1.0.3 Implementation of Topical Reports

1.0.3.1 Thermal Topical Report

The NRC has reviewed and approved Topical Report HI-2200343 [1.0.7]. This report outlines a methodology for developing heat load patterns for each canister. Throughout this FSAR, the areas where the topical report can be applied are identified. However, since the topical report itself is specifically focused on the thermal methodology, this section provides an outline of the approach for implementing that methodology. For additional clarity, a flowchart of the process is included in Figure 1.0.1.

Change Control
The NRC's SER [1.0.8] explicitly lays out restrictions on the scope of the review for the topical report. Most notably, limitation 4.2 describes the model reviewed for the scope of the topical report as invariant. However, since this FSAR is subject to the provisions of 10CFR72.48, use of that topical report needs to address the change control process.

Because the topical report SER describes the model used as "invariant," the first step in any use of the topical report is to evaluate the proposed heat load pattern using the exact model from the topical report. Once it has been demonstrated that the heat load pattern meets the peak cladding temperature requirements in the topical report model, then the heat load pattern can be considered acceptable, similar to any of the explicit patterns listed in the CoC.

After the heat load pattern is shown to meet the peak cladding temperature in the invariant topical report model, then any required changes to the model can be considered under the 10CFR72.48 process. If the changes do not require prior NRC approval, they can be incorporated following Holtec's 10CFR72.48 process. Then the heat load pattern should be run in the revised model, following the methodology in the Topical Report, to ensure that all the acceptance criteria are still met.

Shielding
The topical report specifically provides a methodology for calculating heat load patterns. However, this FSAR also defines a set of qualified fuel parameters. Regardless of the heat load patterns calculated per the Topical Report, the fuel must also meet the required fuel qualification table (FQT) combinations of burnup, cooling time, and enrichment outlined in this FSAR.

Structural
The acceptance criteria in the Topical Report are the temperatures of the components. This FSAR has structural analysis based on calculated temperatures. If the proposed thermal pattern under the Topical Report causes temperatures above what is used in the structural analysis in the FSAR, the revised temperature must be evaluated for structural under the provisions of 10CFR72.48 to determine if the new calculated temperature is acceptable without prior NRC approval. If the new calculated temperature would not be acceptable without prior NRC approval, either a new pattern should be developed per the Topical Report, or an amendment submitted to address the structural analysis.

Figure 1.0.1: Thermal Topical Report Implementation

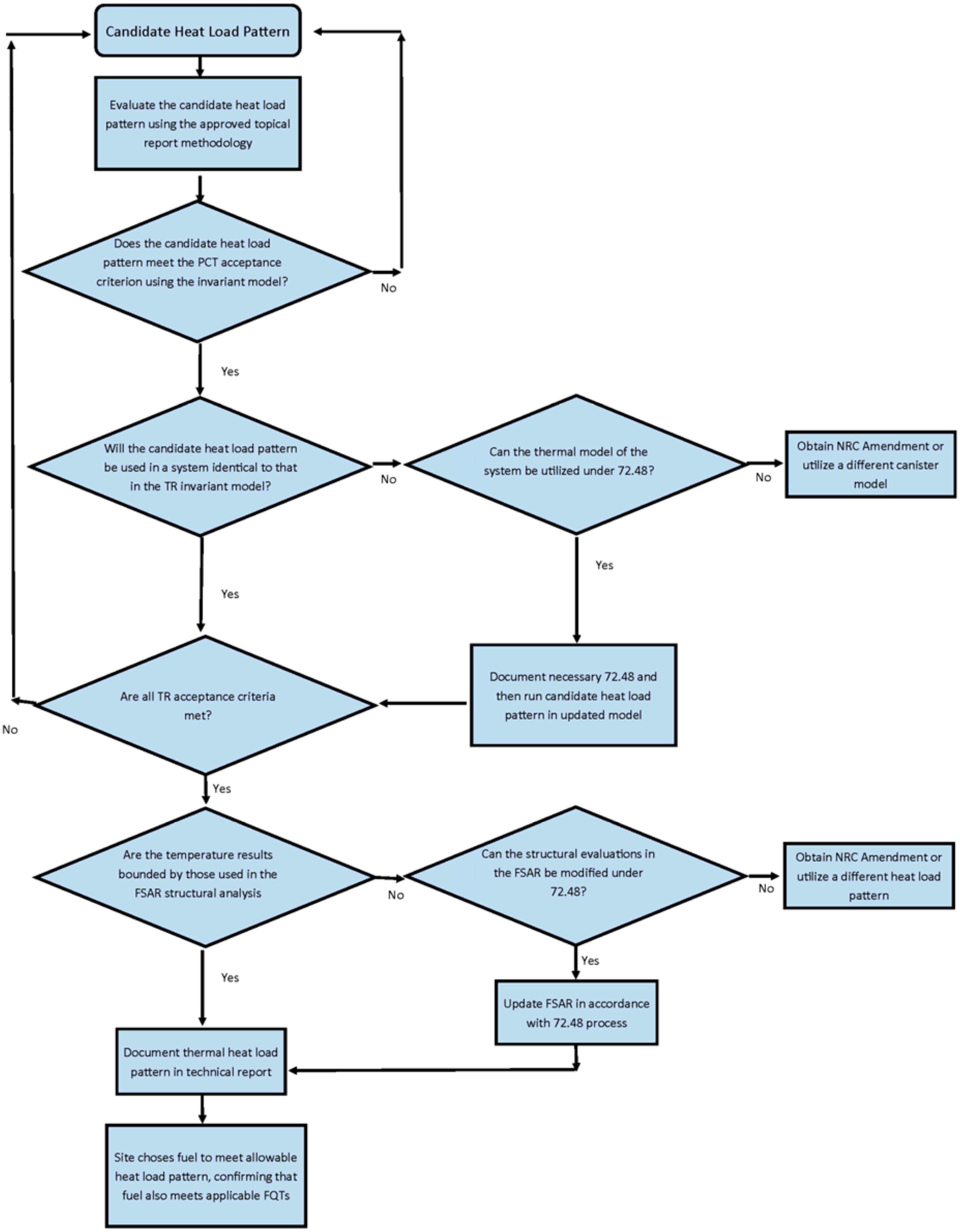

Table 1.2.2

KEY PARAMETERS FOR HI-STORM 100 MULTI-PURPOSE CANISTERS

	PWR	BWR
Pre-disposal service life (years)	40	40
Design temperature, max./min. (°F)	725°[†]/-40°[††]	725°[†]/-40°[††]
Design internal pressure (psig)		
Normal conditions	100	100
Off-normal/Short-term conditions	110	110
Accident Conditions	200	200
Total heat load, max. (kW)[††††]	36.9	36.9
Maximum permissible peak fuel cladding temperature:		
Long Term Normal (°F)	752	752
Short Term Operations (°F)	752 or 1058[†††]	752 or 1058[†††]
Off-normal and Accident (°F)	1058	1058

[†] Maximum normal condition design temperatures for the MPC fuel basket. A complete listing of design temperatures for all components is provided in Table 2.2.3.

[††] Temperature based on off-normal minimum environmental temperatures specified in Section 2.2.2.2 and no fuel decay heat load.

[†††] See Section 4.5 for discussion of the applicability of the 1058°F temperature limit during MPC drying.

[††††] Maximum heat load shown is for regionalized loading. This maximum heat load does not apply to patterns developed according to Topical Report HI-2200343

Table 1.2.2 (cont'd)

KEY PARAMETERS FOR HI-STORM 100 MULTI-PURPOSE CANISTERS

	PWR	BWR
MPC internal environment Helium fill (99.995% fill helium purity) (See Note 2)	(all pressure ranges are at a reference temperature of 70°F)	(all pressure ranges are at a reference temperature of 70°F)
MPC-24[Note 3] (heat load ≤ 27.77 kW, see Table 2.1.31)	≥ 29.3 psig and ≤ 48.5 psig OR 0.1212 +/-10% g-moles/liter	
(heat load > 27.77 kW)	≥ 45.5 psig and ≤ 48.5 psig	
MPC-24E/24EF[Note 3] (heat load ≤ 28.17 kW, see Table 2.1.31)	≥ 29.3 psig and ≤ 48.5 psig OR 0.1212 +/-10% g-moles/liter	
(heat load > 28.17 kW)	≥ 45.5 psig and ≤ 48.5 psig	
MPC-68/68F/68FF[Note 3] (heat load ≤ 28.19 kW, see Table 2.1.31)		≥ 29.3 psig and ≤ 48.5 psig OR 0.1218 +/-10% g-moles/liter
(heat load >28.19 kW)		≥ 45.5 psig and ≤ 48.5 psig
MPC-32/32F[Note 3] (heat load ≤ 28.74 kW, see Table 2.1.31)	≥ 29.3 psig and ≤ 48.5 psig	
(heat load >28.74 kW)	≥ 45.5 psig and ≤ 48.5 psig	
Maximum permissible multiplication factor (k_{eff}) including all uncertainties and biases	< 0.95	< 0.95
Fixed Neutron Absorber ^{10}B Areal Density (g/cm^2) Boral/Metamic	0.0267/0.0223 (MPC-24) 0.0372/0.0310 (MPC-24E, MPC-24EF MPC-32 & MPC-32F)	0.0372/0.0310 (MPC-68 & MPC-68FF) 0.01/NA (MPC-68F) (See Note 1)
End closure(s)	Welded	Welded
Fuel handling	Opening compatible with standard grapples	Opening compatible with standard grapples
Heat dissipation	Passive	Passive

NOTE:

1. All MPC-68F canisters are equipped with Boral neutron absorber.
2. Refer to Section 4.4.5.1 for detailed information on heat load values.
3. For patterns developed in accordance with Topical Report HI-2200343, these backfill ranges may be modified

1.6 REFERENCES

[1.0.1] 10CFR Part 72, "Licensing Requirements for the Storage of Spent Fuel in an Independent Spent Fuel Storage Installation", Title 10 of the Code of Federal Regulations, 1998 Edition, Office of the Federal Register, Washington, D.C.

[1.0.2] Regulatory Guide 3.61 (Task CE306-4) "Standard Format for a Topical Safety Analysis Report for a Spent Fuel Storage Cask", USNRC, February 1989.

[1.0.3] NUREG-1536, "Standard Review Plan for Dry Cask Storage Systems", U.S. Nuclear Regulatory Commission, January 1997.

[1.0.4] American Concrete Institute, "Code Requirements for Nuclear Safety Related Concrete Structures", ACI 349-85, ACI, Detroit, Michigan.†

[1.0.5] American Concrete Institute, "Building Code Requirements for Structural Plain Concrete (ACI 318.1-89) (Revised 1992) and Commentary - ACI 318.1R-89 (Revised 1992)".

[1.0.6] "Spent Nuclear Fuel Effective Thermal Conductivity Report," U.S. Department of Energy Document Identifier BBA000000-01717-5705-00010, Rev. 00, Tables S-1 through S-4.

[1.0.7] "Topical Report for Allowance of Heat Load Patterns in HI-STORM 100 and HI-STORM FW Systems," HI-2200343-A, Holtec International

[1.0.8] Final Safety Evaluation Report for the Holtec International Topical Report for Allowance of Heat Load Patterns in HI-STORM 100 and HI-STORM FW Systems," US NRC, ML21125A191

[1.1.1] ASME Boiler & Pressure Vessel Code, Section III, Subsection NB, American Society of Mechanical Engineers, 1995 with Addenda through 1997.

[1.1.2] USNRC Docket No. 72-1008, Final Safety Analysis Report for the (Holtec International Storage, Transport, and Repository) HI-STAR System, latest revision.

[1.1.3] USNRC Docket No. 71-9261, Safety Analysis Report for Packaging for the (Holtec International Storage, Transport, and Repository) HI-STAR System, latest revision.

[1.1.4] 10CFR Part 50, "Domestic Licensing of Production and Utilization Facilities", Title 10 of the Code of Federal Regulations, 1998 Edition, Office of the Federal

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† The 1997 edition of ACI-349 is specified for embedment design for deployment of the anchored HI-STORM 100A and HI-STORM 100SA.

Table 1.II.2.3
MPC-32M, MPC-32 Version 1 and MPC-68 Version 1 Design Data[1]

Item	Value	Comment
Design Life/Service Life /License Life (years)	40 /100/20	Service life is a conservative estimate of useful life if a Designer developed and an NRC-approved aging management program is followed by the user.
Canister Fill Gas	High purity Helium	Helium is the standard fill gas with a long history of satisfactory performance
Quantity of Helium gas Installed	Established in Tables 4.II.3.1 and 4.II.3.2 by thermal analysis	Sufficient to provide adequate helium circulation corresponding to the canister's aggregate heat load to maintain the peak fuel cladding temperature below the ISG- 11 Rev 3 limit under normal condition of storage. May be evaluated according to topical report HI-2200343-
Number of Damaged Fuel Isolator (DFI) Cells	Up to 16 peripheral cells for MPC-32M DFIs are not permitted in Version1 models of MPC-32 or MPC-68	Supplement 4.II provides substantiating thermal analysis Supplement 5.II provided criticality analysis and required soluble boron levels.
Number of Damaged Fuel Containers (DFCs)	Up to 16 peripheral cells for MPC-32M See Table 2.1.22 for DFCs in MPC-68 Version 1 See Table 2.1.24 for DFCs in MPC-32 Version 1	Supplement 4.II provides substantiating thermal analysis Supplement 5.II provided criticality analysis and required soluble boron levels. Contents for the Version 1 canisters are identical to those qualified in the original canister designs

Table 1.III.1
Key Parameters for MPC-68M

	BWR
MPC internal environment Helium fill (99.995% fill helium purity)	(all pressure ranges are at a reference temperature of 70°F)
(heat load $\leq$ 28.19 kW)	> 29.3 psig and < 48.5 psig OR 0.1218 +/-10% g-moles/liter
(heat load >28.19 kW)	> 45.5 psig and < 48.5 psig
Quarter Symmetric Heat Load (QSHL, Figure 2.III.1)	$\geq$ 43.5 psig and $\leq$ 46.5 psig
QSHL patterns in Figures 2.III.2 through 2.III.4	> 45.5 psig and < 48.5 psig (Note 1)
B_4C content in Metamic-HT (wt. %)	As specified on drawing in Section 1.5

Notes:

1. For patterns developed in accordance with Topical Report HI-2200343 [1.0.7], these backfill ranges may be modified

methodology described in Section 2.1.9.1.1 or 2.1.9.1.2 depending on whether uniform fuel loading or regionalized fuel loading is being implemented[†]. The total permissible MPC heat load, for both uniform and regionalized loading, is determined in the following two subsections 2.1.9.1.1 and 2.1.9.1.2. Total MPC heat load and individual cell limits may also be determined using the methodology outlined in Topical Report HI-2200343. These fuel assemblies must still meet the fuel qualification requirements based on burnup, enrichment, and cooling time outlined in Paragraph 2.1.9.1.3. The decay heat limits are independent of burnup, cooling time, or enrichment and are based strictly on the thermal analysis described in Chapter 4 or the topical report [1.0.7] referenced above . Decay heat limits must be met for all contents in a fuel storage location (i.e., fuel and PWR non-fuel hardware, as applicable).

2.1.9.1.1 Uniform Fuel Loading Decay Heat Limits for ZR-Clad Fuel

Table 2.1.26 provides the maximum allowable decay heat per fuel storage location for ZR-clad fuel in uniform fuel loading for each MPC model in aboveground storage[*]. Even if the limits in Table 2.1.26 are met, the user must follow the instructions in the next section to calculate Q_{CoC} to determine if certain operational steps are required per the CoC. If the user needs to load fuel assemblies with a decay heat higher than the limits in Table 2.1.26, a regionalized loading pattern discussed in the next section may be considered.

2.1.9.1.2 Design Heat Load for ZR-Clad Fuel

The discussion in this section provides the approach to determine the maximum permitted per cell heat load for long term-storage in a regionalized pattern. In addition, this section also provides the approach to determine the allowed per cell heat load for those operations that are dependent on the total MPC heat load. These include helium backfill pressure, supplemental cooling, drying method, and time requirements for clearing blockage on HI-STORM inlet vents.

The Design Basis heat load for the aboveground HI-STORM System, Q_d, is 34 kW. Q_d is based on the assumption that every storage cell in the MPC is generating an equal amount of heat. In other words, the specific heat generation rate, q, of each storage location is considered equal. Thus, in an MPC with n storage locations,

$$Q_d = n\, q \qquad \text{Equation a}$$

In reality, however, the population of SNF and associated NFH loaded in the MPC invariably has unequal decay heat. If we consider the loaded decay heat in a cell as r, and r_i denotes the loaded decay heat in location i, then the aggregate MPC heat load, Q_t, is given by a simple summation, i.e.,

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[†] Note that the stainless steel-clad fuel decay heat limits apply to all fuel in the MPC, if a mixture of stainless steel and ZR-clad fuel is stored in the same MPC. The stainless steel-clad fuel assembly decay heat limits may be found in Table 2.1.17 through 2.1.24

[*] Maximum allowable heat loads in 100U underground storage are defined in Supplement 2.I; however the discussion in Section 2.1.9.1 also applies to the 100U.

calculated for 4 and 5 years.

- ZR-clad fuel assemblies must have a minimum enrichment, as defined in the glossary, greater than or equal to the value used in determining the maximum allowable burnup per Section 2.1.9.1.3 to be authorized for storage in the MPC.

- When complying with the maximum fuel storage location decay heat limits, users must account for the decay heat from both the fuel assembly and any PWR non-fuel hardware, as applicable for the particular fuel storage location, to ensure the decay heat emitted by all contents in a storage location does not exceed the limit.

- ~~There are two options for helium backfill range (shown in Table 1.2.2). The lower helium backfill range has different per cell heat load limits given in Table 2.1.31.~~

Section 12.2.10 provides a practical example of determining fuel storage location decay heat, burnup, and cooling time limits and verifying compliance for a set of example fuel assemblies.

2.1.9.1.5 Supplemental Cooling Threshold Heat Loads

Fuel loading operations involving the handling of High Burnup Fuel (HBF) in a dewatered MPC emplaced in a HI-TRAC transfer cask require additional cooling under certain thermal loads to address reduced heat dissipation relative to the normal storage condition. To address this requirement the Supplemental Cooling System (SCS) defined in Appendix 2.C is mandated under threshold heat loads defined in Section 4.5 and Table 2.1.30. The specific design of a SCS must accord with site-specific needs and resources, including the availability of plant utilities. However, a set of specifications to ensure that the performance objectives of the SCS are satisfied by plant-specific designs are set forth in Appendix 2.C.

Table 2.II.1.6

Burnup and Cooling Time Fuel Qualification Requirements for MPC-32M

Cell Decay Heat Load Limit (kW)	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

Table 2.II.1.7

Allowable Heat Loads and Soluble Boron Requirements for MPC-32M Fuel Wet Loading and Unloading Operation with DFCs and DFIs

Row No.	DFC/DFI (Note 1)	Number of DFC/DFI Locations	Locations/Storage Cell Numbers (Note 2)	Penalty on per storage cell heat load limit (Note 3)	Min. Soluble Boron Content
1	DFC	4	2, 11, 22, 31 (NOTE 4)	0%	Table 2.II.1.10
2		8	1, 4, 5, 10, 23, 28, 29, 32	5%	Table 2.II.1.10
3		12	1, 2, 4, 5, 10, 16, 17, 23, 28, 29, 31, 32	5%	Table 2.II.1.10
4		16	1, 2, 3, 4, 5, 10, 11, 16, 17, 22, 23, 28, 29, 30, 31, 32 (NOTE 4)	0%	Table 2.II.1.11
5		16	1, 2, 3, 4, 5, 10, 11, 16, 17, 22, 23, 28, 29, 30, 31, 32	5%	Table 2.II.1.11
6	DFI	4	2, 11, 22, 31	10%	Table 2.II.1.9
7		12	1, 2, 4, 5, 10, 16, 17, 23, 28, 29, 31, 32	40%	Table 2.II.1.9
8		16	1, 2, 3, 4, 5, 10, 11, 16, 17, 22, 23, 28, 29, 30, 31, 32	40%	Table 2.II.1.9
9	DFI or DFC	16	1, 2, 3, 4, 5, 10, 11, 16, 17, 22, 23, 28, 29, 30, 31, 32	DFCs – 5% DFIs – 40%	Table 2.II.1.11

Note 1: Damaged fuel assemblies or fuel debris can be loaded in DFCs while only damaged fuel assemblies that can be handles by normal means can be loaded in DFIs.

Note 2: DFCs/DFIs are allowed for storage in certain basket peripheral locations as defined herein. Basket storage cell numbers are identified in Figure 2.1-1.

Note 3: Heat load penalties are applicable to ONLY those cells where DFCs/DFIs are located and are applied to the allowable undamaged fuel assembly decay heat limit in that storage cell location. The penalties remain the same for all regionalized patterns and discrete loading patterns.

Note 4: Storage cell locations 6, 9, 24, 27 all must remain empty.

non-mechanistic). The basis for the lateral deflection limit in the active fuel region, θ, is provided in [2.III.6.1] as

$$\theta = \frac{\delta}{w}$$

where δ is defined as the maximum total deflection sustained by the basket panels under the loading event and *w* is the nominal inside (width) dimension of the storage cell. The limiting value of θ is provided in Table 2.III.4. The above deflection-based criterion has been used previously in the HI-STAR 180 Transportation Package [2.III.6.2] to qualify similar Metamic-HT fuel baskets.

ii. Thermal

The design and operation of the HI-STORM 100 System with the MPC-68M must meet the intent of the review guidance contained in ISG-11, Revision 3 [2.0.8] as described in Subsection 2.0.1.

All applicable material design temperature limits in Section 2.2 and 4.3 continue to apply to the MPC-68M. Temperature limits of MPC-68M fuel basket and basket shim materials are specified in Table 4.III.2.

The MPC-68M is designed for both uniform and regionalized fuel loading strategies as described in Subsection 2.0.1. The regions for the MPC-68M are given in Table 2.III.1. Additionally, four quarter-symmetric heat load patterns have been defined for MPC-68M as shown in Figures 2.III.1 through 2.III.4. The same temperature limits apply to these configurations. Alternative heat load patterns may be developed following the methodology in the Topical Report HI-2200343 [1.0.7].

iii. Shielding

Same as Subsection 2.0.1.

iv. Criticality

Same as Subsection 2.0.1 with the clarifications herein.

Criticality control is maintained by the geometric spacing of the fuel assemblies and spatially distributed B-10 isotope in the Metamic-HT. No soluble boron is required in the MPC-68M water. The minimum specified boron concentration in the Metamic-HT purchasing specification must be met in every lot of the material manufactured. No credit is taken for burnup. Enrichment limits are delineated in Table 2.III.2.

v. Confinement

Same as Subsection 2.0.1

BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.1.1, SR 3.1.1.2 , and SR 3.1.1.3 (continued)

of Appendix A to the CoC and the storage cell heat loads are less than or equal to the limits in either Table 3-3 of Appendix A to the CoC (regionalized) or Table 3-4 of Appendix A to the CoC (uniform), then the lower helium backfill pressure range in Table 3-2 item (i) can be used. The higher backfill pressure range in Table 3-2 item (ii) must be used if the cask heat load is greater than the value in Table 3-2 and the storage cell heat load is greater than the value in either Table 3-3 or Table 3-4. Note that the higher backfill pressure range in Table 3-2 item (ii) is just a subset of the wider range in item (i), and therefore can always be used as an option. The storage cell heat load limits specified in Table 3-3 and Table 3-4 for MPC-68/68F/68FF are also applicable to the MPC-68M, consistent with the analyses in the FSAR. Alternatively, the quantity of helium can be calculated based on the methodology in Topical Report HI-2200343-A

Meeting the helium leak rate limit ensures there is adequate helium in the MPC for long term storage and that there is no credible effluent dose from the cask.

All of these surveillances must be successfully performed once, prior to TRANSPORT OPERATIONS to ensure that the conditions are established for SFSC storage which preserve the analysis basis supporting the cask design.

REFERENCES

1. FSAR Sections 1.2, 4.4, 4.5, 7.2, 7.3 and 8.1
2. Interim Staff Guidance Document 11
3. Interim Staff Guidance Document 18
4. Deleted

BASES

ACTIONS
(continued)

B.1

If the heat removal system has been determined to be inoperable, it must be restored to operable status within the Completion Time per the Table in the CoC for OVERPACKS containing MPCs with heat loads in excess of the heat loads in Table B.1-1 (below) at the time of inspection. This is a reasonable period of time to take action to remove the obstructions in the air flow path.

Table B.1-1
(Threshold* heat loads for HI-STORM 100 System Surveillance Frequency and Completion Time to restore heat removal system to operable status)

MPC Model(s)	**Threshold Heat Load (per canister)**	**Threshold Heat Load (per assembly)**
24 (all variants)	18 kW	0.75 kW
68 (all variants)	18 kW	0..264 kW
32 (all variants)	16 kW	0.5 kW

Alternatively, for OVERPACKS containing MPCs with heat loads up to the thresholds in Table B.1-1 at the time of inspection, the system must be restored to operable status within twenty-four hours. Twenty-four hours is a reasonable period of time for these lower heat load systems since the temperature limits of the system components and fuel cladding are not exceeded and the event is not time limiting.

Note that topical report HI-2200343 provides an optional method for calculating completion time for all the actions in this LCO.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.2 (continued)

As an alternative, for OVERPACKs with air temperature monitoring instrumentation installed in the air outlets, the temperature rise between ambient and the OVERPACK air outlet may be monitored to verify operability of the heat removal system. Blocked air ducts will reduce air flow and increase the temperature rise experienced by the air as it removes heat from the MPC. Based on the analyses, provided the air temperature rise is less than the limit stated in the SR (or calculated using the topical report), adequate air flow and, therefore, adequate heat transfer is occurring to provide assurance of long term fuel cladding integrity. The reference ambient temperature used to perform this Surveillance shall be measured at the ISFSI facility.

The Frequency for aboveground systems per the Completion Time Table in the CoC and 16 hours for underground systems is reasonable based on the time necessary for SFSC components to heat up to unacceptable temperatures assuming design basis heat loads, and allowing for corrective actions to take place upon discovery of blockage of air ducts. For aboveground systems containing MPCs with heat loads less than or equal to the threshold heat loads in Table B.1-1 at the time of inspection, the surveillance frequency of 30 days is appropriate, since the system components and peak cladding temperature limits for 30-day accident are not exceeded and the event is not time limiting.

REFERENCES

1. FSAR Chapter 4
2. FSAR Sections 11.2.13 and 11.2.14
3. ANSI/ANS 57.9-1992

12.II.2 Development of Operating Controls and Limits

Same as in the main body of Chapter 12, with the HI-STORM 100S Version E replacing the HI-STORM 100 and the HI-TRAC options including the HI-TRAC MS with the following exceptions.

12.II.2.7 Design Features

This section describes HI-STORM 100S Version E System design features that are Important to Safety. These features require design controls and fabrication controls. The design features, detailed in this FSAR and in Appendix D to CoC 72-1014, are established in specifications and drawings that are controlled through the quality assurance program. Fabrication controls and inspections to assure that the HI-STORM 100S Version E is fabricated in accordance with the design drawings and the requirements of this FSAR are described in Supplement 9.II.

12.II.2.10 Verifying Compliance with Fuel Assembly Decay Heat, Burnup, and Cooling Time Limits

The equation described in Paragraph 2.II.1.5.1 is used to determine allowable decay heat per storage location, burnup, and cooling time for the approved contents of the MPC-32M. For MPCs covered by the main body of this chapter, Section 12.2.10 applies. For MPC-32 Version 1 and MPC-68 Version 1, the information for MPC-32 and MPC-68 (respectively) in Section 12.2.10 applies. Alternatively, decay heat limits can be calculated in accordance with the methodology in Topical Report HI-2200343-A.

12.II.3 Technical Specifications

Technical Specifications for the HI-STORM 100S Version E are provided in Appendix C to Certificate of Compliance 72-1014. Authorized Contents (i.e., fuel specifications) and Design Features are provided in Appendix D to CoC 72-1014. Bases applicable to the Technical Specifications are provided in FSAR Appendix 12.II.A. The format and content of the HI-STORM 100 System Technical Specifications and Bases are that of the Improved Standard Technical Specifications for power reactors, to the extent they apply to a dry spent fuel storage cask system. NUMARC Document 93-03, “Writer’s Guide for the Restructured Technical Specifications” [12.3.1] was used as a guide in the development of the Technical Specifications and Bases.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.1.1 , SR 3.1.1.2, and SR 3.1.1.3

The long-term integrity of the stored fuel is dependent on storage in a dry, inert environment. For moderate burnup fuel cavity dryness may be demonstrated either by evacuating the cavity to a very low absolute pressure and verifying that the pressure is held over a specified period of time or by recirculating dry helium through the MPC cavity to absorb moisture until the gas temperature or dew point at the specified location reaches and remains below the acceptance limit for the specified time period. A low vacuum pressure or a demoisturizer exit temperature meeting the acceptance limit is an indication that the cavity is dry. For high burnup fuel and high decay heat load MPCs, the forced helium dehydration method of moisture removal must be used to provide necessary cooling of the fuel during drying operations. Cooling provided by normal operation of the forced helium dehydration system ensures that the fuel cladding temperature remains below the applicable limits since forced recirculation of helium provides more effective heat transfer than that which occurs during normal storage operations.

Table 3-1 of Appendix C to the CoC provides the appropriate requirements for drying the MPC cavity based on the burnup class of the fuel (moderate or high) and the applicable short-term temperature limit. The temperature limits are consistent with the guidance in NRC Interim Staff Guidance (ISG) Document 11. Alternatively, the quantity of helium can be calculated based on the methodology in Topical Report HI-2200343-A

Having the proper quantity of helium in the MPC ensures adequate heat transfer from the fuel to the fuel basket and surrounding structure of the MPC and precludes any overpressure event from challenging the normal, off-normal, or accident design pressure of the MPC.

Meeting the helium leak rate limit ensures there is adequate helium in the MPC for long term storage and that there is no credible effluent dose from the cask.

(continued)

BASES

LCO (continued)

This LCO is not intended to address low frequency, unexpected Design Event III and IV class events such as design basis accidents and extreme environmental phenomena that could potentially block one or more of the air ducts for an extended period of time (i.e., longer than the total Completion Time of the LCO). This class of events is addressed site-specifically as required by Section 3.4.10 of Appendix D to the CoC.

APPLICABILITY

The LCO is applicable during STORAGE OPERATIONS. Once an OVERPACK containing an MPC loaded with spent fuel has been placed into it's storage configuration, the heat removal system must be operable to ensure adequate dissipation of the decay heat from the fuel assemblies.

ACTIONS

A note has been added to the ACTIONS which states that, for this LCO, separate Condition entry is allowed for each SFSC. This is acceptable since the Required Actions for each Condition provide appropriate compensatory measures for each SFSC not meeting the LCO. Subsequent SFSCs that don't meet the LCO are governed by subsequent Condition entry and application of associated Required Actions.

A.1

Although the heat removal system remains operable, the blockage should be cleared expeditiously.

B.1

If the heat removal system has been determined to be inoperable, it must be restored to operable status within the Completion Time per Table 3-3 Appendix C. This is a reasonable period of time to take action to remove the obstructions in the air flow path.

Note that topical report HI-2200343 provides an optional method for calculating completion time for all the actions in this LCO.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.1.2 (continued)

As an alternative, for OVERPACKs with air temperature monitoring instrumentation installed in the air outlets, the temperature rise between ambient and the OVERPACK air outlet may be monitored to verify operability of the heat removal system. Blocked air ducts will reduce air flow and increase the temperature rise experienced by the air as it removes heat from the MPC. Based on the analyses, provided the air temperature rise is less than the limit stated in the SR (or calculated using the topical report), adequate air flow and, therefore, adequate heat transfer is occurring to provide assurance of long term fuel cladding integrity. The reference ambient temperature used to perform this Surveillance shall be measured at the ISFSI facility.

The Frequency per the Completion Time Table in the CoC is reasonable based on the time necessary for SFSC components to heat up to unacceptable temperatures assuming design basis heat loads, and allowing for corrective actions to take place upon discovery of blockage of air ducts.

REFERENCES

1. FSAR Chapter 4
2. FSAR Sections 11.II.2.13 and 11.II.2.14
3. ANSI/ANS 57.9-1992