1. b. Description (continued)

There are twelve types of MPCs: the MPC-24, MPC-24E, MPC-24EF, MPC-32, MPC-32F, MPC-32 Version 1, MPC-32M, MPC-68, MPC-68 Version 1, MPC-68F, MPC-68FF, and MPC-68M. The number suffix indicates the maximum number of fuel assemblies permitted to be loaded in the MPC. All nine 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 neutron shield jacket attached to the exterior. All transfer cask sizes have identical cavity diameters. The higher weight HI-TRAC transfer casks have thicker shielding and larger outer dimensions than the lighter HI-TRAC transfer casks.

Above Ground Systems

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. 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 air vents at the bottom and at the top to allow air to circulate naturally through the cavity to cool the MPC inside. 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 and are outfitted with an extended baseplate and gussets to enable the overpack to be anchored to the concrete storage pad in high seismic applications. The Version E can be arrayed in a free standing or anchored configuration

Underground Systems

The HI-STORM 100U System is an underground storage system identified with the HI-STORM 100 Cask System. The HI-STORM 100U storage Vertical Ventilated Module (VVM) utilizes a storage design identified as an air-cooled vault or caisson. The HI-STORM 100U storage VVM relies on vertical ventilation instead of conduction through the soil, as it is essentially a below-grade storage cavity. 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 it is mounted 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 VVM in the 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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3.1 SFSC INTEGRITY

3.1.1 Multi-Purpose Canister

LCO 3.1.1 The MPC shall be dry and helium filled.

Table 3-1 provides decay heat and burnup limits for forced helium dehydration (FHD) and vacuum drying. FHD is not subject to time limits. Vacuum drying of MPCs may be subject to time limits, from the end of bulk water removal until the start of helium backfill, as shown in Table 3-1.

APPLICABILITY: During TRANSPORT OPERATIONS and STORAGE OPERATIONS.

ACTIONS

----------NOTES----------
Separate Condition entry is allowed for each MPC.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. MPC cavity vacuum drying pressure or demoisturizer exit gas temperature limit not met.	A.1 Perform an engineering evaluation to determine the quantity of moisture left in the MPC. AND	7 days
	A.2 Develop and initiate corrective actions necessary to return the MPC to compliance with Table 3-1.	30 days

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.1.2	Verify all OVERPACK inlets and outlet area are free of blockage from solid debris or floodwater. OR For OVERPACKS with installed temperature monitoring equipment, verify that the difference between the average OVERPACK air outlet temperature and ISFSI ambient temperature is $\leq$ 142°F (MPC-32M), or $\leq$ 163°F (MPC-32 Version 1/MPC-68 Version 1), or $\leq$ 155°F (MPC-24/24E/24EF/32/32F), or $\leq$ 137°F (MPC-68/68F/68FF) or $\leq$ 164°F (MPC-68M)	Table 3-3 Table 3-3

3.1 SFSC INTEGRITY

3.1.4 Supplemental Cooling System

LCO 3.1.4 A supplemental cooling system (SCS) shall be operable

----------NOTE----------
Upon reaching steady state operation, the SCS may be temporarily disabled for a short duration (≤ 7 hours) to facilitate necessary operational evolutions, such as movement of the TRANSFER CASK through a door way, or other similar operation.

APPLICABILITY: This LCO is not applicable to the MPC-32M or 68M. This LCO is not applicable to the HI-TRAC MS TRANSFER CASK. For all other MPCs and TRANSFER CASKs, this LCO is applicable when the loaded MPC is in the TRANSFER CASK and:

a. Within 4 hours of the completion of MPC drying operations in accordance with LCO 3.1.1 or within 4 hours of transferring the MPC into the TRANSFER CASK if the MPC is to be unloaded

AND

b. The MPC contains one or more fuel assemblies with an average burnup > 45,000 MWD/MTU

AND

c1. MPC backfilled to higher helium backfill limits in Appendix A Table 3-2 AND any storage cell decay heat load exceeds 90% of maximum allowable storage cell heat load defined in Appendix B, Section 2.4.1 or 2.4.2 and FSAR Section 2.1.9.1 procedures.

OR

c2. MPC backfilled to lower helium backfill limits in Appendix A Table 3-2 AND any storage cell heat load exceeds 90% of storage cell heat load limits defined in Appendix A Table 3-3 or 3-4.

OR

c3. MPC-32 Version 1/MPC-68 Version 1 where any storage cell heat load exceeds 90% of storage cell heat load limits defined in Appendix D Section 2.4.

Table 3-3
Completion Time for Actions to Restore HI-STORM 100S Version E SFSC Heat Removal System to Operable [Note1]

MPC Material	MPC Type	Decay Heat Limits per Storage Location	Condition A Completion Time	Condition B Completion Time	Surveillance Frequency
Alloy X Except Duplex [Note3]	MPC-32 Version 1/ MPC- 68 Version 1	Appendix D, Section 2.4	8 hrs	24 hrs	24 hrs
Alloy X	MPC-32 Version 1/ MPC-68 Version 1	Appendix D, Section 2.4	8 hrs	16 hrs	16 hrs
Alloy X	MPC-32 Version 1	0.5 kW	24 hrs	64 hrs	30 days
	MPC-68 Version 1	0.264 kW			
	MPC-32M	0.75 kW[Note 2]			
Alloy X Except Duplex [Note 3]	MPC-32M	Appendix D Section[Note 2] 2.4.1 OR Appendix D Section[Note 2] 2.4.2	8 hrs	24 hrs	24 hrs
Alloy X	MPC-32M	Appendix D Section[Note 2] 2.4.1 OR Appendix D Section[Note 2] 2.4.2	8 hrs	24 hrs	24 hrs

Notes: 1. For limits applicable to MPC-24/24E/24EF/32/32F/68/68F/68FF/68M see Appendix A Table 3-5.
2. For MPC-32M, heat load limits may need to be modified based on fuel height, in accordance with Appendix D Section 2.4.4.
3. If any component of the MPC is made of duplex, these completion times are not applicable.

5.3 Radiation Protection Program

5.3.1 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.

5.3.2 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.

5.3.3 Based on the analysis performed pursuant to Section 5.3.2, 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 OVERPACK.
b. The side of the TRANSFER CASK and OVERPACK
c. The inlet and outlet ducts on the OVERPACK

5.3.4 Notwithstanding the limits established in Section 5.3.3, the measured dose rates on a loaded OVERPACK shall not exceed the following values:

a. 20 mrem/hr (gamma + neutron) on the top of the OVERPACK
b. 200 mrem/hr (gamma + neutron) on the side of the OVERPACK, excluding inlet and outlet ducts
c. 4000 mrem/hr (gamma + neutron) on the side of the TRANSFER CASK

5.3.5 The licensee shall measure the TRANSFER CASK and OVERPACK surface neutron and gamma dose rates as described in Section 5.3.8 for comparison against the limits established in Section 5.3.3 for the TRANSFER CASK and Section 5,3,3 or Section 5.3.4, whichever are lower for the OVERPACK.

5.4 Fabrication Helium Leak Test

At completion of welding the MPC shell to baseplate, an MPC confinement weld helium leak test shall be performed using a helium mass spectrometer. This test shall include the base metals of the MPC shell and baseplate. A helium leak test shall also be performed on the base metal of the fabricated MPC lid. The confinement boundary leakage rate tests shall be performed in accordance with ANSI N14.5 to “leaktight” criteria. If a leakage rate exceeding the acceptance criteria is detected, then the area of leakage shall be determined and the area repaired per ASME Code Section III, Subsection NB requirements. Re-testing shall be performed until the leakage rate acceptance criterion is met.

5.3 Radiation Protection Program

5.3.1 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.

5.3.2 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.

5.3.3 Based on the analysis performed pursuant to Section 5.3.2, 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 OVERPACK.
b. The side of the TRANSFER CASK and OVERPACK
c. The inlet and outlet ducts on the OVERPACK

5.3.4 Notwithstanding the limits established in Section 5.3.3, the measured dose rates on a loaded OVERPACK shall not exceed the following values:

a. 20 mrem/hr (gamma + neutron) on the top of the OVERPACK
b. 200 mrem/hr (gamma + neutron) on the side of the OVERPACK, excluding inlet and outlet ducts
c. 4000 mrem/hr (gamma + neutron) on the side of the TRANSFER CASK

5.3.5 The licensee shall measure the TRANSFER CASK and OVERPACK surface neutron and gamma dose rates as described in Section 5.3.8 for comparison against the limits established in Section 5.3.3 or Section 5.3.4, whichever are lower.

Table 2.1-4
BURNUP AND COOLING TIME FUEL QUALIFICATION FOR MPC-32M

Cell Decay Heat Load Limit (kW) (Notes 1, 2)	**Polynomial Coefficients, see Paragraph 2.II.1.5.2**			
	A	**B**	**C**	**D**
≤ 0.83	6.57083E-14	-4.02593E-09	1.47107E-04	8.01647E-01
0.83 < decay heat ≤ 1.25	4.11020E-14	-4.62813E-09	2.17444E-04	-5.55545E-01
1.25 < decay heat ≤ 1.46	1.21147E-14	-1.08013E-09	8.66361E-05	4.04455E-01
1.46 < decay heat ≤ 1.81	3.82652E-15	-2.38729E-10	4.75134E-05	6.36443E-01
1.81 < decay heat ≤ 3.26	3.76103E-16	4.83486E-11	1.74805E-05	6.53455E-01

The burnup and cooling time for every fuel loaded into the MPC-32M must satisfy the following equation:

$$Ct = A \cdot Bu^3 + B \cdot Bu^2 + C \cdot Bu + D$$

where,

Ct = Minimum cooling time (years),
Bu = Assembly-average burnup (MWd/mtU),
A, B, C, D = Polynomial coefficients listed in Table 2.1-4

Notes:
1) Decay heat per fuel assembly is presented
2) A decay heat value that is equal to or greater than the appropriate decay heat load limit