

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES**

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
9336	1	71-9336	USA/9336/B(U)F-96	1 OF	5

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>)
Holtec International
Holtec Center
One Holtec Drive
Marlton, NJ 08053 | b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION
Holtec International Report No. HI-2073710, <i>Safety Analysis Report on the HI-STAR 60 Transport Package, Revision 2, dated May 15, 2009.</i> |
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4. CONDITIONS

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

5.

(a) Packaging

- (1) Model No.: HI-STAR 60
- (2) Description

The HI-STAR 60 packaging is designed for transportation of irradiated nuclear fuel assemblies. The fuel basket provides criticality control and the cask provides the containment boundary, helium retention boundary, gamma and neutron radiation shielding, and heat rejection capability. The outer diameter of the HI-STAR 60 package is approximately 1924 mm without impact limiters and approximately 2864 mm with impact limiters. The maximum gross weight of the loaded HI-STAR 60 package, as presented for transportation, is 74.4 Metric Tons.

Fuel Basket

The fuel basket, designated F-12 for the transport of 12 Pressurized Water Reactor (PWR) fuel assemblies, is a fully welded, stainless steel, honeycomb structure and features flux traps between some but not all cells.

Fuel Impact Attenuators

Fuel Impact Attenuators are spacers designed to limit internal gaps between the fuel assembly end-fittings and the internal surfaces of the package. Fuel Impact Attenuators also mitigate the G loads on the fuel assemblies due to secondary internal impact.

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

Cask

The HI-STAR 60 cask is a multi-layer steel cylinder with a welded base-plate and bolted lid (closure plate). The inner shell of the cask forms an internal cylindrical cavity for housing the basket. The outer surface of the cask inner shell is buttressed with intermediate steel shells for radiation shielding. The cask closure plate incorporates a dual O-ring design to ensure its containment function. The containment system consists of the cask 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.

Impact Limiters

The HI-STAR 60 cask is fitted with two impact limiters fabricated of aluminum honeycomb crush material completely enclosed by an all-welded austenitic stainless steel skin. The two impact limiters are attached to the cask with 8 bolts at the top and bottom, respectively.

Fastener Strain Limiters

Fastener strain limiters are collapsible devices designed to limit the axial stress imparted to the impact limiter attachment bolts.

(3) Drawings

The package shall be constructed and assembled in accordance with the following Holtec International Drawings Numbers:

- (a) HI-STAR 60 Cask Drawing No. 5238, sheets 1-7, Rev. 4
- (b) HI-STAR 60 Fuel Basket Drawing No. 5217, sheets 1-3, Rev. 6
- (c) HI-STAR 60 Impact Limiter Drawing No. 5237, sheets 1-3, Rev. 4

5.(b) Contents

(1) Type, Form, and Quantity of Material

- (a) Undamaged fuel assemblies meeting the specifications and requirements provided in Conditions 5.b(1)(b) through 5.b(1)(h) below. Fuel assemblies with known or suspected cladding defects greater than pinhole leaks or hairline cracks and which cannot be handled by normal means are not authorized for transportation.

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5.(b)(1) Type, Form and Quantity of Material (continued)

- (b) Fuel assemblies with missing fuel rods in fuel rod locations shall not be transported unless dummy fuel rods that displace an amount of water greater than or equal to that displaced by the original fuel rod(s) have been installed in the fuel assembly.
- (c) Fuel assembly authorized for transportation is irradiated 15x15 PWR fuel with uranium oxide pellets and a Zr-4 per ASTM B 811-1997 cladding type. The maximum initial enrichment of any assembly to be transported is 4.1 percent by weight of uranium-235. The fuel assembly weight is not to exceed 471 kg per assembly.
- (d) The post-irradiation cooling time, average burnup and minimum initial enrichment of each assembly are listed in Table 1.

Table 1 - Fuel Assembly Cooling Time, Average Burnup and Initial Enrichment

Post-irradiation Cooling Time (years)	Assembly Burnup (MWD/MTU)	Assembly Initial Enrichment (wt% U ²³⁵)
≥ 5	≤ 45,000	≥ 3.6
≥ 5	≤ 40,000	≥ 3.4
≥ 5	≤ 37,000	≥ 3.0
≥ 5	≤ 30,000	≥ 2.67
≥ 5	≤ 27,000	≥ 2.4

- (e) The maximum decay heat of an individual assembly is 0.875 kW.
- (f) Fuel assemblies shall not contain non-fuel hardware.
- (g) The characteristics of the fuel assemblies authorized for transportation are listed in Table 2. All parameters are design nominal values.

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5(b)(1)(g)

Type, Form and Quantity of Material (Continued)

Table 2 - PWR Fuel Assembly Characteristics

Fuel Assembly Type	15x15
Design Initial U (kg/assembly)	≤ 300
No. of Fuel Rod Locations	204
Fuel Rod Clad O.D. (mm)	≥ 10.0
Fuel Rod Clad Thickness (mm)	≥ 0.7
Fuel Pellet Diameter (mm)	≤ 8.43
Fuel Rod Pitch (mm)	≤ 13.3
Active Fuel Length (mm)	≤ 2900
Fuel Assembly Length (mm)	≤ 3530
Fuel Assembly Width (mm)	≤ 199.3
No. of Guide and/or Instrument Tubes	21
Guide/Instrument Tube Thickness (mm)	≥ 0.5

- (h) The major fuel parameters and host reactor operating parameters are listed in Table 3 below

Table 3 – Fuel and Host Reactor Operating Parameters

Fuel Parameters	
Initial Fill Pressure	<3.44 MPa
Maximum End Of Life (EOL) Hoop Stress in the Cladding at 400°C Peak Cladding Temperature	90 MPa
Co ⁵⁹ content of Fuel Assembly Hardware	<1200 ppm
Maximum Cladding Oxide Thickness at EOL	0.05 mm
Host Reactor Operating Parameters	
Average - Maximum Rod Power during Normal Operations	<20-60 kW/m
Minimum Reactor Coolant Inlet Temperature	273°C
Maximum Reactor Coolant Outlet Temperature	329°C
Maximum Soluble Boron Content in Core	<1500 ppm
Typical Cycle Length	12 to 24 months
pH Value of Primary Coolant at 25°C	4.2 – 10.5
Hydrogen Control of Primary Coolant System	25-50 cm ³ (STP)/kg-H ₂ O

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5.b.(2) Maximum Quantity of Material Per Package

12 PWR fuel assemblies, as described in 5(b)(1), in the F-12 basket.

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

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

- (a) The package shall be prepared for shipment and operated in accordance with Chapter 7 of the application.
- (b) The package shall meet the acceptance tests and be maintained in accordance with Chapter 8 of the application.

7. The personnel barrier shall be installed and remain installed while transporting the package if necessary to meet package surface temperature and/or package dose rates.

8. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.

9. Transport by air of fissile material is not authorized.

10. Expiration Date: May 31, 2019

REFERENCES:

Holtec International Report No. HI-2073710, *Safety Analysis Report on the HI-STAR 60 Transport Package*, Revision 2, dated May 15, 2009.

Supplement dated: April 17 2014.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION



Michele Sampson, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Date: May 6, 2014



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION REPORT

Docket No. 71-9336
Model No. HI-STAR 60
Certificate of Compliance No. 9336
Revision No. 1

SUMMARY

By application dated April 17, 2014, Holtec International requested renewal of Certificate of Compliance No. 9336 for the Model No. HI-STAR 60 shipping package. Holtec International did not request any changes to the package design or authorized contents. The certificate has been renewed for a five year term.

CONCLUSION

By application dated April 17, 2014, Holtec International requested renewal of Certificate of Compliance No. 9336 for the Model No. HI-STAR 60 shipping package. Holtec International did not request any changes to the package design or authorized contents. The staff reviewed the documents referenced in the certificate and determined that the documentation was available and complete. The staff also reviewed the operating and maintenance procedures for the package and found them to be adequate. The certificate of compliance is revised to update the revision number, remove unnecessary change bars, and make editorial changes.

The certificate has been renewed for a five year term that expires on May 31, 2019. This change does not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9336, Revision No. 1, on May 6, 2014.