RENEWED CERTIFICATE OF COMPLIANCE NO. 1008

APPENDIX B

APPROVED CONTENTS AND DESIGN FEATURES

FOR THE HI-STAR 100 CASK SYSTEM

AMENDMENT 1

TABLE OF CONTENTS

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REVISION HISTORY

Amendment	Section	Change Description
1	Throughout	Editorial changes and typographical corrections.
	1.0	Revised definitions of DAMAGED FUEL ASSEMBLY, DAMAGED FUEL CONTAINER, and PLANAR-AVERAGE INITIAL ENRICHMENT.
	1.1	Revised Section 1.1.1 to permit storage of certain non-fuel hardware.
	1.4	Revised Item 6 to clarify the requirements for cask storage pad.
	1.5	Revised Section 1.5.2 to replace the term “painted surface of” with “paint used on.”
	Table 1.1-1	Added limits for non-fuel hardware (BPRAs and TPDs), array class 8x8F, and Thoria Rods.
	Table 1.1-2	Revised certain fuel assembly parameters, added array/class 15x15H fuel assembly, and added clarifying notes.
	Table 1.1-3	Revised certain fuel assembly parameters, added array/class 8x8F fuel assembly, and added clarifying notes.
	Tables 1.1-4 and 1.1-5	Revised to clarify limits, reflect addition of BPRAs and TPDs, and permit linear interpolation between points.
	Table 1.1-6	Added table specifying cooling and average burnup limits for non-fuel hardware.
	Table 1.3-1	Added exception to ASME Code NB-5230 for the MPC lid-to-shell weld and added clarifying text.

APPENDIX B DESIGN FEATURES

1.0 Definitions

---Note ---
The defined terms of this section appear in capitalized type and are applicable throughout this Appendix.

Term	Definition
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, missing fuel rods that are not replaced with dummy fuel rods, or those that cannot be handled by normal means. Fuel assemblies which 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-STAR 100 design are shown in Figures 2.1.1 and 2.1.2 of the Final Safety Analysis Report (SAR) for the HI-STAR 100 Cask System.
FUEL DEBRIS	FUEL DEBRIS is ruptured fuel rods, severed rods, loose fuel pellets or fuel assemblies with known or suspected defects which cannot be handled by normal means due to fuel cladding damage.
INTACT FUEL ASSEMBLY	INTACT FUEL ASSEMBLIES are fuel assemblies without known or suspected cladding defects greater than pinhole leaks or hairline cracks and which can be handled by normal means. Partial fuel assemblies, that is fuel assemblies from which fuel rods are missing, shall not be classified as INTACT FUEL ASSEMBLIES unless dummy fuel rods are used to displace an amount of water greater than or equal to that displaced by the original fuel rod(s).
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.

1.1 Fuel Specifications

1.1.1 Fuel To Be Stored In The HI-STAR 100 SFSC

1. INTACT FUEL ASSEMBLIES, DAMAGED FUEL ASSEMBLIES, FUEL DEBRIS, and certain non-fuel hardware meeting the limits specified in Table 1.1-1 (which refers to Tables 1.1-2 through 1.1-6) may be stored in the HI-STAR 100 SFSC System.

2. For MPCs partially loaded with stainless steel clad fuel assemblies, all remaining fuel assemblies in the MPC shall meet the maximum decay heat generation limit for the stainless steel clad fuel assemblies.

3. For MPCs partially loaded with DAMAGED FUEL ASSEMBLIES or FUEL DEBRIS, all remaining Zircaloy clad INTACT FUEL ASSEMBLIES in the MPC shall meet the maximum decay heat generation limits for the DAMAGED FUEL ASSEMBLIES.

4. For MPC-68's partially loaded with array/class 6x6A, 6x6B, 6x6C, or 8x8A fuel assemblies, all remaining Zircaloy clad INTACT FUEL ASSEMBLIES in the MPC shall meet the maximum decay heat generation limits for the 6x6A, 6x6B, 6x6C, and 8x8A fuel assemblies.

1.1.2 Preferential Fuel Loading

Preferential fuel loading shall be used whenever fuel assemblies with significantly different post-irradiation cooling times (equal to or greater than one year) are to be loaded in the same MPC. That is, fuel assemblies with the longest post-irradiation cooling times shall be loaded into fuel storage locations at the periphery of the basket. Fuel assemblies with shorter post-irradiation cooling times shall be placed toward the center of the basket.

1.2 Functional and Operating Limits Violations

If any Fuel Specifications defined in Section 1.1 are violated, the following actions shall be completed:

1. The affected fuel assemblies shall be placed in a safe condition without delay and in a controlled manner.

2. Within 24 hours, notify the NRC Operations Center.

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

The above actions are not a substitute for the reporting requirements ontained in 10 CFR 72.75.

1.3 Codes and Standards

The American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), 1995 Edition with Addenda through 1997, is the governing Code for the HI-STAR 100 Cask System, as clarified in Specification 1.3.1 below.

1.3.1 Exceptions to Codes, Standards, and Criteria

Table1.3-1 lists approved exceptions to the ASME Code for the design of the HI-STAR 100 Cask System.

1.3.2 Construction/Fabrication Exceptions to Codes, Standards, and Criteria

Proposed alternatives to the ASME Code, Section III, 1995 Edition with Addenda through 1997 including exceptions allowed by Specification 1.3.1 may be used 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, 1995 Edition with Addenda through 1997, would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

   Requests for exceptions shall be submitted in accordance with 10 CFR 72.4

1.4 Site Specific Parameters and Analyses

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

1. The temperature of 80^{o} F is the maximum allowed average yearly temperature.

2. The allowed temperature extremes, averaged over a three day period, shall be greater than -40^{o} F and less than 125^{o} F.

3. The horizontal and vertical seismic acceleration levels are bounded by the values listed below in Table 1-4.

Table 1-4

Design-Basis Earthquake Input on the Top Surface of an ISFSI Pad

Horizontal g-Level in Each of Two Orthogonal Directions	Horizontal g-Level Vector Sum	Corresponding Vertical g-Level (Upward)
0.222 g	0.314 g	1.00 x 0.222 g = 0.222 g
0.235 g	0.332 g	0.75 x 0.235 g = 0.176 g
0.24 g	0.339 g	0.667 x 0.24 g = 0.160 g
0.25 g	0.354 g	0.500 x 0.25 g = 0.125 g

4. The analyzed flood condition of 13 fps water velocity and a height of 656 feet of water (full submergence of the loaded cask) are not exceeded.

5. The potential for fire and explosion shall be addressed, based on site-specific considerations. This includes the condition that the on-site transporter fuel tank will contain no more than 50 gallons of combustible transporter fuel.

6. In addition to the requirements of 10CFR72.212(b)(2)(ii), the cask storage pads and foundation shall include the following characteristics as applicable to the drop and tipover analyses:

   a. Concrete Thickness: $\leq$ 36 inches

   b. Concrete Compressive Strength: $\leq$ 4,200 psi at 28 days

   c. Reinforcement top and bottom (both directions):
      Reinforcement area and spacing determined by analysis
      Reinforcement shall be 60 ksi yield strength ASTM material

   d. Soil Effective Modulus of Elasticity: $\leq$ 28,000 psi
      (measured prior to installation of ISFSI)

      An acceptable method of defining the soil effective modulus of elasticity applicable to the drop and tipover analyses is provided in Table 13 of NUREG/CR-6608 with soil classification in accordance with ASTM D2487-93, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System, USCS), and density determination in accordance with ASTM D1586-84, Standard Test Method for Penetration Test and Split/Barrel Sampling of Soils.

7. In cases where engineered features (i.e., berms, 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.

1.5 Design Specifications

1.5.1 Specifications Important for Criticality Control

1.5.1.1 MPC-24

1. Minimum flux trap size: 1.09 in.

2. Minimum ^{10}B loading in the Boral neutron absorbers: 0.0267 g/cm^2

1.5.1.2 MPC-68 and MPC-68F

1. Minimum fuel cell pitch: 6.43 in.

2. Minimum ^{10}B loading in the Boral neutron absorbers: 0.0372 g/cm^2 in the MPC-68, and 0.01 g/cm^2 in the MPC-68F.

1.5.2 Specifications Important for Thermal Performance

1.5.2.1 OVERPACK

The paint used on the HI-STAR 100 OVERPACK must have an emissivity no less than 0.85.

I. MPC MODEL: MPC-24

A. Allowable Contents

1. Uranium oxide, PWR INTACT FUEL ASSEMBLIES, with or without Burnable Poison Rods (BPRAs) or Thimble Plug Devices (TPDs) listed in Table 1.1-2, and meeting the following specifications:

a. Cladding type:	Zircaloy (Zr) or stainless steel (SS) as specified in Table 1.1-2 for the applicable fuel assembly array/ class
b. Initial enrichment:	As specified in Table 1.1-2 for the applicable fuel assembly array/class.
c. Decay heat per assembly	
i. Zr Clad:	An assembly decay heat as specified in Table 1.1-4 for the applicable post-irradiation cooling time.
ii. SS Clad	≤ 575 watts
d. Post-irradiation cooling time and average burnup per assembly	
i. Zr clad:	An assembly post-irradiation cooling time and average burnup as specified in Table 1.1-5. BPRA and TPD post-irradiation cooling time and average burnup as specified in Table 1.1.6.
ii. SS clad:	An assembly post-irradiation cooling time ≥ 9 years and an average burnup ≤ 30,000 MWD/MTU. OR An assembly post-irradiation cooling time ≥ 15 years and an average burnup ≤ 40,000 MWD/MTU.
e. Nominal fuel assembly length:	≤ 176.8 inches
f. Nominal fuel assembly width:	≤ 8.54 inches
g. Fuel assembly weight:	≤ 1,680 lbs (including non-fuel hardware)

I. MPC MODEL: MPC-24 (continued)

B. Quantity per MPC: Up to 24 PWR fuel assemblies.

C. Fuel assemblies shall not contain control components except as specifically authorized by this certificate of compliance. BPRAs and TPDs are authorized for loading in the HI-STAR 100 System with their associated fuel assemblies provided the burnup and cooling time limits specified in Table 1.1-6 are met.

D. DAMAGED FUEL ASSEMBLIES and FUEL DEBRIS are not authorized for loading into the MPC-24.

Table 1.1-1 (Page 3 of 16)
Fuel Assembly Limits

II. MPC MODEL: MPC-68

A. Allowable Contents

1. Uranium oxide, BWR INTACT FUEL ASSEMBLIES listed in Table 1.1-3, with or without Zircaloy channels, and meeting the following specifications:

a. Cladding type:	Zircaloy (Zr) or stainless steel (SS) as specified in Table 1.1-3 for the applicable fuel assembly array/ class.
b. Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for the applicable fuel assembly array/class.
c. Initial maximum rod enrichment:	As specified in Table 1.1-3 for the applicable fuel assembly array/class.
d. Decay heat per assembly	
i. Zr clad	An assembly decay heat as specified in Table 1.1-4 for the applicable post-irradiation cooling time, except for (1) array/class 6x6A, 6x6C, and 8x8A fuel assemblies, which shall have a decay heat $\leq$ 115 watts and (2) array/class 8x8F fuel assemblies, which shall have a decay heat $\leq$ 183.5 watts.
ii. SS clad	$\leq$ 95 watts
e. Post-irradiation cooling time, average burnup per assembly:	
i. Zr clad:	An assembly post-irradiation cooling time and average burnup as specified in Table 1.1-5, except for (1) array/class 6x6A, 6x6C, and 8x8A fuel assemblies, which shall have a cooling time $\geq$ 18 years, an average burnup $\leq$ 30,000 MWD/MTU, and (2) array/class 8x8F fuel assemblies, which shall have a cooling time $\geq$ 10 years, an average burnup $\leq$ 27,500 MWD/MTU.
ii. SS clad:	An assembly cooling time after discharge $\geq$ 10 years, an average burnup $\leq$ 22,500 MWD/MTU.
e. Nominal fuel assembly length:	$\leq$ 176.2 inches
f. Nominal fuel assembly width:	$\leq$ 5.85 inches
g. Fuel assembly weight	$\leq$ 700 lbs, including channels

Table 1.1-1 (Page 4 of 16)
Fuel Assembly Limits

II. MPC MODEL: MPC-68 (continued)

A. Allowable Contents (continued)

2. Uranium oxide, BWR DAMAGED FUEL ASSEMBLIES, with or without Zircaloy channels, placed in DAMAGED FUEL CONTAINERS. BWR DAMAGED FUEL ASSEMBLIES shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6A, 6x6C, 7x7A, or 8x8A, and meet the following specifications:

a. Cladding type:	Zircaloy (Zr)
b. Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for the applicable fuel assembly array/class.
c. Initial maximum rod enrichment:	As specified in Table 1.1-3 for the applicable fuel assembly array/class.
d. Decay heat per assembly	$\leq$ 115 watts
e. Post-irradiation cooling time and average burnup per assembly:	An assembly post-irradiation cooling time $\geq$ 18 years and an average burnup $\leq$ 30,000 MWD/MTU.
f. Nominal fuel assembly length:	$\leq$ 135.0 inches
g. Nominal fuel assembly width:	$\leq$ 4.70 inches
h. Fuel assembly weight	$\leq$ 400 lbs, including channels

II. MPC MODEL: MPC-68 (continued)

A. Allowable Contents (continued)

3. Mixed oxide (MOX), BWR INTACT FUEL ASSEMBLIES, with or without Zircaloy channels. MOX BWR INTACT FUEL ASSEMBLIES shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6B, and meet the following specifications:

a. Cladding type:	Zircaloy (Zr)
b. Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for fuel assembly array/class 6x6B.
c. Initial maximum rod enrichment:	As specified in Table 1.1-3 for fuel assembly array/class 6x6B.
d. Decay heat per assembly	$\leq$ 115 watts
e. Post-irradiation cooling time and average burnup per assembly:	An assembly post-irradiation cooling time $\geq$ 18 years and an average burnup $\leq$ 30,000 MWD/MTIHM.
f. Nominal fuel assembly length:	$\leq$ 135.0 inches
g. Nominal fuel assembly width:	$\leq$ 4.70 inches
h. Fuel assembly weight	$\leq$ 400 lbs, including channels

II. MPC MODEL: MPC-68 (continued)

A. Allowable Contents (continued)

4. Mixed oxide (MOX), BWR DAMAGED FUEL ASSEMBLIES, with or without Zircaloy channels, placed in DAMAGED FUEL CONTAINERS. MOX BWR DAMAGED FUEL ASSEMBLIES shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6B, and meet the following specifications:

a. Cladding type:	Zircaloy (Zr)
b. Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for array/class 6x6B.
c. Initial maximum rod enrichment:	As specified in Table 1.1-3 for array/class 6x6B.
d. Decay heat per assembly	≤ 115 watts
e. Post-irradiation cooling time and average burnup per assembly:	An assembly post-irradiation cooling time ≥ 18 years and an average burnup ≤ 30,000 MWD/MTIHM.
f. Nominal fuel assembly length:	≤ 135.0 inches
g. Nominal fuel assembly width:	≤ 4.70 inches
h. Fuel assembly weight	≤ 400 lbs, including channels

II. MPC MODEL: MPC-68 (continued)

A. Allowable Contents (continued)

5. Thoria rods (ThO_2 and UO_2) placed in Dresden Unit 1 Thoria Rod Canisters (as shown in Figure 2.1.2A of the SAR) and meeting the following specifications:

a. Cladding type:	Zircaloy (Zr)
b. Composition:	98.2 wt.% ThO_2, 1.8 wt. % UO_2 with an enrichment of 93.5 wt. % ^{235}U.
c. Number of rods per Thoria Rod Canister:	$\leq$ 18
d. Decay heat per Thoria Rod Canister:	$\leq$ 115 Watts
e. Post-irradiation fuel cooling time and average burnup per Thoria Rod Canister:	A fuel post-irradiation cooling time $\geq$ 18 years and an average burnup $\leq$ 16,000 MWD/MTIHM.
f. Initial heavy metal weight:	$\leq$ 27 kg/canister
g. Nominal fuel cladding O.D.:	$\geq$ 0.412 inches
h. Nominal fuel cladding I.D.:	$\leq$ 0.362 inches
i. Nominal fuel pellet O.D.:	$\leq$ 0.358 inches
j. Nominal active fuel length:	$\leq$ 111 inches
k. Canister weight:	$\leq$ 550 lbs, including fuel

II. MPC MODEL: MPC-68 (continued)

B. Quantity per MPC: Up to one (1) Dresden Unit 1 Thoria Rod Canister plus any combination of DAMAGED FUEL ASSEMBLIES in DAMAGED FUEL CONTAINERS and INTACT FUEL ASSEMBLIES, up to a total of 68.

C. Fuel assemblies with stainless steel channels are not authorized for loading in the MPC-68.

D. Dresden Unit 1 fuel assemblies (fuel assembly array/class 6x6A, 6x6B, 6x6C, or 8x8A) with one Antimony-Beryllium neutron source are authorized for loading in the MPC-68. The Antimony-Beryllium source material shall be in a water rod location.

III. MPC MODEL: MPC-68F

A. Allowable Contents

1. Uranium oxide, BWR INTACT FUEL ASSEMBLIES, with or without Zircaloy channels. BWR INTACT FUEL ASSEMBLIES shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6A, 6x6C, 7x7A, or 8x8A and meet the following specifications:

a.	Cladding type:	Zircaloy (Zr)
b.	Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for the applicable fuel assembly array/class.
c.	Initial maximum rod enrichment:	As specified in Table 1.1-3 for the applicable fuel assembly array/class.
d.	Decay heat per assembly	$\leq$ 115 watts
e.	Post-irradiation cooling time and average burnup per assembly:	An assembly post-irradiation cooling time $\geq$ 18 years and an average burnup $\leq$ 30,000 MWD/MTU.
f.	Nominal fuel assembly length:	$\leq$ 176.2 inches
g.	Nominal fuel assembly width:	$\leq$ 5.85 inches
h.	Fuel assembly weight	$\leq$ 700 lbs, including channels

III. MPC MODEL: MPC-68F (continued)

A. Allowable Contents (continued)

2. Uranium oxide, BWR DAMAGED FUEL ASSEMBLIES, with or without Zircaloy channels, placed in DAMAGED FUEL CONTAINERS. BWR DAMAGED FUEL ASSEMBLIES shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6A, 6x6C, 7x7A, or 8x8A, and meet the following specifications:

a.	Cladding type:	Zircaloy (Zr)
b.	Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for the applicable fuel assembly array/class.
c.	Initial maximum rod enrichment:	As specified in Table 1.1-3 for the applicable fuel assembly array/class.
d.	Decay heat per assembly	$\leq$ 115 watts
e.	Post-irradiation cooling time and average burnup per assembly:	A post-irradiation cooling time after discharge $\geq$ 18 years and an average burnup $\leq$ 30,000 MWD/MTU.
f.	Nominal fuel assembly length:	$\leq$ 135.0 inches
g.	Nominal fuel assembly width:	$\leq$ 4.70 inches
h.	Fuel assembly weight	$\leq$ 400 lbs, including channels

Table 1.1-1 (Page 11 of 16)
Fuel Assembly Limits

III. MPC MODEL: MPC-68F (continued)

A. Allowable Contents (continued)

3. Uranium oxide, BWR FUEL DEBRIS, with or without Zircaloy channels, placed in DAMAGED FUEL CONTAINERS. The original fuel assemblies for the uranium oxide BWR FUEL DEBRIS shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6A, 6x6C, 7x7A, or 8x8A, and meet the following specifications:

a.	Cladding type:	Zircaloy (Zr)
b.	Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for the applicable original fuel assembly array/class.
c.	Initial maximum rod enrichment:	As specified in Table 1.1-3 for the applicable original fuel assembly array/class.
d.	Decay heat per DFC:	$\leq$ 115 watts
e.	Post-irradiation cooling time and average burnup per assembly:	A post-irradiation cooling time after discharge $\geq$ 18 years and an average burnup $\leq$ 30,000 MWD/MTU for the original fuel assembly.
f.	Nominal original fuel assembly length:	$\leq$ 135.0 inches
g.	Nominal original fuel assembly width:	$\leq$ 4.70 inches
h.	Fuel debris weight	$\leq$ 400 lbs, including channels

III. MPC MODEL: MPC-68F (continued)

A. Allowable Contents (continued)

4. Mixed oxide(MOX), BWR INTACT FUEL ASSEMBLIES, with or without Zircaloy channels. MOX BWR INTACT FUEL ASSEMBLIES shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6B, and meet the following specifications:

a. Cladding type:	Zircaloy (Zr)
b. Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for fuel assembly array/class 6x6B.
c. Initial maximum rod enrichment:	As specified in Table 1.1-3 for fuel assembly array/class 6x6B.
d. Decay heat per assembly	$\leq$ 115 watts
e. Post-irradiation cooling time and average burnup per assembly:	An assembly post-irradiation cooling time after discharge $\geq$ 18 years and an average burnup $\leq$ 30,000 MWD/MTIHM.
f. Nominal fuel assembly length:	$\leq$ 135.0 inches
g. Nominal fuel assembly width:	$\leq$ 4.70 inches
h. Fuel assembly weight	$\leq$ 400 lbs, including channels

III. MPC MODEL: MPC-68F (continued)

A. Allowable Contents (continued)

5. Mixed oxide (MOX), BWR DAMAGED FUEL ASSEMBLIES, with or without Zircaloy channels, placed in DAMAGED FUEL CONTAINERS. MOX BWR INTACT FUEL ASSEMBLIES shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6B, and meet the following specifications:

a.	Cladding type:	Zircaloy (Zr)
b.	Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for array/class 6x6B.
c.	Initial maximum rod enrichment:	As specified in Table 1.1-3 for array/class 6x6B.
d.	Decay heat per assembly	$\leq$ 115 watts
e.	Post-irradiation cooling time and average burnup per assembly:	A post-irradiation cooling time after discharge $\geq$ 18 years and an average burnup $\leq$ 30,000 MWD/MTIHM.
f.	Nominal fuel assembly length:	$\leq$ 135.0 inches
g.	Nominal fuel assembly width:	$\leq$ 4.70 inches
h.	Fuel assembly weight	$\leq$ 400 lbs, including channels

Table 1.1-1 (Page 14 of 16)
Fuel Assembly Limits

III. MPC MODEL: MPC-68F (continued)

A. Allowable Contents (continued)

6. Mixed oxide (MOX), BWR FUEL DEBRIS, with or without Zircaloy channels, placed in DAMAGED FUEL CONTAINERS. The original fuel assemblies for the MOX BWR FUEL DEBRIS shall meet the criteria specified in Table 1.1-3 for fuel assembly array/class 6x6B, and meet the following specifications:

a. Cladding type:	Zircaloy (Zr)
b. Maximum PLANAR-AVERAGE INITIAL ENRICHMENT:	As specified in Table 1.1-3 for original fuel assembly array/class 6x6B.
c. Initial maximum rod enrichment:	As specified in Table 1.1-3 for original fuel assembly array/class 6x6B.
d. Decay heat per DFC	$\leq$ 115 watts
e. Post-irradiation cooling time and average burnup per assembly:	A post-irradiation cooling time after discharge $\geq$ 18 years and an average burnup $\leq$ 30,000 MWD/MTIHM for the original fuel assembly.
f. Nominal original fuel assembly length:	$\leq$ 135.0 inches
g. Nominal original fuel assembly width:	$\leq$ 4.70 inches
h. Fuel debris weight	$\leq$ 400 lbs, including channels

III. MPC MODEL: MPC-68F (continued)

A. Allowable Contents (continued)

5. Thoria rods (ThO_2 and UO_2) placed in Dresden Unit 1 Thoria Rod Canisters (as shown in Figure 2.1.2A of the SAR) and meeting the following specifications:

a.	Cladding type:	Zircaloy (Zr)
b.	Composition:	98.2 wt.% ThO_2, 1.8 wt. % UO_2 with an enrichment of 93.5 wt. % ^{235}U.
c.	Number of rods per Thoria Rod Canister:	$\leq$ 18
d.	Decay heat per Thoria Rod Canister:	$\leq$ 115 Watts
e.	Post-irradiation fuel cooling time and average burnup per Thoria Rod Canister:	A fuel post-irradiation cooling time $\geq$ 18 years and an average burnup $\leq$ 16,000 MWD/MTIHM.
f.	Initial heavy metal weight:	$\leq$ 27 kg/canister
g.	Nominal fuel cladding O.D.:	$\geq$ 0.412 inches
h.	Nominal fuel cladding I.D.:	$\leq$ 0.362 inches
i.	Nominal fuel pellet O.D.:	$\leq$ 0.358 inches
j.	Nominal active fuel length:	$\leq$ 111 inches
k.	Canister weight:	$\leq$ 550 lbs, including fuel

III. MPC MODEL: MPC-68F (continued)

B. Quantity per MPC:

Up to four (4) DFCs containing uranium oxide or MOX BWR FUEL DEBRIS. The remaining MPC-68F fuel storage locations may be filled with array/class 6x6A, 6x6B, 6x6C, 7x7A, and 8x8A fuel assemblies of the following type, as applicable:

1. Uranium oxide BWR INTACT FUEL ASSEMBLIES;
2. MOX BWR INTACT FUEL ASSEMBLIES;
3. Uranium oxide BWR DAMAGED FUEL ASSEMBLIES placed in DFCs;
4. MOX BWR DAMAGED FUEL ASSEMBLIES placed in DAMAGED FUEL CONTAINERS; or
5. Up to one (1) Dresden Unit 1 Thoria Rod Canister.

C. Fuel assemblies with stainless steel channels are not authorized for loading in the MPC-68F.

D. Dresden Unit 1 fuel assemblies (fuel assembly array/class 6x6A, 6x6B, 6x6C or 8x8A) with one Antimony-Beryllium neutron source are authorized for loading in the MPC-68F. The antimony-Beryllium neutron source material shall be in a water rod location.

Table 1.1-2 (Page 1 of 4)
PWR FUEL ASSEMBLY CHARACTERISTICS (Note 1)

Fuel Assembly Array/Class	**14x14A**	**14x14B**	**14x14C**	**14x14D**	**15x15A**
Clad Material (Note 2)	Zr	Zr	Zr	SS	Zr
Design Initial U (kg/assy.) (Note 3)	≤ 407	≤ 407	≤ 425	≤ 400	≤ 464
Initial Enrichment (wt % ^{235}U)	≤ 4.6	≤ 4.6	≤ 4.6	≤ 4.0	≤ 4.1
No. of Fuel Rods (Note 5)	179	179	176	180	204
Clad O.D. (in.)	≥ 0.400	≥ 0.417	≥ 0.440	≥ 0.422	≥ 0.418
Clad I.D. (in.)	≤ 0.3514	≤ 0.3734	≤ 0.3880	≤ 0.3890	≤ 0.3660
Pellet Dia. (in.)	≤ 0.3444	≤ 0.3659	≤ 0.3805	≤ 0.3835	≤ 0.3580
Fuel Rod Pitch (in.)	≤ 0.556	≤ 0.556	≤ 0.580	≤ 0.556	≤ 0.550
Active Fuel Length (in.)	≤ 150	≤ 150	≤ 150	≤ 144	≤ 150
No. of Guide Tubes	17	17	5 (Note 4)	16	21
Guide Tube Thickness (in.)	≥ 0.017	≥ 0.017	≥ 0.038	≥ 0.0145	≥ 0.0165

Table 1.1-2 (Page 2 of 4)
PWR FUEL ASSEMBLY CHARACTERISTICS (Note 1)

Fuel Assembly Array/Class	**15x15B**	**15x15C**	**15x15D**	**15x15E**	**15x15F**
Clad Material (Note 2)	Zr	Zr	Zr	Zr	Zr
Design Initial U (kg/assy.) (Note 3)	≤ 464	≤ 464	≤ 475	≤ 475	≤ 475
Initial Enrichment (wt % ^{235}U)	≤ 4.1	≤ 4.1	≤ 4.1	≤ 4.1	≤ 4.1
No. of Fuel Rods (Note 5)	204	204	208	208	208
Clad O.D. (in.)	≥ 0.420	≥ 0.417	≥ 0.430	≥ 0.428	≥ 0.428
Clad I.D. (in.)	≤ 0.3736	≤ 0.3640	≤ 0.3800	≤ 0.3790	≤ 0.3820
Pellet Dia. (in.)	≤ 0.3671	≤ 0.3570	≤ 0.3735	≤ 0.3707	≤ 0.3742
Fuel Rod Pitch (in.)	≤ 0.563	≤ 0.563	≤ 0.568	≤ 0.568	≤ 0.568
Active Fuel Length (in.)	≤ 150	≤ 150	≤ 150	≤ 150	≤ 150
No. of Guide Tubes	21	21	17	17	17
Guide Tube Thickness (in.)	≥ 0.015	≥ 0.0165	≥ 0.0150	≥ 0.0140	≥ 0.0140

Table 1.1-2 (Page 3 of 4)
PWR FUEL ASSEMBLY CHARACTERISTICS (Note 1)

Fuel Assembly Array/ Class	**15x15G**	**15x15H**	**16x16A**	**17x17A**	**17x17B**	**17x17C**
Clad Material (Note 2)	SS	Zr	Zr	Zr	Zr	Zr
Design Initial U (kg/assy.) (Note 3)	≤ 420	≤ 475	≤ 443	≤ 467	≤ 467	≤ 474
Initial Enrichment (wt % ^{235}U)	≤ 4.0	≤ 3.8	≤ 4.6	≤ 4.0	≤ 4.0	≤ 4.0
No. of Fuel Rods (Note 5)	204	208	236	264	264	264
Clad O.D. (in.)	≥ 0.422	≥ 0.414	≥ 0.382	≥ 0.360	≥ 0.372	≥ 0.377
Clad I.D. (in.)	≤ 0.3890	≤ 0.3700	≤ 0.3320	≤ 0.3150	≤ 0.3310	≤ 0.3330
Pellet Dia. (in.)	≤ 0.3825	≤ 0.3622	≤ 0.3255	≤ 0.3088	≤ 0.3232	≤ 0.3252
Fuel Rod Pitch (in.)	≤ 0.563	≤ 0.568	≤ 0.506	≤ 0.496	≤ 0.496	≤ 0.502
Active Fuel Length (in.)	≤ 144	≤ 150	≤ 150	≤ 150	≤ 150	≤ 150
No. of Guide Tubes	21	17	5 (Note 4)	25	25	25
Guide Tube Thickness (in.)	≥ 0.0145	≥ 0.0140	≥ 0.0400	≥ 0.016	≥ 0.014	≥ 0.020

Table 1.1-2 (Page 4 of 4)
PWR FUEL ASSEMBLY CHARACTERISTICS (Note 1)

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. Zr. Designates cladding material made of Zirconium or Zirconium alloys.

3. Design initial uranium weight is the uranium weight specified for each assembly by the fuel manufacturer or reactor user. For each PWR fuel assembly, the total uranium weight limit specified in this table may be increased up to 2.0 percent for comparison with users' fuel records to account for manufacturer tolerances.

4. Each guide tube replaces four fuel rods.

5. Missing fuel rods must be replaced with dummy fuel rods that displace an equal or greater amount of water as the original fuel rods.

Table 1.1-3 (Page 1 of 5)
BWR FUEL ASSEMBLY CHARACTERISTICS (Note 1)

Fuel Assembly Array/Class	**6x6A**	**6x6B**	**6x6C**	**7x7A**	**7x7B**	**8x8A**
Clad Material (Note 2)	Zr	Zr	Zr	Zr	Zr	Zr
Design Initial U (kg/assy.) (Note 3)	≤ 110	≤ 110	≤ 110	≤ 100	≤ 195	≤ 120
Maximum PLANAR-AVERAGE INITIAL ENRICHMENT (wt.% ^{235}U)	≤ 2.7	≤ 2.7 for the UO_2 rods. See Note 4 for MOX rods	≤ 2.7	≤ 2.7	≤ 4.2	≤ 2.7
Initial Maximum Rod Enrichment (wt.% ^{235}U)	≤ 4.0	≤ 4.0	≤ 4.0	≤ 5.5	≤ 5.0	≤ 4.0
No. of Fuel Rods (Note 14)	35 or 36	35 or 36 (up to 9 MOX rods)	36	49	49	63 or 64
Clad O.D. (in.)	≥ 0.5550	≥ 0.5625	≥ 0.5630	≥ 0.4860	≥ 0.5630	≥ 0.4120
Clad I.D. (in.)	≤ 0.5105	≤ 0.4945	≤ 0.4990	≤ 0.4204	≤ 0.4990	≤ 0.3620
Pellet Dia. (in.)	≤ 0.4980	≤ 0.4820	≤ 0.4880	≤ 0.4110	≤ 0.4910	≤ 0.3580
Fuel Rod Pitch (in.)	≤ 0.710	≤ 0.710	≤ 0.740	≤ 0.631	≤ 0.738	≤ 0.523
Active Fuel Length (in.)	≤ 120	≤ 120	≤ 77.5	≤ 80	≤ 150	≤ 120
No. of Water Rods (Note 11)	1 or 0	1 or 0	0	0	0	1 or 0
Water Rod Thickness (in.)	≥ 0	≥ 0	N/A	N/A	N/A	≥ 0
Channel Thickness (in.)	≤ 0.060	≤ 0.060	≤ 0.060	≤ 0.060	≤ 0.120	≤ 0.100

Table 1.1-3 (Page 2 of 5)
BWR FUEL ASSEMBLY CHARACTERISTICS (Note 1)

Fuel Assembly Array/Class	**8x8B**	**8x8C**	**8x8D**	**8x8E**	**8x8F**	**9x9A**	**9x9B**
Clad Material (Note 2)	Zr	Zr	Zr	Zr	Zr	Zr	Zr
Design Initial U (kg/assy.) (Note 3)	≤ 185	≤ 185	≤ 185	≤ 185	≤ 185	≤ 177	≤ 177
Maximum PLANAR-AVERAGE INITIAL ENRICHMENT (wt.% ^{235}U)	≤ 4.2	≤ 4.2	≤ 4.2	≤ 4.2	< 3.6	≤ 4.2	≤ 4.2
Initial Maximum Rod Enrichment (wt.% ^{235}U)	≤ 5.0	≤ 5.0	≤ 5.0	≤ 5.0	≤ 5.0	≤ 5.0	≤ 5.0
No. of Fuel Rods (Note 14)	63 or 64	62	60 or 61	59	64	74/66 (Note 5)	72
Clad O.D. (in.)	≥ 0.4840	≥ 0.4830	≥ 0.4830	≥ 0.4930	≥ 0.4576	≥ 0.4400	≥ 0.4330
Clad I.D. (in.)	≤ 0.4295	≤ 0.4250	0.4230	≤ 0.4250	≤ 0.3996	≤ 0.3840	≤ 0.3810
Pellet Dia. (in.)	≤ 0.4195	≤ 0.4160	≤ 0.4140	≤ 0.4160	≤ 0.3913	≤ 0.3760	≤ 0.3740
Fuel Rod Pitch (in.)	≤ 0.642	≤ 0.641	≤ 0.640	≤ 0.640	≤ 0.609	≤ 0.566	≤ 0.572
Design Active Fuel Length (in.)	≤ 150	≤ 150	≤ 150	≤ 150	≤ 150	≤ 150	≤ 150
No. of Water Rods (Note 11)	1 or 0	2	1 - 4 (Note 7)	5	N/A (Note 12)	2	1 (Note 6)
Water Rod Thickness (in.)	≥ 0.034	> 0.00	> 0.00	≥ 0.034	≥ 0.0315	> 0.00	> 0.00
Channel Thickness (in.)	≤ 0.120	≤ 0.120	≤ 0.120	≤ 0.100	≤ 0.055	≤ 0.120	≤ 0.120

Table 1.1-3 (Page 3 of 5)
BWR FUEL ASSEMBLY CHARACTERISTICS (Note 1)

Fuel Assembly Array/Class	**9x9C**	**9x9D**	**9x9E (Note 13)**	**9x9F (Note 13)**	**10x10A**
Clad Material (Note 2)	Zr	Zr	Zr	Zr	Zr
Design Initial U (kg/assy.) (Note 3)	≤ 177	≤ 177	≤ 177	≤ 177	≤ 186
Maximum PLANAR-AVERAGE INITIAL ENRICHMENT (wt.% ^{235}U)	≤ 4.2	≤ 4.2	≤ 4.1	≤ 4.1	≤ 4.2
Initial Maximum Rod Enrichment (wt.% ^{235}U)	≤ 5.0	≤ 5.0	≤ 5.0	≤ 5.0	≤ 5.0
No. of Fuel Rods (Note 14)	80	79	76	76	92/78 (Note 8)
Clad O.D. (in.)	≥ 0.4230	≥ 0.4240	≥ 0.4170	≥ 0.4430	≥ 0.4040
Clad I.D. (in.)	≤ 0.3640	≤ 0.3640	≤ 0.3640	≤ 0.3860	≤ 0.3520
Pellet Dia. (in.)	≤ 0.3565	≤ 0.3565	≤ 0.3530	≤ 0.3745	≤ 0.3455
Fuel Rod Pitch (in.)	≤ 0.572	≤ 0.572	≤ 0.572	≤ 0.572	≤ 0.510
Design Active Fuel Length (in.)	≤ 150	≤ 150	≤ 150	≤ 150	≤ 150
No. of Water Rods (Note 11)	1	2	5	5	2
Water Rod Thickness (in.)	≥ 0.020	≥ 0.0300	≥ 0.0120	≥ 0.0120	≥ 0.0300
Channel Thickness (in.)	≤ 0.100	≤ 0.100	≤ 0.120	≤ 0.120	≤ 0.120

Table 1.1-3 (Page 4 of 5)
BWR FUEL ASSEMBLY CHARACTERISTICS (Note 1)

Fuel Assembly Array/Class	**10x10B**	**10x10C**	**10x10D**	**10x10E**
Clad Material (Note 2)	Zr	Zr	SS	SS
Design Initial U (kg/assy.) (Note 3)	≤ 186	≤ 186	≤ 125	≤ 125
Maximum PLANAR-AVERAGE INITIAL ENRICHMENT (wt% ^{235}U)	≤ 4.2	≤ 4.2	≤ 4.0	≤ 4.0
Initial Maximum Rod Enrichment (wt.% ^{235}U)	≤ 5.0	≤ 5.0	≤ 5.0	≤ 5
No. of Fuel Rods (Note 14)	91/83 (Note 9)	96	100	96
Clad O.D. (in.)	≥ 0.3957	≥ 0.3780	≥ 0.3960	≥ 0.3940
Clad I.D. (in.)	≤ 0.3480	≤ 0.3294	≤ 0.3560	≤ 0.3500
Pellet Dia. (in.)	≤ 0.3420	≤ 0.3224	≤ 0.3500	≤ 0.3430
Fuel Rod Pitch (in.)	≤ 0.510	≤ 0.488	≤ 0.565	≤ 0.557
Design Active Fuel Length (in.)	≤ 150	≤ 150	≤ 83	≤ 83
No. of Water Rods (Note 11)	1 (Note 6)	5 (Note 10)	0	4
Water Rod Thickness (in.)	> 0.00	≥ 0.031	N/A	≥ 0.022
Channel Thickness (in.)	≤ 0.120	≤ 0.055	≤ 0.080	≤ 0.080

Table 1.1-3 (Page 5 of 5)
BWR FUEL ASSEMBLY CHARACTERISTICS (Note 1)

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. Zr designates cladding material made from Zirconium or Zirconium alloys.

3. Design initial uranium weight is the uranium weight specified for each assembly by the fuel manufacturer or reactor user. For each BWR fuel assembly, the total uranium weight limit specified in this table may be increased up to 1.5% for comparison with users' fuel records to account for manufacturer's tolerances.

4. $\leq$ 0.635 wt. % ^{235}U and $\leq$ 1.578 wt. % total fissile plutonium (^{239}Pu and ^{241}Pu), (wt. % of total fuel weight, i.e., UO_2 plus PuO_2).

5. This assembly class contains 74 total fuel rods; 66 full length rods and 8 partial length rods.

6. Square, replacing nine fuel rods.

7. Variable

8. This assembly class contains 92 total fuel rods; 78 full length rods and 14 partial length rods.

9. This assembly class contains 91 total fuel rods, 83 full length rods and 8 partial length rods.

10. One diamond-shaped water rod replacing the four center fuel rods and four rectangular water rods dividing the assembly into four quadrants.

11. These rods may be sealed at both ends and contain Zr material in lieu of water.

12. This assembly is known as "QUAD+" and has four rectangular water cross segments dividing the assembly into four quadrants.

13. For the SPC 9x9-5 fuel assembly, each fuel rod must meet either the 9x9E or 9x9F set of limits for clad O.D., clad I.D., and pellet diameter.

14. Missing fuel rods must be replaced with dummy fuel rods that displace an equal or greater amount of water as the original fuel rods. Storage of 6x6A, 6x6B, 6x6C, 7x7A, and 8x8A fuel assemblies with missing fuel rods are permitted provided the assemblies are stored as DAMAGED FUEL ASSEMBLIES or FUEL DEBRIS.

Table 1.1-4

FUEL ASSEMBLY COOLING AND DECAY HEAT GENERATION (Note 1)

Post-Irradiation Cooling Time (years)	MPC-24 PWR Assembly With or Without BPRAs or TPDs Decay Heat (Watts)	MPC-68 BWR Assembly Decay Heat (Watts)
≥ 5	≤792	≤272
≥ 6	≤773	≤261
≥ 7	≤703	≤238
≥ 8	≤698	≤236
≥ 9	≤692	≤234
≥10	≤687	≤232
≥11	≤683	≤231
≥12	≤678	≤229
≥13	≤674	≤228
≥14	≤669	≤227
≥15	≤665	≤226

Note: 1. Linear interpolation between points permitted.

Table 1.1-5

FUEL ASSEMBLY COOLING AND AVERAGE BURNUP (Note 1)

Post-Irradiation Cooling Time (years)	MPC-24 PWR Assembly Burnup (Without BPRAs and With or Without TPDs) (MWD/MTU)	MPC-24 PWR Assembly Burnup (With BPRAs) (MWD/MTU)	MPC-68 BWR Assembly Burnup (MWD/MTU)
≥ 5	≤28,700	≤28,300	≤26,000
≥ 6	≤32,700	≤32,300	≤29,100
≥ 7	≤33,300	≤32,700	≤29,600
≥ 8	≤35,500	≤35,000	≤31,400
≥ 9	≤37,000	≤36,500	≤32,800
≥10	≤38,200	≤37,600	≤33,800
≥11	≤39,300	≤38,700	≤34,800
≥12	≤40,100	≤39,500	≤35,500
≥13	≤40,800	≤40,200	≤36,200
≥14	≤41,500	≤40,800	≤36,900
≥15	≤42,100	≤41,400	≤37,600

Note: 1. Linear interpolation between points permitted.

Table 1.1-6

NON-FUEL HARDWARE COOLING AND AVERAGE BURNUP (Note 1)

Post-Irradiation Cooling Time (years)	MPC-24 BPRA Burnup (MWD/MTU)	MPC-24 TPD Burnup (MWD/MTU)
≥ 3	≤20,000	NC (Note 2)
≥ 4	NC	≤20,000
≥ 5	≤30,000	NC
≥ 6	≤40,000	≤30,000
≥ 7	NC	≤40,000
≥ 8	≤50,000	NC
≥ 9	≤60,000	≤50,000
≥10	NC	≤60,000
≥11	NC	NC
≥12	NC	≤90,000
≥13	NC	≤180,000
≥14	NC	≤630,000

Notes:

1. Linear interpolation between points is permitted, except that TPD burnups >180,000 MWD/MTU and ≤630,000 MWD/MTU must be cooled ≥14 years.
2. Not Calculated

Table 1.3-1 (Page 1 of 5)
LIST OF ASME CODE EXCEPTIONS FOR THE HI-STAR 100 CASK SYSTEM

Component	Reference ASME Code Section/Article	Code Requirement	Exception, Justification & Compensatory Measures
MPC	NB-1100	Statement of requirements for Code stamping of components.	MPC enclosure vessel is designed and will be fabricated in accordance with ASME Code, Section III, Subsection NB to the maximum practical extent, but Code stamping is not required.
MPC	NB-2000	Requires materials to be supplied by ASME-approved material supplier.	Materials will be supplied by Holtec-approved suppliers with Certified Material Test Reports (CMTRs) in accordance with NB-2000 requirements.
MPC Lid and Closure Ring Welds	NB-4243	Full penetration welds required for Category C Joints (flat head to main shell per NB-3352.3).	MPC lid and closure ring are not full penetration welds. They are welded independently to provide a redundant seal. Additionally, a weld efficiency factor of 0.45 has been applied to the analyses of these welds.
MPC Lid to Shell Weld	NB-5230	Radiographic (RT) or ultrasonic (UT) examination required	Only UT or multi-layer liquid penetrant (PT) examination is permitted. If PT alone is used, at a minimum, it will include the root and final weld layers and each approximately 3/8 inch of weld depth.
MPC Closure Ring, Vent and Drain Cover Plate Welds	NB-5230	Radiographic (RT) or ultrasonic (UT) examination required	Root (if more than one weld pass is required) and final liquid penetrant examination to be performed in accordance with NB-5245. The MPC vent and drain cover plate welds are leak tested. The closure ring provides independent redundant closure for vent and drain cover plates.

Table 1.3-1 (Page 2 of 5)
LIST OF ASME CODE EXCEPTIONS FOR THE HI-STAR 100 CASK SYSTEM

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

Table 1.3-1 (Page 3 of 5)
LIST OF ASME CODE EXCEPTIONS FOR THE HI-STAR 100 CASK SYSTEM

Component	Reference ASME Code Section/Article	Code Requirement	Exception, Justification & Compensatory Measures
MPC Enclosure Vessel	NB-7000	Vessels are required to have overpressure protection	No overpressure protection is provided. The function of the MPC enclosure vessel is to contain the radioactive contents under normal, off-normal, and accident conditions. The MPC vessel is designed to withstand maximum internal pressure considering 100% fuel rod failure and maximum accident temperatures.
MPC Enclosure Vessel	NB-8000	States requirements for nameplates, stamping and reports per NCA-8000.	The HI-STAR 100 Cask 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.
Overpack Helium Retention Boundary	NB-1100	Statement of requirements for Code stamping of components	Overpack helium retention boundary 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.
Overpack Helium Retention Boundary	NB-2000	Requires materials to be supplied by ASME approved Material Supplier	Material will be supplied by Holtec approved suppliers with CMTRs per NB-2000.
Overpack Helium Retention Boundary	NB-7000	Vessels are required to have overpressure protection	No overpressure protection is provided. Function of overpack vessel is to contain helium contents under normal, off-normal, and accident conditions. Overpack vessel is designed to withstand maximum internal pressure and maximum accident temperatures.

Table 1.3-1 (Page 4 of 5)
LIST OF ASME CODE EXCEPTIONS FOR THE HI-STAR 100 CASK SYSTEM

Component	Reference ASME Code Section/Article	Code Requirement	Exception, Justification & Compensatory Measures
Overpack Helium Retention Boundary	NB-8000	Statement of requirements for nameplates, stamping and reports per NCA-8000	The HI-STAR 100 Cask System is to be marked and identified in accordance with 10CFR71 and 10CFR72 requirements. Code stamping is not required. QA data package to be in accordance with Holtec approved QA program.
MPC Basket Assembly	NG-2000	Requires materials to be supplied by ASME-approved material supplier.	Materials will be supplied by Holtec-approved supplier with CMTRs per NG-2000 requirements.
MPC Basket Assembly	NG-8000	States requirements for nameplates, stamping and reports per NCA-8000.	The HI-STAR 100 Cask System will be marked and identified in accordance with 10CFR71 and 10CFR72 requirements. No code stamping is required. The MPC basket data package will be in conformance with Holtec's QA program.
Overpack Intermediate Shells	NF-4622	All welds, including repair welds, shall be post-weld heat treated (PWHT).	Intermediate shell-to-top flange welds and intermediate shell-to-bottom plate welds do not require PWHT. These welds attach non-pressure retaining parts to pressure retaining parts. The pressure retaining parts are >7 inches thick. Localized PWHT will cause material away from the weld to experience elevated temperatures which will have an adverse effect on the material properties.

Component	Reference ASME Code Section/Article	Code Requirement	Exception, Justification & Compensatory Measures
Overpack Helium Retention Boundary	NG-2000	Perform radiographic examination after post-weld heat treatment (PWHT)	Radiography of helium retention boundary welds after PWHT is not required. All welds (including repairs) will have passed radiographic examination prior to PWHT of the entire containment boundary. Confirmatory radiographic examination after PWHT is not necessary because PWHT is not known to introduce new weld defects in nickel steels.
Overpack Intermediate Shells	NF-2000	Requires materials to be supplied by ASME approved Material Supplier	Materials will be supplied by Holtec-approved supplier with CMTRs in accordance with NF-2000 requirements.
Overpack Helium Retention Boundary	NB-2330	Defines the methods for determining the T_{NDT} for impact testing of materials	T_{NDT} shall be defined in accordance with Regulatory Guides 7.11 and 7.12 for the helium retention boundary components.