

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES**

| 1. | a. CERTIFICATE NUMBER | b. REVISION NUMBER | c. DOCKET NUMBER | d. PACKAGE IDENTIFICATION NUMBER | PAGE | PAGES |
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2. PREAMBLE

- a. This certificate is issued to certify that the package (packaging and contents) described in Item 5 below meets the applicable safety standards set forth in Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material."
- b. This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.
3. THIS CERTIFICATE IS ISSUED ON THE BASIS OF A SAFETY ANALYSIS REPORT OF THE PACKAGE DESIGN OR APPLICATION

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|----|--|----|--|
| a. | ISSUED TO (<i>Name and Address</i>) | b. | TITLE AND IDENTIFICATION OF REPORT OR APPLICATION |
| | Holtec International 1 Holtec Blvd. Camden, NJ 08104 | | Safety Analysis Report on the HI-STAR 100 Cask System, Revision No. 20, dated June 27, 2019. |

4. CONDITIONS

This certificate is conditional upon fulfilling the requirements of 10 CFR Part 71, as applicable, and the conditions specified below.

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(a) Packaging

- (1) Model No.: HI-STAR 100
- (2) Description

The Model No. HI-STAR 100 package is a canister based system, with either a Multi-Purpose Canister (MPC) or a Greater – Than – Class C Waste Canister (GWC), inside an overpack designed for transportation of irradiated nuclear fuel or reactor related waste (reactor internals). The overpack, which provides containment boundary, helium retention boundary, gamma and neutron radiation shielding, as well as heat rejection capability, has an outer diameter of approximately 96 inches, without impact limiters, and approximately 128 inches with impact limiters. The Model No. HI-STAR 100 includes two versions: the HI-STAR 100 Version HB (also referred to as the HI-STAR HB) and the HI-STAR 100 Version HB GTCC (also referred to as HI-STAR HB GTCC).

The maximum gross weight of the Model No. HI-STAR 100 package, as presented for shipment, shall not exceed 282,000 pounds; the HI-STAR HB has a maximum gross weight of 189,300 pounds, and the HI-STAR HB GTCC has a maximum gross weight of 145,100 pounds.

Multi-Purpose Canister

There are seven MPC models designated as the MPC-24, MPC-24E, MPC-24EF, MPC-32, MPC-68, MPC-68F, and MPC-HB. All MPCs have identical exterior dimensions, except 1) the MPC-24E/EFs and the MPC-32s custom-designed for the Trojan and the Diablo Canyon

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5.(a)(2) Description (continued)

plants respectively, approximately nine inches shorter than the generic MPC design; and 2) the MPC-HB custom-designed for the Humboldt Bay plant, approximately 76 inches shorter than the generic MPC design;

The MPC is a welded cylindrical structure with flat ends, consisting of a honeycombed fuel basket, baseplate, canister shell, lid, and closure ring. The outer diameter (68-3/8 inches) and cylindrical height (190-1/4 inches) of each generic MPC is fixed. A steel spacer is used with the Trojan and Diablo Canyon MPCs to ensure the MPC-overpack interface is bounded by the generic design. The MPC-HBs are transported in the HI-STAR HB overpack. The fuel basket designs vary based on the MPC model.

Multi-Purpose Non-Fuel Waste Canister

The GWC is a welded cylindrical structure with flat ends, consisting of an internal structure, a baseplate, canister shell, lid, and an optional closure ring. The outer diameter and height of each generic GWC match those of the generic MPCs. The Humboldt Bay GWC-HB model requires a closure ring; its containment system is constituted by the GWC baseplate, the canister shell, the lid, the closure ring, and the vent and drain port cover plates. The GWC-HB canister is transported in the HI-STAR HB GTCC overpack.

Overpack

The HI-STAR 100 overpack is a multi-layer steel cylinder, with an internal diameter of 68-3/4 inches and an outer diameter of 96 inches, that includes a welded baseplate and bolted lid (closure plate). The inner shell of the overpack forms an internal cylindrical cavity to house the MPC or the GWC. The outer surface of the overpack inner shell is buttressed with intermediate steel shells for radiation shielding.

The HI-STAR 100 MPC overpack closure plate incorporates a dual O-ring design to ensure its containment function; the containment system consists of the overpack inner shell, bottom plate, top flange, top closure plate, top closure inner O-ring seal, vent port plug and seal, and drain port plug and seal, and their respective welds.

The HI-STAR 100 HB GTCC overpack closure plate does not include containment seals, nor the corresponding inter-seal leak test port.

Impact Limiters

The HI-STAR 100 overpack is fitted with two standard impact limiters fabricated of aluminum honeycomb completely enclosed by an all-welded austenitic stainless steel skin. The two impact limiters are attached to the overpack with 20 and 16 bolts at the top and bottom, respectively. The HI-STAR HB and HB GTCC packages are fitted with slightly longer impact limiters, designated as HB impact limiters, incorporating a customized material crush strength.

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(3) Drawings

The package shall be constructed and assembled in accordance with the following drawings or figures in Holtec International Report No. HI-951251, *Safety Analysis Report on the HI-STAR 100 Cask System*, Revision No. 20:

- (a) HI-STAR 100 Overpack Drawing 3913, Sheets 1-9, Rev. 13
- (b) MPC Enclosure Vessel Drawing 3923, Sheets 1-9, Rev. 35
- (c) MPC-24E/EF Fuel Basket Drawing 3925, Sheets 1-4, Rev. 9
- (d) MPC-24 Fuel Basket Assembly Drawing 3926, Sheets 1-4, Rev. 17
- (e) MPC-68/68F/68FF Fuel Basket Drawing 3928, Sheets 1-4, Rev. 18
- (f) HI-STAR 100 Impact Limiter Drawing C1765, Sheet 1, Rev. 6; Sheet 2, Rev. 5; Sheet 3, Rev. 5; Sheet 4, Rev. 5; Sheet 5, Rev. 2; Sheet 6, Rev. 7; and Sheet 7, Rev. 1.
- (g) HI-STAR 100 Assembly for Transport Drawing 3930, Sheets 1-3, Rev. 2
- (h) Trojan MPC-24E/EF Spacer Ring Drawing 4111, Sheets 1-2, Rev. 0
- (i) Damaged Fuel Container for Trojan Plant SNF Drawing 4119, Sheet 1-4, Rev. 1
- (j) Spacer for Trojan Failed Fuel Can Drawing 4122, Sheets 1-2, Rev. 0
- (k) Failed Fuel Can for Trojan SNC Drawings PFFC-001, Rev. 8 and PFFC-002, Sheets 1 and 2, Rev. 7
- (l) MPC-32 Fuel Basket Assembly Drawing 3927, Sheets 1-4, Rev. 16
- (m) HI-STAR HB Overpack Drawing 4082, Sheets 1-7, Rev. 8
- (n) MPC-HB Enclosure Vessel Drawing 4102, Sheets 1-4, Rev. 1
- (o) MPC-HB Fuel Basket Drawing 4103, Sheets 1-3, Rev. 6
- (p) Damaged Fuel Container HB Drawing 4113, Sheets 1-2, Rev. 2

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5.(a)(3) Drawings (continued)

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|--------------------------------------|-------------------------------------|
| (q) Diablo Canyon Enclosure Vessel | Drawing 4459, Sheets 1-6, Rev. 14 |
| (r) Diablo Canyon MPC-32 Fuel Basket | Drawing 4458, Sheets 1-3, Rev. 12 |
| (s) MPC Spacer Ring | Drawing 10341, Sheet 1 of 1, Rev. 0 |
| (t) HI-STAR 100 HB GTCC Overpack | Drawing 10315, Sheets 1-3, Rev. 2 |
| (u) GWC-HB Canister | Drawing 10316, Sheets 1-4, Rev. 2 |
| (v) HB Impact Limiter | Drawing 10447, Sheets 1-7, Rev. 0 |

5.(b) Contents

(1) Type, Form, and Quantity of Material

- (a) HI-STAR 100: Fuel assemblies meeting the specifications and quantities provided in Appendix A of Chapter 7 of the application, and meeting the requirements provided in Conditions 5.b(4) through 5.b(6) below, are authorized for transportation.
- (b) HI-STAR 100 HB GTCC: Dewatered solid activated and surface contaminated reactor related hardware. Dry concentrated residues of spent fuel pool debris, including materials generated from fuel assembly cladding failures and special nuclear materials, with a hydrogen concentration less than 5 percent by volume of process waste container.

(2) Maximum quantity of material per package:

- (a) HI-STAR 100: 24 PWR fuel assemblies in the MPC-24, -24E or -24EF; 32 PWR assemblies in the MPC-32; 68 BWR assemblies in the MPC-68 or -68F, and 80 Humboldt Bay BWR assemblies in the MPC-HB.
- (b) HI-STAR 100 HB GTCC: For reactor-related hardware, Co-60 activity shall not exceed 381 Ci or 35.3 times the Type A quantity; the Co-60 specific activity shall not exceed 6×10^{-4} Ci/g. For process waste, the effective A_2 value is 1.22 Ci and the specific activity shall not exceed 10^{-3} Ci/g; the post-irradiation minimum cooling time is 1 year and the maximum decay heat is 0.01 kW.

(3) Maximum weight of contents:

- (a) HI-STAR 100: 40,320 pounds (MPC-24, -24E, -24EF); 53,760 pounds (MPC-32); 51,872 pounds (MPC-32 Diablo Canyon); 47,600 pounds (MPC-68); 37,400 pounds (MPC-68F); 32,000 pounds (MPC-HB)

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5.(b) Contents (continued)

(b) HI-STAR 100 HB GTCC: 4,000 lbs, including dunnage. Fissile material mass limit, including special nuclear material, is 19 g.

- (4) For MPCs partially loaded with stainless steel clad fuel assemblies, all remaining fuel assemblies in the MPC shall meet the more restrictive of the decay heat limits for the stainless steel clad fuel assemblies or of the applicable Zircaloy clad fuel assemblies.
- (5) For MPCs partially loaded with damaged fuel assemblies or fuel debris, all remaining Zircaloy clad intact fuel assemblies in the MPC shall meet the more restrictive of the decay heat limits for the damaged fuel assemblies or of the intact fuel assemblies.
- (6) For MPC-68s 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 more restrictive of the decay heat limits for the 6x6A, 6x6B, 6x6C, and 8x8A fuel assemblies or of the applicable Zircaloy clad fuel assemblies.
- (7) PWR non-fuel hardware and neutron sources are not authorized for transportation, except as specifically provided for in Appendix A of Chapter 7 of the application. BWR stainless steel channels and control blades are not authorized for transportation.

5.(c) Criticality Safety Index (CSI)= 0.0

6. In addition to the requirements of Subpart G of 10 CFR Part 71:

- (a) Each package shall be prepared for shipment and operated in accordance with detailed written operating procedures, including the provisions provided in Chapter 7 of the application.
- (b) The package must meet the Acceptance Tests and Maintenance Program of Chapter 8 of the application.

- 7. The package shall be located on the transport vehicle such that the bottom surface of the bottom impact limiter is at least 9 feet (along the axis of the overpack) from the edge of the vehicle.
- 8. The personnel barrier shall be installed at all times during the transporting of a loaded overpack, except for the HI-STAR HB GTCC overpack.
- 9. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.
- 10. Transport by air of fissile material is not authorized.
- 11. Revision No.11 of this certificate may be used until August 31, 2020.

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12. Expiration Date: April 30, 2024

REFERENCES:

Holtec International Report No. HI-951251, *Safety Analysis Report on the HI-STAR 100 Cask System*, Revision 20, dated June 27, 2019.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

/RA/

John McKirgan, Chief
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Date: August 28, 2019

