1t*
Decay Heat per DSC	*Per TS Table 1-1t*
Minimum B-10 Concentration in Poison Plates	*Per TS Table 1-1t*

Proprietary Information on This Page
Withheld Pursuant to 10 CFR 2.390

- Maximum off-normal ambient temperature of 117 °F with insolation, and
- Minimum off-normal ambient temperature of -40 °F without insolation.

The HSM-H thermal model described in Section T.4.4.4 above provides the surface temperatures that are applied to the DSC shell, basket and payload model. The results are presented in Table T.4-28.

T.4.6.7.3 Off-Normal Ambient Temperatures during Transfer

The thermal performance of the NUHOMS®-61BTH DSC during transfer under the minimum ambient temperature of 0 °F with no insolation and 117 °F with maximum insolation, for Type 1 and Type 2 DSCs are examined.

Note that a solar shield is used for transfer operations when the ambient temperature exceeds 100 °F up to 117 °F. This is done according to the NUHOMS® CoC 1004, Technical Specification *4.4.1*.B, "TC/DSC Transfer Operations at High Ambient Temperatures" for transfer operations, when ambient temperatures exceed 100 °F, which requires that a solar shield shall be used to provide protection against direct solar radiation.

T.4.6.7.4 Boundary Conditions, Off-Normal Transfer

The off-normal conditions of transfer analyses are performed for the following ambient conditions:

- Maximum off-normal ambient temperature of 117 °F without insolation.

The 61BTH DSC temperature profiles calculated using the OS197FC-B thermal model as described in Section T.4.5 are applied to the corresponding surfaces of the DSC thermal analysis finite element model described in Section T.4.6.2.

T.4.6.7.5 61BTH DSC Thermal Analyses Results for Off-Normal Conditions of Storage and Transfer

Fuel Cladding Temperatures

The maximum fuel cladding temperatures during off-normal conditions of storage and transfer are evaluated for both Type 1 and Type 2 DSCs and compared with the corresponding fuel cladding temperature limits. The results are reported in Table T.4-17.

DSC Basket Component Temperatures

The maximum temperatures of the DSC components for off-normal conditions of storage and transfer are listed in Table T.4-18 and Table T.4-19 for Type 1 and Type 2 DSCs, respectively.

T.4.6.7.6 Off-Normal 61BTH DSC Maximum Internal Pressure during Storage/Transfer

T.8.1 Procedures for Loading the Cask

T.8.1.1 Preparation of the Transfer Cask and DSC

Notes:

- If using the OS200/OS200 FC TC for transfer of the NUHOMS®-61BTH DSC, verify that it has been fitted with an internal aluminum sleeve (refer to Drawing NUH-08-8004-SAR provided in Appendix U.1, Section U.1.5). This step, if required, can be performed at any time prior to placing the DSC in the TC.

1. Prior to placement in dry storage, the candidate intact and damaged fuel assemblies shall be evaluated (by plant records or other means) to verify that they meet the physical, thermal and radiological criteria specified in Technical Specification 2.1.

2. Prior to being placed in service, the transfer cask is to be cleaned or decontaminated as necessary to insure a surface contamination level of less than those specified in Technical Specification *3.3.1*.

3. Place the transfer cask in the vertical position in the cask decon area using the cask handling crane and the transfer cask lifting yoke.

4. Place scaffolding around the cask so that the transfer cask top cover plate and surface of the cask are easily accessible to personnel.

5. Remove the transfer cask top cover plate and examine the cask cavity for any physical damage and ready the cask for service.

5a. If using OS200/OS200FC TC to load, verify that a cask spacer of appropriate height (Refer to Drawing NUH-08-8005-SAR provided in Appendix U.1, Section U.1.5) is placed at the bottom of the TC.

6. Examine the DSC for any physical damage which might have occurred since the receipt inspection was performed. The DSC is to be cleaned and any loose debris removed. Record the DSC serial number which is located on the grapple ring. Verify the correct DSC type, basket type, and poison material types against the DSC serial number. Verify that the DSC is appropriate for the specific fuel loading campaign per Technical Specification 2.1.

   CAUTION: If loading fuel assemblies through the basket hold down ring (HDR) or top grid assembly (TGA), verify that the lifting grapple will be able to release fuel assemblies while inside the HDR/TGA.

7. Using a crane, lower the DSC into the cask cavity by the internal lifting lugs and rotate the DSC to match the cask and DSC alignment marks.

8. If damaged fuel assemblies are to be included in a specific loading campaign, place the required number of bottom end caps provided (up to a maximum of 61) into the bottom

b. Position the lifting yoke and the top shield plug and lower the shield plug into the DSC. Note that separate rigging may be used to install the shield plug prior to engaging the trunnions with the lifting yoke.

CAUTION: Verify that all the lifting height restrictions as a function of temperature specified in Technical Specification *4.4.1.*A can be met in the following steps which involve lifting of the transfer cask.

9. Visually verify that the top shield plug is properly seated within the DSC.

10. Position the lifting yoke with the cask trunnions and verify that it is properly engaged.

11. Raise the transfer cask to the pool surface. Prior to raising the top of the cask above the water surface, stop vertical movement.

12. Inspect the top shield plug to verify that it is properly seated within the DSC. If not, lower the cask and reposition the top shield plug and/or remove the shield plug and reposition the hold down ring. Repeat Steps 8 through 12 as necessary.

13. Continue to raise the cask from the pool and spray the exposed portion of the cask with water until the top region of the cask is accessible.

14. Drain any excess water from the top of the DSC shield plug back to the fuel pool. Check the radiation levels at the center of top shield plug and around the perimeter of the cask. Disconnect the top shield plug rigging.

15. Drain a minimum of 50 gallons of water. Optionally up to approximately 1100 gallons of water (as indicated on the flow meter) may be drained from the DSC back into the fuel pool or other suitable location to meet the weight limit on the crane. Use 1-3 psig of helium to backfill the DSC with an inert gas per ISG-22 [8.2] guidance and Technical Specification 3.1.1 as water is being removed from the DSC.

15a. From this point, until the DSC has been inserted into the HSM, the DSC will be inspected for damage after any TC drop of 15 inches or greater.

16. Lift the cask from the fuel pool. As the cask is raised from the pool, continue to spray the cask with water and decon as directed. Provisions shall be made to assure that air will not enter the DSC cavity. One way to achieve this is by replenishing the helium in the DSC cavity during cask movement from the fuel pool to the decon area in case of malfunction of equipment used for cask movement.

17. Move the cask with loaded DSC to the cask decon area.

17A. Replace the water removed from the DSC cavity in Step 15 with water from the fuel pool or an equivalent source.

18. Install cask seismic restraints if required by Technical Specification 4.3.3 Step 7 (required only on plant specific basis).

T.8.1.3 DSC Drying and Backfilling

CAUTION: During performance of steps listed in Section T.8.1.3, monitor the TC/DSC annulus water level and replenish as necessary to maintain cooling.

1. Check the radiation levels along the perimeter of the cask. The cask exterior surface should be decontaminated as necessary. Temporary shielding may be installed as necessary to minimize personnel exposure.

2. Place scaffolding around the cask so that any point on the surface of the cask is easily accessible to personnel.

3. Disengage the rigging cables from the top shield plug and remove the eyebolts. Disengage the lifting yoke from the trunnions and position it clear of the cask.

4. Decontaminate the exposed surfaces of the DSC shell perimeter and remove the inflatable TC/DSC annulus seal.

4a. In accordance with Technical Specification *4.3.2*, verify that the neutron shield (NS) is filled before the draining operation in Step 5 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

5. Connect the cask drain line to the cask, open the cask cavity drain port and allow water from the annulus to drain out until the water level is approximately 12 inches below the top edge of the DSC shell. Take swipes around the outer surface of the DSC shell and check for smearable contamination in accordance with the Technical Specification *3.3.1* limits.

CAUTION: Radiation dose rates are expected to be high at the vent and siphon port locations. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

5a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 6 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

6. Drain approximately 1100 gallons of water or more (as indicated on a flowmeter) from the DSC back into the fuel pool or other suitable location if not drained in T.8.1.2 Step 15. Consistent with ISG-22 [8.2] guidance and Technical Specification 3.1.1, helium at 1-3 psig is used to backfill the DSC with an inert gas as water is being removed from the DSC. The minimum volume of water to be drained is to minimize hydrogen generation within the DSC cavity. It is also acceptable to completely drain the water within the DSC instead of draining only minimum volume.

CAUTION: Radiation dose rates are expected to be high at the vent and siphon port locations. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

7. Not used.

8. Install the automatic welding machine onto the inner top cover plate and place the inner top cover plate with the automatic welding machine onto the DSC. Optionally, the inner top cover plate and the automatic welding machine can be placed separately. Verify proper fit-up of the inner top cover plate with the DSC shell.

9. Check radiation levels along the surface of the inner top cover plate. Temporary shielding may be installed as necessary to minimize personnel exposure

10. Insert approximately ¼ inch tubing of sufficient length and adequate temperature resistance through the vent port such that it terminates just below the DSC top shield plug. Connect the tubing to a hydrogen monitor to allow continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner top cover plate, in compliance with Technical Specification *4.3.3*.
11. Cover the TC/DSC annulus to prevent debris and weld splatter from entering the annulus.
12. Ready the automatic welding machine and tack weld the inner top cover plate to the DSC shell. Install the inner top cover plate weldment and remove the automatic welding machine.

    CAUTION: Continuously monitor the hydrogen concentration in the DSC cavity using the arrangement or other alternate methods described in step 10 during the inner top cover plate cutting/welding operations. Verify that the measured hydrogen concentration does not exceed a safety limit of 2.4% [8.3 and 8.4] (60.0% of flammability limit of 4.0%). If this limit is exceeded, stop all welding operations and purge the DSC cavity with 2-3 psig helium via the tubing to reduce the hydrogen concentration safely below the 2.4% limit.
13. Perform dye penetrant weld examination of the inner top cover plate weld in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.
14. If loading a Type 2 61BTH DSC or if using a suction pump rather than blowdown to remove water, skip to step 16; otherwise, place the strongback so that it sits on the inner top cover plate and is oriented such that:
    - The DSC siphon and vent ports are accessible
    - The strongback stud holes line up with the TC lid bolt holes
15. Lubricate the studs and, using a crossing pattern, adjust the strongback studs to snug tight ensuring approximately even pressure on the cover plate.
16. Remove purge lines and connect the VDS to the DSC siphon and vent ports.
17. Install temporary shielding to minimize personnel exposure throughout the subsequent welding operations as required.

17a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 18 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

18. Remove water from DSC cavity if not fully drained in Step 6.
    a. If using blowdown method to remove water, engage helium supply (up to 10 psig for Type 1 DSC or 15 psig for Type 2 DSC) and open the valve on the vent port and allow helium to force the water from the DSC cavity through the siphon port. Use of helium is required per Technical Specification 3.1.1.
    b. Alternatively a suction pump may be used to remove water from DSC.
19. Once the water stops flowing from the DSC, close the DSC siphon port and disengage the gas source or turn off the suction pump, as applicable.

19a. Verify that the TC axial surface dose rates are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. The configuration for determining the TC axial dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

Note: The user shall ensure that the vacuum pump is isolated from the DSC cavity when demonstrating compliance with Technical Specification 3.1.1 requirements. Simply closing the valve between the DSC and the vacuum pump is not sufficient, as a faulty valve allows the vacuum pump to continue to draw a vacuum on the DSC. Turning off the pump, or opening the suction side of the pump to atmosphere are examples of ways to assure that the pump is not continuing to draw a vacuum on the DSC.

28. If loading a Type 1 61BTH DSC, and if the strongback was not installed in Step 14, install the strongback at this time. Open the valve on the vent port and allow helium to flow into the DSC cavity to pressurize the DSC between 14.5 to 16.0 psig for 61BTH Type 1 and 18.5 to 20.0 psig for 61BTH Type 2 psig and hold for 10 minutes. Depressurize the DSC cavity by releasing the helium through the VDS to the plant spent fuel pool or radioactive waste system to about 2.5 psig in accordance with Technical Specification 3.1.2.b limits.

    CAUTION: Radiation dose rates are expected to be high at the vent and siphon port locations. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

29. Close the valves on the helium source.

30. Remove the strongback, if installed in step 14 or step 28 above, decontaminate as necessary, and store.

T.8.1.4 <u>DSC Sealing Operations</u>

CAUTION: During performance of steps listed in Section T.8.1.4, monitor the cask/DSC annulus water level and replenish as necessary to maintain cooling.

1. Disconnect the VDS from the DSC. Seal weld the prefabricated plugs over the vent and siphon ports. Inject helium into blind space just prior to completing welding and perform a dye penetrant weld examination in accordance with the *CoC Appendix A Inspections, Test, and Evaluations Item 4.3* requirements. Use of an optional test head is acceptable to perform the helium leak test of the inner top cover plate and vent/siphon port welds in accordance with *CoC Appendix A Inspections, Test, and Evaluations Item 4.1*. If an optional test head is not used, proceed to Step 2.

2. Temporary shielding may be installed as necessary to minimize personnel exposure. Install the automatic welding machine onto the outer top cover plate and place the outer top cover plate with the automatic welding system onto the DSC. Optionally, outer top cover plate may be installed separately from the welding machine. Verify proper fit up of the outer top cover plate with the DSC shell.

3. Tack weld the outer top cover plate to the DSC shell. Place the outer top cover plate weld root pass.

4. Helium leak test the inner top cover plate and vent/siphon port plate welds using the leak test port in the outer top cover plate in accordance with *CoC Appendix A Inspections, Test, and Evaluations Item 4.1* limits. Verify that the personnel performing the leak test are qualified in accordance with SNT-TC-1A [8.5]. Alternatively, this can be done with a test head in step 1 of Section T.8.1.4.

5. If a leak is found, remove the outer cover plate root pass (if not using test head), the vent and siphon port plugs and repair the inner cover plate welds. Then install the strongback (if used) and repeat procedure steps from T.8.1.3 step 21.

6. Perform dye penetrant examination of the root pass weld. Weld out the outer top cover plate to the DSC shell and perform dye penetrant examination on the weld surface in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

7. Install and seal weld the prefabricated plug, if applicable, over the outer cover plate test port and perform dye penetrant weld examinations in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

8. Remove the automatic welding machine from the DSC.

8a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 9 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

9. Open the cask drain port valve and drain the water from the cask/DSC annulus.

10. Rig the cask top cover plate and lower the cover plate onto the transfer cask.

11. If using the OS200/OS200FC TC to load, place a sleeve ring spacer at the top of the aluminum sleeve (refer to Drawing NUH-08-8004-SAR provided in Appendix U.1, Section U.1.5).

12. Bolt the cask cover plate into place, tightening the bolts to the required torque in a star pattern.

    CAUTION: Monitor the applicable time limits of Technical Specification 3.1.3 until the completion of DSC transfer step 6 of Section T.8.1.6, if loading Type 2 61BTH DSC.

13. Verify that the TC radial dose rates measured at the surface of the Transfer Cask are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. The configuration for determining the TC radial surface dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

T.8.1.5 Transfer Cask Downending and Transfer to ISFSI

NOTE:

Alternate Procedure for Downending of Transfer Cask: Some plants have limited floor hatch openings above the cask/trailer/skid, which limit crane travel (within the hatch opening) that would be needed in order to downend the TC with the trailer/skid in a stationary position. For these situations, alternate procedures are to be developed on a plant-specific basis, with detailed steps for downending.

1. Re-attach the transfer cask lifting yoke to the crane hook, as necessary. Ready the transfer trailer and cask support skid for service.

2. Move the scaffolding away from the cask as necessary. Engage the lifting yoke and lift the cask over the cask support skid on the transfer trailer.

3. The transfer trailer should be positioned so that the cask support skid is accessible to the crane with the trailer supported on the vertical jacks.

4. Position the cask lower trunnions onto the transfer trailer support skid pillow blocks.

5. Move the crane forward while simultaneously lowering the cask until the cask upper trunnions are just above the support skid upper trunnion pillow blocks.

6. Inspect the positioning of the cask to insure that the cask and trunnion pillow blocks are properly aligned.

7. Lower the cask onto the skid until the weight of the cask is distributed to the trunnion pillow blocks.

8. Inspect the trunnions to insure that they are properly seated onto the skid and install the trunnion tower closure plates if required.

9. Remove the bottom ram access cover plate from the cask if integral ram/trailer is not used. Install the two-piece temporary neutron/gamma shield plug to cover the bottom ram access. Install the ram trunnion support frame on the bottom of the transfer cask. (The temporary shield plug and ram trunnion support frame are not required with the integral ram/trailer.)

T.8.1.6 <u>DSC Transfer to the HSM</u>

Note: If using the HSM-HS module for storage of the NUHOMS®-61BTH DSC at sites with high seismic levels, verify that at least 3 modules are connected together per the requirements of *CoC Condition II.2.a*.

1. Prior to transferring the cask to the ISFSI or prior to positioning the transfer cask at the HSM designated for storage, remove the HSM door using a porta-crane, inspect the cavity of the HSM, removing any debris and ready the HSM to receive a DSC. The doors on adjacent HSMs should remain in place.

   CAUTION: The insides of empty modules have the potential for high dose rates due to adjacent loaded modules. Proper ALARA practices should be followed for operations inside these modules and in the areas outside these modules whenever the door from the empty HSM has been removed.

2. Inspect the HSM air inlet and outlets to ensure that they are clear of debris. Inspect the screens on the air inlet and outlets for damage.

   CAUTION: Verify that the requirements of Technical Specification *4.4.1*.B, "TC/DSC Transfer Operations at High Ambient Temperatures," are met prior to the next step.

CAUTION: Verify that the applicable time limits of Technical Specification 3.1.3 are met if loading Type 2 61BTH DSC.

7. Back the transfer trailer to within a few inches of the HSM, set the trailer brakes and disengage the tractor. Drive the tractor clear of the trailer. Extend the transfer trailer vertical jacks.

8. Remove the skid tie-down bolts and use the skid positioning system to bring the cask into approximate vertical and horizontal alignment with the HSM. Using optical survey equipment and the alignment marks on the cask and the HSM, adjust the position of the cask until it is properly aligned with the HSM.

9. Using the skid positioning system, fully insert the cask into the HSM access opening docking collar.

10. Secure the cask trunnions to the front wall embedments of the HSM using the cask restraints.

11. After the cask is docked with the HSM, verify the alignment of the transfer cask using the optical survey equipment.

12. Position the hydraulic ram behind the cask in approximate horizontal alignment with the cask and level the ram. Remove either the bottom ram access cover plate or the outer plug of the two-piece temporary shield plug if installed. Power up the ram hydraulic power supply and extend the ram through the bottom cask opening into the DSC grapple ring.

13. Activate the hydraulic cylinder on the ram grapple and engage the grapple arms with the DSC grapple ring.

14. Recheck all alignment marks and ready all systems for DSC transfer. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

    If the alignment tolerance is exceeded, the following actions should be taken:

    a. Confirm that the transfer system is properly configured,

    b. Check and repair the alignment equipment, or

    c. Confirm the locations of the alignment targets on the TC and HSM.

15. Activate the hydraulic ram to initiate insertion of the DSC into the HSM. Stop the ram when the DSC reaches the support rail stops at the back of the module.

16. Disengage the ram grapple mechanism so that the grapple is retracted away from the DSC grapple ring.

17. Retract and disengage the hydraulic ram system from the cask and move it clear of the cask. Remove the cask restraints from the HSM.

18. Using the skid positioning system, disengage the cask from the HSM access opening. Insert the DSC axial retainer.

19. Install the HSM door using a portable crane and secure it in place. Door may be welded for security. Verify that the HSM dose rates are compliant with the limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.3.1 and 3.3.2*.

20. Replace the transfer cask top cover plate. Secure the skid to the trailer, retract the vertical jacks and disconnect the skid positioning system.

21. If this is the final loading, fully drain the liquid neutron shield.

22. Tow the trailer and cask to the designated equipment storage area. Return the remaining transfer equipment to the storage area.

23. Close and lock the ISFSI access gate and activate the ISFSI security measures.

24. Ensure the HSM or HSM-H maximum air exit temperature requirements of *CoC Appendix A Inspections, Tests, and Evaluations Item 4.4* are met.

T.8.1.7 Monitoring Operations

1. Perform routine security surveillance in accordance with the licensee's ISFSI security plan.

2. Perform one of the two alternate daily surveillance activities listed below:

   a. A daily visual surveillance of the HSM air inlets and outlets to insure that no debris is obstructing the HSM vents in accordance with Technical Specification *3.1.4*.a requirements.

   b. A temperature measurement of the thermal performance, for each HSM, on a daily basis in accordance with Technical Specification *3.1.4*.b requirements.

T.8.2 Procedures for Unloading the Cask

T.8.2.1 DSC Retrieval from the HSM

1. Ready the transfer cask, transfer trailer, and support skid for service and tow the trailer to the HSM. If using the OS200/OS200FC TC to unload, verify that it has been fitted with an internal aluminum sleeve and a cask spacer of appropriate height (refer to Drawings NUH-08-8004-SAR and NUH-08-8005-SAR provided in Appendix U.1, Section U.1.5).
2. Back the trailer to within a few feet of the HSM and remove the cask top cover plate.

   CAUTION: High dose rates are expected in the HSM cavity after removal of HSM door. Proper ALARA practices should be followed.
3. Remove the HSM door using a porta-crane. Remove the DSC axial retainer.
4. Continue to back the transfer trailer within a few inches of the HSM. Using the skid positioning system, align the cask with the HSM and position the skid until the cask is docked with the HSM access opening.
5. Using optical survey equipment, verify alignment of the cask with respect to the HSM. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

   If the alignment tolerance is exceeded, the following actions should be taken:

   a. Confirm that the transfer system is properly configured,

   b. Check and repair the alignment equipment, or

   c. Confirm the locations of the alignment targets on the TC and HSM.

5a. Install the cask restraints.

6. Install (if required) and align the hydraulic ram with the cask.
7. Extend the ram through the cask into the HSM until it is inserted in the DSC grapple ring.
8. Activate the arms on the ram grapple mechanism with the DSC grapple ring.

8a. From this point, until fuel has been removed from the DSC or the DSC has been removed from the TC, the DSC will be inspected for damage after any TC drop of 15 inches or greater.

9. Retract ram and pull the DSC into the cask.
10. Retract the ram grapple arms.
11. Disengage the ram from the cask. Install the ram access penetration cover plate.

12. Remove the cask restraints.
13. Using the skid positioning system, disengage the cask from the HSM.

    If using the OS200/OS200FC TC to unload, place a sleeve ring spacer at the top of the aluminum sleeve (refer to Drawing NUH-08-8004-SAR provided in Appendix U.1, Section U.1.5).
14. Install the cask top cover plate and ready the trailer for transfer.
15. Replace the door on the HSM.

T.8.2.2 Removal of Fuel from the DSC

When the DSC has been removed from the HSM, there are several potential options for off-site shipment of the fuel. It is preferred to ship the DSC intact to a reprocessing facility, monitored retrievable storage facility or permanent geologic repository in a compatible shipping cask licensed under 10CFR71.

If fuel needs to be removed from the DSC, either at the end of service life or for inspection after an accident, precautions must be taken against the potential for the presence of damaged or oxidized fuel and to prevent radiological exposure to personnel during this operation. A sampling of the atmosphere within the DSC will be taken prior to inspection or removal of fuel.

This can be achieved with this design by the use of the purge and fill valves which permit a determination of the atmosphere within the DSC before the removal of the inner top cover and shield plugs, prior to filling the DSC cavity with water. If the atmosphere within the DSC is helium and radioactivity check of the atmosphere in the DSC cavity did not detect the presence of any airborne radioactive particulates, then operations should proceed normally with fuel removal either via the TC or in the pool, if available. However, if air or airborne radioactive particulates are present within the DSC, then appropriate filters should be in place to preclude the uncontrolled release of any potential airborne radioactive particulate from the DSC via the purge-fill valves. This will protect both personnel and the operations area from potential contamination. For the accident case, personnel protection in the form of respirators or supplied air should be considered in accordance with licensee's Radiation Protection Program.

If the work is performed outside the fuel/reactor building, a tent may be constructed over the work area, which may be kept under a negative pressure to control airborne particulates. Any radioactive gas release will be Kr-85, which is not readily captured. Whether the krypton is vented through the plant stack or allowed to be released directly depends on the plant operating requirements.

Following opening of the DSC, the cask and DSC are filled with water prior to lowering the top of the cask below the surface of the fuel pool to prevent a sudden inrush of pool water. Cask placement into the pool is performed in the usual manner. Fuel unloading procedures will be governed by the plant operating license under 10CFR50. The generic procedures for these operations are as follows:

14. Locate the DSC siphon and vent port using the indications on the outer top cover plate. Place a portable drill press on the top of the DSC. Position the drill with the siphon port.

15. Place an exhaust hood or tent over the DSC, if necessary. The exhaust should be filtered or routed to the site radwaste system.

    CAUTION: Radiation dose rates are expected to be high at the vent and siphon port locations. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

16. Drill a hole through the DSC top cover plates to expose the siphon port quick connect.

17. Drill a second hole through the top cover plates to expose the vent port quick connect.

18. Obtain a sample of the DSC atmosphere. Fill the DSC with water from the fuel pool through the siphon port with the vent port open and routed to the plant's off-gas system.

    CAUTION:

(a) The water fill rate must be regulated during this reflooding operation to ensure that the DSC vent pressure does not exceed 20.0 psig.

(b) Per Technical Specification *4.3.3*, provide for continuous hydrogen monitoring of the DSC cavity atmosphere during all subsequent cutting operations to ensure that a safety limit of 2.4% (60.0% of flammability limit of 4.0%) is not exceeded [8.3]. Purge with 2-3 psig helium as necessary to maintain the hydrogen concentration safely below this limit.

19. Place welding blankets around the cask and scaffolding to keep dose rates ALARA.

20. Using a mechanical cutting system or plasma arc-gouging, or other suitable means, remove the seal weld from the outer top cover plate and DSC shell. A fire watch should be

T.11.1.2 Extreme Temperatures

No change. The off-normal maximum ambient temperature of 125 °F is used in Section 8.1.2.2. For the NUHOMS®-61BTH system, a maximum ambient temperature of 117 °F is used. Therefore, the analyses in Section 8.1.2.2 bound TCs and Standardized HSM used in the NUHOMS®-61BTH system.

T.11.1.2.1 Postulated Cause of Event

No change to Section 8.1.2.2.

T.11.1.2.2 Detection of Event

No change to Section 8.1.2.2.

T.11.1.2.3 Analysis of Effects and Consequences

The thermal evaluation of the NUHOMS®-61BTH system for off-normal conditions is presented in Chapter T.4. The 100 ºF normal condition with insolation bounds the 117 ºF case without insolation for the DSC in the TC. Therefore the normal condition maximum temperatures are bounding. The 117 ºF case with the DSC in the HSM-H is not bounded by the normal conditions and therefore evaluated in Chapter T.4.

The NUHOMS® TC and the Standardized HSM were evaluated for a maximum heat load of 24 kW and maximum off-normal ambient temperature of 125 ºF. The maximum heat load of the 61BTH Type 1 DSC in the TC or the Standardized HSM is limited to 22 kW. Therefore the evaluations presented in Section 8.1.2.2 (for HSM Models 80/102) or in their respective appendices (for Models 152/202) are bounding for these components.

The structural evaluation of the 61BTH Type 2 DSC in HSM-H off-normal temperature conditions is presented in Section T.3.6.2.2. The structural evaluation of the basket due to off-normal thermal conditions is presented in Section T.3.6.1.3. The structural evaluation of HSM-H and OS197FC-B Transfer Cask for off-normal conditions with 61BTH DSC are presented in Section T.3.6.

As indicated in Section T.3.6, the structural evaluation of the HSM-HS and OS200/OS200FC Transfer Cask, as presented in Chapter U.3, Section U.3.6.2.3 and Chapter U.3, Section U.3.6.2.4, respectively, are not affected when loaded with the 61BTH DSC.

T.11.1.2.4 Corrective Actions

Restrictions for onsite handling of the transfer cask with a loaded DSC under extreme temperature conditions are presented in Technical Specifications *4.4.1*.A and *4.4.1*.B. There is no change to this requirement as a result of addition of the NUHOMS®-61BT DSC.

Table U.2-2
Thermal and Radiological Characteristics for Control Components Stored in the NUHOMS®-32PTH1 DSC

Parameter	***BPRAs, NSAs, CRAs, RCCAs, VSIs, Neutron Sources, and APSRAs***	***TPAs and ORAs***
Maximum Gamma Source (γ/sec/DSC)	*Per TS Table 1-1ee*	
Decay Heat (Watts/DSC)	*256*	*256*

Note: NSAs and Neutron Sources shall only be stored in the interior compartments of the basket. Interior compartments are those that are completely surrounded by other compartments, including the corners. There are twelve interior compartments in the 32PTH1 DSC.

Table U.2-3
PWR Fuel Assembly Design Characteristics for the NUHOMS®-32PTH1 DSC

Assembly Class		***B&W 15x15***	***WE 17x17***	***CE 15x15***	***WE 15x15***	***CE 14x14***	***WE 14x14***	***CE 16x16***
Maximum Unirradiated Length (in)[(1)]	*32PTH1-S*	*162.6*	*162.6*	*162.6*	*162.6*	*162.6*	*162.6*	*162.6*
	32PTH1-M	*170.0*	*170.0*	*170.0*	*170.0*	*170.0*	*170.0*	*170.0*
	32PTH1-L	*178.3*	*178.3*	*178.3*	*178.3*	*178.3*	*178.3*	*178.3*
Fissile Material		UO_2	UO_2	UO_2	UO_2	UO_2	UO_2	UO_2
Maximum MTU/Assembly		*0.492*	*0.492*	*0.492*	*0.492*	*0.492*	*0.492*	*0.492*
Maximum Number of Fuel Rods		*208*	*264*	*216*	*204*	*176*	*179*	*236*

Notes:

(1) Maximum Assembly + Control Component Length (unirradiated).

Proprietary Information on This Page
Withheld Pursuant to 10 CFR 2.390

U.8.1 Procedures for Loading the Cask

U.8.1.1 Preparation of the TC and DSC

1. Prior to placement in dry storage, the candidate intact, damaged fuel, and failed fuel assemblies shall be evaluated (by plant records or other means) to verify that they meet the physical, thermal and radiological criteria specified in Technical Specification 2.1. Depending on the length of the fuel assemblies to be loaded, fuel spacers may be placed within the DSC to reduce the fuel assembly/DSC cavity gap in consideration of Part 71 requirements. There are no requirements for fuel spacers under Part 72. Fuel spacers, if used, may be placed below the assembly, above the assembly, or both, and shall be evaluated for any adverse impact.

2. Prior to being placed in service, the TC is to be cleaned or decontaminated as necessary to insure a surface contamination level of less than those specified in Technical Specification *3.3.1*.

3. Place the TC in the vertical position in the cask decon area using the cask handling crane and the TC lifting yoke.

4. Place scaffolding around the cask so that the transfer cask top cover plate and surface of the cask are easily accessible to personnel.

5. Remove the TC top cover plate and examine the cask cavity for any physical damage and ready the cask for service.

6. Examine the DSC for any physical damage which might have occurred since the receipt inspection was performed. The DSC is to be cleaned and any loose debris removed.

7. Record the DSC serial number which is located on the grapple ring. Verify the correct DSC type, basket type and poison material types against the DSC serial number. Verify that the DSC is appropriate for the specific fuel loading campaign per the criteria specified in Technical Specification 2.1.

8. Using a crane, lower the DSC into the cask cavity by the internal lifting lugs and rotate the DSC to match the cask and DSC alignment marks.

9. If damaged fuel assemblies are included in a specific loading campaign, place the required number of bottom end caps provided (up to a maximum of 16) into the cell locations per Technical Specification 2.1. Optionally, this step may be performed at any prior time.

10. Fill the cask/DSC annulus with clean, demineralized water. Place the inflatable seal into the upper cask liner recess and seal the cask-DSC annulus by pressurizing the seal with compressed air.

    10a. If failed fuel is to be loaded in the DSC, place the empty failed fuel cans (refer to Appendix U.1, drawing NUH32PTH1-1006-SAR) in the appropriate locations in the

4. Disengage the lifting yoke from the cask lifting trunnions and move the yoke clear of the cask. Spray the lifting yoke with clean demineralized water if it is raised out of the fuel pool.

5. The potential for fuel misloading is essentially eliminated through the implementation of procedural and administrative controls. The controls instituted to ensure that failed/damaged and/or intact fuel assemblies and control components (CCs), if applicable, are placed into a known cell location within a DSC, will typically consist of the following:

   - A cask/DSC loading plan is developed to verify that the damaged and/or intact fuel assemblies, and CCs, if applicable, meet the burnup, enrichment and cooling time parameters of Technical Specification 2.1.
   - The loading plan is independently verified and approved before the fuel load.
   - A fuel movement schedule is then written, verified and approved based upon the loading plan. All fuel movements from any rack location are performed under strict compliance of the fuel movement schedule.
   - If loading damaged fuel assemblies, verify that the required number of bottom end caps are installed in appropriate fuel compartment tube locations before fuel load.
   - If loading failed fuel, verify that the required number of failed fuel cans are installed in the appropriate locations (refer to drawing NUH32PTH1-1006-SAR), or, once loaded with fuel, are installed in the appropriate locations in the basket.

6. Prior to loading of a spent fuel assembly (and CCs, if applicable) into the DSC, the identity of the assembly (and CCs, if applicable) is to be verified by two individuals using an underwater video camera or other means. Verification of CC identification is optional if the CC has not been moved from the host fuel assembly since its last verification. Read and record the identification number from the fuel assembly (and CCs, if applicable) and check this identification number against the DSC loading plan which indicates which fuel assemblies (and CCs, if applicable) are acceptable for dry storage.

7. Position the fuel assembly for insertion into the selected DSC storage cell and load the fuel assembly. Repeat Step 6 and 7 for each SFA loaded into the DSC. A maximum of 16 damaged fuel assemblies or 16 failed fuel assemblies may be loaded into the basket per Technical Specification 2.1. After the DSC has been fully loaded, check and record the identity and location of each fuel assembly and CCs, if applicable, in the DSC. If loading damaged fuel assemblies, place top end caps over each damaged fuel assembly placed into the basket. If loading failed fuel, ensure that the failed fuel can lids are installed.

8. After all the SFAs and CCs, if applicable, have been placed into the DSC and their identities verified, position the lifting yoke and the top shield plug and lower the shield plug onto the DSC. Note that separate rigging may be used to install the shield plug prior to engaging the trunnions with the lifting yoke.

   CAUTION: Verify that all the lifting height restrictions as a function of temperature specified in Technical Specification *4.4.1.*A can be met in the following steps which involve lifting of the TC.

9. Visually verify that the top shield plug is properly seated onto the DSC.

10. Position the lifting yoke with the TC trunnions and verify that it is properly engaged.

10a. From this point, until the DSC has been inserted into the HSM, the DSC will be inspected for damage after any TC drop of 15 inches or greater.

11. Raise the TC to the pool surface. Prior to raising the top of the cask above the water surface, stop vertical movement.

12. Inspect the top shield plug to verify that it is properly seated onto the DSC. If not, lower the cask and reposition the top shield plug. Repeat Steps 8 through 12 as necessary.

13. Continue to raise the TC from the pool and spray the exposed portion of the cask with water until the top region of the cask is accessible.

14. Drain any excess water from the top of the DSC shield plug back to the fuel pool.

15. Check the radiation levels at the center of the top shield plug and around the perimeter of the cask. Disconnect the top shield plug rigging.

16. Drain a minimum of 50 gallons of water from the DSC cavity. Optionally, up to approximately 900 gallons of water (as indicated by the flowmeter) may be drained from the DSC back into the pool or other suitable location to meet the weight limit on the crane. Use 1 to 3 psig of helium to backfill the DSC with helium per ISG-22 [8.5] guidance and Technical Specification 3.1.1 as water is being removed from the DSC cavity.

17. Lift the TC from the fuel pool. As the cask is raised from the pool, continue to spray the cask with water and decon as directed. Provisions shall be made to assure that air will not enter the DSC cavity. One way to achieve this is by replenishing the helium in the DSC cavity during cask movement from the fuel pool to the decon area in case of malfunction of equipment used for cask movement.

18. Move the TC with loaded DSC to the cask decon area.

18a. Replace the water removed from the DSC cavity in Step 16 with water from the fuel pool or an equivalent source which meets the requirements of Technical Specifications 3.2.1.

19. If applicable to keep the occupational exposure ALARA, temporary shielding may be installed as necessary to minimize personnel exposure. Install cask seismic restraints if required by *CoC Appendix A Inspections, Tests, and Evaluations Item 3.1.7* (required only on plant specific basis).

U.8.1.3 DSC Drying and Backfilling

CAUTION: During performance of steps listed in Section U.8.1.3, monitor the TC/DSC annulus water level and replenish as necessary to maintain cooling.

1. Check the radiation levels along the perimeter of the cask. The cask exterior surface should be decontaminated as necessary. Temporary shielding may be installed as necessary to minimize personnel exposure.

2. Place scaffolding around the cask so that any point on the surface of the cask is easily accessible to personnel.

3. Disengage the rigging cables from the top shield plug and remove the eyebolts. Disengage the lifting yoke from the trunnions and position it clear of the cask.

4. Decontaminate the exposed surfaces of the DSC shell perimeter and remove the inflatable TC/DSC annulus seal.

4a. In accordance with Technical Specification *4.3.2*, verify that the neutron shield (NS) is filled before the draining operation in Step 5 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

5. Connect the cask drain line to the cask, open the cask cavity drain port and allow water from the annulus to drain out until the water level is approximately twelve inches below the top edge of the DSC shell. Take swipes around the outer surface of the DSC shell and check for smearable contamination in accordance with the Technical Specification *3.3.1* limits.

   CAUTION: Radiation dose rates are expected to be high at the vent and siphon port locations. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

5a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 6 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

6. Drain approximately 900 gallons of water (as indicated on a flowmeter) from the DSC back into the fuel pool or other suitable location, if not drained in Section U.8.1.2, Step 16. Consistent with ISG-22 [8.5] guidance and Technical Specification 3.1.1, helium at 1-3 psig is used to backfill the DSC with an inert gas as water is being removed from the DSC.

7. Not used.

8. Install the automatic welding machine onto the inner top cover plate and place the inner top cover plate with the automatic welding machine onto the DSC. Optionally, the inner top cover plate and the automatic welding machine can be placed separately. Verify proper fit-up of the inner top cover plate with the DSC shell.

9. Check radiation levels along surface of the inner top cover plate. Temporary shielding may be installed as necessary to minimize personnel exposure.

10. Insert a 1/4-inch tubing of sufficient length and adequate temperature resistance through the vent port such that it terminates just below the DSC shield plug. Connect the flexible tubing to a hydrogen monitor to allow continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner cover plate, in compliance with Technical Specification *4.3.3*. Optionally, other methods may be used for continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner top cover plate, to comply with the Technical Specification.

11. Cover the cask/DSC annulus to prevent debris and weld splatter from entering the annulus.

12. Ready the automatic welding machine and tack weld the inner top cover plate to the DSC shell. Install the inner top cover plate weldment and remove the automatic welding machine.

    CAUTION: Continuously monitor the hydrogen concentration in the DSC cavity using the arrangement or other alternate methods described in Step 10 during the inner top cover plate cutting/welding operations. Verify that the measured hydrogen concentration does not exceed a safety limit of 2.4% [8.2 and 8.3] (60.0% of flammability limit of 4.0%). If this limit is exceeded, stop all welding operations and purge the DSC cavity with approximately 2-3 psig helium via the tubing to reduce the hydrogen concentration safely below the 2.4% limit.

13. Perform dye penetrant weld examination of the inner top cover plate weld in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

14. Remove purge lines and connect the VDS to the DSC siphon and vent ports.

15. Install temporary shielding to minimize personnel exposure throughout the subsequent welding operations as required.

15a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 16 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

16. a. If using blowdown method to remove water, engage helium supply (up to 15 psig) and open the valve on the vent port and allow helium to force the water from the DSC cavity through the siphon port. Use of helium is required per Technical Specification 3.1.1.

    b. Alternatively a suction pump may be used to remove water from DSC.

17. Once the water stops flowing from the DSC, close the DSC siphon port and disengage the helium source or turn off the section pump, as applicable.

17a. Verify that the TC axial surface dose rates are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. The configuration for determining the TC axial dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

18. Connect the hose from the vent port and the siphon port to the intake of the vacuum pump. Connect a hose from the discharge side of the VDS to the plant's radioactive waste system or spent fuel pool. Connect the VDS to a helium source.

    Note: Proceed cautiously when evacuating the DSC to avoid freezing consequences.

    CAUTION: During the vacuum drying evolution, personnel should be in the area of loading operations, or in nearby low dose areas in order to take proper action in the event of a malfunction.

19. Open the valve on the suction side of the pump, start the VDS and draw a vacuum on the DSC cavity. The cavity pressure should be reduced in steps of approximately 100 mm Hg, 50 mm Hg, 25 mm Hg, 15 mm Hg, 10 mm Hg, 5 mm Hg, and 3 mm Hg. After pumping down to each level (these levels are optional), the pump is valved off and the cavity pressure monitored. The cavity pressure will rise as water and other volatiles in the cavity evaporate. When the cavity pressure stabilizes, the pump is valved in to complete the vacuum drying process. It may be necessary to repeat some steps, depending on the rate and extent of the pressure increase. Vacuum drying is complete when the pressure stabilizes for a minimum of 30 minutes at 3 mm Hg absolute or less as specified in Technical Specification 3.1.1.

    Note: The user shall ensure that the vacuum pump is isolated from the DSC cavity when demonstrating compliance with Technical Specification 3.1.1 requirements. Simply closing the valve between the DSC and the vacuum pump is not sufficient, as a faulty valve allows the vacuum pump to continue to draw a vacuum on the DSC. Turning off the pump, or opening the suction side of the pump to atmosphere are examples of ways to assure that the pump is not continuing to draw a vacuum on the DSC.

CAUTION: Radiation dose rates are expected to be high at the vent and siphon port locations. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

20. Open the valve to the vent port and allow the helium to flow into the DSC cavity.
21. Pressurize the DSC with helium up to 0 to 15 psig.
22. Helium leak test the inner top cover plate weld for a leak rate of 1 x 10^{-4} atm-cm^3 /sec. This test is optional.
23. If a leak is found, repair the weld, repressurize the DSC and repeat the helium leak test.
24. Once no leaks are detected, depressurize the DSC cavity by releasing the helium through the VDS to the plant's spent fuel pool or radioactive waste system.
25. Re-evacuate the DSC cavity using the VDS. The cavity pressure should be reduced in steps of approximately 10 mm Hg, 5 mm Hg, and 3 mm Hg. After pumping down to each level, the pump is valved off and the cavity pressure is monitored level (these levels are optional). When the cavity pressure stabilizes, the pump is valved in to continue the vacuum drying process. Vacuum drying is complete when the pressure stabilizes for a minimum of 30 minutes at 3 mm Hg absolute or less in accordance with Technical Specification 3.1.1 limits.

    Note: The user shall ensure that the vacuum pump is isolated from the DSC cavity when demonstrating compliance with Technical Specification 3.1.1 requirements. Simply closing the valve between the DSC and the vacuum pump is not sufficient, as a faulty valve allows the vacuum pump to continue to draw a vacuum on the DSC. Turning off the pump, or opening the suction side of the pump to atmosphere are examples of ways to assure that the pump is not continuing to draw a vacuum on the DSC.
26. Open the valve on the vent port and allow helium to flow into the DSC cavity to pressurize the DSC between 18.5 and 20.0 psig and hold for 10 min. Depressurize the DSC cavity by releasing the helium through the VDS to the plant spent fuel pool or radioactive waste system to about 2.5 psig in accordance with Technical Specification 3.1.2.b limits.

    CAUTION: Radiation dose rates are expected to be high at the vent and siphon port locations. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.
27. Close the valves on the helium source.

U.8.1.4 DSC Sealing Operations

CAUTION: During performance of steps listed in Section U.8.1.4, monitor the Cask/DSC annulus water level and replenish as necessary to maintain cooling.

1. Disconnect the VDS from the DSC. Seal weld the prefabricated plugs over the vent and siphon ports. Inject helium into blind space just prior to completing welding, and perform a dye penetrant weld examination in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements. Use of an optional test head is acceptable to perform the helium leak test of

the inner top cover plate and vent/siphon port welds in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1*. If an optional test head is not used, proceed to Step 2.

2. Temporary shielding may be installed as necessary to minimize personnel exposure. Install the automatic welding machine onto the outer top cover plate and place the outer top cover plate with the automatic welding system onto the DSC. Optionally, outer top cover plate may be installed separately from the welding machine. Verify proper fit up of the outer top cover plate with the DSC shell.

3. Tack weld the outer top cover plate to the DSC shell. Place the outer top cover plate weld root pass.

4. Helium leak test the inner top cover plate and vent/siphon port plate welds using the leak test port in the outer top cover plate in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1* limits. Verify that the personnel performing the leak test are qualified in accordance with SNT-TC-1A [8.4]. Alternatively this can be done with a test head in step 1 of Section U.8.1.4.

5. If a leak is found, remove the outer cover plate root pass (if not using test head), the vent and siphon port plugs and repair the inner cover plate welds. Repeat procedure steps from U.8.1.3 Step 19.

6. Perform dye penetrant examination of the root pass weld. Weld out the outer top cover plate to the DSC shell and perform dye penetrant examination on the weld surface in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

7. Install and seal weld the prefabricated plug, if applicable, over the outer cover plate test port and perform dye penetrant weld examinations in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirement.

8. Remove the automatic welding machine from the DSC.

8a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 9 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

9. Open the cask drain port valve and drain the water from the cask/DSC annulus.

   CAUTION: Monitor the applicable time limits of Technical Specification 3.1.3 until the completion of DSC transfer Step 15 of Section U.8.1.6.

   If the TC is in a horizontal orientation on the transfer skid, and the required time limit for completion of a DSC transfer specified in Technical Specification 3.1.3 are not met, initiate air circulation in the TC/DSC annulus by starting one of the blowers provided on the transfer skid and continue blower operation for a minimum duration of 36 hours.

   When transfer operations are ready to continue secure air circulation and either complete the DSC insertion OR return the TC/DSC to an upright configuration and fill with clean demineralized water within the applicable time limits of Technical Specification 3.1.3.

10. Rig the cask top cover plate and lower the cover plate onto the TC.

11. Bolt the cask cover plate into place, tightening the bolts to the required torque in a star pattern.

12. Verify that the TC radial dose rates measured at the surface of the Transfer Cask are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. The configuration for determining the TC radial surface dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

2. Inspect the HSM air inlet and outlets to ensure that they are clear of debris. Inspect the screens on the air inlet and outlets for damage.

   CAUTION: Verify that the requirements of Technical Specification *4.4.1*.B "TC/DSC Transfer Operations at High Ambient Temperatures (32PTH1 DSC only)" are met prior to next step.

3. Using a suitable vehicle, transfer the cask from the plant's fuel/reactor building to the ISFSI along the designated transfer route.

4. Once at the ISFSI, position the transfer trailer to within a few feet of the HSM.

5. Check the position of the trailer to ensure the centerline of the HSM and cask approximately coincide. If the trailer is not properly oriented, reposition the trailer, as necessary.

6. Using crane, unbolt and remove the cask top cover plate.

   CAUTION: Verify that the applicable time limits of Technical Specification 3.1.3 are met.

7. Back the transfer trailer to within a few inches of the HSM, set the trailer brakes and disengage the tractor. Drive the tractor clear of the trailer. Extend the transfer trailer vertical jacks.

8. Connect the skid positioning system hydraulic power unit to the positioning system via the hose connector panel on the trailer, and power it up. Remove the skid tie-down bracket fasteners and use the skid positioning system to bring the cask into approximate vertical and horizontal alignment with the HSM. Using optical survey equipment and the alignment marks on the cask and the HSM, adjust the position of the cask until it is properly aligned with the HSM.

9. Using the skid positioning system, fully insert the cask into the HSM access opening docking collar.

10. Secure the cask trunnions to the front wall embedments of the HSM using the cask restraints.

11. After the cask is docked with the HSM, verify the alignment of the TC using the optical survey equipment.

12. Position the hydraulic ram behind the cask in approximate horizontal alignment with the cask and level the ram. Remove either the bottom ram access cover plate or the outer plug of the two-piece temporary shield plug if installed. Power up the ram hydraulic power supply and extend the ram through the bottom cask opening into the DSC grapple ring.

13. Activate the hydraulic cylinder on the ram grapple and engage the grapple arms with the DSC grapple ring.

14. Recheck all alignment marks and ready all systems for DSC transfer. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

    If the alignment tolerance is exceeded, the following actions should be taken:

    a. Confirm that the transfer system is properly configured,

    b. Check and repair the alignment equipment, or

    c. Confirm the locations of the alignment targets on the TC and HSM.

15. Activate the hydraulic ram to initiate insertion of the DSC into the HSM. Stop the ram when the DSC reaches the support rail stops at the back of the module.

16. Disengage the ram grapple mechanism so that the grapple is retracted away from the DSC grapple ring.

17. Retract and disengage the hydraulic ram system from the cask and move it clear of the cask. Remove the cask restraints from the HSM.

18. Using the skid positioning system, disengage the cask from the HSM access opening.

19. Install the DSC axial in retainer through the HSM door opening.

20. Install the HSM door using a portable crane and secure it in place. Door may be welded for security. Verify that the HSM dose rates are compliant with the limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Items 3.3.1 and 3.3.2*.

21. Replace the TC top cover plate. Secure the skid to the trailer, retract the vertical jacks and disconnect the skid positioning system.

22. If this is the final loading, fully drain the liquid neutron shield.

23. Tow the trailer and cask to the designated equipment storage area. Return the remaining transfer equipment to the storage area.

24. Close and lock the ISFSI access gate and activate the ISFSI security measures.

25. Ensure the HSM-H maximum air exit temperature requirements of *CoC Appendix A Inspections, Tests, and Evaluations Item 4.4* are met.

U.8.1.7 <u>Monitoring Operations</u>

1. Perform routine security surveillance in accordance with the licensee's ISFSI security plan.

2. Perform **one** of the two alternate daily surveillance activities listed below:

    a. A daily visual surveillance of the HSM air inlets and outlets to insure that no debris is obstructing the HSM vents in accordance with Technical Specification *3.1.4*.a requirements.

b. A temperature measurement of the thermal performance, for each HSM, on a daily basis in accordance with Technical Specification *3.1.4.*b requirements.

U.8.2 Procedures for Unloading the Cask

U.8.2.1 DSC Retrieval from the HSM

1. Ready the TC, transfer trailer, and support skid for service and tow the trailer to the HSM.

2. Back the trailer to within a few feet of the HSM and remove the cask top cover plate.

   CAUTION: High dose rates are expected in the HSM cavity after removal of HSM door. Proper ALARA practices should be followed.

3. Remove the HSM door using a crane. Remove the DSC axial retainer.

4. Continue to back the transfer trailer within a few inches of the HSM. Using the skid positioning system align the cask with the HSM and position the skid until the cask is docked with the HSM access opening.

5. Using optical survey equipment, verify alignment of the cask with respect to the HSM. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

   If the alignment tolerance is exceeded, the following actions should be taken:

   a. Confirm that the transfer system is properly configured,

   b. Check and repair the alignment equipment, or

   c. Confirm the locations of the alignment targets on the TC and HSM.

5a. Install the cask restraints.

6. Install (if required) and align the hydraulic ram with the cask.

7. Extend the ram through the cask into the HSM until it is inserted in the DSC grapple ring.

8. Activate the arms on the ram grapple mechanism with the DSC grapple ring.

8a. From this point, until fuel has been removed from the DSC or the DSC has been removed from the TC, the DSC will be inspected for damage after any TC drop of 15 inches or greater.

9. Retract ram and pull the DSC into the cask.

10. Retract the ram grapple arms.

11. Disengage the ram from the cask. Install the ram access penetration cover plate.

12. Remove the cask restraints.

13. Using the skid positioning system, disengage the cask from the HSM.

14. Install the cask top cover plate and ready the trailer for transfer.

15. Replace the door on the HSM.

U.8.2.2 Removal of Fuel from the DSC

When the DSC has been removed from the HSM, there are several potential options for off-site shipment of the fuel. It is preferred to ship the DSC intact to a reprocessing facility, monitored retrievable storage facility or permanent geologic repository in a compatible shipping cask licensed under 10CFR71.

If it becomes necessary to remove fuel from the DSC prior to off-site shipment, there are two basic options available at the ISFSI or reactor site. The fuel assemblies could be removed and use of prudent housekeeping measures and monitoring of airborne particulates. Procedures may require personnel to perform the work using respirators or supplied air.

If fuel needs to be removed from the DSC, either at the end of service life or for inspection after an accident, precautions must be taken against the potential for the presence of damaged or oxidized fuel and to prevent radiological exposure to personnel during this operation. A sampling of the atmosphere within the DSC will be taken prior to inspection or removal of fuel.

This can be achieved with this design by the use of the purge and fill valves which permit a determination of the atmosphere within the DSC before the removal of the inner top cover and shield plugs, prior to filling the DSC cavity with water (borated water for the 32PTH1). If the atmosphere within the DSC is helium and radioactivity check of the atmosphere in the DSC cavity did not detect the presence of any airborne radioactive particulates, then operations should proceed normally with fuel removal either via the TC or in the pool, if available. However, if air or airborne radioactive particulates are present within the DSC, then appropriate filters should be in place to preclude the uncontrolled release of any potential airborne radioactive particulate from the DSC via the purge-fill valves. This will protect both personnel and the operations area from potential contamination. For the accident case, personnel protection in the form of respirators or supplied air should be considered in accordance with licensee's Radiation Protection Program.

If the work is performed outside the fuel/reactor building, a tent may be constructed over the work area, which may be kept under a negative pressure to control airborne particulates. Any radioactive gas release will be Kr-85, which is not readily captured. Whether the krypton is vented through the plant stack or allowed to be released directly depends on the plant operating requirements.

Following opening of the DSC, the cask and DSC are filled with water prior to lowering the top of cask below the surface of the fuel pool to prevent a sudden inrush of pool water. Cask placement into the pool is performed in the usual manner. Fuel unloading procedures will be governed by the plant operating license under 10CFR50. The generic procedures for these operations are as follows:

14. Locate the DSC siphon and vent port using the indications on the top cover plate. Place a portable drill press on the top of the DSC. Position the drill with the siphon port.

15. Place an exhaust hood or tent over the DSC, if necessary. The exhaust should be filtered or routed to the site radwaste system.

    CAUTION: Radiation dose rates are expected to be high at the vent and siphon port location. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

16. Drill a hole through the DSC top cover plate to expose the siphon port quick connect.

17. Drill a second hole through the top cover plate to expose the vent port quick connect.

18. Obtain a sample of the DSC atmosphere. Fill the DSC with water from the fuel pool or an equivalent source which meets the requirements of Technical Specification *3.2.1*. Fill through the siphon port with the vent port open and routed to the plant's off-gas system.

CAUTION:

(a) The water fill rate must be regulated during this reflooding operation to ensure that the DSC vent pressure does not exceed 20.0 psig.

(b) Per Technical Specification *4.3.3*, provide for continuous hydrogen monitoring of the DSC cavity atmosphere during all subsequent cutting operations to ensure that a safety limit of 2.4% (60.0% of flammability limit of 4.0%) is not exceeded [8.2 and 8.3]. Purge with 2-3 psig helium as necessary to maintain the hydrogen concentration safely below this limit.

19. Place welding blankets around the cask and scaffolding to keep dose rates ALARA.

U.11.1.2 Extreme Temperatures

No change. The off-normal maximum ambient temperature of 125 °F is used in UFSAR Section 8.1.2.2. For the NUHOMS® 32PTH1 system, a maximum ambient temperature of 117 °F is used. Chapter U.3, Section U.3.4.4.3 summarizes the thermal analysis for the 32PTH1 DSC, HSM-H (HSM-HS) and OS200 TC.

U.11.1.2.1 Postulated Cause of Event

No change. See UFSAR Section 8.1.2.2.

U.11.1.2.2 Detection of Event

No change. See UFSAR Section 8.1.2.2.

U.11.1.2.3 Analysis of Effects and Consequences

The thermal evaluation of the NUHOMS® 32PTH1 system for off-normal conditions is presented in Chapter U.4. The 106 ºF normal condition with insolation bounds the 117 ºF case without insolation for the DSC in the TC. Therefore the normal condition maximum temperatures are bounding. The 117 ºF case with the DSC in the HSM-H is not bounded by the normal conditions and therefore evaluated in Chapter U.4.

The structural evaluation of the 32PTH1 DSC for off-normal temperature conditions is presented in Chapter U.3, Section U.3.6.2.2. The structural evaluation of the basket due to off-normal thermal conditions is presented in Chapter U.3, Section U.3.6.1.3. The structural evaluation of HSM-H and OS200 Transfer Cask for off-normal conditions with 32PTH1 DSC are presented in Chapter U.3, Section U.3.6.2.3 and Chapter U.3, Section U.3.6.2.4, respectively.

U.11.1.2.4 Corrective Actions

Restrictions for onsite handling of the TC with a loaded DSC under extreme temperature conditions are presented in Technical Specifications *4.4.1*.A and *4.4.1*.B.

U.11.1.3 Off-Normal Releases of Radionuclides

The NUHOMS® 32PTH1 DSC is designed and tested to the leak tight criteria of ANSI N14.5 [11.2]. Therefore the estimated quantity of radionuclides expected to be released annually to the environment due to normal or off-normal events is zero.

U.11.1.3.1 Postulated Cause of Event

In accordance with the Standard Review Plan, NUREG-1536 [11.3] and ISG-5 Rev. 1 [11.4] for off-normal conditions, it is conservatively assumed that 10% of the fuel rods fail.

U.11.1.3.2 Detection of Event

Failed fuel rods would go undetected, but are not a safety concern since the canister is designed and tested to the leak tight criteria of ANSI N14.5 [11.2].

Cask Support Skid: The OS197L TC support skid differs from the OS197 TC support skid shown in UFSAR Figure 1.3-8 as described below:

1. The OS197L TC support skid has permanently mounted 2.5" thick side shielding and accommodates an additional 3" thick side shielding bolted to the permanent shielding when transferring the OS197L TC.

2. The OS197L TC support skid also has a 2.5" shielding inner top cover and an additional 3" shielding outer top cover to shield the upper sections of the cask.

The OS197L TC support skid utilized for the standardized NUHOMS® system is illustrated in Figure W.1-3.

Hydraulic Ram: The high capacity hydraulic ram system is similar to the hydraulic ram system described in the UFSAR. The capacity of this ram is increased in order to increase the ram capacity margin (and to accommodate other future DSC designs). There is no change to the maximum ram forces allowed (80 kips) during system operation.

A picture of the OS197L TC system is provided in Figure W.1-4.

W.1.2.2 Operational Features

The primary operations with the OS197L TC (in sequence of occurrence) for the NUHOMS® system are the same as the systems operation described in Section 1.3.3 of the UFSAR except as noted below for operations 8 and 13 (of Section 1.3.3):

Lifting Cask from Pool: The loaded OS197L TC is lifted out of the pool for placement (in the vertical position) in a decontamination area shield on the drying pad in the decon pit. During bare cask movement from the fuel pool to the decontamination area, remote crane operations in conjunction with laser/optical targeting and cameras or other similar equipment for confirmation of the cask locations are to be used to minimize personnel exposure due to the reduced shielding configuration of the OS197L TC during this transit movement. The licensee shall meet the specific radiation protection program requirements associated with the use of OS197L TC as specified in applicable Technical Specification *4.3.2*.

The cask is then placed inside the decontamination area lower shield and the upper shield or bell is then placed on top (see Figure W.1-2).

Placement of Cask on Transfer Trailer Skid: The OS197L TC is then lifted onto the cask support skid. The plant's crane is used to downend the cask from a vertical to a horizontal position. The inner top skid shielding is added to the skid and the cask is also covered with an additional outer top shielding. The outer top additional skid shielding is to be installed inside the fuel handling building if the floor loads can accommodate it (if floor loading is a concern, the outer top trailer shielding may be placed on the skid outside the fuel handling building). The cask is then secured to the skid and readied for the subsequent transfer operations.

W.8 Operating Systems

The following is a description of the operational sequences for use of the OS197L TC. In general, the steps are similar to those for the OS197 TC, described in detail in Appendix K.8 or M.8 of the UFSAR. This chapter consolidates these procedures and includes the differences in operational steps when using OS197L TC relative to the OS197 TC. Figures are provided to illustrate the differences in operational steps.

Notes: A general licensee shall meet the requirements of applicable *CoC Conditions (such as II.3.b)* prior to the use of OS197L TC for onsite transfer of an authorized payload.

The generic term "DSC" used throughout this chapter may be the 61BT or 32PT DSC. The term "cask" or "TC" is used for the OS197L TC.

<u>Discussion of Similarities and Differences Between Use of the OS197 TC and OS197L TC Systems:</u>

Placement of the DSC into the OS197L TC and preparations for placement of the TC into the fuel pool are the same as for the OS197 TC. The DSC/TC annulus is filled with clean water and sealed with the annulus seal. The TC neutron shield is also filled with clean demineralized water. The DSC may be filled with fuel pool water either prior to lowering OS197L TC into the pool, or the OS197L TC lowered to within a few feet of submergence and the DSC filled at that time. The OS197L TC with DSC is then lowered to the fuel pool bottom and landed, and the yoke removed. Sequence 1 below shows the cask as it enters the pool.

accomplished. They are not intended to be limiting, in that the licensee may evaluate that alternate acceptable means are available to accomplish the same operational objective.

W.8.1.1 Preparation of the TC and DSC

1. Prior to placement in dry storage, the candidate intact and damaged fuel assemblies shall be evaluated (by plant records or other means) to verify that they meet the physical, thermal and radiological criteria specified in Technical Specification 2.1.

2. Prior to being placed in service, the TC is to be cleaned or decontaminated as necessary to insure a surface contamination level of less than those specified in Technical Specification *3.3.1*.

3. Place the TC in the vertical position in the cask decon area using the cask handling crane and the TC lifting yoke.

4. Place scaffolding around the cask so that the transfer cask top cover plate and surface of the cask are easily accessible to personnel.

5. Remove the TC top cover plate and examine the cask cavity for any physical damage and ready the cask for service.

6. Examine the DSC for any physical damage which might have occurred since the receipt inspection was performed. The DSC is to be cleaned and any loose debris removed.

7. Record the DSC serial number which is located on the grapple ring. Verify the correct DSC type, basket type and poison material types against the DSC serial number. Verify that the DSC is appropriate for the specific fuel loading campaign per the criteria specified in Technical Specification 2.1.

8. Using a crane, lower the DSC into the cask cavity by the internal lifting lugs and rotate the DSC to match the cask and DSC alignment marks.

9. If damaged fuel assemblies are included in a specific loading campaign, place the required number of bottom end caps provided into the cell locations per Technical Specification 2.1. Optionally, this step may be performed at any prior time.

10. Fill the cask/DSC annulus with clean, demineralized water. Place the inflatable seal into the upper cask liner recess and seal the cask-DSC annulus by pressurizing the seal with compressed air.

    For the 32PT DSC, fill the DSC cavity with water from the fuel pool, or an equivalent source which meets the requirements of Technical Specification 3.2.1.

11. For the 61BT DSC, fill the DSC cavity with water from the fuel pool, an equivalent source, or demineralized water. (Note: this step may be accomplished in the fuel pool).

    NOTE: A TC/DSC annulus pressurization tank filled with demineralized water as described above is connected to the top vent port of the TC via a hose to provide a positive head above the level of water in the TC/DSC annulus. This is an optional arrangement, which provides additional assurance that contaminated water from the fuel pool will not enter the TC/DSC annulus, provided a positive head is maintained at all times.

12. If not done previously, place the top shield plug onto the DSC and examine the top shield plug to ensure a proper fit. The top shield plug, once fitted is removed and disconnected from the yoke.

13. Position the cask lifting yoke above the transfer cask and engage the cask lifting trunnions and the rigging cables to the DSC top shield plug. Adjust the rigging cables as necessary to obtain even cable tension.

14. Visually inspect the yoke lifting hooks to insure that they are properly positioned and engaged on the cask lifting trunnions.

15. Provide for later connection to the vacuum drying system (VDS) or an optional water draining/pumping device to the siphon port of the DSC and position any connecting hose such that the hose will not interfere with loading (yoke, fuel, shield plug, rigging, etc.). A flowmeter or other suitable means for measuring the amount of water removed must be installed at a suitable location as part of this water removal system.

16. Move the scaffolding away from the cask as necessary.

17. Lift the cask just far enough to allow the weight of the cask to be distributed onto the yoke lifting hooks. Reinspect the lifting hooks to insure that they are properly positioned on the cask trunnions.

18. a. Optionally, secure a sheet of suitable material to the bottom of the TC to minimize the potential for ground-in contamination. This may also be done prior to initial placement of the cask in the decon area.

    b. Fill the TC liquid neutron shield with demineralized water. This step may be completed at any time prior to immersion of the TC/DSC into the pool.

19. Prior to the cask being lowered into the fuel pool, the water level in the pool should be adjusted as necessary to accommodate the cask/DSC volume. If the water placed in the DSC cavity was obtained from the fuel pool, a level adjustment may not be necessary.

W.8.1.2 DSC Fuel Loading

Note: The licensee shall verify that the lifting device used for handling the OS197L TC meets the requirements of the sites lifting program. Licensee shall use remote operations and optical targeting system and other mitigating ALARA practices when handling the bare OS197L TC when loaded with fuel as required by the sites ALARA program and the Radiation Protection Program requirements of Technical Specification *4.3.2*.

1. Lift the cask/DSC and position it over the cask loading area of the spent fuel pool in accordance with the plant's 10CFR50 cask handling procedures.

top shield plug and lower the shield plug onto the DSC. Note that separate rigging may be used to install the shield plug prior to engaging the trunnions with the lifting yoke.

CAUTION: Verify that all the lifting height restrictions as a function of temperature specified in Technical Specification *4.4.1.*A. can be met in the following steps which involve lifting of the TC.

10. Visually verify that the top shield plug is properly seated onto the DSC.

11. Position the lifting yoke with the TC trunnions and verify that it is properly engaged.

11a. From this point, until the DSC has been inserted into the HSM, the DSC will be inspected for damage after any TC drop of 15 inches or greater.

12. Raise the TC to the pool surface. Prior to raising the top of the cask above the water surface, stop vertical movement.

13. Inspect the top shield plug to verify that it is properly seated onto the DSC. If not, lower the cask and reposition the top shield plug. Repeat Steps 9 through 13 as necessary.

14. Continue to raise the TC from the pool until the top region of the cask is accessible and spray the exposed portion of the cask with water.

15. Drain any excess water from the top of the DSC shield plug back to the fuel pool.

16. Take a preliminary measurement of the OS197L TC dose rates at 3 feet from the top of the cask with the shield plug installed and water in the DSC cavity.

16a. Disconnect the top shield plug rigging from the shield plug.

CAUTION: Prior to the next step, evacuate personnel from the area, as specified by plant's ALARA practices, due to the high cask dose rates. Crane operations shall be performed remotely and an optical targeting system with remote camera monitoring shall be used to minimize personnel exposure.

CAUTION: The surface dose rates during the movement of a bare loaded TC from the spent fuel pool to the decontamination area supplemental shielding may be as high as 9.8 rem/hr.

17. Lift the TC from the fuel pool.

18. Move the TC with loaded DSC to the cask decon area and carefully place it in the decontamination area shielding sleeve.

18a. Disengage the lifting yoke from the trunnions and position it clear of the cask.

19. Place the decontamination area shielding bell over the side of the cask above the upper trunnions. Placement of the shielding bell shall be performed in accordance with the plant's heavy load procedures. The shielding sleeve and bell provide the additional shielding to produce similar shielding as the OS197 TC.

20. If applicable to keep the occupational exposure ALARA, temporary shielding may be installed as necessary to minimize personnel exposure. Install cask seismic restraints if required by *CoC Appendix A Inspections, Tests, and Evaluations Item 3.1.7*. (Required only on plant specific basis).

21. Remove the lifting lugs from the top shield plug.

W.8.1.3 <u>DSC Drying and Backfilling</u>

CAUTION: During performance of steps listed in Section W.8.1.3, monitor the TC/DSC annulus water level and replenish if necessary until drained.

CAUTION: During performance of steps listed in Section W.8.1.3, the opening at the top and bottom of the decontamination area shielding shall be monitored (visual inspection) to assure no significant blockage of openings. Although blockage is improbable as all 16 openings would require sealing, personnel shall perform visual inspection of shielding sleeve and bell openings during the operations when DSC is in the sleeve.

1. Check the radiation levels along the perimeter of the cask/shields. The cask exterior surface should be decontaminated by providing spray mechanisms on the inside of the shield bell or other methods, using good ALARA practices. Water mixed with a commercial decontamination agent may be used for decontamination. Install additional temporary shielding as necessary to minimize personnel exposure.

2. Place scaffolding around the cask so that any point on the surface of the cask is easily accessible to personnel.

3. Decontaminate the exposed surfaces of the DSC shell perimeter above the TC/DSC annulus seal. Remove the inflatable TC/DSC annulus seal.

3a. In accordance with Technical Specification *4.3.2*, verify that the neutron shield (NS) is filled before the draining operation in Step 4 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

4. Connect the cask drain line to the cask, open the cask cavity drain port and allow water from the annulus to drain out until the water level is approximately twelve inches below the top edge of the DSC shell. Take swipes around the outer surface of the DSC shell and check for smearable contamination in accordance with Technical Specification *3.3.1*, taking corrective actions in accordance with that technical specification, if required, potentially involving removal of the fuel assemblies, removal of the DSC from the TC, and decontamination of the entire length of the DSC outer surface.

CAUTION: Radiation dose rates are expected to be high at the vent and siphon port locations. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

4a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 5 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

5. Drain approximately the number of gallons of water shown in the table below (as indicated on a flowmeter) from the DSC back into the fuel pool or other suitable location. Consistent with ISG-22 [8.5] guidance and Technical Specification 3.1.1, helium at 1-3 psig is used to backfill the DSC with an inert gas (helium) as water is being removed from the DSC. Only helium may be used to assist in the removal of water.

DSC	Gallons of Water
32PT	750
61BT	1100

Alternatively, if a slow helium purge is used while monitoring for hydrogen, less than these amounts of water may be drained, because this approach will prevent buildup of flammable gas to a flammability limit.

6. Disconnect hose from DSC siphon port.

7. Install the automatic welding machine onto the inner top cover plate and place the inner top cover plate with the automatic welding machine onto the DSC. Optionally, the inner top cover plate and the automatic welding machine can be placed separately. Verify proper fit-up of the inner top cover plate with the DSC shell.

8. Check radiation levels along surface of the inner top cover plate. Temporary shielding may be installed as necessary to minimize personnel exposure.

9. Insert tubing of sufficient length and adequate temperature resistance through the vent port such that it terminates just below the DSC shield plug. Connect the tubing to a hydrogen monitor to allow continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner cover plate, in compliance with Technical Specification *4.3.3*. Optionally, other methods may be used for continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner top cover plate, to comply with the Technical Specification.

10. Cover the cask/DSC annulus to prevent debris and weld splatter from entering the annulus.

11. Ready the automatic welding machine and tack weld the inner top cover plate to the DSC shell. Install the inner top cover plate weldment and remove the automatic welding machine.

    CAUTION: Continuously monitor the hydrogen concentration in the DSC cavity using the arrangement or other alternate methods described in Step 9 during the inner top cover plate cutting/welding operations. Verify that the measured hydrogen concentration does not exceed a safety limit of 2.4% [8.2 and 8.3] (60.0% of flammability limit of 4.0%). If this limit is exceeded, stop all welding operations and purge the DSC cavity with approximately 2-3 psig helium via the tubing to reduce the hydrogen concentration safely below the 2.4% limit.

12. Perform dye penetrant weld examination of the inner top cover plate weld in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

13. Remove purge lines and connect the VDS to the DSC siphon and vent ports.

14. Install temporary shielding to minimize personnel exposure throughout the subsequent welding operations as required.

15. Install Strongback on 61BT. (Strongback is optional for 32PT.)

    a. Place strongback so that it sits on the inner top cover plate and is oriented such that:

    - the DSC siphon and vent ports are accessible
    - the strongback stud holes line up with the TC lid bolt holes.

    b. Lubricate the studs and, using a cross pattern, adjust the strongback studs to snug tight ensuring approximately even pressure on the cover plate.

16. a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in this step is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

    b. If using blowdown method to remove water, engage helium supply (up to 15 psig) and open the valve on the vent port and allow helium to force the water from the DSC cavity through the siphon port. Use of helium is required per Technical Specification 3.1.1.

    c. If using water pumps to remove water without blowdown, pump water from DSC. Use 1 to 3 psig of helium to backfill the DSC with helium per ISG-22 [8.5] guidance and Technical Specification 3.1.1 as water is being removed from the DSC cavity.

17. Once the water stops flowing from the DSC, close the DSC siphon port and disengage the helium source and/or turn off the suction pump, as applicable. Verify that the TC axial surface dose rates are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. The configuration for determining the TC axial surface dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

    CAUTION: Radiation dose rates are expected to be high at the vent and siphon port locations. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

18. Connect the hose from the vent port and the siphon port to the intake of the vacuum pump. Connect a hose from the discharge side of the VDS to the plant's radioactive waste system or spent fuel pool. Connect the VDS to a helium source.

    Note: Proceed cautiously when evacuating the DSC to avoid freezing consequences.

19. Open the valve on the suction side of the pump, start the VDS and draw a vacuum on the DSC cavity. The cavity pressure should be reduced in steps of approximately 100 mm Hg,

atmosphere are examples of ways to assure that the pump is not continuing to draw a vacuum on the DSC.

26. Open the valve on the vent port and allow helium to flow into the DSC cavity to pressurize the DSC as shown in the table below (Value A) and hold for 10 min. Depressurize the DSC cavity by releasing the helium through the VDS to the plant spent fuel pool or radioactive waste system to value shown in table below (Value B) in accordance with Technical Specification 3.1.2 limits.

DSC	Value A (psig)	Value B (psig)
32PT	16.5 – 18.0	2.5 ± 1.0
61BT	11.0 – 12.5	2.5 ± 1.0

27. Close the valves on the helium source.

28. Remove the strongback, decontaminate as necessary, and store (if used).

W.8.1.4 DSC Sealing Operations

CAUTION: During performance of steps listed in Section W.8.1.4, monitor the cask/DSC annulus water level and replenish as necessary to maintain cooling.

CAUTION: During performance of steps listed in Section W.8.1.4, the opening at the top and bottom of the decontamination area shielding shall be monitored (visual inspection) to assure no significant blockage of openings. Although blockage is improbable as all 16 openings would require sealing, personnel shall perform visual inspection of shielding sleeve and bell openings during the operations when DSC is in the sleeve.

1. Disconnect the VDS from the DSC. Seal weld the prefabricated plugs over the vent and siphon ports. Inject helium into blind space just prior to completing welding, and perform a dye penetrant weld examination in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

2. Temporary shielding may be installed as necessary to minimize personnel exposure. Install the automatic welding machine onto the outer top cover plate and place the outer top cover plate with the automatic welding system onto the DSC. Optionally, outer top cover plate may be installed separately from the welding machine. Verify proper fit up of the outer top cover plate with the DSC shell.

3. Tack weld the outer top cover plate to the DSC shell. Place the outer top cover plate weld root pass.

4. Perform a helium leak test of the DSC inner top cover plate and vent/siphon port plate welds using the leak test port in the outer top cover plate in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1* limits. Verify that the personnel performing the leak test are qualified in accordance with SNT-TC-1A [8.4]. Alternatively this can be done with a test head in step 1 of Section W.8.1.4.

5. If a leak is found, remove the outer cover plate root pass (if not using test head), the vent and siphon port plugs and repair the inner cover plate welds. Repeat procedure steps from W.8.1.3 Step 20.

6. Perform dye penetrant examination of the root pass weld. Weld out the outer top cover plate to the DSC shell and perform dye penetrant examination on the weld surface in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

7. Install and seal weld the prefabricated plug, if applicable, over the outer cover plate test port and perform dye penetrant weld examinations in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirement.

8. Remove the automatic welding machine from the DSC.

8a. In accordance with Technical Specification *4.3.2*, verify that the NS is filled before the draining operation in Step 9 is initiated and continually monitored during the first five minutes of the draining evolution to ensure the NS remains filled.

9. Drain the DSC/TC annulus.

10. Rig the cask top cover plate and lower the cover plate onto the TC.

11. Bolt the cask cover plate into place, tightening the bolts to the required torque in a star pattern.

12. Verify that the TC radial dose rates measured at the surface of the decontamination area shielding are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*. The configuration for determining the TC radial surface dose rates shall be in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

W.8.1.5 TC Downending and Transfer to ISFSI

Note: Licensee shall use remote operations and other mitigating ALARA practices when handling the bare OS197L TC when loaded with fuel as required by the sites ALARA program and the Radiation Protection Program requirements of Technical Specification *4.3.2*.

Note: Alternate Procedure for Downending of Transfer Cask: Some plants have limited floor hatch openings above the cask/trailer/skid, which limit crane travel (within the hatch opening) that would be needed in order to downend the TC with the trailer/skid in a stationary position. For these situations, alternate procedures are to be developed on a plant-specific basis, with detailed steps for downending.

CAUTION: The surface dose rates during the movement of the bare TC from the decontamination area to the transfer trailer may be as high as 9.8 rem/hr.

CAUTION: Restrict personnel from the area, as specified by plant's ALARA practices, due to the high cask dose rates. Crane operations shall be performed remotely and an optical targeting system with remote camera monitoring shall be used to minimize personnel exposure upon removal of the decontamination area shielding bell from the cask. Failure of remote operating devices should be considered and proper repair/recovery operations should be planned to keep doses ALARA.

1. Verify that the neutron shield is filled, in accordance with Technical Specification *4.3.2*.
2. Move the scaffolding away from the cask as necessary.
3. Rig and remove the decontamination area shielding bell from the cask. Removal of the shielding bell shall be performed in accordance with the plant's heavy load procedures.
4. Re-attach the TC lifting yoke to the crane hook, as necessary. Ready the transport trailer and cask support skid for service.
5. The transport trailer should be positioned so that cask support skid is accessible to the crane with the trailer supported on the vertical jacks.
6. Position the cask lower trunnions onto the transfer trailer support skid pillow blocks.
7. Move the crane forward while simultaneously lowering the cask until the cask upper trunnions are just above the support skid upper trunnion pillow blocks.
8. Inspect the positioning of the cask to insure that the cask and trunnion pillow blocks are properly aligned.
9. Lower the cask onto the skid until the weight of the cask is distributed to the trunnion pillow blocks.
10. Place the inner top shield on the skid (this must be performed inside the fuel handling building). Placement of the shields shall be performed in accordance with the plant's heavy load procedures and shall be evaluated within the plant 72.212 (50.59) for the dry fuel loading procedures.
11. Inspect the trunnions to ensure that they are properly seated onto the skid and install the trunnion tower closure plates, if required.

CAUTION: Per *CoC Condition II.3.b(4)*, during transfer operation of a loaded OS197L TC, every hour, visually monitor the outer top trailer shield vents and the opening around the cask ends for any sign of steaming which may indicate leakage of water from the cask neutron shield. If steaming is determined to be due to leakage of neutron shield water and not due to any rain or snow or other ambient conditions, then Licensee shall take appropriate corrective actions including terminating the transfer operation and returning the loaded cask to the fuel handling building for further assessment.

The following step may be performed outside if the fuel building weight limits preclude placement of the outer top skid shielding inside the fuel building (See *CoC Condition II.3.b(3)* for restrictions).

CAUTION: Verify that the requirements of Technical Specification *4.4.1.B* are met prior to next step.

12. Install the outer top skid shielding. During installation, the bottom most part of the body of the outer top shield shall not be hoisted by the crane more than 4 inches above the top horizontal plate of the inner top shield.

W.8.1.6 DSC Transfer to the HSM

CAUTION: Per *CoC Condition II.3.b(4)*, during transfer operation of a loaded OS197L TC, every hour, visually monitor the outer top trailer shield vents and the opening around the cask ends for any sign of steaming which may indicate leakage of water from the cask neutron shield. If steaming is determined to be due to leakage of neutron shield water and not due to any rain or snow or other ambient conditions, then Licensee shall take appropriate corrective actions including terminating the transfer operation and returning the loaded cask to the fuel handling building for further assessment.

CAUTION: During the actual movement of the transfer cask on the transfer trailer to the ISFSI, the gap between the transfer trailer deck and bottom of the skid shall be monitored (visual inspection) to assure no significant blockage of airflow. Although blockage is improbable as over 60 feet of gap would require sealing, personnel shall maintain a visual scan of the trailer.

1. Prior to transferring the cask to the ISFSI or prior to positioning the transfer cask at the HSM designated for storage, remove the HSM door using a porta-crane, inspect the cavity of the HSM, removing any debris and ready the HSM to receive a DSC. The doors on adjacent HSMs should remain in place.

   CAUTION: Very high dose rates in the empty HSM are expected if adjacent to a loaded HSM. Proper ALARA practices should be followed during these operations.

2. Inspect the HSM air inlet and outlets to ensure that they are clear of debris. Inspect the screens on the air inlet and outlets for damage.

   CAUTION: Verify that the requirements of Technical Specification *4.4.1.B* are met prior to next step.

3. Using a suitable vehicle, transfer the cask from the plant's fuel/reactor building to the ISFSI along the designated transfer route.

4. Once at the ISFSI, position the transport trailer to within several inches of the HSM.

5. Check the position of the trailer to ensure the centerline of the HSM and cask approximately coincide. If the trailer is not properly oriented, reposition the trailer, as necessary.

6. If not already installed, install the alignment targets, including the cast top centerline target through the skid shielding.

7. Using crane, unbolt and remove the cask top cover plate.

8. Back the cask to within a few inches of the HSM, set the trailer brakes and disengage the tractor. Drive the tractor clear of the trailer. Extend the transfer trailer vertical jacks.

9. Remove the skid tie-down bracket fasteners and use the skid positioning system to bring the cask into approximate vertical and horizontal alignment with the HSM. Using optical survey equipment and the alignment marks on the cask and the HSM, adjust the position of the cask until it is properly aligned with the HSM.

10. Using the skid positioning system, fully insert the cask into the HSM access opening docking collar.

11. Secure the cask trunnions to the front wall embedments of the HSM using the cask restraints.

12. After the cask is docked with the HSM, verify the alignment of the TC using the optical survey equipment.

13. Position the hydraulic ram behind the cask in approximate horizontal alignment with the cask and level the ram. Remove either the bottom ram access cover plate or the outer plug of the two-piece temporary shield plug if installed. Power up the ram hydraulic power supply and extend the ram through the bottom cask opening into the DSC grapple ring.

14. Activate the hydraulic cylinder on the ram grapple and engage the grapple arms with the DSC grapple ring.

15. Recheck all alignment marks and ready all systems for DSC transfer. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

    If the alignment tolerance is exceeded, the following actions should be taken:

    a. Confirm that the transfer system is properly configured,

    b. Check and repair the alignment equipment, or

    c. Confirm the locations of the alignment targets on the TC and HSM.

16. Activate the hydraulic ram to initiate insertion of the DSC into the HSM. Stop the ram when the DSC reaches the support rail stops at the back of the module.

17. Disengage the ram grapple mechanism so that the grapple is retracted away from the DSC grapple ring.

18. Retract and disengage the hydraulic ram system from the cask and move it clear of the cask. Remove the cask restraints from the HSM.

19. Using the skid positioning system, disengage the cask from the HSM access opening.

20. Install the DSC axial retainer through the HSM door opening.

21. Install the HSM door using a portable crane or other suitable lifting device and secure it in place. Door may be welded for security. Verify that the HSM dose rates are compliant with the limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Items 3.3.1 and 3.3.2*.

22. Replace the TC top cover plate. Secure the skid to the trailer, retract the vertical jacks and disconnect the skid positioning system.

23. If this is the final loading, fully drain the liquid neutron shield.

24. Tow the trailer and cask to the designated equipment storage area. Return the remaining transfer equipment to the storage area.

25. Close and lock the ISFSI access gate and activate the ISFSI security measures.

26. Ensure the HSM maximum air exit temperature requirements of *CoC Appendix A Inspections, Tests, and Evaluations Item 4.4* are met.

W.8.1.7 Monitoring Operations

1. Perform routine security surveillance in accordance with the licensee's ISFSI security plan.

2. Perform one of the two alternate daily surveillance activities listed below:

   a. A daily visual surveillance of the HSM air inlets and outlets to insure that no debris is obstructing the HSM vents in accordance with Technical Specification *3.1.4.*a. requirements.

   b. A temperature measurement of the thermal performance, for each HSM, on a daily basis in accordance with Technical Specification *3.1.4.*b requirements.

W.8.2 Procedures for Unloading the Cask

The operational differences specified above for loading operations when using OS197L TC (relative to the use of OS197 TC described in Chapter 5) will also apply for unloading operations.

W.8.3 Identification of Subjects for Safety Analysis

There is no change relative to Section 5.1.3 regarding criticality control, chemical safety, operational shutdown modes and maintenance techniques.

In addition to the typical instrumentation listed in Table 5.1-1 of Section 5.1.3, the use of OS197L TC shall require optical targets and instruments to implement specific remote crane operations described in Section W.8.1 above.

Table Y.2-1
BWR Fuel Specification for the Fuel to be Stored in the NUHOMS®-69BTH DSC

PHYSICAL PARAMETERS: *Fuel Class*	*Per TS Table 1-1gg*
Fuel Damage	*Per TS Table 1-1gg*
RECONSTITUTED FUEL ASSEMBLIES: • *Maximum Number of Irradiated Stainless Steel Rods in Reconstituted Assemblies per DSC* • *Maximum Number of Irradiated Stainless Steel Rods per Reconstituted Fuel Assembly* • *Maximum Number of Reconstituted Assemblies per DSC with unlimited number of low enriched UO_2 rods or Zr rods or Zr pellets or Unirradiated Stainless Steel Rods*	*Per TS Table 1-1gg*
Number of intact assemblies	*Per TS Table 1-1gg*
Number and location of damaged assemblies	*Per TS Table 1-1gg*
Channels	*Per TS Table 1-1gg*
Fissile Material	*UO_2*
UO_2	*198 kg/assembly*
Maximum assembly weight including channels	*Per TS Table 1-1gg*

Table Y.2-1
BWR Fuel Specification for the Fuel to be Stored in the NUHOMS®-69BTH DSC
(Concluded)

THERMAL/RADIOLOGICAL PARAMETERS:	
Allowable Heat Load Zoning Configurations for each 69BTH DSC	*Per TS Table 1-1gg*
Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 1	*Per Table 1-7a1 for Zone 1 fuel or Table 1-7c for Zone 2 fuel or Table 1-7d for Zone 3 fuel or Table 1-7g for Zone 4 fuel or Table 1-7j for Zone 5 fuel or Table 1-7h for Zone 6 fuel.*
Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 2	*Per Table 1-7c for Zone 1 fuel or Table 1-7g for Zone 3 fuel or Table 1-7k for Zone 4 fuel or Table 1-7i for Zone 5 fuel.*
Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 3	*Per Table 1-7c for Zone 1 fuel or Table 1-7g for Zone 3 fuel or Table 1-7k for Zone 4 fuel or Table 1-7i for Zone 5 fuel.*
Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 4	*Per Table 1-7h for Zone 2 fuel or Table 1-7l for Zone 4 fuel or Table 1-7k for Zone 5 fuel.*
Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 5	*Per Table 1-7b for Zone 1 fuel or Table 1-7e for Zone 2 fuel or Table 1-7f for Zone 3 fuel or Table 1-7l for Zone 4 fuel or Table 1-7i for Zone 5 fuel.*
Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 6	*Per Table 1-7b for Zone 1 fuel or Table 1-7e for Zone 2 fuel and Zone 4 fuel or Table 1-7f for Zone 3 fuel.*
Burnup, Enrichment, and Minimum Cooling Time for Heat Load Zoning Configuration 7	*Per Table 1-7e for Zone 2 fuel or Table 1-7g for Zone 3 fuel or Table 1-7m for Zone 4 fuel or Table 1-7i for Zone 5 fuel.*
Burnup, Enrichment, and Minimum Cooling Time for fuel with ≤ 20 GWd/MTU and 0.5 to 0.9 wt. % in all Heat Load Zoning Configurations	*Per Table 1-7a for zone 1, 2, 3, 4, 5, and 6 fuel.*
Maximum Lattice Average Initial Enrichment	*Per TS Table 1-1gg*
Maximum Pellet Enrichment	*Per TS Table 1-1gg*
Maximum decay heat limits for HLZCs 1, 2, 3, 4, 5, 6 and 7	*Per TS Table 1-1gg*
Decay heat per DSC	*Per TS Table 1-1gg*
Minimum B-10 Concentration in Poison Plates	*Per TS Table 1-1gg*

Proprietary Information on This Page
Withheld Pursuant to 10 CFR 2.390

During transfer from the spent fuel pool building to the ISFSI, the drop distance from the bottom of the transfer cask, resting horizontally on the trailer skid, is less than 68". Similarly, at the ISFSI, with the transfer trailer resting on the approach slab, the vertical distance from the concrete pad to the centerline of the cask is adjusted so that the transfer cask is aligned with the centerline of the HSM-H/HSM-HS door opening. As shown in Appendix U.1 of the SAR, TN drawing no. NUH-03-7003-SAR, sheet 5 of 10, the centerline of the HSM-H/HSM-HS door opening is 8'-10" (106") from the ground pad surface. The OD of the OS200/OS200FC transfer cask is 92.11" (TN drawing no. NUH-08-8002-SAR, sheet 1 of 3); thus, the distance from the ground to the cask shell bottom is approximately 60" (106"- 92.11/2"). Therefore, the maximum drop height is less than 60". For conservatism, 80" drop height is used. Technical Specification *4.4.1.A* also restricts handling of the loaded transfer cask to a height of less than 80" outside the spent fuel pool building.

In spite of the incredible nature of any scenario that could lead to a drop accident for the TC, a conservative range of drop scenarios are developed and evaluated. These bounding scenarios assure that the integrity of the DSC and spent fuel cladding is not compromised. Analyses of these scenarios demonstrate that the TC will maintain the structural integrity of the DSC pressure containment boundary. Therefore, there is no potential for a release of radioactive materials to the environment due to a cask drop. The range of drop scenarios conservatively selected for the 69BTH DSC design are:

- A horizontal side drop from a height of 80 inches (75g horizontal drop).
- Vertical end drops for the NUHOMS® system are non-mechanistic and thus, no end drops are postulated for the OS200 TC loaded with a 69BTH DSC. However, 75g vertical end drop analyses are performed as a means of enveloping the 25g corner drop (in conjunction with the 75g horizontal side drop).
- An oblique corner drop from a height of 80 inches at an angle of 30º to the horizontal, onto the top or bottom corner of the TC. This case is not specifically evaluated. The side drop and end drop cases envelop the corner drop.

Y.3.7.4.2 DSC Shell Assembly Drop Evaluation

The shell assembly consists of the DSC shell, the shield plugs, and the top and bottom inner and outer cover plates. The shell assembly drop evaluation is presented in three parts:

1. DSC shell assembly horizontal drop analysis,
2. DSC shell assembly vertical drop analysis, and
3. DSC shell stability analysis.

Y.3.7.4.2.1 DSC Shell Assembly Horizontal Drop Analysis

The DSC shell assembly is analyzed for the postulated horizontal side drop using the ANSYS top end and bottom end solid element models of the DSC shell assembly discussed in Section Y.3.6.1.2. Each model includes a portion of the height of the cylindrical shell. Each of the DSC

Y.8.1 Procedures for Loading the Cask

Y.8.1.1 Preparation of the Transfer Cask and DSC

1. Prior to placement in dry storage, the candidate intact and damaged fuel assemblies shall be evaluated (by plant records or other means) to verify that they meet the physical, thermal and radiological criteria specified in Technical Specification 2.1.

2. Prior to being placed in service, the transfer cask is to be cleaned or decontaminated as necessary to ensure a surface contamination level of less than those specified in Technical Specification *3.3.1*.

3. Place the transfer cask in the vertical position in the cask decon area (or other designated area) using the cask handling crane and the transfer cask lifting yoke.

4. Place scaffolding around the cask so that the top region of the transfer cask and surface of the cask are easily accessible to personnel.

5. Remove the transfer cask top cover plate and examine the cask cavity for any physical damage and ready the cask for service.

6. Examine the DSC for any physical damage which might have occurred since the receipt inspection was performed. The DSC is to be cleaned and any loose debris removed. Record the DSC serial number which is located on the grapple ring. Verify the correct DSC basket type, and poison material types against the DSC serial number. Verify that the DSC is appropriate for the specific fuel loading campaign per Technical Specification 2.1.

7. Using a crane, lower the DSC into the cask cavity by the internal lifting lugs and rotate the DSC to match the cask and DSC alignment marks.

8. If damaged fuel assemblies are to be included in a specific loading campaign, place the required number of bottom end caps provided (up to a maximum of 24) into the bottom of the appropriate four outer “6 compartment” arrays of the basket, per Technical Specification 2.1. Optionally, this step may be performed at any prior time.

9. Fill the TC/DSC annulus with clean, demineralized water. Place the inflatable seal into the upper cask liner recess and seal the TC/DSC annulus by pressurizing the seal with compressed air.

10. Fill the DSC cavity with water from the fuel pool or an equivalent source.

    NOTE: A TC/DSC annulus pressurization tank filled with clean, demineralized water is connected to the top vent port of the TC via a hose to provide a positive head above the level of water in the TC/DSC annulus. This is an optional arrangement, which provides additional assurance that contaminated water from the fuel pool will not enter the TC/DSC annulus, provided a positive head is maintained at all times.

CAUTION: Verify that all the lifting height restrictions as a function of temperature specified in Technical Specification *4.4.1* can be met in the following steps which involve lifting of the transfer cask.

9. Visually verify that the top shield plug is properly seated within the DSC.

10. Position the lifting yoke arms under the cask trunnions and verify that it is properly engaged.

10a. From this point, until the DSC has been inserted into the HSM, the DSC will be inspected for damage after any TC drop of fifteen inches or greater.

11. Raise the transfer cask to the pool surface. Prior to raising the top of the cask above the water surface, stop vertical movement.

12. Inspect the top shield plug to verify that it is properly seated within the DSC. If not, lower the cask and reposition the top shield plug and/or remove the shield plug and reposition the hold down ring. Repeat Steps 8 through 12, as necessary.

13. Continue to raise the cask from the pool and spray the exposed portion of the cask with water until the top region of the cask is accessible.

14. Drain any excess water from the top of the DSC shield plug back to the fuel pool. Check the radiation levels at the center of top shield plug and around the perimeter of the cask. Disconnect the top shield plug rigging.

15. As required for crane load limitations, drain water (as indicated on the flow meter) from the DSC back into the fuel pool or other suitable location. Use 1-3 psig of helium to backfill the DSC with an inert gas per NUREG-1536 [8.2] guidance and Technical Specification 3.1.1 as water is being removed from the DSC.

16. Lift the cask from the fuel pool. As the cask is raised from the pool, continue to spray the cask with water and decon as directed. Due to the possibility of delays during lifting/movement of the cask to the decon area, provisions shall be made to assure air will not enter the DSC cavity. One way to accomplish this is to include appropriate connections to allow replenishing the helium in the DSC cavity during any such delays.

17. Move the cask with loaded DSC to the cask decon area.

17a. Replace the water removed from the DSC cavity in Step 15 with water from the fuel pool or an equivalent source.

18. Install cask seismic restraints if required by *CoC Appendix A Inspections, Tests, and Evaluations Item 3.1.7* (required only on plant specific basis).

19. Verify that the transfer cask dose rates are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

Y.8.1.3 DSC Drying and Backfilling

CAUTION: During performance of steps listed in Section Y.8.1.3, monitor the TC/DSC annulus water level and replenish as necessary to maintain cooling.

1. Check the radiation levels along the perimeter of the cask. The cask exterior surface should be decontaminated as necessary. Temporary shielding may be installed as necessary to minimize personnel exposure.

2. Place scaffolding around the cask so that any point on the surface of the cask is easily accessible to personnel.

3. Disengage the rigging cables from the top shield plug and remove the eyebolts. Disengage the lifting yoke from the trunnions and position it clear of the cask.

4. Decontaminate the exposed surfaces of the DSC shell perimeter and remove the inflatable TC/DSC annulus seal.

5. Connect the cask drain line to the cask, open the cask cavity drain port and allow water from the annulus to drain out until the water level is approximately twelve inches below the top edge of the DSC shell. Take swipes around the outer surface of the DSC shell and check for smearable contamination in accordance with the Technical Specification *3.3.1* limits.

   CAUTION: Radiation dose rates are expected to be high at the vent and siphon port locations. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

6. Drain approximately 510 gallons of water (as indicated on a flowmeter) from the DSC back into the fuel pool or other suitable location if not drained in Step 15 of Section Y.8.1.2. Consistent with NUREG-1536 [8.2] guidance and Technical Specification 3.1.1, helium at 1-3 psig is used to backfill the DSC with an inert gas as water is being removed from the DSC.

7. Monitor TC/DSC annulus water level and replenish, as necessary, until drained.

8. Install the automated welding machine onto the inner top cover plate and place the inner top cover plate with the automated welding machine onto the DSC. Optionally, the inner top cover plate and the automated welding machine can be placed separately. Verify proper fit-up of the inner top cover plate with the DSC shell.

9. Check radiation levels along the surface of the inner top cover plate. Temporary shielding may be installed, as necessary, to minimize personnel exposure. Verify that the TC dose rates are compliant with the limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

10. Insert approximately ¼ inch tubing of sufficient length and adequate temperature resistance through the vent port such that it terminates just below the DSC top shield plug. Connect the tubing to a hydrogen monitor to allow continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner top cover plate, in compliance with Technical Specification *4.3.3*. Optionally, other methods may be used

for continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner top cover plate, to comply with the Technical Specification.

11. Cover the TC/DSC annulus to prevent debris and weld splatter from entering the annulus.

12. Ready the automated welding machine and tack weld the inner top cover plate to the DSC shell. Install the inner top cover plate weldment and remove the automated welding machine.

    CAUTION: Continuously monitor the hydrogen concentration in the DSC cavity using the arrangement or other alternate methods described in step 10 during the inner top cover plate cutting/welding operations. Verify that the measured hydrogen concentration does not exceed a safety limit of 2.4% [8.3 and 8.4] (60.0% of flammability limit of 4.0%). If this limit is exceeded, stop all welding operations and purge the DSC cavity with 2-3 psig helium via the tubing to reduce the hydrogen concentration safely below the 2.4% limit.

13. Perform dye penetrant weld examination of the inner top cover plate weld in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

14. Remove purge lines and connect the VDS to the DSC siphon and vent ports.

15. Install temporary shielding to minimize personnel exposure throughout the subsequent welding operations as required.

16. a. If using blowdown method to remove water, engage helium supply (up to15 psig) and open the valve on the vent port and allow helium to force the water from the DSC cavity through the siphon port. Use of helium is required per Technical Specification 3.1.1.

    b. Alternately a suction pump may be used (separately or in combination with helium pressure above) to remove water from DSC.

17. Once the water stops flowing from the DSC, close the DSC siphon port and disengage the gas source or turn off the suction pump, as applicable.

18. Connect the hose from the vent port and the siphon port to the intake of the vacuum pump. Connect a hose from the discharge side of the VDS to the plant's radioactive waste system or spent fuel pool. Connect the VDS to a helium source.

    NOTE: Proceed cautiously when evacuating the DSC to avoid freezing consequences.

19. Open the valve on the suction side of the pump, start the VDS and draw a vacuum on the DSC cavity. The cavity pressure should be reduced in steps of approximately 100 mm Hg, 50 mm Hg, 25 mm Hg, 15 mm Hg, 10 mm Hg, 5 mm Hg, and 3 mm Hg. After pumping down to each level (these levels are optional), the pump is valved off and the cavity pressure monitored. The cavity pressure will rise as water and other volatiles in the cavity evaporate. When the cavity pressure stabilizes, the pump is valved in to complete the vacuum drying process. It may be necessary to repeat some steps,

the DSC cavity by releasing the helium through the VDS to the plant spent fuel pool or radioactive waste system to approximately 2.5 psig in accordance with Technical Specification 3.1.2b limits.

CAUTION: Radiation dose rates are expected to be high at the vent and siphon port locations. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

27. Close the valves on the helium source.

Y.8.1.4 DSC Sealing Operations

CAUTION: During performance of steps listed in Section Y.8.1.4, monitor the cask/DSC annulus water level and replenish as necessary to maintain cooling.

1. Disconnect the VDS from the DSC. Seal weld the prefabricated plugs over the vent and siphon ports. Inject helium into blind space just prior to completing welding and perform a dye penetrant weld examination in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements. Use of an optional test head is acceptable to perform the helium leak test of the inner top cover plate and vent/siphon port welds in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1*. If an optional test head is not used, proceed to Step 2.
2. Temporary shielding may be installed, as necessary, to minimize personnel exposure. Install the automated welding machine onto the outer top cover plate and place the outer top cover plate with the automated welding system onto the DSC. Optionally, outer top cover plate may be installed separately from the welding machine. Verify proper fit up of the outer top cover plate with the DSC shell.
3. Tack weld the outer top cover plate to the DSC shell. Place the outer top cover plate weld root pass.
4. Perform helium leakage test of the inner top cover plate and vent/siphon port plate welds using the test port in the outer top cover plate in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1* limits. Verify that the personnel performing the leakage test are qualified in accordance with SNT-TC-1A [8.5]. Alternatively, this leakage test can be done with a test head in step 1 of Section Y.8.1.4.
5. If a leak is found, remove the outer cover plate root pass (if not using test head), the vent and siphon port plugs and repair the inner cover plate welds. Then repeat procedure steps from Section Y.8.1.3 step 18.
6. Perform dye penetrant examination of the root pass weld. Weld out the outer top cover plate to the DSC shell and perform dye penetrant examination on the weld surface in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.
7. Install and seal weld the prefabricated plug, if applicable, over the outer cover plate test port and perform dye penetrant weld examinations in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

8. Remove the automated welding machine from the DSC.

9. Open the cask drain port valve and drain the water from the cask/DSC annulus.

   CAUTION: If the DSC decay heat load is greater than 24.0 kW, monitor the applicable time limits of Technical Specification 3.1.3 until the completion of DSC transfer step 15 of Section Y.8.1.6.

   If the TC is in a horizontal orientation on the transfer skid, and the required time limit for completion of a DSC transfer specified in Technical Specification 3.1.3 are not met, initiate air circulation in the TC/DSC annulus by starting one of the blowers provided on the transfer skid and continue blower operation for a minimum duration of 36 hours.

   When transfer operations are ready to continue secure air circulation and either complete the DSC insertion OR return the TC/DSC to an upright configuration and fill with clean demineralized water within the applicable time limits of Technical Specification 3.1.3.

10. Rig the cask top cover plate and lower the cover plate onto the transfer cask.

11. Bolt the cask cover plate into place, tightening the bolts to the required torque in a star pattern.

12. Verify that the TC dose rates are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2.*

Y.8.1.5 Transfer Cask Downending and Transfer to ISFSI

NOTE: **Alternate procedure for downending of transfer cask:** Some plants have limited floor hatch openings above the cask/trailer/skid, or other conditions which limit crane travel in the direction that would be needed in order to downend the TC with the trailer/skid in a stationary position. For these situations, alternate procedures are to be developed on a plant-specific basis, with detailed steps for downending.

1. Re-attach the transfer cask lifting yoke to the crane hook, as necessary. Ready the transfer trailer and cask support skid for service.
2. Move the scaffolding away from the cask, as necessary. Engage the lifting yoke and lift the cask over the cask support skid on the transfer trailer.
3. The transfer trailer should be positioned so that the cask support skid is accessible to the crane with the trailer supported on the vertical jacks.
4. Position the cask lower trunnions onto the transfer trailer support skid pillow blocks.
5. Move the crane forward while simultaneously lowering the cask until the cask upper trunnions are just above the support skid upper trunnion pillow blocks.
6. Inspect the positioning of the cask to ensure that the cask and trunnion pillow blocks are properly aligned.
7. Lower the cask onto the skid until the weight of the cask is distributed to the trunnion pillow blocks.
8. Inspect the trunnions to ensure that they are properly seated onto the skid and install the trunnion tower closure plates, if required.
9. Remove the bottom ram access cover plate from the cask if integral ram/trailer is not used. Install the two-piece temporary neutron/gamma shield plug to cover the bottom ram access. Install the ram trunnion support frame on the bottom of the transfer cask.

(The temporary shield plug and ram trunnion support frame are not required with the integral ram/trailer.)

Y.8.1.6 DSC Transfer to the HSM

NOTE: If using the HSM-HS module for storage at sites with high seismic levels, verify that at least 3 modules are connected together per the requirements of *CoC Condition II.2.a*.

1. Prior to transferring the cask to the ISFSI or prior to positioning the transfer cask at the HSM designated for storage, remove the HSM door using a porta-crane, inspect the cavity of the HSM, removing any debris and ready the HSM to receive a DSC. The doors on adjacent HSMs should remain in place.

   CAUTION: The insides of empty modules have the potential for high dose rates due to adjacent loaded modules. Proper ALARA practices should be followed for operations inside these modules and in the areas outside these modules whenever the door from the empty HSM has been removed.

2. Inspect the HSM air inlet and outlets to ensure that they are clear of debris. Inspect the screens on the air inlet and outlets for damage.

   CAUTION: Verify that the requirements of Technical Specification *4.4.1.B*, "TC/DSC Transfer Operations at High Ambient Temperatures," are met prior to the next step.

3. Using a suitable vehicle, transfer the cask from the plant's fuel/reactor building to the ISFSI along the designated transfer route.

4. Once at the ISFSI, position the transfer trailer to within a few feet of the HSM.

5. Check the position of the trailer to ensure the centerline of the HSM and cask approximately coincide. If the trailer is not properly oriented, reposition the trailer, as necessary.

6. Using a crane, unbolt and remove the cask top cover plate.

7. Back the trailer to within a few inches of the HSM, set the trailer brakes and disengage the tractor. Drive the tractor clear of the trailer. Extend the transfer trailer vertical jacks.

8. Remove the skid tie-down bolts and use the skid positioning system to bring the cask into approximate vertical and horizontal alignment with the HSM. Using optical survey equipment and the alignment marks on the cask and the HSM, adjust the position of the cask until it is properly aligned with the HSM.

9. Using the skid positioning system, fully insert the cask into the HSM access opening docking collar.

10. Secure the cask trunnions to the front wall embedments of the HSM using the cask restraints.

11. After the cask is docked with the HSM, verify the alignment of the transfer cask using the optical survey equipment.

12. Position the hydraulic ram behind the cask in approximate horizontal alignment with the cask and level the ram. Remove either the bottom ram access cover plate (if not previously removed) or the outer plug of the two-piece temporary shield plug if installed. Power up the ram hydraulic power supply and extend the ram through the bottom cask opening into the DSC grapple ring.

13. Activate the hydraulic cylinder on the ram grapple and engage the grapple arms with the DSC grapple ring.

14. Recheck all alignment marks and ready all systems for DSC transfer. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

    If the alignment tolerance is exceeded, the following actions should be taken:

    a. Confirm that the transfer system is properly configured,

    b. Check and repair the alignment equipment, or

    c. Confirm the locations of the alignment targets on the TC and HSM.

15. Activate the hydraulic ram to initiate insertion of the DSC into the HSM. Stop the ram when the DSC reaches the support rail stops at the back of the module.

    CAUTION: Verify that the applicable time limits of Technical Specification 3.1.3 are met if loading a 69BTH DSC with heat load greater than 24 kW.

16. Disengage the ram grapple mechanism from the DSC grapple ring.

17. Retract and disengage the hydraulic ram system from the cask and move it clear of the cask. Remove the cask restraints from the HSM.

18. Using the skid positioning system, disengage the cask from the HSM access opening. Insert the DSC axial retainer.

19. After inserting the DSC axial retainer, the transfer trailer may be moved as necessary to install the HSM door. Install the HSM door using a portable crane and secure it in place. Door may be welded for security. Verify that the HSM dose rates are compliant with the limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.3.1 and 3.3.2*.

20. Replace the transfer cask top cover plate. Secure the skid to the trailer, retract the vertical jacks and disconnect the skid positioning system.

21. If this is the final loading, fully drain the liquid neutron shield.

22. Tow the trailer and cask to the designated equipment storage area. Return the remaining transfer equipment to the storage area.

23. Close and lock the ISFSI access gate and activate the ISFSI security measures.

24. Ensure the HSM maximum air exit temperature requirements of *CoC Appendix A Inspections, Tests, and Evaluations Item 4.4* are met.

Y.8.1.7 Monitoring Operations

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

2. Perform one of the two alternate daily surveillance activities listed below:

   a. A daily visual surveillance of the HSM air inlets and outlets to ensure that no debris is obstructing the HSM vents in accordance with Technical Specification *3.1.4.a* requirements.

   b. A temperature measurement of the thermal performance, for each HSM, on a daily basis in accordance with Technical Specification *3.1.4.b* requirements.

Y.8.2 Procedures for Unloading the Cask

Y.8.2.1 DSC Retrieval from the HSM

1. Ready the transfer cask, transfer trailer, and support skid for service and tow the trailer to the HSM.

2. Back the trailer to within a few feet of the HSM and remove the cask top cover plate.

   CAUTION: High dose rates are expected in the HSM cavity after removal of HSM door. Proper ALARA practices should be followed.

3. Remove the HSM door using a porta-crane. Remove the DSC axial retainer.

4. Continue to back the trailer within a few inches of the HSM. Using the skid positioning system, align the cask with the HSM and position the skid until the cask is docked with the HSM access opening.

5. Using optical survey equipment, verify alignment of the cask with respect to the HSM. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

   If the alignment tolerance is exceeded, the following actions should be taken:

   a. Confirm that the transfer system is properly configured,

   b. Check and repair the alignment equipment, or

   c. Confirm the locations of the alignment targets on the TC and HSM.

5a. Install the cask restraints.

6. Install (if required) and align the hydraulic ram with the cask.

7. Extend the ram through the cask into the HSM until it is inserted in the DSC grapple ring.

8. Activate the arms on the ram grapple mechanism with the DSC grapple ring.

8a. From this point, until fuel has been removed from the DSC or the DSC has been removed from the TC, the DSC will be inspected for damage after any TC drop of fifteen inches or greater.

9. Retract ram and pull the DSC into the cask.

10. Retract the ram grapple arms.

11. Disengage the ram from the cask. Install the ram access penetration cover plate.

12. Remove the cask restraints.

13. Using the skid positioning system, disengage the cask from the HSM.

14. Install the cask top cover plate and ready the trailer for transfer.

15. Replace the door on the HSM.

Y.8.2.2 Removal of fuel from the DSC

When the DSC has been removed from the HSM, there are several potential options for off-site shipment of the fuel. It is preferred to ship the DSC intact to a reprocessing facility, monitored retrievable storage facility or permanent geologic repository in a compatible shipping cask licensed under 10 CFR 71.

If fuel needs to be removed from the DSC, either at the end of service life or for inspection after an accident, precautions must be taken against the potential for the presence of damaged or oxidized fuel and to prevent radiological exposure to personnel during this operation. A sampling of the atmosphere within the DSC will be taken prior to inspection or removal of fuel.

This can be achieved with this design by the use of the purge and fill valves which permit a determination of the atmosphere within the DSC before the removal of the inner top cover and shield plugs, prior to filling the DSC cavity with water. If the atmosphere within the DSC is helium and radioactivity check of the atmosphere in the DSC cavity did not detect the presence of any airborne radioactive particulates, then operations should proceed normally with fuel removal either via the TC or in the pool, if available. However, if air or airborne radioactive particulates are present within the DSC, then appropriate filters should be in place to preclude the uncontrolled release of any potential airborne radioactive particulate from the DSC via the purge-fill valves. This will protect both personnel and the operations area from potential contamination. For the accident case, personnel protection in the form of respirators or supplied air should be considered in accordance with licensee's Radiation Protection Program.

If the work is performed outside the fuel/reactor building, a tent may be constructed over the work area, which may be kept under a negative pressure to control airborne particulates. Any radioactive gas release will be Kr-85, which is not readily captured. Whether the krypton is vented through the plant stack or allowed to be released directly depends on the plant operating requirements.

Following opening of the DSC, the cask and DSC are filled with water prior to lowering the top of the cask below the surface of the fuel pool to prevent a sudden inrush of pool water. Cask placement into the pool is performed in the usual manner. Fuel unloading procedures will be governed by the plant operating license under 10 CFR 50. The generic procedures for these operations are as follows:

14. Locate the DSC siphon and vent port using the indications on the outer top cover plate. Place a portable drill press on the top of the DSC. Position the drill with the siphon port.

15. Place an exhaust hood or tent over the DSC, if necessary. The exhaust should be filtered or routed to the site radwaste system.

    CAUTION: Radiation dose rates are expected to be high at the vent and siphon port locations. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

16. Drill a hole through the DSC top cover plates to expose the siphon port quick connect.

17. Drill a second hole through the top cover plates to expose the vent port quick connect.

18. Obtain a sample of the DSC atmosphere. Fill the DSC with water from the fuel pool through the siphon port with the vent port open and routed to the plant’s off-gas system.

CAUTION:

(a) The water fill rate must be regulated during this reflooding operation to ensure that the DSC vent pressure does not exceed 20.0 psig.

(b) Per Technical Specification *4.3.3*, provide for continuous hydrogen monitoring of the DSC cavity atmosphere during all subsequent cutting operations to ensure that a safety limit of 2.4% (60.0% of flammability limit of 4.0%) is not exceeded [8.3]. Purge with 2-3 psig helium as necessary to maintain the hydrogen concentration safely below this limit.

19. Using a mechanical cutting system, plasma arc-gouging, or other suitable means, remove the seal weld from the outer top cover plate and DSC shell and remove the outer top cover plate.

Y.11.1.2 Extreme Temperatures

No change. The off-normal maximum ambient temperature of 125 °F is used in Chapter 8, Section 8.1.2.2. For the NUHOMS®-69BTH system, a maximum ambient temperature of 117 °F is used. Appendix Y.3, Section Y.3.4.4.3 addresses the thermal stress analysis for the 69BTH DSC, HSM-H (HSM-HS) and OS200 TC.

Y.11.1.2.1 Postulated Cause of Event

No change. See Chapter 8, Section 8.1.2.2.

Y.11.1.2.2 Detection of Event

No change. See Chapter 8, Section 8.1.2.2.

Y.11.1.2.3 Analysis of Effects and Consequences

The thermal evaluation of the NUHOMS®-69BTH system for off-normal conditions is presented in Appendix Y.4. The 106 °F normal condition with insolation bounds the 117 °F case without insolation for the DSC in the TC. Therefore the normal condition maximum temperatures are bounding. The 117 °F case with the DSC in the HSM-H is not bounded by the normal conditions and therefore evaluated in Chapter Y.4.

The structural evaluation of the 69BTH DSC for off-normal temperature conditions is presented in Appendix Y.3, Section Y.3.6.2.2. The structural evaluation of the basket due to off-normal thermal conditions is presented in Appendix Y.3, Section Y.3.6.1.3. The structural evaluation of HSM-H and OS200 Transfer Cask for off-normal conditions with 69BTH DSC is addressed in Appendix Y.3, Sections Y.3.6.1.4 to Y.3.6.1.8 and Appendix Y.3, Section Y.3.6.1.9, respectively.

Y.11.1.2.4 Corrective Actions

Restrictions for onsite handling of the TC with a loaded DSC under extreme temperature conditions are presented in Technical Specifications *4.4.1*.A and *4.4.1*.B.

Y.11.1.3 Off-Normal Releases of Radionuclides

The NUHOMS®-69BTH DSC is designed and tested to the leak tight criteria of ANSI N14.5 [11.2]. Therefore the estimated quantity of radionuclides expected to be released annually to the environment due to normal or off-normal events is zero.

Y.11.1.3.1 Postulated Cause of Event

In accordance with the Standard Review Plan, NUREG-1536 [11.3] for off-normal conditions, it is conservatively assumed that 10% of the fuel rods fail.

Table Z.2-1

PWR Fuel Specification for the Fuel to be Stored in the NUHOMS®-37PTH DSC

PHYSICAL PARAMETERS: *Fuel Class*	 *Per TS Table 1-1ll*
Fuel Damage	*Per TS Table 1-1ll*
Reconstituted Fuel Assemblies: • *Maximum Number of Irradiated Stainless Steel Rods in Reconstituted Assemblies per DSC* • *Maximum Number of Irradiated Stainless Steel Rods per Reconstituted Fuel Assembly* • *Maximum Number of Reconstituted Assemblies per DSC with Unlimited Number of Low Enriched UO_2 Rods, or Zr Rods or Zr Pellets or Unirradiated Stainless Steel Rods*	*Per TS Table 1-1ll*
Control Components (CCs)	*Per TS Table 1-1ll*
Number of Intact Assemblies	*Per TS Table 1-1ll*
Number and Location of Damaged Assemblies	*Per TS Table 1-1ll*
Fissile Material	UO_2
Maximum Initial Uranium Content	*492 kg/assembly*
Maximum Assembly plus CC Weight	*Per TS Table 1-1ll*
Thermal/Radiological Parameters: *Allowable heat load zoning configurations for each 37PTH DSC Per TS Table 1-1ll.*	 *FQTs for applicable heat load zones are as follows:* *Table 1-3a for 0.4 kW,* *Table 1-3b for 0.6 kW,* *Table 1-3d for 0.7 kW,* *Table 1-3i for 1.2 kW, and* *Table 1-3p for 0.2 to 0.6 wt. % U-235.*
Maximum Planar Average Initial Fuel Enrichment	*Per TS Table 1-1ll*
Decay Heat per DSC	*Per TS Table 1-1ll*
Minimum Boron Loading	*Per TS Table 1-1ll*

Table Z.2-2

Thermal and Radiological Characteristics for Control Components Stored in the NUHOMS®-37PTH DSC

Parameter	***BPRAs, NSAs, CRAs, RCCAs, VSIs, APSRAs and Neutron Sources***	***TPAs and ORAs***
Maximum gamma source (γ/sec/DSC)	*Per TS Table 1-1qq*	
Decay heat (watts/DSC)	*296*	*296*

Note: NSAs and neutron sources shall only be stored in the interior compartments of the basket. Interior compartments are those compartments that are completely surrounded by other compartments, including the corners. There are thirteen interior compartments in the 37PTH DSC.

Table Z.2-3
PWR Fuel Assembly Design Characteristics for the NUHOMS®-37PTH DSC

Assembly Class		***WE 17x17***	***CE 15x15***	***WE 15x15***	***CE 14x14***	***WE 14x14***	***CE 16x16***
Maximum unirradiated length (in.)[(1)]	*37PTH-S*	*162.6*	*162.6*	*162.6*	*162.6*	*162.6*	*162.6*
	37PTH-M	*170.0*	*170.0*	*170.0*	*170.0*	*170.0*	*170.0*
Maximum number of fuel rods		*264*	*216*	*204*	*176*	*179*	*236*

[(1)] *Maximum assembly + control component length (unirradiated)*

Proprietary Information on This Page
Withheld Pursuant to 10 CFR 2.390

out of the transfer cask or tilting of the transfer cask in such a way as to result in a corner drop are also non-mechanistic, highly unlikely events. Nevertheless, for conservatism a corner drop is postulated and evaluated for the NUHOMS® system.

During transfer from the spent fuel pool building to the ISFSI, the drop distance from the bottom of the transfer cask, resting horizontally on the trailer skid, is less than 68″. Similarly, at the ISFSI, with the transfer trailer resting on the approach slab, the vertical distance from the concrete pad to the centerline of the cask is adjusted so that the transfer cask is aligned with the centerline of the HSM-H/HSM-HS door opening. As shown in Appendix U.1 of the SAR, TN drawing no. NUH-03-7003-SAR, sheet 5 of 10, the centerline of the HSM-H/HSM-HS door opening is 8′-10″ (106″) from the ground pad surface. The OD of the OS200/OS200FC transfer cask is 92.11″ (TN drawing no. NUH-08-8002-SAR, sheet 1 of 3); thus, the distance from the ground to the cask shell bottom is approximately 60″ (106″- 92.11/2″). Therefore, the maximum drop height is less than 60″. Technical Specification *4.4.1.A* also restricts handling of the loaded transfer cask to a height of less than 80″ outside the spent fuel pool building.

In spite of the incredible nature of any scenario that could lead to a drop accident for the TC, a conservative range of drop scenarios are developed and evaluated. These bounding scenarios assure that the integrity of the DSC and spent fuel cladding is not compromised. Analyses of these scenarios demonstrate that the TC will maintain the structural integrity of the DSC pressure containment boundary. Therefore, there is no potential for a release of radioactive materials to the environment due to a cask drop. The range of drop scenarios conservatively selected for the 37PTH DSC design are:

- A horizontal side drop from a height of 80 inches (75g horizontal drop).
- Vertical end drops for the NUHOMS® system are non-mechanistic and thus, no end drops are postulated for the OS200 TC loaded with a 37PTH DSC. However, 75g vertical end drop analyses are performed as a means of enveloping the 25g corner drop (in conjunction with the 75g horizontal side drop).
- An oblique corner drop from a height of 80 inches at an angle of 30º to the horizontal, onto the top or bottom corner of the TC. This case is not specifically evaluated. The side drop and end drop cases envelop the corner drop.

Z.3.7.4.2 37PTH DSC Shell Assembly Drop Evaluation

The shell assembly consists of the DSC shell, the shield plugs, and the top and bottom inner and outer cover plates. The shell assembly drop evaluation is presented in three parts:

1. DSC shell assembly horizontal drop analysis
2. DSC shell assembly vertical drop analysis
3. DSC shell stability analysis

Z.3.7.4.2.1 DSC Shell Assembly Horizontal Drop Analysis

The DSC shell assembly is analyzed for the postulated horizontal side drop using the ANSYS 3-D models of the DSC shell assembly discussed in Section Z.3.6.1.2. Half-symmetry (180°)

Z.8.1 Procedures for Loading the Cask

Z.8.1.1 Preparation of the TC and DSC

1. Prior to placement in dry storage, the candidate intact and damaged fuel assemblies shall be evaluated (by plant records or other means) to verify that they meet the physical, thermal and radiological criteria specified in Technical Specification 2.1.

2. Prior to being placed in service, the TC is to be cleaned or decontaminated as necessary to ensure a surface contamination level of less than those specified in Technical Specification *3.3.1*.

3. Place the TC in the vertical position in the cask decon area (or other designated area) using the cask handling crane and the TC lifting yoke.

4. Place scaffolding around the cask so that the top region of the transfer cask and surface of the cask are easily accessible to personnel.

5. Remove the TC top cover plate and examine the cask cavity for any physical damage and ready the cask for service. If required by the plant lifting crane capacity limit, drain the TC neutron shield water to an acceptable location.

NOTE: Verify that a cask spacer of appropriate height (refer to Drawing NUH-08-8005-SAR provided in Appendix U, Section U.1.5) is placed at the location of the TC.

6. Examine the DSC for any physical damage which might have occurred since the receipt inspection was performed. The DSC is to be cleaned and any loose debris removed.

7. Record the DSC serial number which is located on the grapple ring. Verify the correct DSC type, basket type and poison material types against the DSC serial number. Verify that the DSC is appropriate for the specific fuel loading campaign per the criteria specified in Technical Specification 2.1.

8. Using a crane, lower the DSC into the cask cavity by the internal lifting lugs and rotate the DSC to match the cask and DSC alignment marks.

9. If damaged fuel assemblies are included in a specific loading campaign, place the required number of bottom end caps provided (up to a maximum of 4) into the cell locations per Technical Specification 2.1. Optionally, this step may be performed at any prior time.

10. Fill the cask/DSC annulus with clean, demineralized water. Place the inflatable seal into the upper cask liner recess and seal the cask-DSC annulus by pressurizing the seal with compressed air.

11. Fill the DSC cavity with water from the fuel pool or an equivalent source which meets the requirements of Technical Specification *3.2.1*.

    NOTE: A TC/DSC annulus pressurization tank filled with demineralized water as described above is connected to the top vent port of the TC via a hose to provide a positive

CAUTION: Verify that all the lifting height restrictions as a function of temperature specified in Technical Specification *4.4.1* can be met in the following steps which involve lifting of the TC.

9. Visually verify that the top shield plug is properly seated onto the DSC.

10. Position the lifting yoke with the TC trunnions and verify that it is properly engaged.

10a. From this point, until the DSC has been inserted into the HSM, the DSC will be inspected for damage after any TC drop of fifteen inches or greater.

11. Raise the TC to the pool surface. Prior to raising the top of the cask above the water surface, stop vertical movement.

12. Inspect the top shield plug to verify that it is properly seated onto the DSC. If not, lower the cask and reposition the top shield plug. Repeat Steps 8 through 12 as necessary.

13. Continue to raise the TC from the pool and spray the exposed portion of the cask with water until the top region of the cask is accessible.

14. Drain any excess water from the top of the DSC shield plug back to the fuel pool.

15. Check the radiation levels at the center of the top shield plug and around the perimeter of the cask. Disconnect the top shield plug rigging.

16. Drain water from the DSC as necessary back into the pool or other suitable location to meet the plant lifting crane capacity limits. Use helium at 1.0 psig to 3.0 psig to backfill the DSC with helium per NUREG-1536 [8.5] guidance and Technical Specification 3.1.1 as water is being removed from the DSC cavity.

17. Lift the TC from the fuel pool. As the cask is raised from the pool, continue to spray the cask with water and decon as directed. Due to the possibility of delays during lifting/movement of the cask to the decon area, provisions shall be made to assure air will not enter the DSC cavity. One way to accomplish this is to include appropriate connections to allow replenishing the helium in the DSC cavity during any such delays.

18. Move the TC with loaded DSC to the cask decon area.

18a. Replace the water removed from the DSC cavity in Step 16 with water from the fuel pool or an equivalent source which meets the requirements of Technical Specifications *3.2.1*.

19. Install cask seismic restraints if required by *CoC Appendix A Inspections, Tests, and Evaluations Item 3.1.7* (required only on plant specific basis).

20. Verify that the transfer cask dose rates are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

Z.8.1.3 DSC Drying and Backfilling

CAUTION: During performance of steps listed in Section Z.8.1.3, monitor the TC/DSC annulus water level and replenish if necessary until drained.

1. Check the radiation levels along the perimeter of the cask. The cask exterior surface should be decontaminated as necessary. Temporary shielding may be installed as necessary to minimize personnel exposure.
2. Place scaffolding around the cask so that any point on the surface of the cask is easily accessible to personnel.
3. Disengage the rigging cables from the top shield plug and remove the eyebolts. Disengage the lifting yoke from the trunnions and position it clear of the cask.
4. Decontaminate the exposed surfaces of the DSC shell perimeter and remove the inflatable TC/DSC annulus seal.
5. Connect the cask drain line to the cask, open the cask cavity drain port and allow water from the annulus to drain out until the water level is approximately twelve inches below the top edge of the DSC shell. Take swipes around the outer surface of the DSC shell and check for smearable contamination in accordance with the Technical Specification *3.3.1* limits.

   CAUTION: Radiation dose rates are expected to be high at the vent and siphon port locations. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.
6. Drain approximately 410 gallons of water or more (as indicated on a flowmeter) from the DSC as necessary back into the fuel pool or other suitable location if not drained in Step 16 of Section Z.8.1.2. Consistent with NUREG-1536 [8.5] guidance and Technical Specification 3.1.1, helium at 1-3 psig is used to backfill the DSC with helium as water is being removed from the DSC. The minimum volume of water to be drained is to minimize hydrogen generation within the DSC cavity. It is also acceptable to completely drain the water within the DSC instead of draining only the minimum volume.

   CAUTION: Radiation dose rates are expected to be high at the vent and siphon port locations. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure. The minimum volume of water to be drained is to minimize hydrogen generation within the DSC cavity
7. Monitor TC/DSC annular water level and replenish, as necessary, until drained.
8. Install the automated welding machine onto the inner top cover plate and place the inner top cover plate with the automated welding machine onto the DSC. Optionally, the inner top cover plate and the automated welding machine can be placed separately. Verify proper fit-up of the inner top cover plate with the DSC shell.
9. Check radiation levels along surface of the inner top cover plate. Temporary shielding may be installed, as necessary, to minimize personnel exposure. Verify that the transfer cask dose rates are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

10. Insert a 1/4-inch tubing of sufficient length and adequate temperature resistance through the vent port such that it terminates just below the DSC shield plug. Connect the flexible tubing to a hydrogen monitor to allow continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner cover plate, in compliance with Technical Specification *4.3.3*. Optionally, other methods may be used for continuous monitoring of the hydrogen atmosphere in the DSC cavity during welding of the inner top cover plate, to comply with the Technical Specification.
11. Cover the cask/DSC annulus to prevent debris and weld splatter from entering the annulus.
12. Ready the automated welding machine and tack weld the inner top cover plate to the DSC shell. Install the inner top cover plate weldment and remove the automated welding machine.

    CAUTION: Continuously monitor the hydrogen concentration in the DSC cavity using the arrangement or other alternate methods described in Step 10 during the inner top cover plate cutting/welding operations. Verify that the measured hydrogen concentration does not exceed a safety limit of 2.4% [8.2] and [8.3] (60.0% of flammability limit of 4.0%). If this limit is exceeded, stop all welding operations and purge the DSC cavity with approximately 2-3 psig helium via the tubing to reduce the hydrogen concentration safely below the 2.4% limit.
13. Perform dye penetrant weld examination of the inner top cover plate weld in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.
14. Remove purge lines and connect the VDS to the DSC siphon and vent ports.
15. Install temporary shielding to minimize personnel exposure throughout the subsequent welding operations as required.
16. Remove water from DSC cavity if not fully drained in Step 6.
    a. If using blowdown method to remove water, engage helium supply (up to 15 psig) and open the valve on the vent port and allow helium to force the water from the DSC cavity through the siphon port. Use of helium is required per Technical Specification 3.1.1.
    b. Alternately a suction pump may be used (separately or in combination with helium pressure above) to remove water from DSC.
17. Once the water stops flowing from the DSC, close the DSC siphon port and disengage the helium source or turn off the section pump, as applicable.
18. Connect the hose from the vent port and the siphon port to the intake of the vacuum pump. Connect a hose from the discharge side of the VDS to the plant's radioactive waste system or spent fuel pool. Connect the VDS to a helium source.

    NOTE: Proceed cautiously when evacuating the DSC to avoid freezing consequences.
19. Open the valve on the suction side of the pump, start the VDS and draw a vacuum on the DSC cavity. The cavity pressure should be reduced in steps of approximately 100 mm Hg, 50 mm Hg, 25 mm Hg, 15 mm Hg, 10 mm Hg, 5 mm Hg, and 3 mm Hg. After pumping down to each level (these levels are optional), the pump is valved off and the cavity pressure monitored. The cavity pressure will rise as water and other volatiles in the cavity evaporate. When the cavity pressure stabilizes, the pump is valved in to complete the vacuum drying process. It may be necessary to repeat some steps, depending on the rate and extent of the pressure increase. Vacuum drying is complete when the pressure

26. Close the valves on the helium source.

Z.8.1.4 DSC Sealing Operations

CAUTION: During performance of steps listed in Section Z.8.1.4, monitor the Cask/DSC annulus water level and replenish as necessary to maintain cooling.

1. Disconnect the VDS from the DSC. Seal weld the prefabricated plugs over the vent and siphon ports. Inject helium into blind space just prior to completing welding, and perform a dye penetrant weld examination in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements. Use of an optional test head is acceptable to perform the helium leak test of the inner top cover plate and vent/siphon port welds in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1*. If an optional test head is not used, proceed to Step 2.

2. Temporary shielding may be installed, as necessary, to minimize personnel exposure. Install the automated welding machine onto the outer top cover plate and place the outer top cover plate with the automated welding system onto the DSC. Optionally, outer top cover plate may be installed separately from the welding machine. Verify proper fit up of the outer top cover plate with the DSC shell.

3. Tack weld the outer top cover plate to the DSC shell. Place the outer top cover plate weld root pass.

4. Helium leak test the inner top cover plate and vent/siphon port plate welds using the leak test port in the outer top cover plate in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.1* limits. Verify that the personnel performing the leak test are qualified in accordance with SNT-TC-1A [8.4]. Alternatively this can be done with a test head in Step 1 of Section Z.8.1.4.

5. If a leak is found, remove the outer cover plate root pass (if not using test head), the vent and siphon port plugs and repair the inner cover plate welds. Repeat procedure steps from Step 19 of Section Z.8.1.3.

6. Perform dye penetrant examination of the root pass weld. Weld out the outer top cover plate to the DSC shell and perform dye penetrant examination on the weld surface in accordance with the *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

7. Install and seal weld the prefabricated plug, if applicable, over the outer cover plate test port and perform dye penetrant weld examinations in accordance with *CoC Appendix A Inspections, Tests, and Evaluations Item 4.3* requirements.

8. Remove the automated welding machine from the DSC.

9. Open the cask drain port valve and drain the water from the cask/DSC annulus.

   CAUTION: Monitor the applicable time limits of Technical Specification 3.1.3 until the completion of DSC transfer Step 15 of Section Z.8.1.6.

   If the TC is in a horizontal orientation on the transfer skid, and the required time limit for completion of a DSC transfer specified in Technical Specification 3.1.3 are not met, initiate air circulation in the TC/DSC annulus by starting one of the blowers provided on the transfer skid and continue blower operation for a minimum duration of 36 hours.

When transfer operations are ready to continue secure air circulation and either complete the DSC insertion OR return the TC/DSC to an upright configuration and fill with clean demineralized water within the applicable time limits of Technical Specification 3.1.3.

10. Rig the cask top cover plate and lower the cover plate onto the TC.
11. Bolt the cask cover plate into place, tightening the bolts to the required torque in a star pattern.
12. Verify that the transfer cask dose rates are compliant with limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Item 3.2*.

Z.8.1.5 TC Downending and Transfer to ISFSI

NOTE: **Alternate Procedure for Downending of Transfer Cask:** Some plants have limited floor hatch openings above the cask/trailer/skid, or other conditions which limit crane travel in the direction that would be needed in order to downend the TC with the trailer/skid in a stationary position. For these situations, alternate procedures are to be developed on a plant-specific basis, with detailed steps for downending.

1. Re-attach the TC lifting yoke to the crane hook, as necessary. Ready the transfer trailer and cask support skid for service.
2. Move the scaffolding away from the cask, as necessary. Engage the lifting yoke and lift the cask over the cask support skid on the transfer trailer.
3. The transfer trailer should be positioned so that cask support skid is accessible to the crane with the trailer supported on the vertical jacks.
4. Position the cask lower trunnions onto the transfer trailer support skid pillow blocks.
5. Move the crane forward while simultaneously lowering the cask until the cask upper trunnions are just above the support skid upper trunnion pillow blocks.
6. Inspect the positioning of the cask to ensure that the cask and trunnion pillow blocks are properly aligned.
7. Lower the cask onto the skid until the weight of the cask is distributed to the trunnion pillow blocks.
8. Inspect the trunnions to ensure that they are properly seated onto the skid and install the trunnion tower closure plates, if required.
9. Remove the bottom ram access cover plate from the cask if integral ram/trailer is not used. Install the two-piece temporary neutron/gamma shield plug to cover the bottom ram access. Install the ram trunnion support frame on the bottom of the transfer cask. (The temporary shield plug and ram trunnion support frame are not required with the integral ram/trailer.)

Z.8.1.6 DSC Transfer to the HSM

NOTE: If using the HSM-HS module for storage at sites with high seismic levels, verify that at least 3 modules are connected together per the requirements of *CoC Condition II.2.a*.

1. Prior to transferring the cask to the ISFSI or prior to positioning the transfer cask at the HSM designated for storage, remove the HSM door using a porta-crane, inspect the cavity of the HSM, removing any debris and ready the HSM to receive a DSC. The doors on adjacent HSMs should remain in place.

   CAUTION: The insides of empty modules have the potential for high dose rates due to adjacent loaded modules. Proper ALARA practices should be followed for operations inside these modules and in the areas outside these modules whenever the door from the empty HSM has been removed.

2. Inspect the HSM air inlet and outlets to ensure that they are clear of debris. Inspect the screens on the air inlet and outlets for damage.
   CAUTION: Verify that the requirements of Technical Specification *4.4.1.B* are met prior to next step.

3. Using a suitable vehicle, transfer the cask from the plant's fuel/reactor building to the ISFSI along the designated transfer route.

4. Once at the ISFSI, position the transfer trailer to within a few feet of the HSM.

5. Check the position of the trailer to ensure the centerline of the HSM and cask approximately coincide. If the trailer is not properly oriented, reposition the trailer, as necessary.

6. Using crane, unbolt and remove the cask top cover plate.

7. Back the trailer to within a few inches of the HSM, set the trailer brakes and disengage the tractor. Drive the tractor clear of the trailer. Extend the transfer trailer vertical jacks.

8. Connect the skid positioning system hydraulic power unit to the positioning system via the hose connector panel on the trailer, and power it up. Remove the skid tie-down bracket fasteners and use the skid positioning system to bring the cask into approximate vertical and horizontal alignment with the HSM. Using optical survey equipment and the alignment marks on the cask and the HSM, adjust the position of the cask until it is properly aligned with the HSM.

9. Using the skid positioning system, fully insert the cask into the HSM access opening docking collar.

10. Secure the cask trunnions to the front wall embedments of the HSM using the cask restraints.

11. After the cask is docked with the HSM, verify the alignment of the TC using the optical survey equipment.

12. Position the hydraulic ram behind the cask in approximate horizontal alignment with the cask and level the ram. Remove either the bottom ram access cover plate (if not previously removed) or the outer plug of the two-piece temporary shield plug if installed. Power up the ram hydraulic power supply and extend the ram through the bottom cask opening into the DSC grapple ring.

13. Activate the hydraulic cylinder on the ram grapple and engage the grapple arms with the DSC grapple ring.

14. Recheck all alignment and ready all systems for DSC transfer. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

    If the alignment tolerance is exceeded, the following actions should be taken:

    a. Confirm that the transfer system is properly configured,

    b. Check and repair the alignment equipment, or

    c. Confirm the locations of the alignment targets on the TC and HSM.

15. Activate the hydraulic ram to initiate insertion of the DSC into the HSM. Stop the ram when the DSC reaches the support rail stops at the back of the module.

    CAUTION: Verify that the applicable time limits of Technical Specification 3.1.3 are met if loading a 37PTH DSC with heat load greater than 22.0 kW.

16. Disengage the ram grapple mechanism away from the DSC grapple ring.

17. Retract and disengage the hydraulic ram system from the cask and move it clear of the cask. Remove the cask restraints from the HSM.

18. Using the skid positioning system, disengage the cask from the HSM access opening.

19. Install the DSC axial in retainer through the HSM door opening.

20. After inserting the DSC axial retainer, the transfer trailer may be moved as necessary to install the HSM door. Install the HSM door using a portable crane and secure it in place. Door may be welded for security. Verify that the HSM dose rates are compliant with the limits specified in *CoC Appendix A Inspections, Tests, and Evaluations Items 3.3.1 and 3.3.2*.

21. Replace the TC top cover plate. Secure the skid to the trailer, retract the vertical jacks and disconnect the skid positioning system.

22. If this is the final loading, fully drain the liquid neutron shield.

23. Tow the trailer and cask to the designated equipment storage area. Return the remaining transfer equipment to the storage area.

24. Close and lock the ISFSI access gate and activate the ISFSI security measures.

25. Ensure the HSM maximum air exit temperature requirements of *CoC Appendix A Inspections, Tests, and Evaluations Item 4.4* are met.

Z.8.1.7 Monitoring Operations

1. Perform routine security surveillance in accordance with the licensee's ISFSI security plan.

2. Perform one of the two alternate daily surveillance activities listed below:

    a. A daily visual surveillance of the HSM air inlets and outlets to ensure that no debris is obstructing the HSM vents in accordance with Technical Specification *3.1.4.a* requirements.

    b. A temperature measurement of the thermal performance, for each HSM, on a daily basis in accordance with Technical Specification *3.1.4.b* requirements.

Z.8.2 Procedures for Unloading the Cask

Z.8.2.1 DSC Retrieval from the HSM

1. Ready the TC, transfer trailer, and support skid for service and tow the trailer to the HSM.

NOTE: Verify that a cask spacer of appropriate height (refer to Drawing NUH-08-8005-SAR provided in Appendix U, Section U.1.5) is placed at the location of the TC.

2. Back the trailer to within a few feet of the HSM and remove the cask top cover plate.

   CAUTION: High dose rates are expected in the HSM cavity after removal of the HSM door. Proper ALARA practices should be followed.

3. Remove the HSM door using a crane. Remove the DSC axial retainer.

4. Continue to back the trailer within a few inches of the HSM. Using the skid positioning system align the cask with the HSM and position the skid until the cask is docked with the HSM access opening.

5. Using optical survey equipment, verify alignment of the cask with respect to the HSM. *The TC shall be aligned with respect to the HSM such that the longitudinal centerline of the DSC in the TC is within ± ⅛ inch of its true position when the TC is docked with the HSM front access opening.*

   If the alignment tolerance is exceeded, the following actions should be taken:

   a. Confirm that the transfer system is properly configured,

   b. Check and repair the alignment equipment, or

   c. Confirm the locations of the alignment targets on the TC and HSM.

5a. Install the cask restraints.

6. Install (if required) and align the hydraulic ram with the cask.

7. Extend the ram through the cask into the HSM until it is inserted in the DSC grapple ring.

8. Activate the arms on the ram grapple mechanism with the DSC grapple ring.

8a. From this point, until fuel has been removed from the DSC or the DSC has been removed from the TC, the DSC will be inspected for damage after any TC drop of 15 inches or greater.

9. Retract ram and pull the DSC into the cask.

10. Retract the ram grapple arms.

11. Disengage the ram from the cask. Install the ram access penetration cover plate.

12. Remove the cask restraints.
13. Using the skid positioning system, disengage the cask from the HSM.
14. Install the cask top cover plate and ready the trailer for transfer.
15. Replace the door on the HSM.

13. Install temporary shielding to reduce personnel exposure as required. Fill the TC/DSC annulus with clean demineralized water and place a protective cover over the annulus.

The process of DSC unloading is similar to that used for DSC loading. DSC opening operations described below are to be carefully controlled in accordance with plant procedures. This operation is to be performed under the site's standard health physics guidelines for welding, grinding, and handling of potentially highly contaminated equipment. These are to include the use of prudent housekeeping measures and monitoring of airborne particulates. Procedures may require personnel to perform the work using respirators or supplied air.

If fuel needs to be removed from the DSC, either at the end of service life or for inspection after an accident, precautions must be taken against the potential for the presence of damaged or oxidized fuel and to prevent radiological exposure to personnel during this operation. A sampling of the atmosphere within the DSC will be taken prior to inspection or removal of fuel.

This can be achieved with this design by the use of the purge and fill valves which permit a determination of the atmosphere within the DSC before the removal of the inner top cover and shield plugs, prior to filling the DSC cavity with water (borated water for the 37PTH). If the atmosphere within the DSC is helium and radioactivity check of the atmosphere in the DSC cavity did not detect the presence of any airborne radioactive particulates, then operations should proceed normally with fuel removal either via the TC or in the pool, if available. However, if air or airborne radioactive particulates are present within the DSC, then appropriate filters should be in place to preclude the uncontrolled release of any potential airborne radioactive particulate from the DSC via the purge-fill valves. This will protect both personnel and the operations area from potential contamination. For the accident case, personnel protection in the form of respirators or supplied air should be considered in accordance with licensee's Radiation Protection Program.

If the work is performed outside the fuel/reactor building, a tent may be constructed over the work area, which may be kept under a negative pressure to control airborne particulates. Any radioactive gas release will be Kr-85, which is not readily captured. Whether the krypton is vented through the plant stack or allowed to be released directly depends on the plant operating requirements.

Following opening of the DSC, the cask and DSC are filled with water prior to lowering the top of cask below the surface of the fuel pool to prevent a sudden inrush of pool water. Cask placement into the pool is performed in the usual manner. Fuel unloading procedures will be governed by the plant operating license under 10CFR50. The generic procedures for these operations are as follows:

14. Locate the DSC siphon and vent port using the indications on the top cover plate. Place a portable drill press on the top of the DSC. Position the drill with the siphon port.

15. Place an exhaust hood or tent over the DSC, if necessary. The exhaust should be filtered or routed to the site radwaste system.

CAUTION: Radiation dose rates are expected to be high at the vent and siphon port location. Use proper ALARA practices (e.g., use of temporary shielding, appropriate positioning of personnel, etc.) to minimize personnel exposure.

16. Drill a hole through the DSC top cover plate to expose the siphon port quick connect.

17. Drill a second hole through the top cover plate to expose the vent port quick connect.

18. Obtain a sample of the DSC atmosphere. Fill the DSC with water from the fuel pool or an equivalent source which meets the requirements of Technical Specification *3.2.1*. Fill through the siphon port with the vent port open and routed to the plant's off-gas system.

    CAUTION:

    a. The water fill rate must be regulated during this reflooding operation to ensure that the DSC vent pressure does not exceed 20.0 psig.

b. Per Technical Specification *4.3.3*, provide for continuous hydrogen monitoring of the DSC cavity atmosphere during all subsequent cutting operations to ensure that a safety limit of 2.4% (60.0% of flammability limit of 4.0%) is not exceeded [8.2] and [8.3]. Purge with helium at 2.5 psig ± 1.0 psig as necessary to maintain the hydrogen concentration safely below this limit.

19. Using a mechanical cutting system, plasma arc-gouging, or other suitable means, remove the seal weld from the outer top cover plate and DSC shell and remove the outer top cover plate.

20. Remove the seal weld from the inner top cover plate to the DSC shell in the same manner as the top cover plate. Remove the inner top cover plate. Remove any remaining excess material on the inside shell surface by grinding.

21. Clean the cask surface of dirt and any debris which may be on the cask surface as a result of the weld removal operation. Any other procedures which are required for the operation of the cask should take place at this point as necessary.

22. Engage the yoke onto the trunnions, install eyebolts into the top shield plug and connect the rigging cables to the eyebolts.

23. Visually inspect the lifting hooks or the yoke to ensure that they are properly positioned on the trunnions.

24. The cask should be lifted just far enough to allow the weight of the TC to be distributed onto the yoke lifting hooks. Inspect the lifting hooks to ensure that they are properly positioned on the trunnions.

25. Install suitable protective material onto the bottom of the TC to minimize cask contamination. Move the cask to the fuel pool.

26. Prior to lowering the cask into the pool, adjust the pool water level, if necessary, to accommodate the volume of water which will be displaced by the cask during the operation.

27. Position the cask over the designated area in the fuel pool.

28. Lower the cask into the pool. As the cask is being lowered, the exterior surface of the cask and lifting yoke should be sprayed with clean demineralized water.

29. Lower the cask into the fuel pool leaving the top surface of the cask approximately one foot above the surface of the pool water. Verify correct connections of the annulus seal and annulus/neutron shield tanks if used.

30. Fill the top of the DSC with water as needed and continue lowering the cask into the pool.

31. Disengage the lifting yoke from the cask and lift the top shield plug from the DSC.

32. If the DSC contains damaged fuel assemblies, remove the top end caps. Remove the fuel from the DSC and place the fuel into the spent fuel racks.

Z.11.1.2 Extreme Temperatures

No change. The off-normal maximum ambient temperature of 125°F is used in Chapter 8, Section 8.1.2.2. For the NUHOMS® 37PTH system, a maximum ambient temperature of 117°F is used. Appendix Z.3, Section Z.3.4.4.3 addresses the thermal stress analysis for the 37PTH DSC, HSM-H (HSM-HS) and OS200 TC.

Z.11.1.2.1 Postulated Cause of Event

No change. See Chapter 8, Section 8.1.2.2.

Z.11.1.2.2 Detection of Event

No change. See Chapter 8, Section 8.1.2.2.

Z.11.1.2.3 Analysis of Effects and Consequences

The thermal evaluation of the NUHOMS® 37PTH system for off-normal conditions is presented in Appendix Z.4. The 106ºF normal condition with insolation bounds the 117ºF case without insolation for the DSC in the TC. Therefore the normal condition maximum temperatures are bounding. The 117ºF case with the DSC in the HSM-H is not bounded by the normal conditions and therefore evaluated in Appendix Z.4.

The structural evaluation of the 37PTH DSC for off-normal temperature conditions is presented in Appendix Z.3, Section Z.3.6.2.2. The structural evaluation of the basket due to off-normal thermal conditions is presented in Appendix Z.3, Section Z.3.6.1.3. The structural evaluation of HSM-H and OS200 Transfer Cask for off-normal conditions with 37PTH DSC are presented in Appendix Z.3, Section Z.3.6.1.4 and Appendix Z.3, Section Z.3.6.1.5, respectively.

Z.11.1.2.4 Corrective Actions

Restrictions for onsite handling of the TC with a loaded DSC under extreme temperature conditions are presented in Technical Specification*s 4.4.1.A and 4.4.1.B*.

Z.11.1.3 Off-Normal Releases of Radionuclides

The NUHOMS® 37PTH DSC is designed and tested to the leak tight criteria of ANSI N14.5 [11.2]. Therefore the estimated quantity of radionuclides expected to be released annually to the environment due to normal or off-normal events is zero.

Z.11.1.3.1 Postulated Cause of Event

In accordance with the Standard Review Plan, NUREG-1536 [11.3] for off-normal conditions, it is conservatively assumed that 10% of the fuel rods fail.

Z.11.1.3.2 Detection of Event

Failed fuel rods would go undetected, but are not a safety concern since the canister is designed and tested to the leak tight criteria of ANSI N14.5 [11.2].