

CERTIFICATE OF COMPLIANCE FOR SPENT FUEL STORAGE CASKS

The U.S. Nuclear Regulatory Commission is issuing this Certificate of Compliance pursuant to Title 10 of the Code of Federal Regulations, Part 72, "Licensing Requirements for Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste" (10 CFR Part 72). This certificate is issued in accordance with 10 CFR 72.238, certifying that the storage design and contents described below meet the applicable safety standards set forth in 10 CFR Part 72, Subpart L, and on the basis of the Final Safety Analysis Report (FSAR) of the cask design. This certificate is conditional upon fulfilling the requirements of 10 CFR Part 72, as applicable, and the conditions specified below.

| Certificate No. | Effective Date | Expiration Date | Docket No. | Amendment No. | Amendment Effective Date | Package Identification No. |
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Issued To: (Name/Address)

Holtec International
Holtec Center
555 Lincoln Drive West
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Safety Analysis Report Title

Holtec International
Final Safety Analysis Report for the
HI-STORM 100 Cask System

CONDITIONS

This certificate is conditioned upon fulfilling the requirements of 10 CFR Part 72, as applicable, the attached Appendix A (Technical Specifications) and Appendix B (Approved Contents and Design Features), and the conditions specified below:

1. CASK

a. Model No.: HI-STORM 100 Cask System

The HI-STORM 100 Cask System (the cask) consists of the following components: (1) interchangeable multi-purpose canisters (MPCs), which contain the fuel; (2) a storage overpack (HI-STORM), which contains the MPC during storage; and (3) a transfer cask (HI-TRAC), which contains the MPC during loading, unloading and transfer operations. The cask stores up to 32 pressurized water reactor (PWR), fuel assemblies or 68 boiling water reactor (BWR) fuel assemblies.

b. Description

The HI-STORM 100 Cask System is certified as described in the Final Safety Analysis Report (FSAR) and in the U.S. Nuclear Regulatory Commission's (NRC) Safety Evaluation Report (SER) accompanying the Certificate of Compliance. The cask comprises three discrete components: the MPCs, the HI-TRAC transfer cask, and the HI-STORM storage overpack.

The MPC is the confinement system for the stored fuel. It is a welded, cylindrical canister with a honeycombed fuel basket, a baseplate, a lid, a closure ring, and the canister shell. All MPC components that may come into contact with spent fuel pool water or the ambient environment are made entirely of stainless steel except for the neutron absorbers, aluminum seals on vent and drain port caps, and aluminum heat conduction elements (AHCEs), which are installed in some early-vintage MPCs. The canister shell, baseplate, lid, vent and drain port cover plates, and closure ring are the main confinement boundary components. All confinement boundary components are made entirely of stainless steel. The honeycombed basket, which is equipped with neutron absorbers, provides criticality control.

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1. b. Description (continued)

There are eight types of MPCs: the MPC-24, MPC-24E, MPC-24EF, MPC-32, MPC-32F, MPC-68, MPC-68F, and MPC-68FF. The number suffix indicates the maximum number of fuel assemblies permitted to be loaded in the MPC. All eight MPC models have the same external diameter.

The HI-TRAC transfer cask provides shielding and structural protection of the MPC during loading, unloading, and movement of the MPC from the spent fuel pool to the storage overpack. The transfer cask is a multi-walled (carbon steel/lead/carbon steel) cylindrical vessel with a water jacket attached to the exterior. Two sizes of HI-TRAC transfer casks are available: the 125 ton-HI-TRAC and the 100 ton HI-TRAC. The weight designation is the approximate maximum weight of a loaded transfer cask during any loading, unloading or transfer operation. Both transfer cask sizes have identical cavity diameters. The 125 ton HI-TRAC transfer cask has thicker lead and water shielding and larger outer dimensions than the 100 ton HI-TRAC transfer cask.

The HI-STORM 100 or 100S storage overpack provides shielding and structural protection of the MPC during storage. The HI-STORM 100S is a variation of the HI-STORM 100 overpack design that includes a modified lid which incorporates the air outlet ducts into the lid, allowing the overpack body to be shortened. The overpack is a heavy-walled steel and concrete, cylindrical vessel. Its side wall consists of plain (un-reinforced) concrete that is enclosed between inner and outer carbon steel shells. The overpack has four air inlets at the bottom and four air outlets at the top to allow air to circulate naturally through the cavity to cool the MPC inside. The inner shell has channels attached to its interior surface to guide the MPC during insertion and removal, provide a flexible medium to absorb impact loads, and allow cooling air to circulate through the overpack. A loaded MPC is stored within the HI-STORM 100 or 100S storage overpack in a vertical orientation. The HI-STORM 100A and 100SA are variants of the HI-STORM 100 family outfitted with an extended baseplate and gussets to enable the overpack to be anchored to the concrete storage pad in high seismic applications.

The HI-STORM 100U storage overpack is an underground variation of the HI-STORM 100 family of vertical ventilated modules. HI-STORM 100U consists of a subterranean steel structure, which creates the MPC storage cavity, and an aboveground closure lid made of a concrete-filled steel weldment. Air inlets and outlets allow air to circulate naturally through the cavity to cool the MPC inside. The subterranean steel structure is seal welded to prevent ingress of any groundwater from the surrounding subgrade and is placed on a stiff foundation. The surrounding subgrade and a top surface pad provide significant radiation shielding. A loaded MPC is stored within the HI-STORM 100U storage overpack in a vertical orientation.

2. OPERATING PROCEDURES

Written operating procedures shall be prepared for cask handling, loading, movement, surveillance, and maintenance. The user's site-specific written operating procedures shall be consistent with the technical basis described in Chapter 8 of the FSAR.

3. ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

Written cask acceptance tests and maintenance program shall be prepared consistent with the technical basis described in Chapter 9 of the FSAR.

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4. QUALITY ASSURANCE

Activities in the areas of design, purchase, fabrication, assembly, inspection, testing, operation, maintenance, repair, modification of structures, systems and components, and decommissioning that are important to safety shall be conducted in accordance with a Commission-approved quality assurance program which satisfies the applicable requirements of 10 CFR Part 72, Subpart G, and which is established, maintained, and executed with regard to the cask system.

5. HEAVY LOADS REQUIREMENTS

Each lift of an MPC, a HI-TRAC transfer cask, or any HI-STORM overpack must be made in accordance to the existing heavy loads requirements and procedures of the licensed facility at which the lift is made. A plant-specific regulatory review (under 10 CFR 50.59 or 10 CFR 72.48, if applicable) is required to show operational compliance with existing plant specific heavy loads requirements. Lifting operations outside of structures governed by 10 CFR Part 50 must be in accordance with Section 5.5 of Appendix A and/or Sections 3.4.6 and Section 3.5 of Appendix B to this certificate, as applicable.

6. APPROVED CONTENTS

Contents of the HI-STORM 100 Cask System must meet the fuel specifications given in Appendix B to this certificate.

7. DESIGN FEATURES

Features or characteristics for the site, cask, or ancillary equipment must be in accordance with Appendix B to this certificate.

8. CHANGES TO THE CERTIFICATE OF COMPLIANCE

The holder of this certificate who desires to make changes to the certificate, which includes Appendix A (Technical Specifications) and Appendix B (Approved Contents and Design Features), shall submit an application for amendment of the certificate.

9. SPECIAL REQUIREMENTS FOR FIRST SYSTEMS IN PLACE

The air mass flow rate through the cask system will be determined by direct measurements of air velocity in the overpack cooling passages for the first HI-STORM Cask Systems placed into service by any user with a heat load equal to or greater than 20 kW. In the aboveground HI-STORM models (HI-STORM 100, 100S, etc.), the velocity will be measured in the annulus formed between the MPC shell and the overpack inner shell. In the belowground HI-STORM model (HI-STORM 100U), the velocity will be measured in the vertical downcomer air passage. An analysis shall be performed that demonstrates the measurements validate the analytic methods and thermal performance predicted by the licensing-basis thermal models in Chapter 4 of the FSAR.

Each first time user of a HI-STORM 100 Cask System Supplemental Cooling System (SCS) that uses components or a system that is not essentially identical to components or a system that has been previously tested, shall measure and record coolant temperatures for the inlet and outlet of cooling provided to the annulus between the HI-TRAC and MPC and the coolant flow rate. The user shall also record the MPC operating pressure and decay heat. An analysis shall be performed, using this information, that validates the thermal methods described in the FSAR which were used to determine the type and amount of supplemental cooling necessary.

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9. SPECIAL REQUIREMENTS FOR FIRST SYSTEMS IN PLACE (continued)

Letter reports summarizing the results of each thermal validation test and SCS validation test and analysis shall be submitted to the NRC in accordance with 10 CFR 72.4. Cask users may satisfy these requirements by referencing validation test reports submitted to the NRC by other cask users.

10. PRE-OPERATIONAL TESTING AND TRAINING EXERCISE

A dry run training exercise of the loading, closure, handling, unloading, and transfer of the HI-STORM 100 Cask System shall be conducted by the licensee prior to the first use of the system to load spent fuel assemblies. The training exercise shall not be conducted with spent fuel in the MPC. The dry run may be performed in an alternate step sequence from the actual procedures, but all steps must be performed. The dry run shall include, but is not limited to the following:

- a. Moving the MPC and the transfer cask into the spent fuel pool.
- b. Preparation of the HI-STORM 100 Cask System for fuel loading.
- c. Selection and verification of specific fuel assemblies to ensure type conformance.
- d. Loading specific assemblies and placing assemblies into the MPC (using a dummy fuel assembly), including appropriate independent verification.
- e. Remote installation of the MPC lid and removal of the MPC and transfer cask from the spent fuel pool.
- f. MPC welding, NDE inspections, pressure testing, draining, moisture removal (by vacuum drying or forced helium dehydration, as applicable), and helium backfilling. (A mockup may be used for this dry-run exercise.)
- g. Operation of the Supplemental Cooling System (if used)
- h. Transfer cask upending/downending on the horizontal transfer trailer or other transfer device, as applicable to the site's cask handling arrangement.
- i. Transfer of the MPC from the transfer cask to the overpack.
- j. Placement of the HI-STORM 100 Cask System at the ISFSI (aboveground systems only).
- k. HI-STORM 100 Cask System unloading, including cooling fuel assemblies, flooding MPC cavity, removing MPC lid welds. (A mockup may be used for this dry-run exercise.)

11. When the Supplemental Cooling System is in operation to provide for decay heat removal in accordance with Section 3.1.4 of Appendix A the licensee is exempt from the requirements of 10 CFR 72.236(f).

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12. AUTHORIZATION

The HI-STORM 100 Cask System, which is authorized by this certificate, is hereby approved for general use by holders of 10 CFR Part 50 licenses for nuclear reactors at reactor sites under the general license issued pursuant to 10 CFR 72.210, subject to the conditions specified by 10 CFR 72.212, and the attached Appendix A and Appendix B. The HI-STORM 100 Cask System may be fabricated and used in accordance with any approved amendment to CoC No. 1014 listed in 10 CFR 72.214. Each of the licensed HI-STORM 100 System components (i.e., the MPC, overpack, and transfer cask), if fabricated in accordance with any of the approved CoC Amendments, may be used with one another provided an assessment is performed by the CoC holder that demonstrates design compatibility.

FOR THE U. S. NUCLEAR REGULATORY COMMISSION

Robert Nelson, Chief
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- Attachments:
1. Appendix A
2. Appendix B

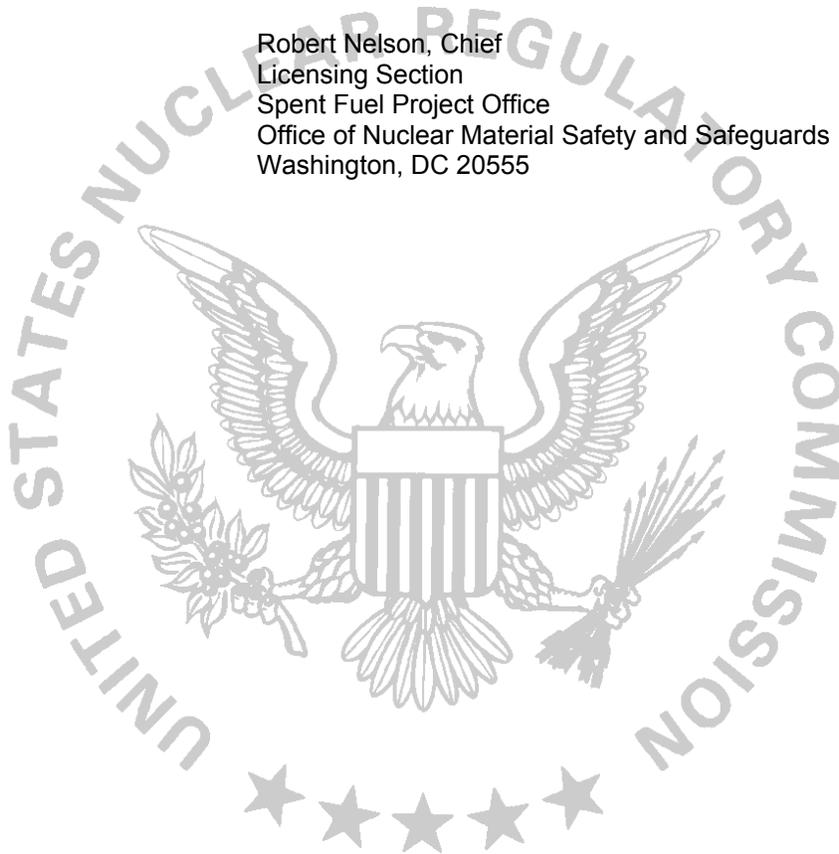


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1.0 USE AND APPLICATION

1.1 Definitions

-----NOTE-----

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

| <u>Term</u> | <u>Definition</u> |
|------------------------------|--|
| ACTIONS | ACTIONS shall be that part of a Specification that prescribes Required Actions to be taken under designated Conditions within specified Completion Times. |
| FUEL BUILDING | The FUEL BUILDING is the site-specific power plant facility, governed by the regulations of 10CFR Part 50, where the loaded OVERPACK or TRANSFER CASK is transferred to or from the transporter. |
| LOADING OPERATIONS | LOADING OPERATIONS include all licensed activities on an OVERPACK or TRANSFER CASK while it is being loaded with fuel assemblies. LOADING OPERATIONS begin when the first fuel assembly is placed in the MPC and end when the OVERPACK or TRANSFER CASK is suspended from or secured on the transporter. LOADING OPERATIONS does not included MPC transfer between the TRANSFER CASK and the OVERPACK, which begins when the MPC is lifted off the HI-TRAC bottom lid and ends when the MPC is supported from beneath by the OVERPACK. |
| MULTI-PURPOSE CANISTER (MPC) | MPCs are the sealed spent nuclear fuel canisters which consist of a honeycombed fuel basket contained in a cylindrical canister shell which is welded to a baseplate, lid with welded port cover plates, and closure ring. The MPC provides the confinement boundary for the contained radioactive materials. |

(continued)

1.1 Definitions (continued)

| | |
|----------------------------------|--|
| OVERPACK | OVERPACKS are the casks which receive and contain the sealed MPCs for interim storage on the ISFSI. They provide gamma and neutron shielding, and provide for ventilated air flow to promote heat transfer from the MPC to the environs. The OVERPACK does not include the TRANSFER CASK. |
| SPENT FUEL STORAGE CASKS (SFSCs) | SFSCs are containers approved for the storage of spent fuel assemblies at the ISFSI. The HI-STORM 100 SFSC System consists of the OVERPACK and its integral MPC. |
| STORAGE OPERATIONS | STORAGE OPERATIONS include all licensed activities that are performed at the ISFSI while an SFSC containing spent fuel is situated within the ISFSI perimeter. STORAGE OPERATIONS does not include MPC transfer between the TRANSFER CASK and the OVERPACK, which begins when the MPC is lifted off the HI-TRAC bottom lid and ends when the MPC is supported from beneath by the OVERPACK (or the reverse). |
| TRANSFER CASK | TRANSFER CASKs are containers designed to contain the MPC during and after loading of spent fuel assemblies and to transfer the MPC to or from the OVERPACK. The HI-STORM 100 System employs either the 125-Ton or the 100-Ton HI-TRAC TRANSFER CASK. |
| VERTICAL VENTILATED MODULE (VVM) | The VVM is an OVERPACK where the contained fuel assemblies are supported in a vertical orientation and where air flow through cooling passages aids in rejecting decay heat to the environment. |

(continued)

1.1 Definitions (continued)

TRANSPORT OPERATIONS

TRANSPORT OPERATIONS include all licensed activities performed on an OVERPACK or TRANSFER CASK loaded with one or more fuel assemblies when it is being moved to and from the ISFSI. TRANSPORT OPERATIONS begin when the OVERPACK or TRANSFER CASK is first suspended from or secured on the transporter and end when the OVERPACK or TRANSFER CASK is at its destination and no longer secured on or suspended from the transporter. TRANSPORT OPERATIONS includes transfer of the MPC between the OVERPACK and the TRANSFER CASK, which begins when the MPC is lifted off the HI-TRAC bottom lid and ends when the MPC is supported from beneath by the OVERPACK (or the reverse).

UNLOADING OPERATIONS

UNLOADING OPERATIONS include all licensed activities on an SFSC to be unloaded of the contained fuel assemblies. UNLOADING OPERATIONS begin when the OVERPACK or TRANSFER CASK is no longer suspended from or secured on the transporter and end when the last fuel assembly is removed from the SFSC. UNLOADING OPERATIONS does not include MPC transfer between the TRANSFER CASK and the OVERPACK, which begins when the MPC is no longer supported from beneath by the OVERPACK and ends when the MPC lowered onto the HI-TRAC bottom lid.

3.1 SFSC INTEGRITY

3.1.2 SFSC Heat Removal System

LCO 3.1.2 The SFSC Heat Removal System shall be operable

-----NOTE-----
The SFSC Heat Removal System is operable when 50% or more of the inlet and outlet vent areas are unblocked and available for flow or when air temperature requirements are met.

APPLICABILITY: During STORAGE OPERATIONS.

ACTIONS
-----NOTE-----
Separate Condition entry is allowed for each SFSC.

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|--|--|-----------------|
| A. SFSC Heat Removal System operable, but partially (< 50%) blocked. | A.1 Remove blockage. | N/A |
| B. SFSC Heat Removal System inoperable. | B.1 Restore SFSC Heat Removal System to operable status. | 8 hours |

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|--|---|
| <p>C. Required Action B.1 and associated Completion Time not met.</p> | <p>C.1 Measure SFSC dose rates in accordance with the Radiation Protection Program.</p> <p><u>AND</u></p> <p>C.2.1 Restore SFSC Heat Removal System to operable status.</p> <p><u>OR</u></p> <p>C.2.2 Transfer the MPC into a TRANSFER CASK.</p> | <p>Immediately and once per 12 hours thereafter</p> <p>64 hours (aboveground OVERPACK, MPC heat \leq 28.74 kW)</p> <p>24 hours (aboveground OVERPACK, MPC heat > 28.74 kW)</p> <p>16 hours (underground OVERPACK)</p> <p>64 hours (aboveground OVERPACK, MPC heat \leq 28.74 kW)</p> <p>24 hours (aboveground OVERPACK, MPC heat > 28.74 kW)</p> <p>16 hours (underground OVERPACK)</p> |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|--------------|--|------------------------------------|
| SR 3.1.2 | Verify all OVERPACK air inlets and outlets air ducts are free of blockage from solid debris or floodwater. | 24 hours (aboveground OVERPACK) |
| | | 16 hours (underground OVERPACK) |
| | <u>OR</u> | |
| | For OVERPACKs with installed temperature monitoring equipment, verify that the difference between the average OVERPACK air outlet temperature and ISFSI ambient temperature is \leq 155°F for aboveground OVERPACKs containing PWR MPCs, \leq 137°F for aboveground OVERPACKs containing BWR MPCs, \leq 85°F for underground OVERPACKs containing PWR MPCs, \leq 93°F for underground OVERPACKs containing BWR MPCs. | 24 hours (aboveground OVERPACK) |
| | | 16 hours (underground OVERPACK) |

3.1 SFSC INTEGRITY

3.1.5 Impressed Current Cathodic Protection System (ICCPS)

LCO 3.1.5 The ICCPS shall be maintained operative

APPLICABILITY: During STORAGE OPERATIONS for any ISFSI that uses an ICCPS for corrosion mitigation.

-----NOTE-----
Separate condition entry is allowed for each ICCPS at a particular ISFSI site.

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|--|-----------------|
| A. ICCPS inoperable after initial startup period. | A.1 Restore ICCPS to operable status | 6 months |
| | <u>OR</u> A.2 Perform engineering evaluation to determine that the affected VVM's will maintain adequate integrity for at least 4 more years. | 1 year |
| B. ICCPS 70% operable status not met. | B.1 Perform engineering evaluation to determine that the affected VVM's will maintain adequate integrity for at least 3 more years. | 1 year |
| | <u>OR</u> B.2 Perform repairs necessary to re-establish integrity of the affected VVM's | 3 years |

ACTIONS
(continued)

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|--|---|-----------------|
| C. Required Actions and associated Completion Times not met. | C.1 Transfer MPC's from affected VVM's to unaffected VVM's or other approved overpacks. | 3 years |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | FREQUENCY |
|---|--|
| SR 3.1.5.1 Verify the ICCPS is operable 1 year after installation of the first VVM and remains operable after initial startup. The ICCPS may be shutdown temporarily as necessary for power outages, repair or preventive maintenance and testing, or system modifications after which the system should be returned to operable status as soon as practicable. This surveillance requirement is suspended for one year after action A.2 has been met | Once within 1 year <u>AND</u> Every 1 month thereafter |
| SR 3.1.5.2 Verify the ICCPS has been operable for at least 70% of the time after initial startup. The verification shall not be performed prior to 8 years from the time of initial startup. If the integrity of the VVM has previously been re-established per ACTION B.2, then the initial startup period may be reset. This surveillance is no longer applicable upon initiation of ACTION C.1. | Once within 10 years <u>AND</u> Every 5 years thereafter |

5.0 ADMINISTRATIVE CONTROLS AND PROGRAMS

The following programs shall be established, implemented and maintained.

5.1 Deleted.

5.2 Deleted.

5.3 Deleted.

5.4 Radioactive Effluent Control Program

This program implements the requirements of 10 CFR 72.44(d).

- a. The HI-STORM 100 Cask System does not create any radioactive materials or have any radioactive waste treatment systems. Therefore, specific operating procedures for the control of radioactive effluents are not required. Specification 3.1.1, Multi-Purpose Canister (MPC), provides assurance that there are not radioactive effluents from the SFSC.
- b. This program includes an environmental monitoring program. Each general license user may incorporate SFSC operations into their environmental monitoring programs for 10 CFR Part 50 operations.
- c. An annual report shall be submitted pursuant to 10 CFR 72.44(d)(3).

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ADMINISTRATIVE CONTROLS AND PROGRAMS

5.5 Cask Transport Evaluation Program

This program provides a means for evaluating various transport configurations and transport route conditions to ensure that the design basis drop limits are met. For lifting of the loaded TRANSFER CASK or OVERPACK using devices which are integral to a structure governed by 10 CFR Part 50 regulations, 10 CFR 50 requirements apply. This program is not applicable when the TRANSFER CASK or OVERPACK is in the FUEL BUILDING or is being handled by a device providing support from underneath (i.e., on a rail car, heavy haul trailer, air pads, etc.) or is being handled by a device designed in accordance with the increased safety factors of ANSI N14.6 and/or having redundant drop protection.

Pursuant to 10 CFR 72.212, this program shall evaluate the site-specific transport route conditions.

- a. For free-standing OVERPACKS and the TRANSFER CASK, the following requirements apply:
 1. The lift height above the transport route surface(s) shall not exceed the limits in Table 5-1 except as provided for in Specification 5.5.a.2. Also, the program shall ensure that the transport route conditions (i.e., surface hardness and pad thickness) are equivalent to or less limiting than either Set A or Set B in HI-STORM FSAR Table 2.2.9.
 2. For site-specific transport route surfaces that are not bounded by either the Set A or Set B parameters of FSAR Table 2.2.9, the program may determine lift heights by analysis based on the site-specific conditions to ensure that the impact loading due to design basis drop events does not exceed 45 g's at the top of the MPC fuel basket. These alternative analyses shall be commensurate with the drop analyses described in the Final Safety Analysis Report for the HI-STORM 100 Cask System. The program shall ensure that these alternative analyses are documented and controlled.

(continued)

ADMINISTRATIVE CONTROLS AND PROGRAMS

5.5 Cask Transport Evaluation Program (continued)

3. The TRANSFER CASK or OVERPACK, when loaded with spent fuel, may be lifted to any height necessary during transportation between the FUEL BUILDING and the CTF and/or ISFSI pad, provided the lifting device is designed in accordance with ANSI N14.6 and has redundant drop protection features.
 4. The TRANSFER CASK and MPC, when loaded with spent fuel, may be lifted to those heights necessary to perform cask handling operations, including MPC transfer, provided the lifts are made with structures and components designed in accordance with the criteria specified in Section 3.5 of Appendix B to Certificate of Compliance No. 1014, as applicable.
- b. For the transport of OVERPACKS to be anchored to the ISFSI pad, the following requirements apply:
1. Except as provided in 5.5.b.2, user shall determine allowable OVERPACK lift height limit(s) above the transport route surface(s) based on site-specific transport route conditions. The lift heights shall be determined by evaluation or analysis, based on limiting the design basis cask deceleration during a postulated drop event to ≤ 45 g's at the top of the MPC fuel basket. Evaluations and/or analyses shall be performed using methodologies consistent with those in the HI-STORM 100 FSAR.
 2. The OVERPACK, when loaded with spent fuel, may be lifted to any height necessary during transportation between the FUEL BUILDING and the CTF and/or ISFSI pad provided the lifting device is designed in accordance with ANSI N14.6 and has redundant drop protection features.

(continued)

ADMINISTRATIVE CONTROLS AND PROGRAMS

5.5 Cask Transport Evaluation Program (continued)

Table 5-1

TRANSFER CASK and Free-Standing OVERPACK Lifting Requirements

| ITEM | ORIENTATION | LIFTING HEIGHT LIMIT (in.) |
|---------------|-------------|----------------------------|
| TRANSFER CASK | Horizontal | 42 (Notes 1 and 2) |
| TRANSFER CASK | Vertical | None Established (Note 2) |
| OVERPACK | Horizontal | Not Permitted |
| OVERPACK | Vertical | 11 (Note 3) |

- Notes:
1. To be measured from the lowest point on the TRANSFER CASK (i.e., the bottom edge of the cask/lid assemblage)
 2. See Technical Specification 5.5.a.3 and 4
 3. See Technical Specification 5.5.a.3.

(continued)

ADMINISTRATIVE CONTROLS AND PROGRAMS

5.6 Deleted.

5.7 Radiation Protection Program

5.7.1 Each cask user shall ensure that the Part 50 radiation protection program appropriately addresses dry storage cask loading and unloading, as well as ISFSI operations, including transport of the loaded OVERPACK or TRANSFER CASK outside of facilities governed by 10 CFR Part 50. The radiation protection program shall include appropriate controls for direct radiation and contamination, ensuring compliance with applicable regulations, and implementing actions to maintain personnel occupational exposures As Low As Reasonably Achievable (ALARA). The actions and criteria to be included in the program are provided below.

5.7.2 As part of its evaluation pursuant to 10 CFR 72.212(b)(2)(i)(C), the licensee shall perform an analysis to confirm that the dose limits of 10 CFR 72.104(a) will be satisfied under the actual site conditions and ISFSI configuration, considering the planned number of casks to be deployed and the cask contents.

5.7.3 Based on the analysis performed pursuant to Section 5.7.2, the licensee shall establish individual cask surface dose rate limits for the HI-TRAC TRANSFER CASK and the HI-STORM OVERPACK to be used at the site. Total (neutron plus gamma) dose rate limits shall be established at the following locations:

- a. The top of the TRANSFER CASK and the OVERPACK.
- b. The side of the TRANSFER CASK and aboveground OVERPACK
- c. The inlet and outlet ducts on the aboveground OVERPACK
- d. The outlet vent on the underground OVERPACK

5.7.4 Notwithstanding the limits established in Section 5.7.3, the measured dose rates on a loaded OVERPACK shall not exceed the following values:

- a. 30 mrem/hr (gamma + neutron) on the top of the aboveground OVERPACK
- b. 300 mrem/hr (gamma + neutron) on the side of the aboveground OVERPACK, excluding inlet and outlet ducts
- c. 40 mrem/hr (gamma+neutron) on the top of the underground OVERPACK

5.7.5 The licensee shall measure the TRANSFER CASK and OVERPACK surface neutron and gamma dose rates as described in Section 5.7.8 for comparison against the limits established in Section 5.7.3 or Section 5.7.4, whichever are lower.

ADMINISTRATIVE CONTROLS AND PROGRAMS

5.7 Radiation Protection Program (cont'd)

- 5.7.6 If the measured surface dose rates exceed the lower of the two limits established in Section 5.7.3 or Section 5.7.4, the licensee shall:
- a. Administratively verify that the correct contents were loaded in the correct fuel storage cell locations.
 - b. Perform a written evaluation to verify whether ~~placement of~~ the as-loaded OVERPACK at the ISFSI will cause the dose limits of 10 CFR 72.104 to be exceeded.
 - c. Perform a written evaluation within 30 days to determine why the surface dose rate limits were exceeded.
- 5.7.7 If the evaluation performed pursuant to Section 5.7.6 shows that the dose limits of 10 CFR 72.104 will be exceeded, the MPC shall ~~not~~ be removed from ~~placed into~~ storage until appropriate corrective action is taken to ensure the dose limits are not exceeded.
- 5.7.8 TRANSFER CASK and OVERPACK surface dose rates shall be measured at approximately the following locations:
- a. A minimum of four (4) dose rate measurements shall be taken on the side of the TRANSFER CASK approximately at the cask mid-height plane. The measurement locations shall be approximately 90 degrees apart around the circumference of the cask. Dose rates shall be measured between the radial ribs of the water jacket.
 - b. A minimum of four (4) TRANSFER CASK top lid dose rates shall be measured at locations approximately half way between the edge of the hole in the top lid and the outer edge of the top lid, 90 degrees apart around the circumference of the top lid.
 - c. A minimum of twelve (12) dose rate measurements shall be taken on the side of the aboveground OVERPACK in three sets of four measurements. One measurement set shall be taken approximately at the cask mid-height plane, 90 degrees apart around the circumference of the cask. The second and third measurement sets shall be taken approximately 60 inches above and below the mid-height plane, respectively, also 90 degrees apart around the circumference of the cask.

ADMINISTRATIVE CONTROLS AND PROGRAMS

5.7 Radiation Protection Program (cont'd)

- d. A minimum of five (5) dose rate measurements shall be taken on the top of the aboveground OVERPACK. One dose rate measurement shall be taken at approximately the center of the lid and four measurements shall be taken at locations on the top concrete shield, approximately half way between the center and the edge of the top concrete shield, 90 degrees apart around the circumference of the lid.
- e. A minimum of four (4) dose rate measurements shall be taken on the top of the underground overpack. These measurements shall be taken approximately 90 degrees apart around the circumference of the lid, approximately 18 inches radially inward from the edge of the lid.
- f. A minimum of four (4) dose rate measurements shall be taken adjacent to the outlet vent screen of the underground OVERPACK, approximately 90 degrees apart.
- eg. A dose rate measurement shall be taken on contact at the surface of each inlet and outlet vent duct screen of the aboveground OVERPACK.

5.7.9 The "Radiation Protection Space" (RPS) is a prismatic subgrade column adjacent to any loaded underground OVERPACK. The RPS boundary is located at a minimum of ten (10) feet from the centerline of a loaded underground OVERPACK on the periphery of an operating ISFSI, and at a minimum of seventeen (17) feet from the centerline of a loaded underground OVERPACK not on the periphery. The RPS boundary shall not be encroached upon during any site construction activity.

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1.0 Definitions

-----NOTE-----

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

| <u>Term</u> | <u>Definition</u> |
|------------------------------|--|
| CASK TRANSFER FACILITY (CTF) | A CASK TRANSFER FACILITY is an aboveground or underground system used during the transfer of a loaded MPC between a transfer cask and a storage OVERPACK. The CASK TRANSFER FACILITY includes the following components and equipment: (1) a Cask Transfer Structure used to stabilize the OVERPACK, TRANSFER CASK and/or MPC during lifts involving spent fuel not bounded by the regulations of 10 CFR Part 50, and (2) Either a stationary lifting device or a mobile lifting device used in concert with the stationary structure to lift the OVERPACK, TRANSFER CASK, and/or MPC |
| DAMAGED FUEL ASSEMBLY | DAMAGED FUEL ASSEMBLIES are fuel assemblies with known or suspected cladding defects, as determined by a review of records, greater than pinhole leaks or hairline cracks, empty fuel rod locations that are not filled with dummy fuel rods, assemblies whose structural integrity has been impaired such that geometric rearrangement of fuel or gross failure of the cladding is expected, or those that cannot be handled by normal means. Fuel assemblies that cannot be handled by normal means due to fuel cladding damage are considered FUEL DEBRIS. |
| DAMAGED FUEL CONTAINER (DFC) | DFCs are specially designed enclosures for DAMAGED FUEL ASSEMBLIES or FUEL DEBRIS which permit gaseous and liquid media to escape while minimizing dispersal of gross particulates. DFCs authorized for use in the HI-STORM 100 System are as follows: <ol style="list-style-type: none"> 1. Holtec Dresden Unit 1/Humboldt Bay design 2. Transnuclear Dresden Unit 1 design 3. Holtec Generic BWR design 4. Holtec Generic PWR design |

(continued)

1.0 Definitions (continued)

| | |
|------------------------------|---|
| FUEL DEBRIS | FUEL DEBRIS is ruptured fuel rods, severed rods, loose fuel pellets or fuel assemblies with known or suspected defects which cannot be handled by normal means due to fuel cladding damage. |
| INTACT FUEL ASSEMBLY | INTACT FUEL ASSEMBLIES are fuel assemblies without known or suspected cladding defects greater than pinhole leaks or hairline cracks and which can be handled by normal means. Fuel assemblies without fuel rods in fuel rod locations shall not be classified as INTACT FUEL ASSEMBLIES unless dummy fuel rods are used to displace an amount of water greater than or equal to that displaced by the fuel rod(s). |
| LOADING OPERATIONS | LOADING OPERATIONS include all licensed activities on an OVERPACK or TRANSFER CASK while it is being loaded with fuel assemblies. LOADING OPERATIONS begin when the first fuel assembly is placed in the MPC and end when the OVERPACK or TRANSFER CASK is suspended from or secured on the transporter. LOADING OPERATIONS does not include MPC transfer between the TRANSFER CASK and the OVERPACK, which begins when the MPC is lifted off the HI-TRAC bottom lid and ends when the MPC is supported from below by the OVERPACK. |
| MINIMUM ENRICHMENT | MINIMUM ENRICHMENT is the minimum assembly average enrichment. Natural uranium blankets are not considered in determining minimum enrichment. |
| MULTI-PURPOSE CANISTER (MPC) | MPCs are the sealed spent nuclear fuel canisters which consist of a honeycombed fuel basket contained in a cylindrical canister shell which is welded to a baseplate, lid with welded port cover plates, and closure ring. The MPC provides the confinement boundary for the contained radioactive materials. |
| NON-FUEL HARDWARE | NON-FUEL HARDWARE is defined as Burnable Poison Rod Assemblies (BPRAs), Thimble Plug Devices (TPDs), Control Rod Assemblies (CRAs), Axial Power Shaping Rods (APSRs), Wet Annular Burnable Absorbers (WABAs), Rod Cluster Control Assemblies (RCCAs), Control Element Assemblies (CEAs), water displacement guide tube plugs, orifice rod assemblies, and vibration suppressor inserts, and components of these devices such as individual rods. |

(continued)

1.0 Definitions (continued)

| | |
|-----------------------------------|---|
| OVERPACK | OVERPACKs are the casks which receive and contain the sealed MPCs for interim storage on the ISFSI. They provide gamma and neutron shielding, and provide for ventilated air flow to promote heat transfer from the MPC to the environs. The term OVERPACK can include a VVM, but does not include the TRANSFER CASK. |
| PLANAR-AVERAGE INITIAL ENRICHMENT | PLANAR-AVERAGE INITIAL ENRICHMENT is the average of the distributed fuel rod initial enrichments within a given axial plane of the assembly lattice. |
| SPENT FUEL STORAGE CASKS (SFSCs) | An SFSC is a container approved for the storage of spent fuel assemblies at the ISFSI. The HI-STORM 100 SFSC System consists of the OVERPACK and its integral MPC. |
| TRANSFER CASK | TRANSFER CASKs are containers designed to contain the MPC during and after loading of spent fuel assemblies and to transfer the MPC to or from the OVERPACK. The HI-STORM 100 System employs either a 125-Ton or a 100-Ton HI-TRAC TRANSFER CASK. |
| TRANSPORT OPERATIONS | TRANSPORT OPERATIONS include all licensed activities performed on an OVERPACK or TRANSFER CASK loaded with one or more fuel assemblies when it is being moved to and from the ISFSI. TRANSPORT OPERATIONS begin when the OVERPACK or TRANSFER CASK is first suspended from or secured on the transporter and end when the OVERPACK or TRANSFER CASK is at its destination and no longer secured on or suspended from the transporter. TRANSPORT OPERATIONS include transfer of the MPC between the OVERPACK and the TRANSFER CASK, which begins when the MPC is lifted off the HI-TRAC bottom lid and ends when the MPC is supported from below by the OVERPACK (or the reverse). |

(continued)

1.0 Definitions (continued)

UNLOADING OPERATIONS

UNLOADING OPERATIONS include all licensed activities on an SFSC to be unloaded of the contained fuel assemblies. UNLOADING OPERATIONS begin when the OVERPACK or TRANSFER CASK is no longer suspended from or secured on the transporter and end when the last fuel assembly is removed from the SFSC. UNLOADING OPERATIONS does not include MPC transfer between the TRANSFER CASK and the OVERPACK, which begins when the MPC is no longer supported from below by the OVERPACK and ends when the MPC is supported by the HI-TRAC bottom lid.

ZR

ZR means any zirconium-based fuel cladding or fuel channel material authorized for use in a commercial nuclear power plant reactor.

3.0 DESIGN FEATURES

3.1 Site

3.1.1 Site Location

The HI-STORM 100 Cask System is authorized for general use by 10 CFR Part 50 license holders at various site locations under the provisions of 10 CFR 72, Subpart K.

3.2 Design Features Important for Criticality Control

3.2.1 MPC-24

1. Flux trap size: ≥ 1.09 in.
2. ^{10}B loading in the neutron absorbers: ≥ 0.0267 g/cm² (Boral) and ≥ 0.0223 g/cm² (METAMIC)

3.2.2 MPC-68 and MPC-68FF

1. Fuel cell pitch: ≥ 6.43 in.
2. ^{10}B loading in the neutron absorbers: ≥ 0.0372 g/cm² (Boral) and ≥ 0.0310 g/cm² (METAMIC)

3.2.3 MPC-68F

1. Fuel cell pitch: ≥ 6.43 in.
2. ^{10}B loading in the Boral neutron absorbers: ≥ 0.01 g/cm²

3.2.4 MPC-24E and MPC-24EF

1. Flux trap size:
 - i. Cells 3, 6, 19, and 22: ≥ 0.776 inch
 - ii. All Other Cells: ≥ 1.076 inches
2. ^{10}B loading in the neutron absorbers: ≥ 0.0372 g/cm² (Boral) and ≥ 0.0310 g/cm² (METAMIC)

3.2.5 MPC-32 and MPC-32F

1. Fuel cell pitch: ≥ 9.158 inches
2. ^{10}B loading in the neutron absorbers: ≥ 0.0372 g/cm² (Boral) and ≥ 0.0310 g/cm² (METAMIC)

DESIGN FEATURES

3.2 Design features Important for Criticality Control (cont'd)

3.2.6 Fuel spacers shall be sized to ensure that the active fuel region of intact fuel assemblies remains within the neutron poison region of the MPC basket with water in the MPC.

3.2.7 The B₄C content in METAMIC shall be ≤ 33.0 wt.%.

3.2.8 Neutron Absorber Tests

Section 9.1.5.3 of the HI-STORM 100 FSAR is hereby incorporated by reference into the HI-STORM 100 CoC. The minimum ¹⁰B for the neutron absorber shall meet the minimum requirements for each MPC model specified in Sections 3.2.1 through 3.2.5 above.

3.3 Codes and Standards

The American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), 1995 Edition with Addenda through 1997, is the governing Code for the HI-STORM 100 System MPCs, aboveground OVERPACKs and TRANSFER CASKs, as clarified in Specification 3.3.1 below, except for Code Sections V and IX. The ASME Code paragraphs applicable to the underground OVERPACKs are listed in Table 3-2. The latest effective editions of ASME Code Sections V and IX, including addenda, may be used for activities governed by those sections, provided a written reconciliation of the later edition against the 1995 Edition, including addenda, is performed by the certificate holder. American Concrete Institute (ACI) 349-85 is the governing Code for plain concrete as clarified in Appendix 1.D of the Final Safety Analysis Report for the HI-STORM 100 Cask System.

3.3.1 Alternatives to Codes, Standards, and Criteria

Table 3-1 lists approved alternatives to the ASME Code for the design of the MPCs, aboveground OVERPACKs and TRANSFER CASKs of the HI-STORM 100 Cask System.

3.3.2 Construction/Fabrication Alternatives to Codes, Standards, and Criteria

Proposed alternatives to the ASME Code, Section III, 1995 Edition with Addenda through 1997 including modifications to the alternatives allowed by Specification 3.3.1 may be used on a case-specific basis when authorized by the Director of the Office of Nuclear Material Safety and Safeguards or designee. The request for such alternative should demonstrate that:

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

(continued)

DESIGN FEATURES

3.3.2 Construction/Fabrication Alternatives to Codes, Standards, and Criteria (cont'd)

2. Compliance with the specified requirements of the ASME Code, Section III, 1995 Edition with Addenda through 1997, would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Requests for alternatives shall be submitted in accordance with 10 CFR 72.4.

(continued)

DESIGN FEATURES

Table 3-1 (page 1 of 9)
LIST OF ASME CODE ALTERNATIVES FOR HI-STORM 100 CASK SYSTEM

| Component | Reference ASME Code Section/Article | Code Requirement | Alternative, Justification & Compensatory Measures |
|--|-------------------------------------|--|---|
| MPC, MPC basket assembly, HI-STORM OVERPACK steel structure, and HI-TRAC TRANSFER CASK steel structure | Subsection NCA | General Requirements. Requires preparation of a Design Specification, Design Report, Overpressure Protection Report, Certification of Construction Report, Data Report, and other administrative controls for an ASME Code stamped vessel. | <p>Because the MPC, OVERPACK, and TRANSFER CASK are not ASME Code stamped vessels, none of the specifications, reports, certificates, or other general requirements specified by NCA are required. In lieu of a Design Specification and Design Report, the HI-STORM FSAR includes the design criteria, service conditions, and load combinations for the design and operation of the HI-STORM 100 System as well as the results of the stress analyses to demonstrate that applicable Code stress limits are met. Additionally, the fabricator is not required to have an ASME-certified QA program. All important-to-safety activities are governed by the NRC-approved Holtec QA program.</p> <p>Because the cask components are not certified to the Code, the terms "Certificate Holder" and "Inspector" are not germane to the manufacturing of NRC-certified cask components. To eliminate ambiguity, the responsibilities assigned to the Certificate Holder in the various articles of Subsections NB, NG, and NF of the Code, as applicable, shall be interpreted to apply to the NRC Certificate of Compliance (CoC) holder (and by extension, to the component fabricator) if the requirement must be fulfilled. The Code term "Inspector" means the QA/QC personnel of the CoC holder and its vendors assigned to oversee and inspect the manufacturing process.</p> |
| MPC | NB-1100 | Statement of requirements for Code stamping of components. | MPC enclosure vessel is designed and will be fabricated in accordance with ASME Code, Section III, Subsection NB to the maximum practical extent, but Code stamping is not required. |

Table 3-1 (page 2 of 9)
LIST OF ASME CODE ALTERNATIVES FOR HI-STORM 100 CASK SYSTEM

| Component | Reference ASME Code Section/Article | Code Requirement | Alternative, Justification & Compensatory Measures |
|-----------------------------------|-------------------------------------|--|---|
| MPC basket supports and lift lugs | NB-1130 | <p>NB-1132.2(d) requires that the first connecting weld of a nonpressure-retaining structural attachment to a component shall be considered part of the component unless the weld is more than $2t$ from the pressure-retaining portion of the component, where t is the nominal thickness of the pressure-retaining material.</p> <p>NB-1132.2(e) requires that the first connecting weld of a welded nonstructural attachment to a component shall conform to NB-4430 if the connecting weld is within $2t$ from the pressure-retaining portion of the component.</p> | <p>The MPC basket supports (nonpressure-retaining structural attachments) and lift lugs (nonstructural attachments (relative to the function of lifting a loaded MPC) that are used exclusively for lifting an empty MPC) are welded to the inside of the pressure-retaining MPC shell, but are not designed in accordance with Subsection NB. The basket supports and associated attachment welds are designed to satisfy the stress limits of Subsection NG and the lift lugs and associated attachment welds are designed to satisfy the stress limits of Subsection NF, as a minimum. These attachments and their welds are shown by analysis to meet the respective stress limits for their service conditions. Likewise, non-structural items, such as shield plugs, spacers, etc. if used, can be attached to pressure-retaining parts in the same manner.</p> |
| MPC | NB-2000 | Requires materials to be supplied by ASME-approved material supplier. | Materials will be supplied by Holtec-approved suppliers with Certified Material Test Reports (CMTRs) in accordance with NB-2000 requirements. |

Table 3-1 (page 3 of 9)
LIST OF ASME CODE ALTERNATIVES FOR HI-STORM 100 CASK SYSTEM

| Component | Reference ASME Code Section/Article | Code Requirement | Alternative, Justification & Compensatory Measures |
|---|-------------------------------------|---|---|
| MPC, MPC basket assembly, HI-STORM OVERPACK and HI-TRAC TRANSFER CASK | NB-3100 NG-3100 NF-3100 | Provides requirements for determining design loading conditions, such as pressure, temperature, and mechanical loads. | These requirements are not applicable. The HI-STORM FSAR, serving as the Design Specification, establishes the service conditions and load combinations for the storage system. |
| MPC | NB-3350 | NB-3352.3 requires, for Category C joints, that the minimum dimensions of the welds and throat thickness shall be as shown in Figure NB-4243-1. | <p>Due to MPC basket-to-shell interface requirements, the MPC shell-to-baseplate weld joint design (designated Category C) does not include a reinforcing fillet weld or a bevel in the MPC baseplate, which makes it different than any of the representative configurations depicted in Figure NB-4243-1. The transverse thickness of this weld is equal to the thickness of the adjoining shell (1/2 inch). The weld is designed as a full penetration weld that receives VT and RT or UT, as well as final surface PT examinations. Because the MPC shell design thickness is considerably larger than the minimum thickness required by the Code, a reinforcing fillet weld that would intrude into the MPC cavity space is not included. Not including this fillet weld provides for a higher quality radiographic examination of the full penetration weld.</p> <p>From the standpoint of stress analysis, the fillet weld serves to reduce the local bending stress (secondary stress) produced by the gross structural discontinuity defined by the flat plate/shell junction. In the MPC design, the shell and baseplate thicknesses are well beyond that required to meet their respective membrane stress intensity limits.</p> |

Table 3-1 (page 4 of 9)
LIST OF ASME CODE ALTERNATIVES FOR HI-STORM 100 CASK SYSTEM

| Component | Reference ASME Code Section/Article | Code Requirement | Alternative, Justification & Compensatory Measures |
|--|-------------------------------------|---|---|
| MPC, MPC Basket Assembly, HI-STORM OVERPACK steel structure, and HI-TRAC TRANSFER CASK steel structure | NB-4120 NG-4120 NF-4120 | NB-4121.2, NG-4121.2, and NF-4121.2 provide requirements for repetition of tensile or impact tests for material subjected to heat treatment during fabrication or installation. | <p>In-shop operations of short duration that apply heat to a component, such as plasma cutting of plate stock, welding, machining, coating, and pouring of lead are not, unless explicitly stated by the Code, defined as heat treatment operations.</p> <p>For the steel parts in the HI-STORM 100 System components, the duration for which a part exceeds the off-normal temperature limit defined in Chapter 2 of the FSAR shall be limited to 24 hours in a particular manufacturing process (such as the HI-TRAC lead pouring process).</p> |
| MPC, MPC basket assembly, HI-STORM OVERPACK steel structure, and HI-TRAC TRANSFER CASK steel structure | NB-4220 NF-4220 | Requires certain forming tolerances to be met for cylindrical, conical, or spherical shells of a vessel. | The cylindricity measurements on the rolled shells are not specifically recorded in the shop travelers, as would be the case for a Code-stamped pressure vessel. Rather, the requirements on inter-component clearances (such as the MPC-to-TRANSFER CASK) are guaranteed through fixture-controlled manufacturing. The fabrication specification and shop procedures ensure that all dimensional design objectives, including inter-component annular clearances are satisfied. The dimensions required to be met in fabrication are chosen to meet the functional requirements of the dry storage components. Thus, although the post-forming Code cylindricity requirements are not evaluated for compliance directly, they are indirectly satisfied (actually exceeded) in the final manufactured components. |
| MPC Lid and Closure Ring Welds | NB-4243 | Full penetration welds required for Category C Joints (flat head to main shell per NB-3352.3). | MPC lid and closure ring are not full penetration welds. They are welded independently to provide a redundant seal. Additionally, a weld efficiency factor of 0.45 has been applied to the analyses of these welds. |

Table 3-1 (page 5 of 9)
LIST OF ASME CODE ALTERNATIVES FOR HI-STORM 100 CASK SYSTEM

| Component | Reference ASME Code Section/Article | Code Requirement | Alternative, Justification & Compensatory Measures |
|--|-------------------------------------|--|---|
| MPC Lid to Shell Weld | NB-5230 | Radiographic (RT) or ultrasonic (UT) examination required | Only UT or multi-layer liquid penetrant (PT) examination is permitted. If PT alone is used, at a minimum, it will include the root and final weld layers and each approximately 3/8 inch of weld depth. |
| MPC Closure Ring, Vent and Drain Cover Plate Welds | NB-5230 | Radiographic (RT) or ultrasonic (UT) examination required | Root (if more than one weld pass is required) and final liquid penetrant examination to be performed in accordance with NB-5245. The closure ring provides independent redundant closure for vent and drain cover plates. |
| MPC Enclosure Vessel and Lid | NB-6111 | All completed pressure retaining systems shall be pressure tested. | <p>The MPC enclosure vessel is seal welded in the field following fuel assembly loading. The MPC enclosure vessel shall then be pressure tested as defined in Chapter 9. Accessibility for leakage inspections preclude a Code compliant pressure test. All MPC enclosure vessel welds (except closure ring and vent/drain cover plate) are inspected by volumetric examination, except the MPC lid-to-shell weld shall be verified by volumetric or multi-layer PT examination. If PT alone is used, at a minimum, it must include the root and final layers and each approximately 3/8 inch of weld depth. For either UT or PT, the maximum undetectable flaw size must be demonstrated to be less than the critical flaw size. The critical flaw size must be determined in accordance with ASME Section XI methods. The critical flaw size shall not cause the primary stress limits of NB-3000 to be exceeded.</p> <p>The inspection results, including relevant findings (indications), shall be made a permanent part of the user's records by video, photographic, or other means which provide an equivalent retrievable record of weld integrity. The video or photographic records should be taken during the final interpretation period described in ASME Section V, Article 6, T-676. The vent/drain cover plate and the closure ring welds are confirmed by liquid penetrant examination. The inspection of the weld must be performed by qualified personnel and shall meet the acceptance requirements of ASME Code Section III, NB-5350 for PT or NB-5332 for UT.</p> |

Table 3-1 (page 6 of 9)
LIST OF ASME CODE ALTERNATIVES FOR HI-STORM 100 CASK SYSTEM

| Component | Reference ASME Code Section/Article | Code Requirement | Alternative, Justification & Compensatory Measures |
|----------------------|--|--|---|
| MPC Enclosure Vessel | NB-7000 | Vessels are required to have overpressure protection | No overpressure protection is provided. The function of the MPC enclosure vessel is to contain the radioactive contents under normal, off-normal, and accident conditions. The MPC vessel is designed to withstand maximum internal pressure considering 100% fuel rod failure and maximum accident temperatures. |
| MPC Enclosure Vessel | NB-8000 | States requirements for nameplates, stamping and reports per NCA-8000. | The HI-STORM100 System is to be marked and identified in accordance with 10CFR71 and 10CFR72 requirements. Code stamping is not required. QA data package to be in accordance with Holtec approved QA program. |
| MPC Basket Assembly | NG-2000 | Requires materials to be supplied by ASME-approved material supplier. | Materials will be supplied by Holtec-approved supplier with CMTRs in accordance with NG-2000 requirements. |

Table 3-1 (page 7 of 9)
LIST OF ASME CODE ALTERNATIVES FOR HI-STORM 100 CASK SYSTEM

| Component | Reference ASME Code Section/Article | Code Requirement | Alternative, Justification & Compensatory Measures |
|--------------------------|-------------------------------------|---|--|
| MPC basket assembly | NG-4420 | NG-4427(a) allows a fillet weld in any single continuous weld to be less than the specified fillet weld dimension by not more than 1/16 inch, provided that the total undersize portion of the weld does not exceed 10 percent of the length of the weld. Individual undersize weld portions shall not exceed 2 inches in length. | <p>Modify the Code requirement (intended for core support structures) with the following text prepared to accord with the geometry and stress analysis imperatives for the fuel basket: For the longitudinal MPC basket fillet welds, the following criteria apply: 1) The specified fillet weld throat dimension must be maintained over at least 92 percent of the total weld length. All regions of undersized weld must be less than 3 inches long and separated from each other by at least 9 inches. 2) Areas of undercuts and porosity beyond that allowed by the applicable ASME Code shall not exceed 1/2 inch in weld length. The total length of undercut and porosity over any 1-foot length shall not exceed 2 inches. 3) The total weld length in which items (1) and (2) apply shall not exceed a total of 10 percent of the overall weld length. The limited access of the MPC basket panel longitudinal fillet welds makes it difficult to perform effective repairs of these welds and creates the potential for causing additional damage to the basket assembly (e.g., to the neutron absorber and its sheathing) if repairs are attempted. The acceptance criteria provided in the foregoing have been established to comport with the objectives of the basket design and preserve the margins demonstrated in the supporting stress analysis.</p> <p>From the structural standpoint, the weld acceptance criteria are established to ensure that any departure from the ideal, continuous fillet weld seam would not alter the primary bending stresses on which the design of the fuel baskets is predicated. Stated differently, the permitted weld discontinuities are limited in size to ensure that they remain classifiable as local stress elevators ("peak stress", F, in the ASME Code for which specific stress intensity limits do not apply).</p> |
| MPC Basket Assembly | NG-8000 | States requirements for nameplates, stamping and reports per NCA-8000. | The HI-STORM100 System is to be marked and identified in accordance with 10CFR71 and 10CFR72 requirements. Code stamping is not required. The MPC basket data package to be in accordance with Holtec approved QA program. |
| OVERPACK Steel Structure | NF-2000 | Requires materials to be supplied by ASME-approved material supplier. | Materials will be supplied by Holtec-approved supplier with CMTRs in accordance with NF-2000 requirements. |

Table 3-1 (page 8 of 9)
LIST OF ASME CODE ALTERNATIVES FOR HI-STORM 100 CASK SYSTEM

| Component | Reference ASME Code Section/Article | Code Requirement | Alternative, Justification & Compensatory Measures |
|--------------------------------------|-------------------------------------|---|--|
| TRANSFER CASK Steel Structure | NF-2000 | Requires materials to be supplied by ASME-approved material supplier. | Materials will be supplied by Holtec-approved supplier with CMTRs in accordance with NF-2000 requirements. |
| OVERPACK Baseplate and Lid Top Plate | NF-4441 | Requires special examinations or requirements for welds where a primary member of thickness 1 inch or greater is loaded to transmit loads in the through thickness direction. | The margins of safety in these welds under loads experienced during lifting operations or accident conditions are quite large. The OVERPACK baseplate welds to the inner shell, pedestal shell, and radial plates are only loaded during lifting conditions and have large safety factors during lifting. Likewise, the top lid plate to lid shell weld has a large structural margin under the inertia loads imposed during a non-mechanistic tipover event. |
| OVERPACK Steel Structure | NF-3256 NF-3266 | Provides requirements for welded joints. | <p>Welds for which no structural credit is taken are identified as "Non-NF" welds in the design drawings. These non-structural welds are specified in accordance with the pre-qualified welds of AWS D1.1. These welds shall be made by welders and weld procedures qualified in accordance with AWS D1.1 or ASME Section IX.</p> <p>Welds for which structural credit is taken in the safety analyses shall meet the stress limits for NF-3256.2, but are not required to meet the joint configuration requirements specified in these Code articles. The geometry of the joint designs in the cask structures are based on the fabricability and accessibility of the joint, not generally contemplated by this Code section governing supports.</p> |

Table 3-1 (page 9 of 9)
LIST OF ASME CODE ALTERNATIVES FOR HI-STORM 100 CASK SYSTEM

| Component | Reference ASME Code Section/Article | Code Requirement | Alternative, Justification & Compensatory Measures |
|---|--|--|--|
| HI-STORM OVERPACK and HI-TRAC TRANSFER CASK | NF-3320 NF-4720 | NF-3324.6 and NF-4720 provide requirements for bolting | <p>These Code requirements are applicable to linear structures wherein bolted joints carry axial, shear, as well as rotational (torsional) loads. The OVERPACK and TRANSFER CASK bolted connections in the structural load path are qualified by design based on the design loadings defined in the FSAR. Bolted joints in these components see no shear or torsional loads under normal storage conditions. Larger clearances between bolts and holes may be necessary to ensure shear interfaces located elsewhere in the structure engage prior to the bolts experiencing shear loadings (which occur only during side impact scenarios).</p> <p>Bolted joints that are subject to shear loads in accident conditions are qualified by appropriate stress analysis. Larger bolt-to-hole clearances help ensure more efficient operations in making these bolted connections, thereby minimizing time spent by operations personnel in a radiation area. Additionally, larger bolt-to-hole clearances allow interchangeability of the lids from one particular fabricated cask to another.</p> |

Table 3-2
Applicable Code Paragraphs for Underground OVERPACKs

| | Item | Code Paragraph[†] | Explanation and Applicability |
|-----|---|--|---|
| 1. | Definition of primary and secondary members | NF-1215 | |
| 2. | Jurisdictional boundary | NF-1133 | The “intervening elements” are termed interfacing SSCs in this FSAR. |
| 3. | Certification of Material | NF-2130(b) and (c) | Materials shall be certified to the applicable Section II of the ASME Code or equivalent ASTM Specification. |
| 4. | Heat treatment of material | NF-2170 and NF-2180 | |
| 5. | Storage of welding material | NF-2400 | |
| 6. | Structural Analysis of Interfacing SSCs | ACI 318-05 | The VVM Interface Pad and Support Foundation are reinforced concrete structures. Loadings come from the external environment and from the VVM. Sections of the Code that may reasonably be applied to subterranean application are applicable. The Code may be, but is not required to be, invoked for the design of the Top Surface Pad. |
| 7. | Welding procedure | Section IX | |
| 8. | Welding material | Section II | |
| 9. | Loading conditions | NF-3111 | |
| 10. | Allowable stress values | NF-3112.3 | |
| 11. | Rolling and sliding supports | NF-3424 | |
| 12. | Differential thermal expansion | NF-3127 | |
| 13. | Stress analysis | NF-3143 NF-3380 NF-3522 NF-3523 | Provisions for stress analysis for Class 3 plate and shell supports and for linear supports are applicable for CLOSURE LID and CEC shells, respectively. These conditions may be, but are not required to be, invoked. |
| 14. | Cutting of plate stock | NF-4211 NF-4211.1 | |
| 15. | Forming | NF-4212 | |
| 16. | Forming tolerance | NF-4221 | Applies to the CEC Divider Shell and CEC Container Shell |
| 17. | Fitting and Aligning Tack Welds | NF-4231 NF-4231.1 | |
| 18. | Alignment | NF-4232 | |
| 19. | Storage of Welding Materials | NF-4411 | |
| 20. | Cleanliness of Weld Surfaces | NF-4412 | Applies to structural and non-structural welds |

Table 3-2 (continued)
Applicable Code Paragraphs for Underground OVERPACKs

| | Item | Code Paragraph[†] | Explanation and Applicability |
|-----|---------------------------------------|-----------------------------------|--|
| 21. | Backing Strips, Peening | NF-4421 NF-4422 | Applies to structural and non-structural welds |
| 22. | Pre-heating and Interpass Temperature | NF-4611 NF-4612 NF-4613 | Applies to structural and non-structural welds |
| 23. | Non-Destructive Examination | NF-5360 | Invokes Section V |
| 24. | NDE Personnel Certification | NF-5522 NF-5523 NF-5530 | - |

† All references to the ASME Code refer to applicable sections of the 1995 edition with addenda through 1997.

DESIGN FEATURES (continued)

3.4 Site-Specific Parameters and Analyses

Site-specific parameters and analyses that will require verification by the system user are, as a minimum, as follows:

1. The temperature of 80° F is the maximum average yearly temperature.
2. The allowed temperature extremes, averaged over a 3-day period, shall be greater than - 40° F and less than 125° F.
3. a. For storage in aboveground OVERPACKs, the resultant horizontal acceleration (vectorial sum of two horizontal Zero Period Accelerations (ZPAs) at a three-dimensional seismic site), G_H , and vertical ZPA, G_V , on the top surface of the ISFSI pad, expressed as fractions of 'g', shall satisfy the following inequality:

$$G_H + \mu G_V \leq \mu$$

where μ is either the Coulomb friction coefficient for the cask/ISFSI pad interface or the ratio r/h , where 'r' is the radius of the cask and 'h' is the height of the cask center-of-gravity above the ISFSI pad surface. The above inequality must be met for both definitions of μ , but only applies to ISFSIs where the casks are deployed in a freestanding configuration. Unless demonstrated by appropriate testing that a higher coefficient of friction value is appropriate for a specific ISFSI, the value used shall be 0.53. If acceleration time-histories on the ISFSI pad surface are available, G_H and G_V may be the coincident values of the instantaneous net horizontal and vertical accelerations. If instantaneous accelerations are used, the inequality shall be evaluated at each time step in the acceleration time history over the total duration of the seismic event.

If this static equilibrium based inequality cannot be met, a dynamic analysis of the cask/ISFSI pad assemblage with appropriate recognition of soil/structure interaction effects shall be performed to ensure that the casks will not tip over or undergo excessive sliding under the site's Design Basis Earthquake.

(continued)

DESIGN FEATURES

3.4 Site-Specific Parameters and Analyses (continued)

- b. For free-standing aboveground casks, under environmental conditions that may degrade the pad/cask interface friction (such as due to icing) the response of the casks under the site's Design Basis Earthquake shall be established using the best estimate of the friction coefficient in an appropriate analysis model. The analysis should demonstrate that the earthquake will not result in cask tipover or cause a cask to fall off the pad. In addition, impact between casks should be precluded, or should be considered an accident for which the maximum g-load experienced by the stored fuel shall be limited to 45 g's.
- c. For those ISFSI sites with design basis seismic acceleration values that may overturn or cause excessive sliding of free-standing aboveground casks, the HI-STORM 100 System OVERPACKs shall be anchored to the ISFSI pad. The site seismic characteristics and the anchorage system shall meet the following requirements:
 - i. The site acceleration response spectra at the top of the ISFSI pad shall have ZPAs that meet the following inequalities:

$$G_H \leq 2.12$$

AND

$$G_V \leq 1.5$$

Where:

G_H is the vectorial sum of the two horizontal ZPAs at a three-dimensional seismic site (or the horizontal ZPA at a two-dimensional site) and G_V is the vertical ZPA.

- ii. Each HI-STORM 100 dry storage cask shall be anchored with twenty-eight (28), 2-inch diameter studs and compatible nuts of material suitable for the expected ISFSI environment. The studs shall meet the following requirements:

Yield Strength at Ambient Temperature: ≥ 80 ksi

Ultimate Strength at Ambient Temperature: ≥ 125 ksi

Initial Tensile Pre-Stress: ≥ 55 ksi AND ≤ 65 ksi

(continued)

DESIGN FEATURES

3.4 Site-Specific Parameters and Analyses (continued)

NOTE: The above anchorage specifications are required for the seismic spectra defined in item 3.4.3.cb.i. Users may use fewer studs or those of different diameter to account for site-specific seismic spectra less severe than those specified above. The embedment design shall comply with Appendix B of ACI-349-97. A later edition of this Code may be used, provided a written reconciliation is performed.

iii. Embedment Concrete Compressive Strength: $\geq 4,000$ psi at 28 days

4. The analyzed flood condition of 15 fps water velocity and a height of 125 feet of water (full submergence of the loaded cask) are not exceeded.
5. The potential for fire and explosion shall be addressed, based on site-specific considerations. This includes the condition that the on-site transporter fuel tank will contain no more than 50 gallons of diesel fuel while handling a loaded OVERPACK or TRANSFER CASK.
6.
 - a. For free-standing aboveground casks, the ISFSI pad shall be verified by analysis to limit cask deceleration during design basis drop and non-mechanistic tip-over events to ≤ 45 g's at the top of the MPC fuel basket. Analyses shall be performed using methodologies consistent with those described in the HI-STORM 100 FSAR. A lift height above the ISFSI pad is not required to be established if the cask is lifted with a device designed in accordance with ANSI N14.6 and having redundant drop protection features.
 - b. For anchored aboveground casks, the ISFSI pad shall be designed to meet the embedment requirements of the anchorage design. A cask tip-over event for an anchored cask is not credible. The ISFSI pad shall be verified

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DESIGN FEATURES

3.4 Site-Specific Parameters and Analyses (continued)

by analysis to limit cask deceleration during a design basis drop event to ≤ 45 g's at the top of the MPC fuel basket, except as provided for in this paragraph below. Analyses shall be performed using methodologies consistent with those described in the HI-STORM 100 FSAR. A lift height above the ISFSI pad is not required to be established if the cask is lifted with a device design in accordance with ANSI N14.6 and having redundant drop protection features.

- c. For underground casks, the support foundation resistance to vertical downward loading, expressed as a stiffness K, shall be $> 2 \times 10^6$ lb/inch where K is the axial stiffness of the support foundation under a rigid punch of diameter equal to the diameter of the outer steel shell of the underground OVERPACK. |

- 7. For underground casks, a site-specific seismic evaluation of an isolated cask (i.e., a single VVM) shall be performed using the methodology set forth in Subsection 3.1.4.7.1 of the HI-STORM 100 FSAR. Subsections 3.1.4.7.1 of the HI-STORM 100 FSAR is hereby incorporated by reference into the HI-STORM 100 CoC. |

- 78. In cases where engineered features (i.e., berms and shield walls) are used to ensure that the requirements of 10CFR72.104(a) are met, such features are to be considered important to safety and must be evaluated to determine the applicable Quality Assurance Category. |

(continued)

DESIGN FEATURES

3.4 Site-Specific Parameters and Analyses (continued)

89. LOADING OPERATIONS, TRANSPORT OPERATIONS, and UNLOADING OPERATIONS shall only be conducted with working area ambient temperatures \geq 0°F. |
910. For those users whose site-specific design basis includes an event or events (e.g., flood) that result in the blockage of any OVERPACK inlet or outlet air ducts for an extended period of time (i.e, longer than the total Completion Time of LCO 3.1.2), an analysis or evaluation may be performed to demonstrate adequate heat removal is available for the duration of the event. Adequate heat removal is defined as fuel cladding temperatures remaining below the short term temperature limit. If the analysis or evaluation is not performed, or if fuel cladding temperature limits are unable to be demonstrated by analysis or evaluation to remain below the short term temperature limit for the duration of the event, provisions shall be established to provide alternate means of cooling to accomplish this objective. |

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DESIGN FEATURES

3.5 Cask Transfer Facility (CTF)

3.5.1 TRANSFER CASK and MPC Lifters

Lifting of a loaded TRANSFER CASK and MPC using devices that are not integral to structures governed by 10 CFR Part 50 shall be performed with a CTF that is designed, operated, fabricated, tested, inspected, and maintained in accordance with the guidelines of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants" and the below clarifications. The CTF Structure requirements below do not apply to heavy loads bounded by the regulations of 10 CFR Part 50, to the loading of an aboveground OVERPACK in a belowground restraint system which permits MPC transfer near grade level and does not require an aboveground CTF, or to the loading of an underground OVERPACK.

3.5.2 CTF Structure Requirements

3.5.2.1 Cask Transfer Station and Stationary Lifting Devices

1. The metal weldment structure of the CTF structure shall be designed to comply with the stress limits of ASME Section III, Subsection NF, Class 3 for linear structures. The applicable loads, load combinations, and associated service condition definitions are provided in Table 3-3. All compression loaded members shall satisfy the buckling criteria of ASME Section III, Subsection NF.
2. If a portion of the CTF structure is constructed of reinforced concrete, then the factored load combinations set forth in ACI-318 (89) for the loads defined in Table 3-3 shall apply.
3. The TRANSFER CASK and MPC lifting device used with the CTF shall be designed, fabricated, operated, tested, inspected and maintained in accordance with NUREG-0612, Section 5.1.
4. The CTF shall be designed, constructed, and evaluated to ensure that if the MPC is dropped during inter-cask transfer operations, its confinement boundary would not be breached. This requirements applies to CTFs with either stationary or mobile lifting devices.

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DESIGN FEATURES

3.5.2.2 Mobile Lift Devices

If a mobile lifting device is used as the lifting device, in lieu of a stationary lifting device, it shall meet the guidelines of NUREG-0612, Section 5.1, with the following clarifications:

1. Mobile lifting devices shall have a minimum safety factor of two over the allowable load table for the lifting device in accordance with the guidance of NUREG-0612, Section 5.1.6(1)(a) and shall be capable of stopping and holding the load during a Design Basis Earthquake (DBE) event.
2. Mobile lifting devices shall conform to meet the requirements of ANSI B30.5, "Mobile and Locomotive Cranes," in lieu of the requirements of ANSI B30.2, "Overhead and Gantry Cranes."
3. Mobile cranes are not required to meet the requirements of NUREG-0612, Section 5.1.6(2) for new cranes.
4. Horizontal movements of the TRANSFER CASK and MPC using a mobile crane are prohibited.

(continued)

DESIGN FEATURES

Table 3-3

Load Combinations and Service Condition Definitions for the CTF Structure (Note 1)

| Load Combination | ASME III Service Condition for Definition of Allowable Stress | Comment |
|---|---|---|
| D* D + S | Level A | All primary load bearing members must satisfy Level A stress limits |
| D + M + W' (Note 2) D + F D + E D + Y | Level D | Factor of safety against overturning shall be ≥ 1.1 |

D = Dead load
D* = Apparent dead load
S = Snow and ice load for the CTF site
M = Tornado missile load for the CTF site
W' = Tornado wind load for the CTF site
F = Flood load for the CTF site
E = Seismic load for the CTF site
Y = Tsunami load for the CTF site

- Notes:
1. The reinforced concrete portion of the CTF structure shall also meet the factored combinations of loads set forth in ACI-318(89).
 2. Tornado missile load may be reduced or eliminated based on a PRA for the CTF site.

DESIGN FEATURES

3.6 Forced Helium Dehydration System

3.6.1 System Description

Use of the Forced Helium Dehydration (FHD) system, (a closed-loop system) is an alternative to vacuum drying the MPC for moderate burnup fuel ($\leq 45,000$ MWD/MTU) and mandatory for drying MPCs containing one or more high burnup fuel assemblies. The FHD system shall be designed for normal operation (i.e., excluding startup and shutdown ramps) in accordance with the criteria in Section 3.6.2.

3.6.2 Design Criteria

- 3.6.2.1 The temperature of the helium gas in the MPC shall be at least 15°F higher than the saturation temperature at coincident pressure.
- 3.6.2.2 The pressure in the MPC cavity space shall be ≤ 60.3 psig (75 psia).
- 3.6.2.3 The hourly recirculation rate of helium shall be ≥ 10 times the nominal helium mass backfilled into the MPC for fuel storage operations.
- 3.6.2.4 The partial pressure of the water vapor in the MPC cavity will not exceed 3 torr. The limit is met if the gas temperature at the demoisurizer outlet is verified by measurement to remain $\leq 21^\circ\text{F}$ for a period of 30 minutes or if the dew point of the gas exiting the MPC is verified by measurement to remain $\leq 22.9^\circ\text{F}$ for ≥ 30 minutes.
- 3.6.2.5 The condensing module shall be designed to de-vaporize the recirculating helium gas to a dew point $\leq 120^\circ\text{F}$.
- 3.6.2.6 The demoisurizing module shall be configured to be introduced into its helium conditioning function after the condensing module has been operated for the required length of time to assure that the bulk moisture vaporization in the MPC (defined as Phase 1 in FSAR Appendix 2.B) has been completed.
- 3.6.2.7 The helium circulator shall be sized to effect the minimum flow rate of circulation required by these design criteria.
- 3.6.2.8 The pre-heater module shall be engineered to ensure that the temperature of the helium gas in the MPC meets these design criteria.

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DESIGN FEATURES

3.6 Forced Helium Dehydration System (continued)

3.6.3 Fuel Cladding Temperature

A steady-state thermal analysis of the MPC under the forced helium flow scenario shall be performed using the methodology described in HI-STORM 100 FSAR Section 4.4, with due recognition of the forced convection process during FHD system operation. This analysis shall demonstrate that the peak temperature of the fuel cladding under the most adverse condition of FHD system operation, is below the peak cladding temperature limit for normal conditions of storage for the applicable fuel type (PWR or BWR) and cooling time at the start of dry storage.

3.6.4 Pressure Monitoring During FHD Malfunction

During an FHD malfunction event, described in HI-STORM 100 FSAR Section 11.1 as a loss of helium circulation, the system pressure must be monitored to ensure that the conditions listed therein are met.

DESIGN FEATURES

3.7 Supplemental Cooling System

3.7.1 System Description

The SCS is a water circulation system for cooling the MPC inside the HI-TRAC transfer cask during on-site transport. Use of the Supplemental Cooling System (SCS) is required for post-backfill HI-TRAC operations of an MPC containing one or more high burnup (> 45,000 MWD/MTU) fuel assemblies and with a predicted peak fuel cladding temperature otherwise in excess of 400°C. The SCS shall be designed for normal operation (i.e., excluding startup and shutdown ramps) in accordance with the criteria in Section 3.7.2.

3.7.2 Design Criteria

3.7.2.1 Not Used.

3.7.2.2 If water is used as the coolant, the system shall be sized to limit the coolant temperature to below 180°F under steady-state conditions for the design basis heat load at an ambient air temperature of 100°F. Any electric motors shall have a backup power supply for uninterrupted operation.

3.7.2.3 The system shall utilize a contamination-free fluid medium in contact with the external surfaces of the MPC and inside surfaces of the HI-TRAC transfer cask to minimize corrosion.

3.7.2.4 All passive components such as tubular heat exchangers, manually operated valves and fittings shall be designed to applicable standards (TEMA, ANSI).

3.7.2.5 The heat dissipation capacity of the SCS shall be equal to or greater than the minimum necessary to ensure that the peak cladding temperature is below 400°C (752°F). All heat transfer surfaces in heat exchangers shall be assumed to be fouled to the maximum limits specified in a widely used heat exchange equipment standard such as the Standards of Tubular Exchanger Manufacturers Association.

3.7.2.6 The coolant utilized to extract heat from the MPC shall be either high purity water or air. Antifreeze may be used to prevent water from freezing if warranted by operating conditions.

DESIGN FEATURES

3.7 Supplemental Cooling System (continued)

- 3.7.2.7 All pressure boundaries (as defined in the ASME Boiler and Pressure Vessel Code, Section VIII Division 1) shall have pressure ratings that are greater than the maximum system operating pressure by at least 15 psi.
- 3.7.2.8 All ASME Code components shall comply with Section VIII Division 1 of the ASME Boiler and Pressure Vessel Code.
- 3.7.2.9 All gasketed and packed joints shall have a minimum design pressure rating of the pump shut-off pressure plus 15 psi.

DESIGN FEATURES

3.8 Combustible Gas Monitoring During MPC Lid Welding

During MPC lid-to-shell welding operations, combustible gas monitoring of the space under the MPC lid is required, to ensure that there is no combustible mixture present in the welding area.

3.9 Corrosion Mitigation Measures

The HI-STORM 100U VVM CEC Container Shell and Bottom Plate shall be protected from corrosion damage due to the corrosivity of the surrounding environment using the following means:

| Implementation and Requirements of Corrosion Mitigation Measures | | | |
|---|--------------------------------------|--|---------------------------------------|
| Surrounding Environment 's Corrosivity (see note iv) | Corrosion Mitigation Measures | | |
| | Coating (see note i) | Concrete Encasement (see note ii) | Cathodic Protection (see note iii) |
| Mild | Required | Choice of either concrete encasement or cathodic protection; or both | |
| Aggressive | Required | Optional | Required |
| Notes: i. An exterior surface preservative (coating) applied on the CEC in accordance with the acceptance criteria set forth in the FSAR. ii. Concrete encasement of the CEC external surfaces to establish a high pH buffer around the CEC metal mass in accordance with the requirements set forth in the FSAR. iii. An impressed current cathodic protection system (ICCPS) in accordance with the design criteria set forth in the FSAR. iv. Surrounding environment corrosivity is categorized as either mild or aggressive in accordance with the requirements set forth in the FSAR. | | | |

3.10 Periodic Corrosion Inspections for Underground Systems

HI-STORM 100U VVM ISFSIs not employing an impressed current cathodic protection system shall be subject to visual and UT inspection of at least one representative VVM to check for significant corrosion of the CEC Container Shell and Bottom Plate at an interval not to exceed 20 years. The VVM chosen for inspection is not required to be in use or to have previously contained a loaded MPC. The VVM considered to be most vulnerable to corrosion degradation shall be selected for inspection. If significant corrosion is identified, either an evaluation to demonstrate sufficient continued structural integrity (sufficient for at least the remainder of the licensing period) shall be performed or the affected VVM shall be promptly scheduled for repair or decommissioning. Through wall corrosion shall not be permitted without promptly scheduling for repair or decommissioning. Promptness of repair or decommissioning shall be commensurate with the extent of degradation of the VVM but shall not exceed 3 years from the date of inspection.

If the representative VVM is determined to require repair or decommissioning, the next most vulnerable VVM shall be selected for inspection. This inspection process shall conclude when a VVM is found that does not require repair or decommissioning. Since the last VVM inspected is considered more prone to corrosion than the remaining un-inspected VVMs, the last VVM inspected becomes the representative VVM for the remaining VVMs.

Inspections

Visual Inspection: Visual inspection of the inner surfaces of the CEC Container Shell and Bottom Plate for indications of significant or through wall corrosion (i.e., holes).

UT Inspection: The UT inspection is performed on the inside surfaces of the CEC. A minimum of 16 data points shall be obtained, 4 near the top, 4 near the mid-height and 4 near the bottom of the CEC Container Shell all approximately 0, 90, 180, and 270 degrees apart; and 4 on the CEC Bottom Plate near the CEC Container Shell approximately 0, 90, 180, and 270 degrees apart. Locations where visual inspection has identified potentially significant corrosion shall also receive UT inspection. Locations suspected of significant corrosion may receive further UT inspection to determine the extent of corrosion.

Inspection Criteria

General wall thinning exceeding 1/8" in depth and local pitting exceeding 1/4" in depth are conditions of significant corrosion.