

Amendment to Incorporate Topical Report For Allowance of Candidate Heat Load Patterns - HI-STORM 100



Background

- Holtec submitted the request for approval of a topical report
- Report outlines a methodology for the thermal evaluation of heat load patterns in the MPC
- Approved in September 2021
- Holtec now plans on submitting an amendment to incorporate this topical report

Proposed CoC Changes – App A/C



Table 3-1a
MPC Cavity Drying Limits for all MPC Types for VENTILATED OVERPACK [Note 9](#)

Fuel Burnup (MWD/MTU)	MPC Heat Load (kW)	Method of Moisture Removal (Notes 1 and 2)
All Assemblies ≤ 45,000	≤ 26 (MPC-24/24E/24EF, MPC-32/32F, MPC-68/68F/68FF)	VDS ^{Note 5} or FHD ^{Note 6}
	≤ 36.9 (MPC-68M) ^{Note 6}	VDS or FHD
	≤ 42.8 (MPC-68M) ^{Note 7}	VDS or FHD
All Assemblies ≤ 45,000	≤ 36.9 (MPC-24/24E/24EF, MPC-32/32F, MPC-68/68F/68FF) ^{Note 6}	VDS ^{Note 8} or FHD
One or more assemblies > 45,000	≤ 29 (MPC-68M)	VDS ^{Note 4}
One or more assemblies > 45,000	≤ 36.9 (MPC-24/24E/24EF/MPC-32/32F/MPC-68/68F/68FF) ^{Note 6}	VDS ^{Note 8} or FHD
	≤ 36.9 (MPC-68M) ^{Note 6}	VDS ^{Note 8} or FHD
	≤ 42.8 (MPC-68M) ^{Note 7}	VDS ^{Note 8} or FHD

8. Vacuum drying of the MPC must be performed using cycles of the drying system, according to the guidance contained in ISG-11 Revision 3. The time limit for these cycles shall be determined based on site specific conditions. Applies when any one assembly heat load is greater than 0.426 kW.
9. [Alternative heat load limits may be developed following the methodology in Topical Report HI-2200343 Revision 2. Dryness criteria are still as specified in Notes 1 or 2 as applicable to the selected drying process.](#)

Table 3-2a
MPC Helium Backfill Limits for VENTILATED OVERPACK [Note 1,2](#)

MPC MODEL	LIMIT
MPC-24/24E/24EF	
i. Cask Heat Load ≤ 27.77 kW (MPC-24) or ≤ 28.17 kW (MPC-24E/EF) = <u>uniformly</u> distributed per Table 3-4 or regionalized loading per Table 3-3	0.1212 +/-10% g-moles/l OR ≥ 29.3 psig and ≤ 48.5 psig
ii. Cask Heat Load >27.77 kW (MPC-24) or > 28.17 kW (MPC-24E/EF) - uniformly distributed or greater than regionalized heat load limits per Table 3-3	≥ 45.5 psig and ≤ 48.5 psig
MPC-68/68F/68FF	
i. Cask Heat Load ≤ 28.19 kW - uniformly distributed per Table 3-4 or regionalized loading per Table 3-3	0.1218 +/-10% g-moles/l OR ≥ 29.3 psig and ≤ 48.5 psig
ii. Cask Heat Load > 28.19 kW - uniformly distributed or greater than regionalized heat load limits per Table 3-3	≥ 45.5 psig and ≤ 48.5 psig

Notes

1. Helium used for [backfill](#) of MPC shall have a purity of ≥ 99.995%. Pressure range is at a reference temperature of 70°F
2. For patterns developed in accordance with Table 3-1, [Note 9](#), helium backfill limits shall be calculated in accordance with Topical Report HI-2200343 [Revision 2](#)

Proposed CoC Changes – App A/C



Table 3-3: Regionalized Storage^{Note 2} Cell Heat Load Limits

MPC Type	Number of Cells in Inner Region ^{Note 1}	Storage Cell Heat Load (Inner Region) (kW)	Number of Cells in Outer Region ^{Note 1}	Storage Cell Heat Load (Outer Region) (kW)
MPC-24	4	1.470	20	0.900
MPC-24E/EF	4	1.540	20	0.900
MPC-32/32F	12	1.131	20	0.600
MPC-68/68F/68FF/68M	32	0.500	36	0.275

Note 1: The location of MPC-32 and MPC-68 inner and outer region cells are defined in Appendix B Figures 2.1-3 and 2.1-4 respectively.

The MPC-24 and MPC-24E/EF cell locations are defined below:

Inner Region Cell numbers 9, 10, 15, 16 in Appendix B Figures 2.1-1 and 2.1-2 respectively.

Outer Region Cell numbers 1-8, 11-14, 17-24 in Appendix B Figures 2.1-1 and 2.1-2 respectively.

Note 2: The storage cell regionalization is defined in Note 1 in accordance with safety analyses under the heat load limits of this Table. [For patterns developed in accordance with Table 3-1, Note 9, these limits do not apply.](#)

Table 3-5: Completion Time for Actions to Restore SFSC Heat Removal System Operable^{Note 2}

MPC Material	MPC Type	Decay Heat Limits per Storage Location	Condition B Completion Time	Condition C Completion Time	Surveillance Frequency
Alloy X Except Duplex ¹	MPC-24/24E/24EF	Appendix B, Section 2.4	8 hrs.	24 hrs.	24 hrs.
	MPC-32/32F				
	MPC-68/68F/68FF/68M				
Alloy X	MPC-24/24E/24EF	Appendix B, Section 2.4	8 hrs.	16 hrs.	16 hrs.
	MPC-32/32F				
	MPC-68/68F/68FF/68M				
Alloy X	MPC-68M	Appendix B, Figures 2.4-1 through 2.4-4	4 hrs.	12 hrs.	12 hrs.
Alloy X Except Duplex ¹	MPC-24	Appendix A, Table 3-3 (Regionalized)	8 hrs.	64 hrs.	24 hrs.
	MPC-24E/EF				
	MPC-32/32F	Appendix A, Table 3-4 (Uniform)			
	MPC-68/68F/68FF/68M				
Alloy X	MPC-24	Appendix A, Table 3-3 (Regionalized)	8 hrs.	24 hrs.	24 hrs.
	MPC-24E/EF				
	MPC-32/32F	Appendix A, Table 3-4 (Uniform)			
	MPC-68/68F/68FF/68M				
Alloy X	MPC-24/24E/24EF	0.75 kW	24 hrs.	64 hrs.	30 days
	MPC-32/32F	0.5 kW			
	MPC-68/68F/68FF/68M	0.264 kW			

Note

1) If any component of the MPC is made of duplex, these completion times are not applicable.

2) For patterns developed in accordance with Table 3-1, Note 9, alternative completion times may be calculated in accordance with Topical Report HI-2200343.Revision 2

Proposed CoC Changes – App B/D

2.4.2 Regionalized Fuel Loading Decay Heat Limits for ZR-Clad Fuel for VENTILATED OVERPACK

The maximum allowable decay heat per fuel storage location for intact or undamaged fuel assemblies in regionalized loading is determined using the following equations:

$$Q(X) = 2 \times Q_0 / (1 + X^y)$$

$$y = 0.23 / X^{0.1}$$

$$q_2 = Q(X) / (n_1 \times X + n_2)$$

$$q_1 = q_2 \times X$$

Where:

Q_0 = Maximum uniform storage MPC decay heat (34 kW)

X = Inner region to outer region assembly decay heat ratio

$$(0.5 \leq X \leq 3)$$

n_1 = Number of storage locations in inner region from Table 2.4-2.

n_2 = Number of storage locations in outer region from Table 2.4-2.

Allowable heat loads for Damaged Fuel and Fuel Debris in regionalized loading are shown in Table 2.4-5.

Optional loading patterns for MPC-68M are shown in Figures 2.4-1 through 2.4-4.

Alternatively to the patterns in Sections 2.4.1 and 2.4.2, decay heat limits may be determined per Topical Report HI-2200343 Revision 2.

Proposed FSAR Updates

- Added a section for “Topical Report Implementation”
- Covers impacts of the Topical Report on:
 - ✓ Structural
 - FSAR structural analyses use calculated temperatures
 - If heat load patterns developed under topical report calculate increased temperatures, these temperatures should be reviewed under provisions of 72.48 to determine if change to structural analysis is acceptable without NRC approval
 - ✓ Shielding – FQTs in CoC apply regardless of heat load pattern
 - ✓ Change Control

Proposed FSAR Updates – Change Control

- Topical Report SER – Limitation 4.2 describes the model reviewed for the scope of the topical report as “invariant”
- FSAR and FSAR thermal model are allowed to be modified under 10CFR72.48
- Therefore, change can be made to FSAR without NRC approval, if it meets the 10 CFR 72.48 criteria
- Then the topical report methodology can be applied
 - ✓ Additional restriction applied that the results from the revised model must be demonstrated to have a lower PCT than those in the topical report when run for identical heat loads
 - ✓ If this criterion is met, then the topical report can be applied to updated FSAR model

Summary

