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December 31, 2013
John Goshen, P.E., Project Manager – Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety and Safeguards

ATTN: USNRC Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Docket No. 72-1040
Certificate of Compliance (CoC) No. 1040

Subject: Responses to NRC Staff Thermal Confirmatory Analysis

References: [1] Conversation Record, "HI-STORM UMAX – Results of NRC Staff Thermal Confirmatory Analysis," December 13, 2013, supplied by email from Mr. John Goshen (NRC) to Dr. Stefan Anton (Holtec) on December 17, 2013
[2] NRC Letter, "NRC Staff Evaluation of Responses to Request for Additional Information for the Holtec International HI-STORM UMAX Canister Storage System Certificate of Compliance No. 1040 (TAC No. L24664), dated October 21, 2013, ML13294A504
[3] Holtec Letter #5021010, "Responses to First Request for Additional Information (RAI), Part Two for HI-STORM UMAX Canister Storage System (TAC No. L24664) from Ms. Veena Gubbi (Holtec) to Mr. John Goshen (NRC), dated April 2, 2013, ML13107B249
[4] Holtec Letter #5021003, "Submittal of Calculation Packages and Computer Input and Analysis Files for the HI-STORM UMAX MPC Storage System License Application" from Dr. Stefan Anton (Holtec) to Mr. John Goshen (NRC), dated July 16, 2012,ML12205A134
[5] Holtec Letter #5021014, "Responses to Second Request for Additional Information (RAI) for HI-STORM UMAX Canister Storage System (TAC No. L24664)" from Dr. Stefan Anton (Holtec) to Mr. John Goshen (NRC), dated August 28, 2013, ML13261A062

The referenced conversation record [1] documents the NRC review of the Holtec HI-STORM UMAX thermal models, in addition to the referenced letter [2] which stated that the responses to the NRC RAIs needed additional information. To respond to these concerns, Holtec has prepared the following proposed changes to the HI-STORM UMAX Certificate of Compliance (CoC), as described below, and documented in Attachments 1 through 6. These revised CoC documents are provided with track changes shown from the CoC provided with RAI 1 responses (Reference [3]). These CoC documents are supported by the calculation files already submitted to the NRC (References [4] and [5]) and no additional calculations are needed.

NMSS26

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CoC 1040 Summary of Changes

The major change to the CoC is in Appendix B, Table 2.3-1. This table has been updated to contain the maximum permissible aggregate heat load for all storage scenarios including those utilizing the helium backfill pressure options shown in Appendix A, Table 3-2. The permissible aggregate heat load has been updated where necessary to contain a significant margin to address NRC concerns on thermal model uncertainties:

- For all lengths of fuel stored in the MPC-37, using helium backfill pressure options 1 or 2, the permissible aggregate heat load has been set to 80% of the design basis heat load, to provide significant margin below the peak cladding temperature (PCT) limit. These permissible heat loads have been updated in Appendix B, Table 2.3-1. Similarly, for fuel stored in the MPC-89, using helium backfill pressure option 1, the permissible aggregate heat load has been limited to 80% of the design basis heat load, and updated in Appendix B, Table 2.3-1.

- For all lengths of fuel stored in the MPC-37, using helium backfill pressure option 3 and the patterns shown in Figures 2.3-8 and 2.3-9,and MPC-89 using helium backfill option 2 and the pattern shown in Figure 2.3-11, the predicted PCT in the RAI-2 responses (Reference [5]) was calculated using 90% of the design basis heat load. In the updated Appendix B, Table 2.3-1, an additional 10% reduction is taken on the aggregate heat load for these patterns. This reduction allows for a similar margin below the peak cladding temperature limit as the 20% reduction requested by the NRC.

In accordance with Holtec's previous response to RAI-2, Question 4-1 (Reference [5]), the helium backfill pressures have been modified in Appendix A, Table 3-2. Therefore, the figures containing the corresponding loading patterns (previously Figures 2.3-10 and 2.3-11) have been removed from Appendix B.

The permissible threshold heat load during vacuum drying for the MPC-37 (Appendix B, previously Figure 2.3-14) has been changed in accordance with the response to RAI-2, Question 2-1 (Reference [5]) to provide a greater margin in peak cladding temperature. No change is required to the threshold heat load during vacuum drying for the MPC-89 (Appendix B, previously Figure 2.3-15), as current pattern provides sufficient margin.

The following conforming changes have also been made:

- CoC – removed Condition 8 due to including limits within Appendix B
- Appendix A
  - Table 3-1 - Fixed typo on "MPC Type" column note
  - Table 3-1 - Added Note 6 on "MPC Heat Load" column referencing Appendix B Table 2.3-1 for aggregate heat load limits

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- Table 3-1 – Revised MPC Heat Load for MPC-37, high burnup fuel, all lengths, in accordance with the vacuum drying threshold heat limit submitted in response to RAI-Round 2, 2-1
- Table 3-1 – Revised figure numbers to correspond to the Appendix B changes
- Table 3-2 – Removed "Permissible Heat Limits" column and replaced with reference to Appendix B Table 2.3-1
- Table 3-2 – Revised the Helium Backfill Pressure Ranges in accordance with the response to RAI, Round 2, 4-1 (Reference [5])

- Appendix B
  - Table of contents – page numbering and figure numbers updated based on updated text, tables, and removed figures
  - Section 2.3.1 – revised to better describe Table 2.3-1
  - Figures 2.3-12 and 2.3-13 (previously numbered Figures 2.3-14 and 2.3-15) – added "Threshold" before "heat load" in titles for clarity
  - Figure 2.3-12 (previously numbered Figure 2.3-14) – revised heat load per assembly, in accordance with the vacuum drying threshold heat limit submitted in response to RAI-Round 2, 2-1 (Reference [5])

These resolutions will be incorporated into the original FSAR, to be submitted within 90 days after issuance of the license in accordance with 10 CFR 72.70.

Holtec trusts that these resolutions will help the staff move forward and issue the SER as soon as possible. Our company is reassured by the management attention being given to our time-critical "UMAX" application for which we thank you again.

If you have any questions please contact me at (856)-797-0900 ext. 3659.

Sincerely,

Dr. Stefan Anton
VP of Engineering,
Acting Licensing Manager,
Holtec International

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Attachments

Attachment 1: Proposed CoC 1040, Changed Pages
Attachment 2: Proposed Appendix A, Changed Pages
Attachment 3: Proposed Appendix B, Changed Pages
Attachment 4: Proposed CoC 1040, complete document
Attachment 5: Proposed Appendix A, complete document
Attachment 6: Proposed Appendix B, complete document

Attachment 1 to Holtec Letter 5021017

Proposed CoC 1040, Changed Pages

4. HEAVY LOADS REQUIREMENTS

Each lift of an MPC or a HI-TRAC VW transfer cask 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 review of the heavy load handling procedures (under 10 CFR 50.59 or 10 CFR 72.48, as 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 5.2 of Appendix A.

5. APPROVED CONTENTS

Contents of the HI-STORM UMAX Canister Storage System must meet the fuel specifications given in Appendix B to this certificate.

6. DESIGN FEATURES

Features or characteristics for the site or system must be in accordance with Appendix B to this certificate.

7. 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.

~~8. SPECIAL REQUIREMENTS FOR FIRST SYSTEMS IN PLACE~~

~~A thermal acceptance test shall be performed in accordance with Section 10.3 of the HI-STORM UMAX FSAR on the first loaded MPC whose aggregate heat load is greater than or equal to 50% of the Design Basis MPC heat load .The measured thermal performance of the storage system shall be used to benchmark the computational fluid mechanics model used in the safety analysis in chapter 4 of the HI-STORM UMAX FSAR.~~

~~A letter report summarizing the results of the thermal validation test and analysis shall be submitted to the NRC in accordance with 10 CFR 72.4. Cask users may satisfy this requirement by referencing a validation test report submitted to the NRC by another cask user.~~

~~9.~~8. PRE-OPERATIONAL TESTING AND TRAINING EXERCISE

A dry run training exercise of the loading, closure, handling, unloading, and transfer of the HI-STORM UMAX Canister Storage 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 or cask loading pool.

b. Preparation of the HI-STORM UMAX Canister Storage 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 or cask loading 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. Transfer of the MPC from the transfer cask to the VVM.

h. HI-STORM UMAX Canister Storage System unloading, including flooding MPC cavity and removing MPC lid welds. (A mockup may be used for this dry-run exercise.)

Any of the above steps can be omitted if the site has already successfully loaded a Holtec MPC System.

~~10.~~9. AUTHORIZATION

The HI-STORM UMAX Canister Storage 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, this certificate, and the attached Appendices A and B. The HI-STORM UMAX Canister Storage System may be fabricated and used in accordance with any approved amendment to CoC No. 1040 listed in 10 CFR 72.214. Each of the licensed HI-STORM UMAX Canister Storage 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

/RA/

TBD
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards
Washington, DC 20555

Dated TBD

Attachments:
1. Appendix A
2. Appendix B

Attachment 2 to Holtec Letter 5021017

Proposed Appendix A, Changed Pages

Table 3-1
MPC Cavity Drying Limits

Fuel Burnup (MWD/MTU)	MPC Type (Note ~~6~~ 5)	MPC Heat Load (kW) (Note 6)	Method of Moisture Removal (Notes 1 and 2)
All Assemblies ≤ 45,000	MPC-37 (Short Fuel)	≤ 42.35 (Heat Load Chart 1: Figure 2.3-1 of Appendix B) ≤ 42.12 (Heat Load Chart 2: Figure 2.3-2 of Appendix B) ≤ 41.91 (Heat Load Chart 3: Figure 2.3-3 of Appendix B)	VDS (Notes 3 and 4) or FHD (Note 4)
	MPC-37 (Standard Fuel)	≤ 42.35 (Heat Load Chart 1: Figure 2.3-1 of Appendix B) ≤ 42.12 (Heat Load Chart 2: Figure 2.3-2 of Appendix B) ≤ 44.12 (Heat Load Chart 3: Figure 2.3-4 of Appendix B)	
	MPC-37 (Long Fuel)	≤ 44.70 (Heat Load Chart 1: Figure 2.3-5 of Appendix B) ≤ 44.46 (Heat Load Chart 2: Figure 2.3-6 of Appendix B) ≤ 46.32 (Heat Load Chart 3: Figure 2.3-7 of Appendix B)	
	MPC-89	≤ 45.40 (Figure 2.3-~~12~~ 10 of Appendix B)	

One or more assemblies > 45,000	MPC-37 (Short, Standard and Long Fuel)	≤ ~~34.36~~33.46 (Threshold Heat Load: Figure 2.3-~~14~~ 12 of Appendix B)	VDS (Notes 3 and 4) or FHD (Note 4)
	MPC-89	≤ 34.75 (Threshold Heat Load: Figure 2.3-~~15~~ 13 of Appendix B)	
One or more assemblies > 45,000	MPC-37 (Short Fuel)	≤ 42.35 (Heat Load Chart 1: Figure 2.3-1 of Appendix B) ≤ 42.12 (Heat Load Chart 2: Figure 2.3-2 of Appendix B) ≤ 41.91 (Heat Load Chart 3: Figure 2.3-3 of Appendix B)	FHD (Note 4)
	MPC-37 (Standard Fuel)	≤ 42.35 (Heat Load Chart 1: Figure 2.3-1 of Appendix B) ≤ 42.12 (Heat Load Chart 2: Figure 2.3-2 of Appendix B) ≤ 44.12 (Heat Load Chart 3: Figure 2.3-4 of Appendix B)	
	MPC-37 (Long Fuel)	≤ 44.70 (Heat Load Chart 1: Figure 2.3-5 of Appendix B) ≤ 44.46 (Heat Load Chart 2: Figure 2.3-6 of Appendix B) ≤ 46.32 (Heat Load Chart 3: Figure 2.3-7 of Appendix B)	
	MPC-89	≤ 45.40 (Figure 2.3-1~~2~~0 of Appendix B)	

Notes:

1. VDS means a vacuum drying system. The acceptance criterion when using a VDS is the MPC cavity pressure shall be ≤ 3 torr for ≥ 30 minutes while the MPC is isolated from the vacuum pump.

2. FHD means a forced helium dehydration system. The acceptance criterion when using an FHD system is the gas temperature exiting the demoisturizer shall be ≤ 21°F for ≥ 30 minutes or the gas dew point exiting the MPC shall be ≤ 22.9°F for ≥ 30 minutes.

3. Vacuum drying of the MPC must be performed with the annular gap between the MPC and the TRANSFER CASK filled with water.

4. Heat load limits are set for each cell; see Appendix B Section 2.3.

5. The fuel assembly lengths loaded in MPC-37 are catalogued as short, standard and long fuel based on the active fuel lengths specified in Appendix B Table 2.1-4.

6. For additional aggregate heat load limits for storage, see Appendix B Table 2.3-1

Table 3-2 MPC Helium Backfill Limits [1]

MPC Type	Helium Backfill Pressure Option	Helium Backfill Pressure Range (psig)	~~Permissible Heat Limits (See Appendix B Section 2.3)~~
MPC-37	1	≥ ~~42~~41.0 and ≤ ~~45.5~~44.2	~~Table 2.3-1 of Appendix B: Heat Load Charts 1 and 3~~
	2	≥ 41.0 and ≤ ~~46.0~~44.5	~~Table 2.3-1 of Appendix B: Heat Load Chart 2~~
	3	≥ ~~42.0~~39.0 and ≤ ~~50.0~~46.0	~~Figures 2.3-10, 2.3-11 and 2.3-14 of Appendix B~~
	4	~~≥ 42.0 and ≤ 47.8~~	~~Figures 2.3-8 and 2.3-9 of Appendix B~~
MPC-89	1	≥ 42.~~5~~ 0 and ≤ ~~47.5~~45.2	~~Figure 2.3-12 of Appendix B~~
	2	≥ ~~42.~~39.0 and ≤ ~~50~~46.0	~~Figures 2.3-13 and 2.3-15 of Appendix B~~

Note: For Permissible Aggregate Heat Load Limit for each helium backfill pressure option see Appendix B, Table 2.3-1.

1 Helium used for backfill of MPC shall have a purity of ≥ 99.995%. Pressure range is at a reference temperature of 70°F

Attachment 3 to Holtec Letter 5021017

Proposed Appendix B, Changed Pages

TABLE OF CONTENTS

2.3 Decay Heat Limits

This section provides the limits on fuel assembly decay heat for storage in the HI-STORM UMAX Canister Storage System. The method to verify compliance, including examples, is provided in Chapter 13 of the HI-STORM UMAX FSAR.

2.3.1 Fuel Loading Decay Heat Limits

Table 2.3-1 provides the maximum permissible decay heat under long-term storage for MPC-37 and MPC-89. Table 2.3-1 also lists the applicable figures providing the permissible decay heat per fuel storage location, including MPCs usingThree discrete heat load charts for storage of short, standard and long fuel are provided in Figures 2.3-1 through 2.3-7 for MPC-37. The permissible heat load under long-term storage for MPC-89 is provided in Figure 2.3-12. Figures 2.3-8 through 2.3-11, and 2.3-13 provide the allowable decay heat per fuel storage location under _the optional helium backfill pressure ranges permitted in Table 3-2 of Appendix A. The optional ranges provide expanded backfill limits at the expense of reduced decay heat allowables. Figures 2.3-14 and 2.3-15 provide the maximum allowable decay heat per fuel storage location for MPC-37 and MPC-89, respectively, when using VDS to dry high burnup fuel.

TABLE 2.3-1 PERMISSIBLE HEAT LOAD FOR LONG-TERM STORAGE					
MPC Type		Heat Load Chart	Helium Backfill Pressure Option (Notes 1,2)	Permissible Heat Load Per Storage Cell	~~Maximum Design Basis~~Permissible Aggregate Heat Load, kW (Note 4)
MPC-37	Short Fuel (~~see Table 2.1-4 for length data~~Note 3)	1	1	Figure 2.3-1	~~42.35~~33.88
		2	2	Figure 2.3-2	~~42.12~~33.70
		3	1	Figure 2.3-3	~~41.91~~33.53
	Standard Fuel (~~see Table 2.1-4 for length data~~Note 3)	1	1	Figure 2.3-1	~~42.35~~33.88
		2	2	Figure 2.3-2	~~42.12~~33.70
		3	1	Figure 2.3-4	~~44.12~~35.30
	Long Fuel (~~see Table 2.1-4 for length data~~Note 3)	1	1	Figure 2.3-5	~~44.70~~35.76
		2	2	Figure 2.3-6	~~44.46~~35.57
		3	1	Figure 2.3-7	~~46.32~~37.06
	Short Fuel (Note 3)		3	Figure 2.3-8	34.28
			3	Figure 2.3-12	33.46
	Standard Fuel (Note 3)		3	Figure 2.3-8	34.28
			3	Figure 2.3-12	33.46
	Long Fuel (Note 3)		3	Figure 2.3-9	36.19
			3	Figure 2.3-12	33.46
MPC-89			1	Figure 2.3-10~~2~~	~~45.40~~36.32
			2	Figure 2.3-11	36.72
			2	Figure 2.3-13	34.75

Notes:

1. For helium backfill pressure option pressure ranges see Appendix A, Table 3-2

2. For the details on the use of VDS to dry High Burnup Fuel see Appendix A, Table 3-1

3. See Table 2.1-4 for fuel length data

4. Aggregate heat load is defined as the sum of heat loads of all stored fuel assemblies. The permissible aggregate heat load is set to 80% of the design basis heat load.

		1 0.785	2 0.785	3 0.785		
	4 0.785	5 1.441	6 1.441	7 1.441	8 0.785	
9 0.785	10 1.441	11 0.915	12 0.915	13 0.915	14 1.441	15 0.785
16 0.785	17 1.441	18 0.915	19 0.915	20 0.915	21 1.441	22 0.785
23 0.785	24 1.441	25 0.915	26 0.915	27 0.915	28 1.441	29 0.785
	30 0.785	31 1.441	32 1.441	33 1.441	34 0.785	
		35 0.785	36 0.785	37 0.785		

Legend

Cell ID Heat Load, kW

Figure 2.3-8
HI-STORM UMAX MPC-37 Permissible Heat Load for Short and Standard Fuel for Helium Backfill Option ~~4~~ 3 in Table 3-2 of Appendix A

		1 0.829	2 0.829	3 0.829		
	4 0.829	5 1.521	6 1.521	7 1.521	8 0.829	
9 0.829	10 1.521	11 0.966	12 0.966	13 0.966	14 1.521	15 0.829
16 0.829	17 1.521	18 0.966	19 0.966	20 0.966	21 1.521	22 0.829
23 0.829	24 1.521	25 0.966	26 0.966	27 0.966	28 1.521	29 0.829
	30 0.829	31 1.521	32 1.521	33 1.521	34 0.829	
		35 0.829	36 0.829	37 0.829		

Legend

Cell ID Heat Load, kW

Figure 2.3-9
HI-STORM UMAX MPC-37 Permissible Heat Load for Long Fuel for Helium Backfill Option ~~4~~3 in Table 3-2 of Appendix A

		~~1~~ ~~0.698~~	~~2~~ ~~0.698~~	~~3~~ ~~0.698~~		
	~~4~~ ~~0.698~~	~~5~~ ~~1.281~~	~~6~~ ~~1.281~~	~~7~~ ~~1.281~~	~~8~~ ~~0.698~~	
~~9~~ ~~0.698~~	~~10~~ ~~1.281~~	~~11~~ ~~0.813~~	~~12~~ ~~0.813~~	~~13~~ ~~0.813~~	~~14~~ ~~1.281~~	~~15~~ ~~0.698~~
~~16~~ ~~0.698~~	~~17~~ ~~1.281~~	~~18~~ ~~0.813~~	~~19~~ ~~0.813~~	~~20~~ ~~0.813~~	~~21~~ ~~1.281~~	~~22~~ ~~0.698~~
~~23~~ ~~0.698~~	~~24~~ ~~1.281~~	~~25~~ ~~0.813~~	~~26~~ ~~0.813~~	~~27~~ ~~0.813~~	~~28~~ ~~1.281~~	~~29~~ ~~0.698~~
	~~30~~ ~~0.698~~	~~31~~ ~~1.281~~	~~32~~ ~~1.281~~	~~33~~ ~~1.281~~	~~34~~ ~~0.698~~	
		~~35~~ ~~0.698~~	~~36~~ ~~0.698~~	~~37~~ ~~0.698~~		

~~Legend~~

~~Cell ID~~ ~~Heat Load, kW~~

~~Figure 2.3-10~~
~~HI-STORM UMAX MPC-37 Permissible Heat Load for Short and Standard Fuel for Helium Backfill Option 3 in Table 3-2 of Appendix A~~

		1 0.737	2 0.737	3 0.737		
	4 0.737	5 1.352	6 1.352	7 1.352	8 0.737	
9 0.737	10 1.352	11 0.859	12 0.859	13 0.859	14 1.352	15 0.737
16 0.737	17 1.352	18 0.859	19 0.859	20 0.859	21 1.352	22 0.737
23 0.737	24 1.352	25 0.859	26 0.859	27 0.859	28 1.352	29 0.737
	30 0.737	31 1.352	32 1.352	33 1.352	34 0.737	
		35 0.737	36 0.737	37 0.737		

Legend

Cell ID Heat Load, kW

Figure 2.3-11
HI-STORM UMAX MPC-37 Permissible Heat Load for Long Fuel for Helium Backfill Option 3 in Table 3-2 of Appendix A

				1 0.431	2 0.431	3 0.431				
		4 0.431	5 0.431	6 0.431	7 0.607	8 0.431	9 0.431	10 0.431		
	11 0.431	12 0.431	13 0.607	14 0.607	15 0.607	16 0.607	17 0.607	18 0.431	19 0.431	
	20 0.431	21 0.607	22 0.607	23 0.607	24 0.607	25 0.607	26 0.607	27 0.607	28 0.431	
29 0.431	30 0.431	31 0.607	32 0.607	33 0.431	34 0.431	35 0.431	36 0.607	37 0.607	38 0.431	39 0.431
40 0.431	41 0.607	42 0.607	43 0.607	44 0.431	45 0.431	46 0.431	47 0.607	48 0.607	49 0.607	50 0.431
51 0.431	52 0.431	53 0.607	54 0.607	55 0.431	56 0.431	57 0.431	58 0.607	59 0.607	60 0.431	61 0.431
	62 0.431	63 0.607	64 0.607	65 0.607	66 0.607	67 0.607	68 0.607	69 0.607	70 0.431	
	71 0.431	72 0.431	73 0.607	74 0.607	75 0.607	76 0.607	77 0.607	78 0.431	79 0.431	
		80 0.431	81 0.431	82 0.431	83 0.607	84 0.431	85 0.431	86 0.431		
				87 0.431	88 0.431	89 0.431				

Legend

Cell ID Heat Load, kW

Figure 2.3-10~~2~~
HI-STORM UMAX MPC-89 Permissible Heat Load for Long-Term Storage

Approved Contents
2.0

				1 0.3~~44~~87	2 0~~.344~~.387	3 0~~.344~~.387				
		4 0~~.344~~.387	5 0~~.344~~.387	6 0~~.344~~.387	7 0~~.485~~.546	8 0~~.344~~.387	9 0~~.344~~.387	10 0~~.344~~.387		
	11 0~~.344~~.387	12 0~~.344~~.387	13 0~~.485~~.546	14 0~~.485~~.546	15 0~~.485~~.546	16 0~~.485~~.546	17 0~~.485~~.546	18 0~~.344~~.387	19 0~~.344~~.387	
	20 0~~.344~~.387	21 0~~.485~~.546	22 0~~.485~~.546	23 0~~.485~~.546	24 0~~.485~~.546	25 0~~.485~~.546	26 0~~.485~~.546	27 0~~.485~~.546	28 0~~.344~~.387	
29 0~~.344~~.387	30 0~~.344~~.387	31 0~~.485~~.546	32 0~~.485~~.546	33 0.~~344~~387	34 0.~~344~~387	35 0.~~344~~387	36 0~~.485~~.546	37 0~~.485~~.546	38 0~~.344~~.387	39 0~~.344~~.387
40 0~~.344~~.387	41 0~~.485~~.546	42 0~~.485~~.546	43 0~~.485~~.546	44 0.~~344~~387	45 0.~~344~~387	46 0.~~344~~387	47 0~~.485~~.546	48 0~~.485~~.546	49 0~~.485~~.546	50 0~~.344~~.387
51 0~~.344~~.387	52 0~~.344~~.387	53 0~~.485~~.546	54 0~~.485~~.546	55 0.~~344~~387	56 0.~~344~~387	57 0.~~344~~387	58 0~~.485~~.546	59 0~~.485~~.546	60 0~~.344~~.387	61 0~~.344~~.387
	62 0~~.344~~.387	63 0~~.485~~.546	64 0~~.485~~.546	65 0~~.485~~.546	66 0~~.485~~.546	67 0~~.485~~.546	68 0~~.485~~.546	69 0~~.485~~.546	70 0~~.344~~.387	
	71 0~~.344~~.387	72 0~~.344~~.387	73 0~~.485~~.546	74 0~~.485~~.546	75 0~~.485~~.546	76 0~~.485~~.546	77 0~~.485~~.546	78 0~~.344~~.387	79 0~~.344~~.387	
		80 0~~.344~~.387	81 0~~.344~~.387	82 0~~.344~~.387	83 0~~.485~~.546	84 0~~.344~~.387	85 0~~.344~~.387	86 0~~.344~~.387		
				87 0~~.344~~.387	88 0~~.344~~.387	89 0~~.344~~.387				

Legend

Cell ID
Heat Load, kW

Figure 2.3-11~~3~~
HI-STORM UMAX MPC-89 Permissible Heat Load for Helium Backfill Option 2 in Table 3-2 of Appendix A

		1 0.97	2 0.97	3 0.97		
	4 0.97	5 0.97	6 0.97	7 0.97	8 0.97	
9 0.97	10 0.97	11 0.87	12 0.78	13 0.87	14 0.97	15 0.97
16 0.97	17 0.97	18 0.87	19 0.87	20 0.78	21 0.97	22 0.97
23 0.97	24 0.97	25 0.78	26 0.78	27 0.78	28 0.97	29 0.97
	30 0.97	31 0.97	32 0.97	33 0.97	34 0.97	
		35 0.97	36 0.97	37 0.97		

Legend

Cell ID Heat Load, kW

Figure 2.3-142
HI-STORM UMAX MPC-37 Permissible Threshold Heat Load for VDS High Burnup Fuel in Table 3-1 of Appendix A and Helium Backfill Option 3 in Table 3-2 of Appendix A

				1 0.44	2 0.44	3 0.44				
		4 0.44	5 0.44	6 0.44	7 0.35	8 0.44	9 0.44	10 0.44		
	11 0.44	12 0.44	13 0.35	14 0.35	15 0.35	16 0.35	17 0.35	18 0.44	19 0.44	
	20 0.44	21 0.35	22 0.35	23 0.35	24 0.35	25 0.35	26 0.35	27 0.35	28 0.44	
29 0.44	30 0.44	31 0.35	32 0.35	33 0.35	34 0.35	35 0.35	36 0.35	37 0.35	38 0.44	39 0.44
40 0.44	41 0.35	42 0.35	43 0.35	44 0.35	45 0.35	46 0.35	47 0.35	48 0.35	49 0.35	50 0.44
51 0.44	52 0.44	53 0.35	54 0.35	55 0.35	56 0.35	57 0.35	58 0.35	59 0.35	60 0.44	61 0.44
	62 0.44	63 0.35	64 0.35	65 0.35	66 0.35	67 0.35	68 0.35	69 0.35	70 0.44	
	71 0.44	72 0.44	73 0.35	74 0.35	75 0.35	76 0.35	77 0.35	78 0.44	79 0.44	
		80 0.44	81 0.44	82 0.44	83 0.35	84 0.44	85 0.44	86 0.44		
				87 0.44	88 0.44	89 0.44				

Legend

Cell ID Heat Load, kW

Figure 2.3-13~~5~~
HI-STORM UMAX MPC-89 Permissible Threshold Heat Load for VDS High Burnup Fuel in Table 3-1 of Appendix A and Helium Backfill Option 2 in Table 3-2 of Appendix A

Attachment 4 to Holtec Letter 5021017

Proposed CoC 1040

NRC FORM 651 (10-2004) 10 CFR 72

U.S. NUCLEAR REGULATORY COMMISSION

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.
1040	TBD	TBD	72-1040	0		USA/72-1040

Issued To: (Name/Address)

Holtec International
Holtec Center
555 Lincoln Drive West
Marlton, NJ 08053

Safety Analysis Report Title

Holtec International
Final Safety Analysis Report for the
HI-STORM UMAX Canister Storage System

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:

APPROVED SPENT FUEL STORAGE CASK

Model No.: HI-STORM UMAX Canister Storage System

DESCRIPTION:

The HI-STORM UMAX Canister Storage System consists of the following components: (1) interchangeable multi-purpose canisters (MPCs), which contain the fuel; (2) underground Vertical Ventilated Modules (VVMs), which contains the MPCs during storage; and (3) a transfer cask (HI-TRAC VW), which contains the MPC during loading, unloading and transfer operations. The MPC stores up to 37 pressurized water reactor fuel assemblies or up to 89 boiling water reactor fuel assemblies.

The HI-STORM UMAX Canister Storage System is certified as described in the" UMAX" Final Safety Analysis Report (FSAR) supplemented by the information on the MPCs and transfer cask in the HI-STORM FW FSAR, and in the U. S. Nuclear Regulatory Commission's (NRC) Safety Evaluation Report (SER) accompanying the Certificate of Compliance (CoC).

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 or passivated aluminum/aluminum alloys. 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 provides criticality control.

DESCRIPTION (continued)

There are two types of MPCs permitted for storage in HI-STORM UMAX VVM: the MPC-37 and MPC-89. The number suffix indicates the maximum number of fuel assemblies permitted to be loaded in the MPC. Both MPC models have the same external diameter.

The HI-TRAC VW transfer cask provides shielding and structural protection of the MPC during loading, unloading, and movement of the MPC from the cask loading area to the VVM. The transfer cask is a multi-walled (carbon steel/lead/carbon steel) cylindrical vessel with a neutron shield jacket attached to the exterior and a retractable bottom lid used during transfer operations.

The HI-STORM UMAX VVM utilizes a storage design identified as an air-cooled vault or caisson. The HI-STORM UMAX VVM relies on vertical ventilation instead of conduction through the fill material around the VVM, as it is essentially a below-grade storage cavity. Air inlets and an air outlet 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 in the MPC storage cavity 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 UMAX VVM in a vertical orientation.

CONDITIONS

1. OPERATING PROCEDURES

   Written operating procedures shall be prepared for handling, loading, movement, surveillance, and maintenance. The user's site-specific written operating procedures shall be consistent with the technical basis described in Chapter 9 of the FSAR.

2. ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

   Written acceptance tests and a maintenance program shall be prepared consistent with the technical basis described in Chapter 10 of the FSAR. 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 leakage test shall also be performed on the base metal of the fabricated MPC lid. The confinement boundary welds leakage rate test shall be performed in accordance with ANSI N14.5 to "leaktight" criterion. 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, Article NB-4450 requirements. Re-testing shall be performed until the leakage rate acceptance criterion is met.

   To verify the effectiveness of the storm water drainage design, a one-time test will be performed after construction of the first VVM at the first site to deploy UMAX to ensure that the design is effective in directing storm water away from the VVM to the ISFSI's drainage system. The VVM will be subjected to a water spray that simulates exposure to rainfall of at least 2 inches per hour for at least one hour. At the conclusion of the water spray, the depth of the water (if any) in the bottom of the module cavity will be measured. Any amount of water accumulation beyond wetting of the Bottom Plate indicates an inadequacy in rain diversion features of the VVM and will be appropriately corrected.

3. 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 storage system

4. HEAVY LOADS REQUIREMENTS

Each lift of an MPC or a HI-TRAC VW transfer cask 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 review of the heavy load handling procedures (under 10 CFR 50.59 or 10 CFR 72.48, as 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 5.2 of Appendix A.

5. APPROVED CONTENTS

Contents of the HI-STORM UMAX Canister Storage System must meet the fuel specifications given in Appendix B to this certificate.

6. DESIGN FEATURES

Features or characteristics for the site or system must be in accordance with Appendix B to this certificate.

7. 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.

~~8. SPECIAL REQUIREMENTS FOR FIRST SYSTEMS IN PLACE~~

~~A thermal acceptance test shall be performed in accordance with Section 10.3 of the HI-STORM UMAX FSAR on the first loaded MPC whose aggregate heat load is greater than or equal to 50% of the Design Basis MPC heat load .The measured thermal performance of the storage system shall be used to benchmark the computational fluid mechanics model used in the safety analysis in chapter 4 of the HI-STORM UMAX FSAR.~~

~~A letter report summarizing the results of the thermal validation test and analysis shall be submitted to the NRC in accordance with 10 CFR 72.4. Cask users may satisfy this requirement by referencing a validation test report submitted to the NRC by another cask user.~~

~~9.~~8. PRE-OPERATIONAL TESTING AND TRAINING EXERCISE

A dry run training exercise of the loading, closure, handling, unloading, and transfer of the HI-STORM UMAX Canister Storage 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 or cask loading pool.

b. Preparation of the HI-STORM UMAX Canister Storage 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 or cask loading 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. Transfer of the MPC from the transfer cask to the VVM.

h. HI-STORM UMAX Canister Storage System unloading, including flooding MPC cavity and removing MPC lid welds. (A mockup may be used for this dry-run exercise.)

Any of the above steps can be omitted if the site has already successfully loaded a Holtec MPC System.

~~10.~~9. AUTHORIZATION

The HI-STORM UMAX Canister Storage 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, this certificate, and the attached Appendices A and B. The HI-STORM UMAX Canister Storage System may be fabricated and used in accordance with any approved amendment to CoC No. 1040 listed in 10 CFR 72.214. Each of the licensed HI-STORM UMAX Canister Storage 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

/RA/

TBD
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards
Washington, DC 20555

Dated TBD

Attachments:
1. Appendix A
2. Appendix B

Attachment 5 to Holtec Letter 5021017

Proposed Appendix A

CERTIFICATE OF COMPLIANCE NO. 1040

APPENDIX A

TECHNICAL SPECIFICATIONS

FOR THE HI-STORM UMAX CANISTER STORAGE SYSTEM

TABLE OF CONTENTS

1.0 USE AND APPLICATION

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

1.1 Definitions

Term	Definition
ACTIONS	ACTIONS shall be that part of a Specification that prescribes Required Actions to be taken under designated Conditions within specified Completion Times.
AMBIENT TEMPERATURE	AMBIENT TEMPERATURE for Short Term Operations (operations involving use of the HI-TRAC, a Lifting device, and/or an on-site transport device) is defined as the 24 hour average of the local temperature as forecast by the National Weather Service.
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, missing structural components such as grid spacers, whose structural integrity has been impaired such that geometric rearrangement of fuel or gross failure of the cladding is expected based on engineering evaluations, or 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 UMAX System are as follows: 1. Holtec Generic BWR design 2. Holtec Generic PWR design

1.1 Definitions

Term	Definition
FUEL DEBRIS	FUEL DEBRIS is ruptured fuel rods, severed rods, loose fuel pellets, containers or structures that are supporting these loose fuel assembly parts, or fuel assemblies with known or suspected defects which cannot be handled by normal means due to fuel cladding damage.
FUEL BUILDING	The FUEL BUILDING is the site-specific power plant facility, governed by the regulations of 10 CFR Part 50, where the loaded OVERPACK or TRANSFER CASK is transferred to or from the transporter.
GROSSLY BREACHED SPENT FUEL ROD	Spent nuclear fuel rod with a cladding defect that could lead to the release of fuel particulate greater than the average size fuel fragment for that particular assembly. A gross cladding breach may be confirmed by visual examination, through a review of reactor operating records indicating the presence of heavy metal isotopes, or other acceptable inspection means.
LOADING OPERATIONS	LOADING OPERATIONS include all licensed activities on a 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 TRANSFER CASK is suspended from or secured on the transporter. LOADING OPERATIONS does not include MPC TRANSFER.
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.
MPC TRANSFER	MPC TRANSFER begins when the MPC is lifted off the TRANSFER CASK bottom lid and ends when the MPC is supported from beneath by the OVERPACK (or the reverse).
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

1.1 Definitions

Term	Definition
	Burnable Absorbers (WABAs), Rod Cluster Control Assemblies (RCCAs), Control Element Assemblies (CEAs), Neutron Source Assemblies (NSAs), water displacement guide tube plugs, orifice rod assemblies, instrument tube tie rods (ITTRs), vibration suppressor inserts, and components of these devices such as individual rods.
OVERPACK	For the HI-STORM UMAX, the term OVERPACK is synonyms with the term VVM defined below.
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.
REPAIRED/RECONSITUTED FUEL ASSEMBLY	Spent nuclear fuel assembly which contains dummy fuel rods that displaces an amount of water greater than or equal to the original fuel rods and/or which contains structural repairs so it can be handled by normal means.
SPENT FUEL STORAGE CASKS (SFSCs)	SFSCs are containers approved for the storage of spent fuel assemblies at the ISFSI. The HI-STORM UMAX 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.
TRANSFER CASK	TRANSFER CASKs are containers designed to contain the MPC during and after loading of spent fuel assemblies, and prior to and during unloading and to transfer the MPC to or from the OVERPACK.
TRANSPORT OPERATIONS	TRANSPORT OPERATIONS include all licensed activities performed on a TRANSFER CASK loaded with one or more fuel assemblies when it is being moved after LOADING OPERATIONS or before UNLOADING OPERATIONS. TRANSPORT OPERATIONS begin when the TRANSFER CASK is first suspended from or secured on the transporter and end when the TRANSFER CASK is at its destination and no longer secured on or suspended from the transporter. TRANSPORT OPERATIONS includes

1.1 Definitions

Term	Definition
	MPC TRANSFER.
VERTICAL VENTILATED MODULE (VVM)	The VVM is a subterranean type overpack which receives and contains the sealed MPC for interim storage at the ISFSI. The VVM supports the MPC in a vertical orientation and provide gamma and neutron shielding and also provides air flow through cooling passages to promote heat transfer from the MPC to the environs.
UNDAMAGED FUEL ASSEMBLY	UNDAMAGED FUEL ASSEMBLIES are: a) fuel assemblies without known or suspected cladding defects greater than pinhole leaks or hairline cracks and which can be handled by normal means; or b) a BWR fuel assembly with an intact channel, a maximum planar average initial of 3.3 wt% U-235, without known or suspected GROSSLY BREACHED SPENT FUEL RODS, and which can be handled by normal means. An UNDAMAGED FUEL ASSEMBLY may be a REPAIRED/RECONSTITUTED FUEL ASSEMBLY.
UNLOADING OPERATIONS	UNLOADING OPERATIONS include all licensed activities on an SFSC to be unloaded of the contained fuel assemblies. UNLOADING OPERATIONS begin when the 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.
ZR	ZR means any zirconium-based fuel cladding or fuel channel material authorized for use in a commercial nuclear power plant reactor.

PURPOSE	The purpose of this section is to explain the meaning of logical connectors. Logical connectors are used in Technical Specifications (TS) to discriminate between, and yet connect, discrete Conditions, Required Actions, Completion Times, Surveillances, and Frequencies. The only logical connectors that appear in TS are AND and OR. The physical arrangement of these connectors constitutes logical conventions with specific meanings.
BACKGROUND	Several levels of logic may be used to state Required Actions. These levels are identified by the placement (or nesting) of the logical connectors and by the number assigned to each Required Action. The first level of logic is identified by the first digit of the number assigned to a Required Action and the placement of the logical connector in the first level of nesting (i.e., left justified with the number of the Required Action). The successive levels of logic are identified by additional digits of the Required Action number and by successive indentions of the logical connectors. When logical connectors are used to state a Condition, Completion Time, Surveillance, or Frequency, only the first level of logic is used, and the logical connector is left justified with the statement of the Condition, Completion Time, Surveillance, or Frequency.

1.0 USE AND APPLICATION

1.2 Logical Connectors

EXAMPLES

The following examples illustrate the use of logical connectors.

EXAMPLE 1.2-1

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met.	A.1 VERIFY . . . AND A.2 Restore . . .	

In this example the logical connector AND is used to indicate that when in Condition A, both Required Actions A.1 and A.2 must be completed.

(continued)

1.2 Logical Connectors

EXAMPLES (continued)

EXAMPLE 1.2-2

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met.	A.1 Stop . . . OR A.2.1 Verify . . . AND A.2.2.1 Reduce . . . OR A.2.2.2 Perform . . . OR A.3 Remove . . .	

This example represents a more complicated use of logical connectors. Required Actions A.1, A.2, and A.3 are alternative choices, only one of which must be performed as indicated by the use of the logical connector OR and the left justified placement. Any one of these three ACTIONS may be chosen. If A.2 is chosen, then both A.2.1 and A.2.2 must be performed as indicated by the logical connector AND. Required Action A.2.2 is met by performing A.2.2.1 or A.2.2.2. The indented position of the logical connector OR indicates that A.2.2.1 and A.2.2.2 are alternative choices, only one of which must be performed.

1.0 USE AND APPLICATION

1.3 Completion Times

PURPOSE	The purpose of this section is to establish the Completion Time convention and to provide guidance for its use.
BACKGROUND	Limiting Conditions for Operation (LCOs) specify the lowest functional capability or performance levels of equipment required for safe operation of the facility. The ACTIONS associated with an LCO state Conditions that typically describe the ways in which the requirements of the LCO can fail to be met. Specified with each stated Condition are Required Action(s) and Completion Times(s).
DESCRIPTION	The Completion Time is the amount of time allowed for completing a Required Action. It is referenced to the time of discovery of a situation (e.g., equipment or variable not within limits) that requires entering an ACTIONS Condition unless otherwise specified, providing the HI-STORM UMAX System is in a specified condition stated in the Applicability of the LCO. Required Actions must be completed prior to the expiration of the specified Completion Time. An ACTIONS Condition remains in effect and the Required Actions apply until the Condition no longer exists or the HI-STORM UMAX System is not within the LCO Applicability. Once a Condition has been entered, subsequent subsystems, components, or variables expressed in the Condition, discovered to be not within limits, will <u>not</u> result in separate entry into the Condition unless specifically stated. The Required Actions of the Condition continue to apply to each additional failure, with Completion Times based on initial entry into the Condition.

(continued)

1.3 Completion Times (continued)

EXAMPLES

The following examples illustrate the use of Completion Times with different types of Conditions and changing Conditions.

EXAMPLE 1.3-1

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Required Action and associated Completion Time not met.	B.1 Perform Action B.1 AND B.2 Perform Action B.2	12 hours 36 hours

Condition B has two Required Actions. Each Required Action has its own separate Completion Time. Each Completion Time is referenced to the time that Condition B is entered.

The Required Actions of Condition B are to complete action B.1 within 12 hours AND complete action B.2 within 36 hours. A total of 12 hours is allowed for completing action B.1 and a total of 36 hours (not 48 hours) is allowed for completing action B.2 from the time that Condition B was entered. If action B.1 is completed within 6 hours, the time allowed for completing action B.2 is the next 30 hours because the total time allowed for completing action B.2 is 36 hours.

(continued)

1.3 Completion Times (continued)

EXAMPLES (continued)

EXAMPLE 1.3-2

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One system not within limit.	A.1 Restore system to within limit.	7 days
B. Required Action and associated Completion Time not met.	B.1 Complete action B.1. AND B.2 Complete action B.2.	12 hours 36 hours

When a system is determined not to meet the LCO, Condition A is entered. If the system is not restored within 7 days, Condition B is also entered and the Completion Time clocks for Required Actions B.1 and B.2 start. If the system is restored after Condition B is entered, Conditions A and B are exited, and therefore, the Required Actions of Condition B may be terminated.

(continued)

1.3 Completion Times (continued)

EXAMPLES (continued)

EXAMPLE 1.3-3

ACTIONS

------------------------------------NOTE------------------------------------
Separate Condition entry is allowed for each component.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. LCO not met.	A.1 Restore compliance with LCO.	4 hours
B. Required Action and associated Completion Time not met.	B.1 Complete action B.1. AND B.2 Complete action B.2.	6 hours 12 hours

The Note above the ACTIONS table is a method of modifying how the Completion Time is tracked. If this method of modifying how the Completion Time is tracked was applicable only to a specific Condition, the Note would appear in that Condition rather than at the top of the ACTIONS Table.

The Note allows Condition A to be entered separately for each component, and Completion Times tracked on a per component basis. When a component is determined to not meet the LCO, Condition A is entered and its Completion Time starts. If subsequent components are determined to not meet the LCO, Condition A is entered for each component and separate Completion Times start and are tracked for each component.

(continued)

1.3 Completion Times (continued)

IMMEDIATE COMPLETION TIME	When "Immediately" is used as a Completion Time, the Required Action should be pursued without delay and in a controlled manner.

1.0 USE AND APPLICATION

1.4 Frequency

PURPOSE	The purpose of this section is to define the proper use and application of Frequency requirements.
DESCRIPTION	Each Surveillance Requirement (SR) has a specified Frequency in which the Surveillance must be met in order to meet the associated Limiting Condition for Operation (LCO). An understanding of the correct application of the specified Frequency is necessary for compliance with the SR. The "specified Frequency" is referred to throughout this section and each of the Specifications of Section 3.0, Surveillance Requirement (SR) Applicability. The "specified Frequency" consists of the requirements of the Frequency column of each SR. Situations where a Surveillance could be required (i.e., its Frequency could expire), but where it is not possible or not desired that it be performed until sometime after the associated LCO is within its Applicability, represent potential SR 3.0.4 conflicts. To avoid these conflicts, the SR (i.e., the Surveillance or the Frequency) is stated such that it is only "required" when it can be and should be performed. With an SR satisfied, SR 3.0.4 imposes no restriction.

(continued)

1.4 Frequency (continued)

EXAMPLES

The following examples illustrate the various ways that Frequencies are specified.

EXAMPLE 1.4-1

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Verify pressure within limit	12 hours

Example 1.4-1 contains the type of SR most often encountered in the Technical Specifications (TS). The Frequency specifies an interval (12 hours) during which the associated Surveillance must be performed at least one time. Performance of the Surveillance initiates the subsequent interval. Although the Frequency is stated as 12 hours, an extension of the time interval to 1.25 times the interval specified in the Frequency is allowed by SR 3.0.2 for operational flexibility. The measurement of this interval continues at all times, even when the SR is not required to be met per SR 3.0.1 (such as when the equipment or variables are outside specified limits, or the facility is outside the Applicability of the LCO). If the interval specified by SR 3.0.2 is exceeded while the facility is in a condition specified in the Applicability of the LCO, the LCO is not met in accordance with SR 3.0.1.

If the interval as specified by SR 3.0.2 is exceeded while the facility is not in a condition specified in the Applicability of the LCO for which performance of the SR is required, the Surveillance must be performed within the Frequency requirements of SR 3.0.2 prior to entry into the specified condition. Failure to do so would result in a violation of SR 3.0.4

(continued)

1.4 Frequency (continued)

EXAMPLES (continued)

EXAMPLE 1.4-2

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
Verify flow is within limits.	Once within 12 hours prior to starting activity AND 24 hours thereafter

Example 1.4-2 has two Frequencies. The first is a one time performance Frequency, and the second is of the type shown in Example 1.4-1. The logical connector "AND" indicates that both Frequency requirements must be met. Each time the example activity is to be performed, the Surveillance must be performed within 12 hours prior to starting the activity.

The use of "once" indicates a single performance will satisfy the specified Frequency (assuming no other Frequencies are connected by "AND"). This type of Frequency does not qualify for the 25% extension allowed by SR 3.0.2.

"Thereafter" indicates future performances must be established per SR 3.0.2, but only after a specified condition is first met (i.e., the "once" performance in this example). If the specified activity is canceled or not performed, the measurement of both intervals stops. New intervals start upon preparing to restart the specified activity.

2.0

This section is intentionally left blank

3.0 LIMITING CONDITIONS FOR OPERATION (LCO) APPLICABILITY

LCO 3.0.1	LCOs shall be met during specified conditions in the Applicability, except as provided in LCO 3.0.2.
LCO 3.0.2	Upon discovery of a failure to meet an LCO, the Required Actions of the associated Conditions shall be met, except as provided in LCO 3.0.5. If the LCO is met or is no longer applicable prior to expiration of the specified Completion Time(s), completion of the Required Action(s) is not required, unless otherwise stated.
LCO 3.0.3	Not applicable.
LCO 3.0.4	When an LCO is not met, entry into a specified condition in the Applicability shall not be made except when the associated ACTIONS to be entered permit continued operation in the specified condition in the Applicability for an unlimited period of time. This Specification shall not prevent changes in specified conditions in the Applicability that are required to comply with ACTIONS or that are related to the unloading of an SFSC.
LCO 3.0.5	Equipment removed from service or not in service in compliance with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate it meets the LCO or that other equipment meets the LCO. This is an exception to LCO 3.0.2 for the system returned to service under administrative control to perform the testing.

3.0 SURVEILLANCE REQUIREMENT (SR) APPLICABILITY

SR 3.0.1	SRs shall be met during the specified conditions in the Applicability for individual LCOs, unless otherwise stated in the SR. Failure to meet a Surveillance, whether such failure is experienced during the performance of the Surveillance or between performances of the Surveillance, shall be failure to meet the LCO. Failure to perform a Surveillance within the specified Frequency shall be failure to meet the LCO except as provided in SR 3.0.3. Surveillances do not have to be performed on equipment or variables outside specified limits.
SR 3.0.2	The specified Frequency for each SR is met if the Surveillance is performed within 1.25 times the interval specified in the Frequency, as measured from the previous performance or as measured from the time a specified condition of the Frequency is met. For Frequencies specified as "once," the above interval extension does not apply. If a Completion Time requires periodic performance on a "once per..." basis, the above Frequency extension applies to each performance after the initial performance. Exceptions to this Specification are stated in the individual Specifications.
SR 3.0.3	If it is discovered that a Surveillance was not performed within its specified Frequency, then compliance with the requirement to declare the LCO not met may be delayed, from the time of discovery, up to 24 hours or up to the limit of the specified Frequency, whichever is less. This delay period is permitted to allow performance of the Surveillance. If the Surveillance is not performed within the delay period, the LCO must immediately be declared not met, and the applicable Condition(s) must be entered.

(continued)

3.0 SURVEILLANCE REQUIREMENT (SR) APPLICABILITY

SR 3.0.3 (continued)	When the Surveillance is performed within the delay period and the Surveillance is not met, the LCO must immediately be declared not met, and the applicable Condition(s) must be entered.
SR 3.0.4	Entry into a specified condition in the Applicability of an LCO shall not be made unless the LCO's Surveillances have been met within their specified Frequency. This provision shall not prevent entry into specified conditions in the Applicability that are required to comply with Actions or that are related to the unloading of an SFSC.

3.1 SFSC INTEGRITY

3.1.1 Multi-Purpose Canister (MPC)

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.

APPLICABILITY: Prior to TRANSPORT 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

ACTIONS (continued)

B. MPC helium backfill limit not met.	B.1 Perform an engineering evaluation to determine the impact of helium differential. AND B.2.1 Develop and initiate corrective actions necessary to return the MPC to an analyzed condition by adding helium to or removing helium from the MPC. OR B.2.2 Develop and initiate corrective actions necessary to demonstrate through analysis, using the models and methods from the HI-STORM UMAX FSAR, that all limits for MPC components and contents will be met.	72 hours 14 days
C. MPC helium leak rate limit for vent and drain port cover plate welds not met.	C.1 Perform an engineering evaluation to determine the impact of increased helium leak rate on heat removal capability and offsite dose. AND C.2 Develop and initiate corrective actions necessary to return the MPC to compliance with SR 3.1.1.3.	24 hours 7 days

D. Required Actions and associated Completion Times not met.	D.1 Remove all fuel assemblies from the SFSC.	30 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.1.1	Verify that the MPC cavity has been dried in accordance with the applicable limits in Table 3-1.	Once, prior to TRANSPORT OPERATIONS
SR 3.1.1.2	Verify MPC helium backfill quantity is within the limit specified in Table 3-2 for the applicable MPC model. Re-performance of this surveillance is not required upon successful completion of Action B.2.2.	Once, prior to TRANSPORT OPERATIONS
SR 3.1.1.3	Verify that the helium leak rate through the MPC vent and drain port cover plates (confinement welds and the base metal)meets the leaktight criteria of ANSI N14.5-1997.	Once, prior to TRANSPORT OPERATIONS

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 vent duct 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
C. Required Action B.1 and associated Completion Time not met.	C.1 Measure SFSC dose rates in accordance with the Radiation Protection Program.	Immediately and once per 12 hours thereafter
	AND	
	C.2.1 Restore SFSC Heat Removal System to operable status.	24 hours
	OR	
	C.2.2 Transfer the MPC into a TRANSFER CASK.	24 hours

SURVEILLANCE REQUIREMENTS

	SURVEILLANCE	FREQUENCY
SR 3.1.2	Verify all VVM inlets and outlets duct screen are free of blockage from solid debris or floodwater.	24 hours
	OR For VVMs with installed temperature monitoring equipment, verify that the difference between the average VVM air outlet duct temperature and ISFSI ambient temperature is ≤ 80°F for VVMs containing MPC-37s and ≤ 85°F for VVMs containing MPC-89s.	24 hours

3.1 SFSC INTEGRITY

3.1.3 MPC Cavity Reflooding

LCO 3.1.3 The MPC cavity pressure shall be < 100 psig

-----NOTE-----
The LCO is only applicable to wet UNLOADING OPERATIONS.

APPLICABILITY: UNLOADING OPERATIONS prior to and during re-flooding.

ACTIONS

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

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. MPC cavity pressure not within limit.	A.1 Stop re-flooding operations until MPC cavity pressure is within limit. <u>AND</u>	Immediately
	A.2 Ensure MPC vent port is not closed or blocked.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.1.3.1	Ensure via analysis or direct measurement that MPC cavity pressure is within limit.	Once, prior to MPC re-flooding operations. <u>OR</u> Once every 1 hour thereafter when using direct measurement.

3.2 SFSC RADIATION PROTECTION.

3.2.1 TRANSFER CASK Surface Contamination.

LCO 3.2.1 Removable contamination on the exterior surfaces of the TRANSFER CASK and accessible portions of the MPC shall each not exceed:

a. 1000 dpm/100 cm^2 from beta and gamma sources

b. 20 dpm/100 cm^2 from alpha sources.

APPLICABILITY: During TRANSPORT OPERATIONS.

ACTIONS

-NOTE-

Separate Condition entry is allowed for each TRANSFER CASK.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. TRANSFER CASK or MPC removable surface contamination limits not met.	A.1 Restore removable surface contamination to within limits.	7 days

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.2.1.1	Verify that the removable contamination on the exterior surfaces of the TRANSFER CASK and accessible portions of the MPC containing fuel is within limits.	Once, prior to TRANSPORT OPERATIONS

3.3 SFSC CRITICALITY CONTROL

3.3.1 Boron Concentration

LCO 3.3.1 The concentration of boron in the water in the MPC shall meet the following limits for the applicable MPC model and the most limiting fuel assembly array/class to be stored in the MPC:

MPC-37: Minimum soluble boron concentration as required by the table below†.

Array/Class	All Undamaged Fuel Assemblies		One or more Damaged Fuel Assemblies or Fuel Debris	
	Maximum Initial Enrichment ≤ 4.0 wt% ^{235}U (ppmb)	Maximum Initial Enrichment 5.0 wt% ^{235}U (ppmb)	Maximum Initial Enrichment ≤ 4.0 wt% ^{235}U (ppmb)	Maximum Initial Enrichment 5.0 wt% ^{235}U (ppmb)
All 14x14 and 16x16A	1000	1500	1300	1800
All 15x15 and 17x17	1500	2000	1800	2300

† For maximum initial enrichments between 4.0 wt% and 5.0 wt% ^{235}U, the minimum soluble boron concentration may be determined by linear interpolation between the minimum soluble boron concentrations at 4.0 wt% and 5.0 wt%.

APPLICABILITY: During PWR fuel LOADING OPERATIONS with fuel and water in the MPC

AND

During PWR fuel UNLOADING OPERATIONS with fuel and water in the MPC.

ACTIONS

---NOTE---

Separate Condition entry is allowed for each MPC.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Boron concentration not within limit.	A.1 Suspend LOADING OPERATIONS or UNLOADING OPERATIONS.	Immediately
	AND	
	A.2 Suspend positive reactivity additions.	Immediately
	AND	
	A.3 Initiate action to restore boron concentration to within limit.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE	FREQUENCY
------------NOTE------------ This surveillance is only required to be performed if the MPC is submerged in water or if water is to be added to, or recirculated through the MPC. ------------------------ SR 3.3.1.1 Verify boron concentration is within the applicable limit using two independent measurements.	Once, within 4 hours prior to entering the Applicability of this LCO. AND Once per 48 hours thereafter.

Table 3-1
MPC Cavity Drying Limits

Fuel Burnup (MWD/MTU)	MPC Type (Note ~~6~~ 5)	MPC Heat Load (kW) (Note 6)	Method of Moisture Removal (Notes 1 and 2)
All Assemblies ≤ 45,000	MPC-37 (Short Fuel)	≤ 42.35 (Heat Load Chart 1: Figure 2.3-1 of Appendix B) ≤ 42.12 (Heat Load Chart 2: Figure 2.3-2 of Appendix B) ≤ 41.91 (Heat Load Chart 3: Figure 2.3-3 of Appendix B)	VDS (Notes 3 and 4) or FHD (Note 4)
	MPC-37 (Standard Fuel)	≤ 42.35 (Heat Load Chart 1: Figure 2.3-1 of Appendix B) ≤ 42.12 (Heat Load Chart 2: Figure 2.3-2 of Appendix B) ≤ 44.12 (Heat Load Chart 3: Figure 2.3-4 of Appendix B)	
	MPC-37 (Long Fuel)	≤ 44.70 (Heat Load Chart 1: Figure 2.3-5 of Appendix B) ≤ 44.46 (Heat Load Chart 2: Figure 2.3-6 of Appendix B) ≤ 46.32 (Heat Load Chart 3: Figure 2.3-7 of Appendix B)	
	MPC-89	≤ 45.40 (Figure 2.3-~~12~~ 10 of Appendix B)	

One or more assemblies > 45,000	MPC-37 (Short, Standard and Long Fuel)	≤ ~~34.36~~33.46 (Threshold Heat Load: Figure 2.3-~~14~~ 12 of Appendix B)	VDS (Notes 3 and 4) or FHD (Note 4)
	MPC-89	≤ 34.75 (Threshold Heat Load: Figure 2.3-~~15~~ 13 of Appendix B)	
One or more assemblies > 45,000	MPC-37 (Short Fuel)	≤ 42.35 (Heat Load Chart 1: Figure 2.3-1 of Appendix B) ≤ 42.12 (Heat Load Chart 2: Figure 2.3-2 of Appendix B) ≤ 41.91 (Heat Load Chart 3: Figure 2.3-3 of Appendix B)	FHD (Note 4)
	MPC-37 (Standard Fuel)	≤ 42.35 (Heat Load Chart 1: Figure 2.3-1 of Appendix B) ≤ 42.12 (Heat Load Chart 2: Figure 2.3-2 of Appendix B) ≤ 44.12 (Heat Load Chart 3: Figure 2.3-4 of Appendix B)	
	MPC-37 (Long Fuel)	≤ 44.70 (Heat Load Chart 1: Figure 2.3-5 of Appendix B) ≤ 44.46 (Heat Load Chart 2: Figure 2.3-6 of Appendix B) ≤ 46.32 (Heat Load Chart 3: Figure 2.3-7 of Appendix B)	
	MPC-89	≤ 45.40 (Figure 2.3-1~~2~~0 of Appendix B)	

Notes:

1. VDS means a vacuum drying system. The acceptance criterion when using a VDS is the MPC cavity pressure shall be ≤ 3 torr for ≥ 30 minutes while the MPC is isolated from the vacuum pump.

2. FHD means a forced helium dehydration system. The acceptance criterion when using an FHD system is the gas temperature exiting the demoisturizer shall be ≤ 21°F for ≥ 30 minutes or the gas dew point exiting the MPC shall be ≤ 22.9°F for ≥ 30 minutes.

3. Vacuum drying of the MPC must be performed with the annular gap between the MPC and the TRANSFER CASK filled with water.

4. Heat load limits are set for each cell; see Appendix B Section 2.3.

5. The fuel assembly lengths loaded in MPC-37 are catalogued as short, standard and long fuel based on the active fuel lengths specified in Appendix B Table 2.1-4.

6. For additional aggregate heat load limits for storage, see Appendix B Table 2.3-1

Table 3-2 MPC Helium Backfill Limits [1]

MPC Type	Helium Backfill Pressure Option	Helium Backfill Pressure Range (psig)	~~Permissible Heat Limits (See Appendix B Section 2.3)~~
MPC-37	1	≥ ~~42~~41.0 and ≤ ~~45.5~~44.2	~~Table 2.3-1 of Appendix B: Heat Load Charts 1 and 3~~
	2	≥ 41.0 and ≤ ~~46.0~~44.5	~~Table 2.3-1 of Appendix B: Heat Load Chart 2~~
	3	≥ ~~42.0~~39.0 and ≤ ~~50.0~~46.0	~~Figures 2.3-10, 2.3-11 and 2.3-14 of Appendix B~~
	4	~~≥ 42.0 and ≤ 47.8~~	~~Figures 2.3-8 and 2.3-9 of Appendix B~~
MPC-89	1	≥ 42.~~5~~0 and ≤ ~~47.5~~45.2	~~Figure 2.3-12 of Appendix B~~
	2	≥ ~~42.~~39.0 and ≤ ~~50~~46.0	~~Figures 2.3-13 and 2.3-15 of Appendix B~~

Note: For Permissible Aggregate Heat Load Limit for each helium backfill pressure option see Appendix B, Table 2.3-1.

1 Helium used for backfill of MPC shall have a purity of ≥ 99.995%. Pressure range is at a reference temperature of 70°F

4.0

This section is intentionally left blank

5.0 ADMINISTRATIVE CONTROLS AND PROGRAMS

The following programs shall be established, implemented and maintained.

5.1 Radioactive Effluent Control Program

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

a. The HI-STORM UMAX Canister Storage 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).

(continued)

5.0 ADMINISTRATIVE CONTROLS AND PROGRAMS (continued)

5.2 Transport Evaluation Program

a. For lifting of the loaded MPC or TRANSFER CASK using equipment which is integral to a structure governed by 10 CFR Part 50 regulations, 10 CFR 50 requirements apply.

b. This program is not applicable when the TRANSFER CASK is in the FUEL BUILDING or is being handled by equipment providing support from underneath (i.e., on a rail car, heavy haul trailer, air pads, etc...)[SA1].

c. The TRANSFER CASK when loaded with spent fuel, may be lifted to and carried at any height necessary during TRANSPORT OPERATIONS and MPC TRANSFER, provided the lifting equipment is designed in accordance with items 1, 2, and 3 below.

1. The metal body and any vertical columns of the lifting equipment shall be designed to comply with stress limits of ASME Section III, Subsection NF, Class 3 for linear structures. All vertical compression loaded primary members shall satisfy the buckling criteria of ASME Section III, Subsection NF.

2. The horizontal cross beam and any lifting attachments used to connect the load to the lifting equipment shall be designed, fabricated, operated, tested, inspected, and maintained in accordance with applicable sections and guidance of NUREG-0612, Section 5.1. This includes applicable stress limits from ANSI N14.6.

3. The lifting equipment shall have redundant drop protection features which prevent uncontrolled lowering of the load.

5.0 ADMINISTRATIVE CONTROLS AND PROGRAMS (continued)

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 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 TRANSFER CASK and the VVM 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 VVM.
b. The side of the TRANSFER CASK
c. The outlet vents on the VVM

5.3.4 Notwithstanding the limits established in Section 5.3.3, the average of the measured dose rates on a loaded VVM or TRANSFER CASK shall not exceed the following values:

a. 30 mrem/hr (gamma + neutron) on the top of the closure lid of the VVM
b. 3500 mrem/hr (gamma + neutron) on the side of the TRANSFER CASK

5.3.5 The licensee shall measure the TRANSFER CASK and VVM 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.

5.0 ADMINISTRATIVE CONTROLS AND PROGRAMS (continued)

5.3 Radiation Protection Program (continued)

5.3.6 If the measured surface dose rates exceed the lower of the two limits established in Section 5.3.3 or Section 5.3.4, 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 a VVM at the ISFSI containing the as-loaded MPC 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.

5.3.7 If the evaluation performed pursuant to Section 5.3.6 shows that the dose limits of 10 CFR 72.104 will be exceeded, the MPC shall not be placed into a VVM or the MPC shall be removed from the VVM until appropriate corrective action is taken to ensure the dose limits are not exceeded.

5.3.8 TRANSFER CASK and VVM 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 top of the VVM. 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.

b. A minimum of four (4) dose rate measurements shall be taken adjacent to the outlet vent duct screen of the VVM, approximately 90 degrees apart.

c. 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.

5.0 ADMINISTRATIVE CONTROLS AND PROGRAMS (continued)

5.3 Radiation Protection Program (continued)

5.3.9 The "Radiation Protection Space" (RPS) is the prismatic subgrade buffer zone surrounding the VVMs in a loaded ISFSI. The RPS boundary is indicated in the Licensing Drawings in Section 1.5 of the system FSAR. The RPS boundary shall not be encroached upon during any site construction activity. The jurisdictional boundary of the RPS extends down from the top of the ISFSI pad to the elevation of the Bottom surface of the Support Foundation Pad. The ISFSI design shall ensure that there is no significant loss of shielding in the RPS due to a credible accident or an extreme environment event during construction activity involving excavation adjacent to the RPS boundary.

Attachment 6 to Holtec Letter 5021017

Proposed Appendix B

CERTIFICATE OF COMPLIANCE NO. 1040

APPENDIX B

APPROVED CONTENTS AND DESIGN FEATURES

FOR THE HI-STORM UMAX CANISTER STORAGE SYSTEM

TABLE OF CONTENTS

1.0 Definitions

Refer to Appendix A for Definitions.

2.0 APPROVED CONTENTS

2.1 Fuel Specifications and Loading Conditions

2.1.1 Fuel to Be Stored in the HI-STORM UMAX Canister Storage System

a. UNDAMAGED FUEL ASSEMBLIES, DAMAGED FUEL ASSEMBLIES, FUEL DEBRIS, and NON-FUEL HARDWARE meeting the limits specified in Table 2.1-1 and other referenced tables may be stored in the HI-STORM UMAX Canister Storage System.

b. All BWR fuel assemblies may be stored with or without ZR channels.

2.1.2 Fuel Loading

Figures 2.3-1 through 2.3-7 and 2.3-12 define the unique cell numbers for the MPC-37 and MPC-89 models, respectively, and the maximum allowable heat load per fuel assembly for each cell under multiple loading conditions. Fuel assembly decay heat limits are specified in Section 2.3.1. Fuel assemblies shall meet all other applicable limits specified in Tables 2.1-1 through 2.1-3.

2.2 Violations

If any Fuel Specifications or Loading Conditions of 2.1 are violated, the following actions shall be completed:

2.2.1 The affected fuel assemblies shall be placed in a safe condition.

2.2.2 Within 24 hours, notify the NRC Operations Center.

2.2.3 Within 30 days, submit a special report which describes the cause of the violation, and actions taken to restore compliance and prevent recurrence.

Table 2.1-1 (page 1 of 4)
Fuel Assembly Limits

I. MPC MODEL: MPC-37

A. Allowable Contents

1. Uranium oxide PWR UNDAMAGED FUEL ASSEMBLIES, DAMAGED FUEL ASSEMBLIES, and/or FUEL DEBRIS meeting the criteria in Table 2.1-2, with or without NON-FUEL HARDWARE and meeting the following specifications (Note 1):

a. Cladding Type:	ZR
b. Maximum Initial Enrichment:	5.0 wt. % U-235 with soluble boron credit per LCO 3.3.1
c. Post-irradiation Cooling Time and Average Burnup Per Assembly:	Cooling Time ≥ 3 years Assembly Average Burnup ≤ 68.2 GWD/MTU
d. Decay Heat Per Fuel Storage Location:	As specified in Section 2.3
e. Fuel Assembly Length:	≤ 199.2 inches (nominal design including NON-FUEL HARDWARE and DFC)
f. Fuel Assembly Width:	≤ 8.54 inches (nominal design)
g. Fuel Assembly Weight:	≤ 2050 lbs (including NON-FUEL HARDWARE and DFC)

Table 2.1-1 (page 2 of 4)
Fuel Assembly Limits

I. MPC MODEL: MPC-37 (continued)

B. Quantity per MPC: 37 FUEL ASSEMBLIES with up to twelve (12) DAMAGED FUEL ASSEMBLIES or FUEL DEBRIS in DAMAGED FUEL CONTAINERS (DFCs). DFCs may be stored in fuel storage locations 1, 3, 4, 8, 9, 15, 23, 29, 30, 34, 35, and 37 (see Figures 2.3-1 through 2.3-7). The remaining fuel storage locations may be filled with PWR UNDAMAGED FUEL ASSEMBLIES meeting the applicable specifications.

C. One (1) Neutron Source Assembly (NSA) is authorized for loading in the MPC-37.

D. Up to thirty (30) BRPAs are authorized for loading in the MPC-37.

Note 1: Fuel assemblies containing BPRAs, TPDs, WABAs, water displacement guide tube plugs, orifice rod assemblies, or vibration suppressor inserts, with or without ITTRs, may be stored in any fuel storage location. Fuel assemblies containing APSRs, RCCAs, CEAs, CRAs, or NSAs may only be loaded in fuel storage locations 5 through 7, 10 through 14, 17 through 21, 24 through 28, and 31 through 33 (see Figures 2.3-1 through 2.3-7).

Table 2.1-1 (page 3 of 4)
Fuel Assembly Limits

II. MPC MODEL: MPC-89

A. Allowable Contents

1. Uranium oxide BWR UNDAMAGED FUEL ASSEMBLIES, DAMAGED FUEL ASSEMBLIES, and/or FUEL DEBRIS meeting the criteria in Table 2.1-3, with or without channels and meeting the following specifications:

a. Cladding Type:	ZR
b. Maximum PLANAR-AVERAGE INITIAL ENRICHMENT(Note 1):	As specified in Table 2.1-3 for the applicable fuel assembly array/class.
c. Initial Maximum Rod Enrichment	5.0 wt. % U-235
d. Post-irradiation Cooling Time and Average Burnup Per Assembly	
i. Array/Class 8x8F	Cooling time ≥ 10 years and an assembly average burnup ≤ 27.5 GWD/MTU.
ii. All Other Array Classes	Cooling Time ≥ 3 years and an assembly average burnup ≤ 65 GWD/MTU
e. Decay Heat Per Assembly	
i. Array/Class 8x8F	≤ 183.5 Watts
ii. All Other Array Classes	As specified in Section 2.3
f. Fuel Assembly Length	≤ 176.5 inches (nominal design)
g. Fuel Assembly Width	≤ 5.95 inches (nominal design)
h. Fuel Assembly Weight	≤ 850 lbs, including a DFC as well as a channel

Table 2.1-1 (page 4 of 4)
Fuel Assembly Limits

II. MPC MODEL: MPC-89 (continued)

B. Quantity per MPC: 89 FUEL ASSEMBLIES with up to sixteen (16) DAMAGED FUEL ASSEMBLIES or FUEL DEBRIS in DAMAGED FUEL CONTAINERS (DFCs). DFCs may be stored in fuel storage locations 1, 3, 4, 10, 11, 19, 29, 39, 51, 61, 71, 79, 80, 86, 87, and 89 (see Figure 2.3-12). The remaining fuel storage locations may be filled with BWR UNDAMAGED FUEL ASSEMBLIES meeting the applicable specifications.

Note 1: The lowest maximum allowable enrichment of any fuel assembly loaded in an MPC-89, based on fuel array class and fuel classification, is the maximum allowable enrichment for the remainder of the assemblies loaded in that MPC.

Table 2.1-2 (page 1 of 3) PWR FUEL ASSEMBLY CHARACTERISTICS (Note 1)					
Fuel Assembly Array/ Class	**14x14 A**	**14x14 B**	**14x14 C**	**15x15 B**	**15x15 C**
No. of Fuel Rod Locations	179	179	176	204	204
Fuel Clad O.D. (in.)	≥ 0.400	≥ 0.417	≥ 0.440	≥ 0.420	≥ 0.417
Fuel Clad I.D. (in.)	≤ 0.3514	≤ 0.3734	≤ 0.3880	≤ 0.3736	≤ 0.3640
Fuel Pellet Dia. (in.) (Note 3)	≤ 0.3444	≤ 0.3659	≤ 0.3805	≤ 0.3671	≤ 0.3570
Fuel Rod Pitch (in.)	≤ 0.556	≤ 0.556	≤ 0.580	≤ 0.563	≤ 0.563
Active Fuel Length (in.)	≤ 150	≤ 150	≤ 150	≤ 150	≤ 150
No. of Guide and/or Instrument Tubes	17	17	5 (Note 2)	21	21
Guide/Instrument Tube Thickness (in.)	≥ 0.017	≥ 0.017	≥ 0.038	≥ 0.015	≥ 0.0165

Table 2.1-2 (page 2 of 3)
PWR FUEL ASSEMBLY CHARACTERISTICS
(Note 1)

Fuel Assembly Array/Class	**15x15 D**	**15x15 E**	**15x15 F**	**15x15 H**	**15x15 I**
No. of Fuel Rod Locations	208	208	208	208	216
Fuel Clad O.D. (in.)	≥ 0.430	≥ 0.428	≥ 0.428	≥ 0.414	≥ 0.413
Fuel Clad I.D. (in.)	≤ 0.3800	≤ 0.3790	≤ 0.3820	≤ 0.3700	≤ 0.3670
Fuel Pellet Dia. (in.) (Note 3)	≤ 0.3735	≤ 0.3707	≤ 0.3742	≤ 0.3622	≤ 0.3600
Fuel Rod Pitch (in.)	≤ 0.568	≤ 0.568	≤ 0.568	≤ 0.568	≤ 0.550
Active Fuel Length (in.)	≤ 150	≤ 150	≤ 150	≤ 150	≤ 150
No. of Guide and/or Instrument Tubes	17	17	17	17	9 (Note 4)
Guide/Instrument Tube Thickness (in.)	≥ 0.0150	≥ 0.0140	≥ 0.0140	≥ 0.0140	≥ 0.0140

Table 2.1-2 (page 3 of 3) PWR FUEL ASSEMBLY CHARACTERISTICS (Note 1)						
Fuel Assembly Array and Class	**16x16 A**	**17x17A**	**17x17 B**	**17x17 C**	**17x17 D**	**17x17 E**
No. of Fuel Rod Locations	236	264	264	264	264	265
Fuel Clad O.D. (in.)	≥ 0.382	≥ 0.360	≥ 0.372	≥ 0.377	≥ 0.372	≥ 0.372
Fuel Clad I.D. (in.)	≤ 0.3350	≤ 0.3150	≤ 0.3310	≤ 0.3330	≤ 0.3310	≤ 0.3310
Fuel Pellet Dia. (in.) (Note 3)	≤ 0.3255	≤ 0.3088	≤ 0.3232	≤ 0.3252	≤ 0.3232	≤ 0.3232
Fuel Rod Pitch (in.)	≤ 0.506	≤ 0.496	≤ 0.496	≤ 0.502	≤ 0.496	≤ 0.496
Active Fuel length (in.)	≤ 150	≤ 150	≤ 150	≤ 150	≤ 170	≤ 170
No. of Guide and/or Instrument Tubes	5 (Note 2)	25	25	25	25	24
Guide/Instrument Tube Thickness (in.)	≥ 0.0350	≥ 0.016	≥ 0.014	≥ 0.020	≥ 0.014	≥ 0.014

Notes:

1. All dimensions are design nominal values. Maximum and minimum dimensions are specified to bound variations in design nominal values among fuel assemblies within a given array/class.
2. Each guide tube replaces four fuel rods.
3. Annular fuel pellets are allowed in the top and bottom 12" of the active fuel length.
4. One Instrument Tube and eight Guide Bars (Solid ZR)

Table 2.1-3 (page 1 of 4)
BWR FUEL ASSEMBLY CHARACTERISTICS
(Note 1)

Fuel Assembly Array and Class	**7x7 B**	**8x8 B**	**8x8 C**	**8x8 D**	**8x8 E**
Maximum Planar-Average Initial Enrichment (wt.% ^{235}U) (Note 14)	≤ 4.8	≤ 4.8	≤ 4.8	≤ 4.8	≤ 4.8
No. of Fuel Rod Locations (Full Length or Total/Full Length)	49	63 or 64	62	60 or 61	59
Fuel Clad O.D. (in.)	≥ 0.5630	≥ 0.4840	≥ 0.4830	≥ 0.4830	≥ 0.4930
Fuel Clad I.D. (in.)	≤ 0.4990	≤ 0.4295	≤ 0.4250	≤ 0.4230	≤ 0.4250
Fuel Pellet Dia. (in.)	≤ 0.4910	≤ 0.4195	≤ 0.4160	≤ 0.4140	≤ 0.4160
Fuel Rod Pitch (in.)	≤ 0.738	≤ 0.642	≤ 0.641	≤ 0.640	≤ 0.640
Design Active Fuel Length (in.)	≤ 150	≤ 150	≤ 150	≤ 150	≤ 150
No. of Water Rods (Note 10)	0	1 or 0	2	1 - 4 (Note 6)	5
Water Rod Thickness (in.)	N/A	≥ 0.034	> 0.00	> 0.00	≥ 0.034
Channel Thickness (in.)	≤ 0.120	≤ 0.120	≤ 0.120	≤ 0.120	≤ 0.100

Table 2.1-3 (2 of 4) BWR FUEL ASSEMBLY CHARACTERISTICS (Note 1)					
Fuel Assembly Array and Class	**8x8F**	**9x9 A**	**9x9 B**	**9x9 C**	**9x9 D**
Maximum Planar-Average Initial Enrichment (wt.% ^{235}U) (Note 14)	≤ 4.5 (Note 12)	≤ 4.8	≤ 4.8	≤ 4.8	≤ 4.8
No. of Fuel Rod Locations	64	74/66 (Note 4)	72	80	79
Fuel Clad O.D. (in.)	≥ 0.4576	≥ 0.4400	≥ 0.4330	≥ 0.4230	≥ 0.4240
Fuel Clad I.D. (in.)	≤ 0.3996	≤ 0.3840	≤ 0.3810	≤ 0.3640	≤ 0.3640
Fuel Pellet Dia. (in.)	≤ 0.3913	≤ 0.3760	≤ 0.3740	≤ 0.3565	≤ 0.3565
Fuel Rod Pitch (in.)	≤ 0.609	≤ 0.566	≤ 0.572	≤ 0.572	≤ 0.572
Design Active Fuel Length (in.)	≤ 150	≤ 150	≤ 150	≤ 150	≤ 150
No. of Water Rods (Note 10)	N/A (Note 2)	2	1 (Note 5)	1	2
Water Rod Thickness (in.)	≥ 0.0315	> 0.00	> 0.00	≥ 0.020	≥ 0.0300
Channel Thickness (in.)	≤ 0.055	≤ 0.120	≤ 0.120	≤ 0.100	≤ 0.100

Table 2.1-3 (page 3 of 4)
BWR FUEL ASSEMBLY CHARACTERISTICS
(Note 1)

Fuel Assembly Array and Class	**9x9 E (Note 2)**	**9x9 F (Note 2)**	**9x9 G**	**10x10 A**	**10x10 B**
Maximum Planar-Average Initial Enrichment (wt.% ^{235}U) (Note 14)	≤ 4.5 (Note 12)	≤ 4.5 (Note 12)	≤ 4.8	≤ 4.8	≤ 4.8
No. of Fuel Rod Locations	76	76	72	92/78 (Note 7)	91/83 (Note 8)
Fuel Clad O.D. (in.)	≥0.4170	≥0.4430	≥0.4240	≥0.4040	≥0.3957
Fuel Clad I.D. (in.)	≤0.3640	≤0.3860	≤0.3640	≤ 0.3520	≤ 0.3480
Fuel Pellet Dia. (in.)	≤0.3530	≤0.3745	≤0.3565	≤ 0.3455	≤ 0.3420
Fuel Rod Pitch (in.)	≤ 0.572	≤ 0.572	≤ 0.572	≤ 0.510	≤ 0.510
Design Active Fuel Length (in.)	≤ 150	≤ 150	≤ 150	≤ 150	≤ 150
No. of Water Rods (Note 10)	5	5	1 (Note 5)	2	1 (Note 5)
Water Rod Thickness (in.)	≥0.0120	≥0.0120	≥0.0320	≥0.0300	> 0.00
Channel Thickness (in.)	≤ 0.120	≤ 0.120	≤ 0.120	≤ 0.120	≤ 0.120

Table 2.1-3 (page 4 of 4)
BWR FUEL ASSEMBLY CHARACTERISTICS
(Note 1)

Fuel Assembly Array and Class	**10x10 C**	**10x10 F**	**10x10 G**
Maximum Planar-Average Initial Enrichment (wt.% ^{235}U) (Note 14)	≤ 4.8	≤ 4.7 (Note 13)	≤ 4.6 (Note 12)
No. of Fuel Rod Locations	96	92/78 (Note 7)	96/84
Fuel Clad O.D. (in.)	≥ 0.3780	≥ 0.4035	≥ 0.387
Fuel Clad I.D. (in.)	≤ 0.3294	≤ 0.3570	≤ 0.340
Fuel Pellet Dia. (in.)	≤ 0.3224	≤ 0.3500	≤ 0.334
Fuel Rod Pitch (in.)	≤ 0.488	≤ 0.510	≤ 0.512
Design Active Fuel Length (in.)	≤ 150	≤ 150	≤ 150
No. of Water Rods (Note 10)	5 (Note 9)	2	5 (Note 9)
Water Rod Thickness (in.)	≥ 0.031	≥ 0.030	≥ 0.031
Channel Thickness (in.)	≤ 0.055	≤ 0.120	≤ 0.060

NOTES:

1. All dimensions are design nominal values. Maximum and minimum dimensions are specified to bound variations in design nominal values among fuel assemblies within a given array/class.
2. This assembly is known as "QUAD+." It has four rectangular water cross segments dividing the assembly into four quadrants.
3. For the SPC 9x9-5 fuel assembly, each fuel rod must meet either the 9x9E or the 9x9F set of limits or clad O.D., clad I.D., and pellet diameter.
4. This assembly class contains 74 total rods; 66 full length rods and 8 partial length rods.
5. Square, replacing nine fuel rods.
6. Variable.
7. This assembly contains 92 total fuel rods; 78 full length rods and 14 partial length rods.
8. This assembly class contains 91 total fuel rods; 83 full length rods and 8 partial length rods.
9. One diamond-shaped water rod replacing the four center fuel rods and four rectangular water rods dividing the assembly into four quadrants.
10. These rods may also be sealed at both ends and contain ZR material in lieu of water.
11. Not used.
12. When loading fuel assemblies classified as DAMAGED FUEL, all assemblies in the MPC are limited to 4.0 wt.% U-235.
13. When loading fuel assemblies classified as DAMAGED FUEL, all assemblies in the MPC are limited to 4.6 wt.% U-235.
14. In accordance with the definition of UNDAMAGED FUEL, certain assemblies may be limited to 3.3 wt.% U-235. When loading these fuel assemblies, all assemblies in the MPC are limited to 3.3 wt.% U-235.

Table 2.1-4 CLASSIFICATION OF FUEL ASSEMBLY FOR MPC-37 IN THE HI-STORM UMAX ISFSI		
MPC Type	**Classification**	**Nominal Active Fuel Length**
MPC-37	Short Fuel	128 inches ≤ L < 144 inches
	Standard Fuel	144 inches ≤ L < 168 inches
	Long Fuel	L ≥ 168 inches
Note 1: L means "nominal active fuel length".		

2.3 Decay Heat Limits

This section provides the limits on fuel assembly decay heat for storage in the HI-STORM UMAX Canister Storage System. The method to verify compliance, including examples, is provided in Chapter 13 of the HI-STORM UMAX FSAR.

2.3.1 Fuel Loading Decay Heat Limits

Table 2.3-1 provides the maximum permissible decay heat under long-term storage for MPC-37 and MPC-89. Table 2.3-1 also lists the applicable figures providing the permissible decay heat per fuel storage location, including MPCs usingThree discrete heat load charts for storage of short, standard and long fuel are provided in Figures 2.3-1 through 2.3-7 for MPC-37. The permissible heat load under long-term storage for MPC-89 is provided in Figure 2.3-12. Figures 2.3-8 through 2.3-11, and 2.3-13 provide the allowable decay heat per fuel storage location under the optional helium backfill pressure ranges permitted in Table 3-2 of Appendix A. The optional ranges provide expanded backfill limits at the expense of reduced decay heat allowables. Figures 2.3-14 and 2.3-15 provide the maximum allowable decay heat per fuel storage location for MPC-37 and MPC-89, respectively, when using VDS to dry high burnup fuel.

TABLE 2.3-1 PERMISSIBLE HEAT LOAD FOR LONG-TERM STORAGE					
MPC Type		Heat Load Chart	Helium Backfill Pressure Option (Notes 1,2)	Permissible Heat Load Per Storage Cell	~~Maximum Design Basis~~Permissible Aggregate Heat Load, kW (Note 4)
MPC-37	Short Fuel (~~see Table 2.1-4 for length data~~Note 3)	1	1	Figure 2.3-1	~~42.35~~33.88
		2	2	Figure 2.3-2	~~42.12~~33.70
		3	1	Figure 2.3-3	~~41.91~~33.53
	Standard Fuel (~~see Table 2.1-4 for length data~~Note 3)	1	1	Figure 2.3-1	~~42.35~~33.88
		2	2	Figure 2.3-2	~~42.12~~33.70
		3	1	Figure 2.3-4	~~44.12~~35.30
	Long Fuel (~~see Table 2.1-4 for length data~~Note 3)	1	1	Figure 2.3-5	~~44.70~~35.76
		2	2	Figure 2.3-6	~~44.46~~35.57
		3	1	Figure 2.3-7	~~46.32~~37.06
	Short Fuel (Note 3)		3	Figure 2.3-8	34.28
			3	Figure 2.3-12	33.46
	Standard Fuel (Note 3)		3	Figure 2.3-8	34.28
			3	Figure 2.3-12	33.46
	Long Fuel (Note 3)		3	Figure 2.3-9	36.19
			3	Figure 2.3-12	33.46
MPC-89			1	Figure 2.3-10~~2~~	~~45.40~~36.32
			2	Figure 2.3-11	36.72
			2	Figure 2.3-13	34.75

Notes:

1. For helium backfill pressure option pressure ranges see Appendix A, Table 3-2

2. For the details on the use of VDS to dry High Burnup Fuel see Appendix A, Table 3-1

3. See Table 2.1-4 for fuel length data

4. Aggregate heat load is defined as the sum of heat loads of all stored fuel assemblies. The permissible aggregate heat load is set to 80% of the design basis heat load.

2.3.2 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 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.

		1 0.873	2 0.873	3 0.873		
	4 0.873	5 1.602	6 1.602	7 1.602	8 0.873	
9 0.873	10 1.602	11 1.017	12 1.017	13 1.017	14 1.602	15 0.873
16 0.873	17 1.602	18 1.017	19 1.017	20 1.017	21 1.602	22 0.873
23 0.873	24 1.602	25 1.017	26 1.017	27 1.017	28 1.602	29 0.873
	30 0.873	31 1.602	32 1.602	33 1.602	34 0.873	
		35 0.873	36 0.873	37 0.873		

Legend

Cell ID Heat Load, kW

Figure 2.3-1
HI-STORM UMAX MPC-37 Permissible Heat Load Chart 1 for Long-term Storage for Short and Standard Fuel

		1 1.215	2 1.215	3 1.215		
	4 1.215	5 1.080	6 1.080	7 1.080	8 1.215	
9 1.215	10 1.080	11 1.080	12 1.080	13 1.080	14 1.080	15 1.215
16 1.215	17 1.080	18 1.080	19 1.080	20 1.080	21 1.080	22 1.215
23 1.215	24 1.080	25 1.080	26 1.080	27 1.080	28 1.080	29 1.215
	30 1.215	31 1.080	32 1.080	33 1.080	34 1.215	
		35 1.215	36 1.215	37 1.215		

Legend

Cell ID Heat Load, kW

Figure 2.3-2
HI-STORM UMAX MPC-37 Permissible Heat Load Chart 2 for Long-term Storage for Short and Standard Fuel

		1 0.922	2 0.922	3 0.922		
	4 0.922	5 1.520	6 1.520	7 1.520	8 0.922	
9 0.922	10 1.710	11 0.950	12 0.950	13 0.950	14 1.710	15 0.922
16 0.922	17 1.520	18 0.950	19 0.570	20 0.950	21 1.520	22 0.922
23 0.922	24 1.710	25 0.950	26 0.950	27 0.950	28 1.710	29 0.922
	30 0.922	31 1.520	32 1.520	33 1.520	34 0.922	
		35 0.922	36 0.922	37 0.922		

Legend

Cell ID Heat Load, kW

Figure 2.3-3
HI-STORM UMAX MPC-37 Permissible Heat Load Chart 3 for Long-term Storage for Short Fuel

		1	2	3		
		0.970	0.970	0.970		
	4	5	6	7	8	
	0.970	1.600	1.600	1.600	0.970	
9	10	11	12	13	14	15
0.970	1.800	1.000	1.000	1.000	1.800	0.970
16	17	18	19	20	21	22
0.970	1.600	1.000	0.600	1.000	1.600	0.970
23	24	25	26	27	28	29
0.970	1.800	1.000	1.000	1.000	1.800	0.970
	30	31	32	33	34	
	0.970	1.600	1.600	1.600	0.970	
		35	36	37		
		0.970	0.970	0.970		

Legend

Cell ID
Heat Load, kW

Figure 2.3-4
HI-STORM UMAX MPC-37 Permissible Heat Load Chart 3 for Long-term Storage for Standard Fuel

		1 0.922	2 0.922	3 0.922		
	4 0.922	5 1.691	6 1.691	7 1.691	8 0.922	
9 0.922	10 1.691	11 1.074	12 1.074	13 1.074	14 1.691	15 0.922
16 0.922	17 1.691	18 1.074	19 1.074	20 1.074	21 1.691	22 0.922
23 0.922	24 1.691	25 1.074	26 1.074	27 1.074	28 1.691	29 0.922
	30 0.922	31 1.691	32 1.691	33 1.691	34 0.922	
		35 0.922	36 0.922	37 0.922		

Legend

Cell ID Heat Load, kW

Figure 2.3-5
HI-STORM UMAX MPC-37 Permissible Heat Load Chart 1 for Long-term Storage for Long Fuel

		1 1.283	2 1.283	3 1.283		
	4 1.283	5 1.140	6 1.140	7 1.140	8 1.283	
9 1.283	10 1.140	11 1.140	12 1.140	13 1.140	14 1.140	15 1.283
16 1.283	17 1.140	18 1.140	19 1.140	20 1.140	21 1.140	22 1.283
23 1.283	24 1.140	25 1.140	26 1.140	27 1.140	28 1.140	29 1.283
	30 1.283	31 1.140	32 1.140	33 1.140	34 1.283	
		35 1.283	36 1.283	37 1.283		

Legend

Cell ID Heat Load, kW

Figure 2.3-6
HI-STORM UMAX MPC-37 Permissible Heat Load Chart 2 for Long-term Storage for Long Fuel

		1 1.019	2 1.019	3 1.019		
	4 1.019	5 1.680	6 1.680	7 1.680	8 1.019	
9 1.019	10 1.890	11 1.050	12 1.050	13 1.050	14 1.890	15 1.019
16 1.019	17 1.680	18 1.050	19 0.630	20 1.050	21 1.680	22 1.019
23 1.019	24 1.890	25 1.050	26 1.050	27 1.050	28 1.890	29 1.019
	30 1.019	31 1.680	32 1.680	33 1.680	34 1.019	
		35 1.019	36 1.019	37 1.019		

Legend

Cell ID Heat Load, kW

Figure 2.3-7
HI-STORM UMAX MPC-37 Permissible Heat Load Chart 3 for Long-term Storage for Long Fuel

		1 0.785	2 0.785	3 0.785		
	4 0.785	5 1.441	6 1.441	7 1.441	8 0.785	
9 0.785	10 1.441	11 0.915	12 0.915	13 0.915	14 1.441	15 0.785
16 0.785	17 1.441	18 0.915	19 0.915	20 0.915	21 1.441	22 0.785
23 0.785	24 1.441	25 0.915	26 0.915	27 0.915	28 1.441	29 0.785
	30 0.785	31 1.441	32 1.441	33 1.441	34 0.785	
		35 0.785	36 0.785	37 0.785		

Legend

Cell ID Heat Load, kW

Figure 2.3-8
HI-STORM UMAX MPC-37 Permissible Heat Load for Short and Standard Fuel for Helium Backfill Option ~~4~~3 in Table 3-2 of Appendix A

		1 0.829	2 0.829	3 0.829		
	4 0.829	5 1.521	6 1.521	7 1.521	8 0.829	
9 0.829	10 1.521	11 0.966	12 0.966	13 0.966	14 1.521	15 0.829
16 0.829	17 1.521	18 0.966	19 0.966	20 0.966	21 1.521	22 0.829
23 0.829	24 1.521	25 0.966	26 0.966	27 0.966	28 1.521	29 0.829
	30 0.829	31 1.521	32 1.521	33 1.521	34 0.829	
		35 0.829	36 0.829	37 0.829		

Legend

Cell ID Heat Load, kW

Figure 2.3-9
HI-STORM UMAX MPC-37 Permissible Heat Load for Long Fuel for Helium Backfill Option ~~4~~3 in Table 3-2 of Appendix A

		~~1~~ ~~0.698~~	~~2~~ ~~0.698~~	~~3~~ ~~0.698~~		
	~~4~~ ~~0.698~~	~~5~~ ~~1.281~~	~~6~~ ~~1.281~~	~~7~~ ~~1.281~~	~~8~~ ~~0.698~~	
~~9~~ ~~0.698~~	~~10~~ ~~1.281~~	~~11~~ ~~0.813~~	~~12~~ ~~0.813~~	~~13~~ ~~0.813~~	~~14~~ ~~1.281~~	~~15~~ ~~0.698~~
~~16~~ ~~0.698~~	~~17~~ ~~1.281~~	~~18~~ ~~0.813~~	~~19~~ ~~0.813~~	~~20~~ ~~0.813~~	~~21~~ ~~1.281~~	~~22~~ ~~0.698~~
~~23~~ ~~0.698~~	~~24~~ ~~1.281~~	~~25~~ ~~0.813~~	~~26~~ ~~0.813~~	~~27~~ ~~0.813~~	~~28~~ ~~1.281~~	~~29~~ ~~0.698~~
	~~30~~ ~~0.698~~	~~31~~ ~~1.281~~	~~32~~ ~~1.281~~	~~33~~ ~~1.281~~	~~34~~ ~~0.698~~	
		~~35~~ ~~0.698~~	~~36~~ ~~0.698~~	~~37~~ ~~0.698~~		

~~Legend~~

~~Cell ID~~ ~~Heat Load, kW~~

~~Figure 2.3-10~~
~~HI-STORM UMAX MPC-37 Permissible Heat Load for Short and Standard Fuel for Helium Backfill Option 3 in Table 3-2 of Appendix A~~

		1 0.737	2 0.737	3 0.737		
	4 0.737	5 1.352	6 1.352	7 1.352	8 0.737	
9 0.737	10 1.352	11 0.859	12 0.859	13 0.859	14 1.352	15 0.737
16 0.737	17 1.352	18 0.859	19 0.859	20 0.859	21 1.352	22 0.737
23 0.737	24 1.352	25 0.859	26 0.859	27 0.859	28 1.352	29 0.737
	30 0.737	31 1.352	32 1.352	33 1.352	34 0.737	
		35 0.737	36 0.737	37 0.737		

Legend

Cell ID Heat Load, kW

Figure 2.3-11
HI-STORM UMAX MPC-37 Permissible Heat Load for Long Fuel for Helium Backfill Option 3 in Table 3-2 of Appendix A

				1 0.431	2 0.431	3 0.431				
		4 0.431	5 0.431	6 0.431	7 0.607	8 0.431	9 0.431	10 0.431		
	11 0.431	12 0.431	13 0.607	14 0.607	15 0.607	16 0.607	17 0.607	18 0.431	19 0.431	
	20 0.431	21 0.607	22 0.607	23 0.607	24 0.607	25 0.607	26 0.607	27 0.607	28 0.431	
29 0.431	30 0.431	31 0.607	32 0.607	33 0.431	34 0.431	35 0.431	36 0.607	37 0.607	38 0.431	39 0.431
40 0.431	41 0.607	42 0.607	43 0.607	44 0.431	45 0.431	46 0.431	47 0.607	48 0.607	49 0.607	50 0.431
51 0.431	52 0.431	53 0.607	54 0.607	55 0.431	56 0.431	57 0.431	58 0.607	59 0.607	60 0.431	61 0.431
	62 0.431	63 0.607	64 0.607	65 0.607	66 0.607	67 0.607	68 0.607	69 0.607	70 0.431	
	71 0.431	72 0.431	73 0.607	74 0.607	75 0.607	76 0.607	77 0.607	78 0.431	79 0.431	
		80 0.431	81 0.431	82 0.431	83 0.607	84 0.431	85 0.431	86 0.431		
				87 0.431	88 0.431	89 0.431				

Legend

Cell ID Heat Load, kW

Figure 2.3-10~~2~~
HI-STORM UMAX MPC-89 Permissible Heat Load for Long-Term Storage

				1 0.3~~44~~87	2 0.~~344~~.387	3 0.~~344~~.387				
		4 0.~~344~~.387	5 0.~~344~~.387	6 0.~~344~~.387	7 0.~~485~~.546	8 0.~~344~~.387	9 0.~~344~~.387	10 0.~~344~~.387		
	11 0.~~344~~.387	12 0.~~344~~.387	13 0.~~485~~.546	14 0.~~485~~.546	15 0.~~485~~.546	16 0.~~485~~.546	17 0.~~485~~.546	18 0.~~344~~.387	19 0.~~344~~.387	
	20 0.~~344~~.387	21 0.~~485~~.546	22 0.~~485~~.546	23 0.~~485~~.546	24 0.~~485~~.546	25 0.~~485~~.546	26 0.~~485~~.546	27 0.~~485~~.546	28 0.~~344~~.387	
29 0.~~344~~.387	30 0.~~344~~.387	31 0.~~485~~.546	32 0.~~485~~.546	33 0.3~~44~~387	34 0.3~~44~~387	35 0.3~~44~~387	36 0.~~485~~.546	37 0.~~485~~.546	38 0.~~344~~.387	39 0.~~344~~.387
40 0.~~344~~.387	41 0.~~485~~.546	42 0.~~485~~.546	43 0.~~485~~.546	44 0.3~~44~~387	45 0.3~~44~~387	46 0.3~~44~~387	47 0.~~485~~.546	48 0.~~485~~.546	49 0.~~485~~.546	50 0.~~344~~.387
51 0.~~344~~.387	52 0.~~344~~.387	53 0.~~485~~.546	54 0.~~485~~.546	55 0.3~~44~~387	56 0.3~~44~~387	57 0.3~~44~~387	58 0.~~485~~.546	59 0.~~485~~.546	60 0.~~344~~.387	61 0.~~344~~.387
	62 0.~~344~~.387	63 0.~~485~~.546	64 0.~~485~~.546	65 0.~~485~~.546	66 0.~~485~~.546	67 0.~~485~~.546	68 0.~~485~~.546	69 0.~~485~~.546	70 0.~~344~~.387	
	71 0.~~344~~.387	72 0.~~344~~.387	73 0.~~485~~.546	74 0.~~485~~.546	75 0.~~485~~.546	76 0.~~485~~.546	77 0.~~485~~.546	78 0.~~344~~.387	79 0.~~344~~.387	
		80 0.~~344~~.387	81 0.~~344~~.387	82 0.~~344~~.387	83 0.~~485~~.546	84 0.~~344~~.387	85 0.~~344~~.387	86 0.~~344~~.387		
				87 0.~~344~~.387	88 0.~~344~~.387	89 0.~~344~~.387				

Legend

Cell ID
Heat Load, kW

Figure 2.3-113
HI-STORM UMAX MPC-89 Permissible Heat Load for Helium Backfill Option 2 in Table 3-2 of Appendix A

		1	2	3		
		0.97	0.97	0.97		
	4	5	6	7	8	
	0.97	0.97	0.97	0.97	0.97	
9	10	11	12	13	14	15
0.97	0.97	0.87	0.78	0.87	0.97	0.97
16	17	18	19	20	21	22
0.97	0.97	0.87	0.87	0.78	0.97	0.97
23	24	25	26	27	28	29
0.97	0.97	0.78	0.78	0.78	0.97	0.97
	30	31	32	33	34	
	0.97	0.97	0.97	0.97	0.97	
		35	36	37		
		0.97	0.97	0.97		

Legend

Cell ID
Heat Load, kW

Figure 2.3-142
HI-STORM UMAX MPC-37 Permissible Threshold Heat Load for VDS High Burnup Fuel in Table 3-1 of Appendix A and Helium Backfill Option 3 in Table 3-2 of Appendix A

				1	2	3				
				0.44	0.44	0.44				
		4	5	6	7	8	9	10		
		0.44	0.44	0.44	0.35	0.44	0.44	0.44		
	11	12	13	14	15	16	17	18	19	
	0.44	0.44	0.35	0.35	0.35	0.35	0.35	0.44	0.44	
	20	21	22	23	24	25	26	27	28	
	0.44	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.44	
29	30	31	32	33	34	35	36	37	38	39
0.44	0.44	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.44	0.44
40	41	42	43	44	45	46	47	48	49	50
0.44	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.44
51	52	53	54	55	56	57	58	59	60	61
0.44	0.44	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.44	0.44
	62	63	64	65	66	67	68	69	70	
	0.44	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.44	
	71	72	73	74	75	76	77	78	79	
	0.44	0.44	0.35	0.35	0.35	0.35	0.35	0.44	0.44	
		80	81	82	83	84	85	86		
		0.44	0.44	0.44	0.35	0.44	0.44	0.44		
				87	88	89				
				0.44	0.44	0.44				

Legend

Cell ID
Heat Load, kW

Figure 2.3-13~~5~~
HI-STORM UMAX MPC-89 Permissible Threshold Heat Load for VDS High Burnup Fuel in Table 3-1 of Appendix A and Helium Backfill Option 2 in Table 3-2 of Appendix A

3.0 DESIGN FEATURES

3.1 Site

3.1.1 Site Location

The HI-STORM UMAX Canister Storage 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-37

1. Basket cell ID: 8.92 in. (min. nominal)
2. Basket cell wall thickness: 0.57 in. (min.nominal)
3. B_4C in the Metamic-HT: 10.0 wt % (min. nominal)

3.2.2 MPC-89

1. Basket cell ID: 5.99 in. (min.nominal)
2. Basket cell wall thickness: 0.38 in. (min.nominal)
3. B_4C in the Metamic-HT: 10.0 wt % (min. nominal)

3.2.3 Metamic-HT Test Requirements

1. The weight percentage of the boron carbide must be confirmed to be greater than or equal to 10% in each lot of Al/ B4C powder.
2. The areal density of the B-10 isotope corresponding to the 10% min. weight density in the manufactured Metamic HT panels shall be independently confirmed by the neutron attenuation test method by testing at least one coupon from a randomly selected panel in each lot.
3. If the B- 10 areal density criterion in the tested panel fails to meet the specified minimum, then the manufacturer has the option to reject the entire lot or to test a statistically significant number of panels and perform statistical analysis to show that the minimum areal density in the panels (that comprise the lot) is satisfied with 95% confidence.
4. All test procedures used in demonstrating compliance with the above requirements shall conform to the cask designer's QA

program which has been approved by the USNRC under docket number 71-0784.

3.3 Codes and Standards

The American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), 2007, is the governing Code for the HI-STORM UMAX system MPC as clarified in Specification 3.3.1 below, except for Code Sections V and IX. However, the HI-STORM UMAX VVM is structurally qualified per the newer 2010 ASME code. The ASME Code paragraphs applicable to the manufacturing of HI-STORM UMAX VVM and transfer cask 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 applicable edition (including addenda) specified above, is performed by the certificate holder. American Concrete Institute ACI-318 (2005) is the governing Code for both plain concrete and reinforced concrete as clarified in Chapter 3 of the Final Safety Analysis Report for the HI-STORM 100 UMAX System.

3.3.1 <u>Alternatives to Codes, Standards, and Criteria</u>

Table 3-1 lists approved alternatives to the ASME Code for the design of the MPCs of the HI-STORM UMAX Canister Storage System.

3.3.2 <u>Construction/Fabrication Alternatives to Codes, Standards, and Criteria</u>

Proposed alternatives to the ASME Code, Section III, 2007 Edition, 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
2. Compliance with the specified requirements of the ASME Code, Section III, 2007 Edition, 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)

3.0 DESIGN FEATURES (continued)

TABLE 3-1
List of ASME Code Alternatives for Multi-Purpose Canisters (MPCs)

MPC Enclosure Vessel	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.	Because the MPC is not an ASME Code stamped vessel, 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 MPCs 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. 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 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.
MPC Enclosure Vessel	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
List of ASME Code Alternatives for Multi-Purpose Canisters (MPCs)

MPC basket supports and lift lugs	NB-1130	NB-1132.2(d) requires that the first connecting weld of a non-pressure 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. 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.	The lugs 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 lug-to-Enclosure Vessel Weld is required to meet the stress limits of Reg. Guide 3.61 in lieu of Subsection NB of the Code.
MPC Enclosure Vessel	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.
MPC Enclosure Vessel	NB-3100 NF-3100	Provides requirements for determining design loading conditions, such as pressure, temperature, and mechanical loads.	These requirements are subsumed by the HI-STORM FW FSAR, serving as the Design Specification, which establishes the service conditions and load combinations for the storage system.
MPC Enclosure Vessel	NB-4120	NB-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.	In-shop operations of short duration that apply heat to a component, such as plasma cutting of plate stock, welding, machining, and coating are not, unless explicitly stated by the Code, defined as heat treatment operations.

TABLE 3-1
List of ASME Code Alternatives for Multi-Purpose Canisters (MPCs)

MPC Enclosure Vessel	NB-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 Enclosure Vessel	NB-4122	Implies that with the exception of studs, bolts, nuts and heat exchanger tubes, CMTRs must be traceable to a specific piece of material in a component.	MPCs are built in lots. Material traceability on raw materials to a heat number and corresponding CMTR is maintained by Holtec through markings on the raw material. Where material is cut or processed, markings are transferred accordingly to assure traceability. As materials are assembled into the lot of MPCs being manufactured, documentation is maintained to identify the heat numbers of materials being used for that item in the multiple MPCs being manufactured under that lot. A specific item within a specific MPC will have a number of heat numbers identified as possibly being used for the item in that particular MPC of which one or more of those heat numbers (and corresponding CMTRS) will have actually been used. All of the heat numbers identified will comply with the requirements for the particular item.
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.

TABLE 3-1
List of ASME Code Alternatives for Multi-Purpose Canisters (MPCs)

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. Vent and drain port cover plate welds are helium leakage tested.
MPC Lid to Shell Weld	NB-5230	Radiographic (RT) or ultrasonic (UT) examination required.	Only progressive liquid penetrant (PT) examination is permitted. PT examination will include the root and final weld layers and each approx. 3/8" of weld depth.
MPC Enclosure Vessel and Lid	NB-6111	All completed pressure retaining systems shall be pressure tested.	The MPC vessel is welded in the field following fuel assembly loading. After the lid to shell weld is completed, the MPC shall then be pressure tested as defined in Chapter 10. Accessibility for leakage inspections precludes a Code compliant pressure test. Since the shell welds of the MPC cannot be checked for leakage during this pressure test, the shop leakage test to 10^{-7} ref cc/sec provides reasonable assurance as to its leak tightness. All MPC enclosure vessel welds (except closure ring and vent/drain cover plate) are inspected by volumetric examination. The MPC lid-to-shell weld shall be verified by progressive PT examination. PT must include the root and final layers and each approximately 3/8 inch of weld depth. The inspection results, including relevant findings (indications) shall be made a permanent part of the user's records by video, photographic, of other means which provide an equivalent 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.

TABLE 3-1
List of ASME Code Alternatives for Multi-Purpose Canisters (MPCs)

MPC Enclosure Vessel	NB-7000	Vessels are required to have overpressure protection.	No overpressure protection is provided. Function of MPC enclosure vessel is to contain radioactive contents under normal, off-normal, and accident conditions of storage. 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-STORM UMAX 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.

Table 3-2
REFERENCE ASME CODE PARAGRAPHS FOR VVM PRIMARY LOAD BEARING PARTS

	Item	Code Paragraph [2.6.1]	Explanation and Applicability
1.	Definition of primary and secondary members	NF-1215	-
2.	Jurisdictional boundary	NF-1133	The VVM's jurisdictional boundary is defined by the bottom surface of the SFP, the top surface of the ISFSI pad and the SES side surfaces.
3.	Certification of material(structural)	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.	Welding procedure	Section IX	-
7.	Welding material	Section II	-
8.	Loading conditions	NF-3111	-
9.	Allowable stress values	NF-3112.3	-
10.	Rolling and sliding supports	NF-3424	-
11.	Differential thermal expansion	NF-3127	-
12.	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 Container Shell, respectively.
13.	Cutting of plate stock	NF-4211 NF-4211.1	-
14.	Forming	NF-4212	-
15.	Forming tolerance	NF-4221	Applies to the Container Shell
16.	Fitting and Aligning Tack Welds	NF-4231 NF-4231.1	-
17.	Alignment	NF-4232	-
18.	Storage of Welding Materials	NF-4411	-
19.	Cleanliness of Weld Surfaces	NF-4412	Applies to structural and non-structural welds

Table 3-2
REFERENCE ASME CODE PARAGRAPHS FOR VVM PRIMARY LOAD BEARING PARTS

	Item	Code Paragraph [2.6.1]	Explanation and Applicability
20.	Backing Strips, Peening	NF-4421 NF-4422	Applies to structural and non-structural welds
21.	Pre-heating and Interpass Temperature	NF-4611 NF-4612 NF-4613	Applies to structural and non-structural welds
22.	Non-Destructive Examination	NF-5360	Invokes Section V
23.	NDE Personnel Certification	NF-5522 NF-5523 NF-5530	-

3.0 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. The resultant zero period acceleration at the top of the grade and at the elevation of the Support Foundation Pad (SFP) at the host site (computed by the Newmark's rule as the sum of A+0.4*B+0.4*C, where A, B, C denote the free field ZPA's in the three orthogonal directions in decreasing magnitude, i.e., $A \geq B \geq C$) shall be less than or equal to 1.3 and 1.214, respectively.
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 based on site-specific considerations. The user shall demonstrate that the site-specific potential for fire is bounded by the fire conditions analyzed by the Certificate Holder, or an analysis of the site-specific fire considerations shall be performed.
6. The moment and shear capacities of the ISFSI Structures shall meet the structural requirements under the load combinations in Table 3.4-1.
7. Radiation Protection Space (RPS) as defined in Subsection 5.3.9 of Appendix A, is intended to ensure that the subgrade material in and around the lateral space occupied by the VVMs remains essentially intact under all service conditions including during an excavation activity adjacent to the RPS.
8. The SFP for a VVM array established in any one construction campaign shall be of monolithic construction, to the extent practicable, to maximize the physical stability of the underground installation.
9. Excavation activities contiguous to a loaded ISFSI on the side facing the excavation can occur down to the depth of the bottom surface of the SFP of the loaded ISFSI considering that there may be minor variations in the depth due to normal construction practices. For all other excavation activities the site-specific seismic analysis performed to demonstrate the stability of the RPS boundary and structural integrity of the ISFSI structure shall be submitted to Holtec International to be incorporated in an amendment request for NRC review and approval prior to any excavation taking place.

10. 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.

11. LOADING OPERATIONS, TRANSPORT OPERATIONS, and UNLOADING OPERATIONS shall only be conducted with working area Ambient Temperature $\geq 0^{\circ}$ F.

12. For those users whose site-specific design basis includes an event or events (e.g., flood) that result in the blockage of any VVM 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.

13. Users shall establish procedural and/or mechanical barriers to ensure that during LOADING OPERATIONS and UNLOADING OPERATIONS, either the fuel cladding is covered by water, or the MPC is filled with an inert gas.

14. The entire haul route shall be evaluated to ensure that the route can support the weight of the loaded transfer cask and its conveyance.

15. The loaded transfer cask and its conveyance shall be evaluated to ensure, under the site specific Design Basis Earthquake, that the cask and its conveyance does not tipover or slide off the haul route.

(continued)

DESIGN FEATURES (continued)

Table 3-3
LOAD COMBINATIONS FOR THE TOP SURFACE PAD, ISFSI PAD, AND SUPPORT FOUNDATION PAD PER ACI-318 (2005)

Load Combination Case	Load Combination
LC-1	1.4D
LC-2	1.2D + 1.6L
LC-3	1.2D + E + L

where:
D: Dead Load including long-term differential settlement effects.
L: Live Load
E: DBE for the Site

DESIGN FEATURES (continued)

Table 3-4
Values of Principal Design Parameters for the Underground ISFSI

Thickness of the Support Foundation Pad, inch (nominal)	≥33
Thickness of the ISFSI Pad, inch (nominal)	≥34
Thickness of the Top Surface Pad, inch (nominal)	≥30
Rebar Size* (min.) and Layout* (max)	#11 @ 9" each face, each direction
Rebar Concrete Cover (top and bottom)*, inch	per 7.7.1 of ACI-318 (2005)
Compressive Strength of Concrete at ≤28 days*, psi	≥4500
Compressive Strength of Self-hardening Engineered Subgrade (SES), psi	≥1,000
Lower Bound Shear Wave Velocity in the Subgrade lateral to the VVM (Figure 3-1 Space A), fps**	≥1,300
Depth Averaged Density of subgrade in Space A. (Figure 3-1)[1]	120
Depth Averaged Density of subgrade in Space B. (Figure 3-1)[1]	110
Depth Averaged Density of subgrade in Space C. (Figure 3-1)[2]	120
Depth Averaged Density of subgrade in Space D. (Figure 3-1)[3]	120
Lower Bound Shear Wave Velocity in the Subgrade below the Support Foundation Pad (Figure 3-1 Space C & D), fps**	≥485
Lower Bound Shear Wave Velocity in the Subgrade laterally surrounding the ISFSI (Figure 3-1 Space B), fps**	≥450

* Applies to Support Foundation Pad and ISFSI Pad.

** Strain compatible effective shear wave velocities shall be computed using the guidance provided in Section 16 of the International Building Code, 2009 Edition. Users must account for potential variability in the subgrade shear wave velocity in accordance with Section 3.7.2 of NUREG-0800.

Notes:

1. A lower average density value may be used in shielding analysis per FSAR Chapter 5 for conservatism.
2. Not required for shielding.
3. This space will typically contain native soil. Not required for shielding.

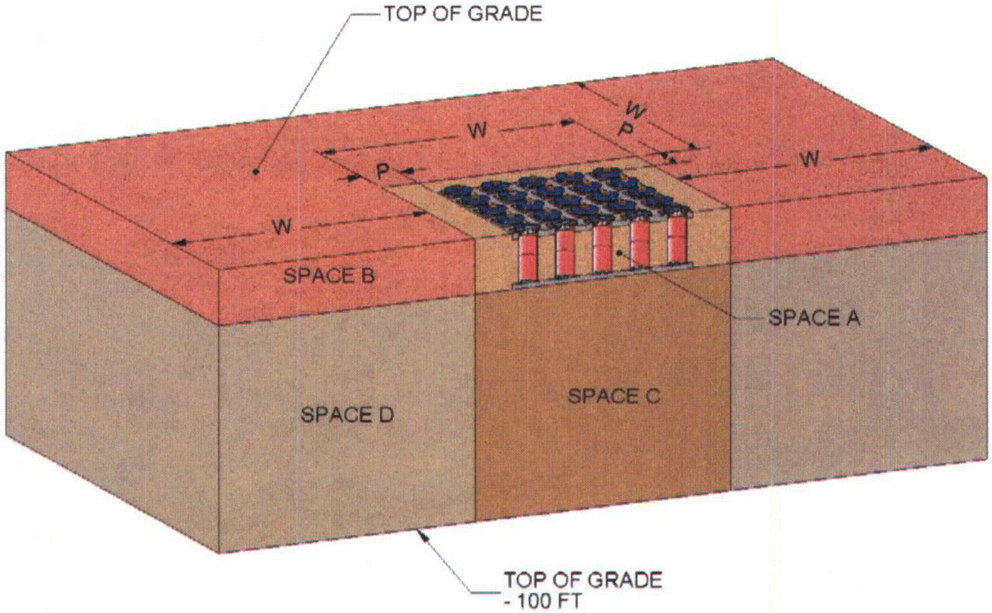

Figure 3-1 - SUBGRADE AND UNDERGRADE SPACE NOMENCLATURE

3.0 DESIGN FEATURES (continued)

3.5 Combustible Gas Monitoring During MPC Lid Welding and Cutting

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

3.6 Periodic Corrosion Inspections for Underground Systems

HI-STORM UMAX 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 or an equivalent method shall be used to measure CEC shell wall thickness to determine the extent of metal loss from corrosion. 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.