

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES**

1.	a. CERTIFICATE NUMBER 5797	b. REVISION NUMBER 23	c. DOCKET NUMBER 71-5797	d. PACKAGE IDENTIFICATION NUMBER USA/5797/B(U)F	PAGE 1	OF 3
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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>)
U.S. Department of Energy
Washington, D.C. 20585 | b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION
Safety Analysis Report for Packaging the ORNL
HFIR Unirradiated Fuel Element Shipping Container,
ORNL/TM-11656, Rev. 11, dated July 2018, as
supplemented. |
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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.: Inner HFIR Unirradiated Fuel Element Shipping Container, and Outer HFIR Unirradiated Fuel Element Shipping Container

(2) Description

Packaging for unirradiated fissile radioactive material as fuel elements for the High Flux Isotope Reactor (HFIR). The containers are right circular cylinders with an 11-gauge carbon steel shell. The lid is attached to the container with sixteen 3/8-16x1-inch steel bolts. The steel shell is filled with stacked fir plywood rings. The plywood rings form a central cavity which is lined with 1-inch thick polyethylene foam.

The packaging for the inner HFIR fuel element has overall dimension of 25 inches OD by 45 inches high, a 10-7/8-inch diameter by 30-1/4-inch deep cavity, and a 660 pound gross weight.

The packaging for the outer HFIR fuel element has overall dimensions of 31.5 inches OD by 45.75 inches high, a 17-3/8-inch diameter by 31-1/8-inch deep cavity, and a 1,050 pound gross weight.

(3) Drawings

- (i) The packaging for the inner HFIR fuel is constructed in accordance with Oak Ridge National Laboratory Drawing Nos. M-20978-EL-003E, Rev. G, and M-20978-EL-008E, Rev. D.

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

- (ii) The packaging for the outer HFIR fuel is constructed in accordance with Oak Ridge National Laboratory Drawing Nos. M-20978-EL-002E, Rev. F, and M-20978-EL-008E, Rev. D.

(b) Contents

(1) Type and form of material

Uranium as U_3O_8 -Al cermet, enriched up to 95% in the U-235 isotope, and each fuel plate clad in aluminum, 10-mils thick. Only intact assemblies comprised of whole fuel plates with no known or suspected cladding defects are authorized, and:

- (i) For the packaging described in 5(a)(3)(i), the contents are described in the Oak Ridge National Laboratory Drawing No.: M11524-OH-106, Rev. 5.
- (ii) For the packaging described in 5(a)(3)(ii) the contents are described in the Oak Ridge National Laboratory Drawing No.: M11524-OH-107, Rev. 5.

(2) Maximum quantity of material per package

- (i) For the contents described in 5(b)(1)(i) not more than 2.63 kg of U-235.
- (ii) For the contents described in 5(b)(1)(ii) not more than 6.88 kg of U-235.

(c) Criticality Safety Index 0.4

6. The lid lifting attachments must be blocked as shown on Oak Ridge National Laboratory Drawing No. M-20978-EL-009E, Rev. 2, to prevent inadvertent use of the attachments during transport.

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

- (a) Each package shall be maintained in accordance with the Maintenance Program in Chapter 8 of the application, as supplemented; and
- (b) Each package shall be operated and prepared for shipment in accordance with the Operating Procedures in Chapter 7 of the application, as supplemented.

8. Use of packagings fabricated after December 31, 1976, is not authorized.

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

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10. Transport by air of fissile material is not authorized.
11. Revision 22 of this certificate may be used until October 31, 2023.
12. Expiration date: October 31, 2027.

REFERENCES

Safety Analysis Report for Packaging the ORNL HFIR Unirradiated Fuel Element Shipping Container, ORNL/TM-11656, Volumes 1 and 2, Revision 11, dated July 2018

Supplement: Safety Analysis Report for Packaging the ORNL HFIR Unirradiated Fuel Element Shipping Container, ORNL/TM-11656, Volumes 1 and 2, Revision 12 (page-changes), dated May 2020

Supplement: Safety Analysis Report for Packaging the ORNL HFIR Unirradiated Fuel Element Shipping Container, ORNL/TM-11656, Volumes 1 and 2, Revision 13 (page-changes), dated September 2020

Supplement: Safety Analysis Report For Packaging: The ORNL HFIR Unirradiated Fuel Element Shipping Container, ORNL/TM-11656 (ORNL/TM-V11656/V1 and V2, Rev. 14, change-pages, dated June 2022)

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Yaira K. Diaz-Sanabria

Signed by Diaz-Sanabria, Yaira
on 10/03/22

Yaira K. Diaz-Sanabria, Chief
Storage and Transportation Licensing Branch
Division of Fuel Management
Office of Nuclear Material Safety
and Safeguards

Date: October 3, 2022



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

**Safety Evaluation Report
U.S. Department of Energy
Docket No. 71-5797
Model No. Inner HFIR Unirradiated Fuel Element Shipping Container,
and Outer HFIR Unirradiated Fuel Element Shipping Container**

BACKGROUND

The High Flux Isotope Reactor (HFIR) Unirradiated Fuel Element Shipping Container is a Type B(U)F package, with contents described as U_3O_8 -Al cermet, enriched up to 95% in U^{235} , and clad in aluminum.

The U.S. Department of Energy (DOE) requested, by letter dated July 12, 2022, (Agencywide Documents Access and Management System [ADAMS] Accession No. ML22195A182), an amendment to the Certificate of Compliance (CoC) No. 5797, Rev. 22 (Docket 71-5797) to (i) install, prior to shipments, fuel combs on the HFIR unirradiated inner or outer fuel elements, (ii) incorporate in the safety analysis report (SAR) the "as-built" tie-down band design change authorized by U.S. Nuclear Regulatory Commission (NRC) Letter Authorization issued on April 15, 2022 (ML22105A053), and (iii) delete the current extra-regulatory requirement (in the SAR) for a 3-year periodic inspection of the containers against the design drawings.

DOE requested also that the CoC be renewed for an additional 5 years.

Based on the statements and representations in the application, the staff finds that these changes do not affect the ability of the Model No. Inner HFIR Unirradiated Fuel Element Shipping Container, and Outer HFIR Unirradiated Fuel Element Shipping Container package to meet the requirements of Title 10 *Code of Federal Regulations* (10 CFR) Part 71.

EVALUATION

Installation of Fuel Element Combs

HFIR fuel element combs, constructed of 6061-T6 aluminum, provide additional structural support and are designed to reduce the frequency of fuel element failures in the reactor: they are installed in segments which are spot welded to the fuel plates at the ends of each segment, as well as in the middle of each segment. Fuel combs were used early in the operating history of the HFIR to stabilize the fuel plates and had been successfully operated on multiple outer fuel elements. The applicant stated that combs are planned to be used on inner fuel elements: they would be installed at the fuel manufacturer facility.

The fuel element combs do not perform a safety function regarding compliance with 10 CFR 71 requirements. The combs have no impact on the performance of the fuel elements during normal conditions or hypothetical accident conditions of transport as they are welded to non-fuel-bearing portions of the fuel plates. Similarly, the combs have no impact on the package

performance. The installation of combs represents an insignificant additional weight for the overall package (i.e., less than two ounces for both combs on an outer element).

The applicant explained the conservative assumptions made for the fuel element construction and determined that the currently approved structural evaluation remains bounding. Similarly, the thermal evaluation is not affected because the key parameters such as cladding and side plate thicknesses, materials of construction, and amount and type of nuclear material, are not changed after the installation of fuel element combs. A small additional amount of aluminum could in fact only yield more conservative results.

The applicant clarified that the containment boundary (i.e., the cladding and fuel matrix) is not changed by the addition of combs to the fuel element, as the comb segments are placed in a ring on the top of the fuel plates and welded to areas of the plates approximately two inches above the fueled portion of the plates. As such, the containment integrity of the cladding is not affected.

In addition, the shielding evaluation is obviously not affected by the use of fuel element combs. The combs, which “stabilize” the fuel plates within the fueled region of the core, do not impact the fuel geometry during normal or accident conditions. The addition of a small amount of aluminum (i.e., combs) on the non-fueled region of the fuel elements will have an insignificant effect on the K_{eff} of the system during either normal or hypothetical accident conditions of transport because aluminum has a small neutron scattering cross-section.

Drawings M-11524-OH-106 and M-11524-OH-107 for the Inner and Outer fuel elements, were revised to Revision No 5 to show the optional combs, including material and dimensions.

Tie-Down Band

The applicant had previously explained that the Tie-Down Band (TDB) is not credited or evaluated as an important-to-safety packaging component for the HFIR Shipping Containers, i.e., the package itself does not rely on the TDB to meet the requirements of 10 CFR Part 71.

The staff had agreed with the applicant’s explanations and issued, on April 15, 2022, a Letter Authorization (ML22105A053) to CoC 5797 Rev. 22, to authorize continued shipments with the identified nonconformances associated with the tie down band shown on drawing M-20978-EL-008E, Rev. C, Oak Ridge National Laboratory (ORNL) drawings M-20978-EL-002E, M-20978-EL-003E, and M-20978-EL-008E. These drawings are now updated to remove the TDBs from the drawing details: ORNL drawing M-20978-EL-002E is now as Rev. F, M-20978-EL-003E is now as Rev. G, and M-20978-EL-008E is now as Rev. D.

A new ORNL drawing M-20978-EL-008B, Shipping Container Tie Down Band For Unirradiated Out/In HFIR Element Details, was also added for reference in the text of chapter 7.1, “Procedures for Loading Packages,” but this drawing is not considered as a licensing drawing referenced in the CoC because it only clarifies that the shoring ring, removed from the CoC licensing drawings, is depicted on ORNL drawing M-20978-EL-008B.

Removal of 3-Year Periodic Inspection

The current application included a 3-year periodic inspection of the HFIR containers against their associated design drawings: this extra regulatory requirement was added some 32 years ago in response to an issue in which one or more containers were found to have been modified

without prior authorization. No further unauthorized modifications have been identified since that time and adequate controls are in place to prevent any unauthorized modification.

Since an "as-built" inspection of these containers on a periodic basis is not required by 10 CFR 71 and since pre-shipment inspections, for excessive wear, water damage, surface contamination, correct installation of hardware, performed in accordance with 10 CFR 71.87, are sufficient, the applicant revised Section 8.2.7 to remove the 3-year periodic inspection of the containers since they are in reality inspected prior to each shipment. Section 9.3.11 of the SAR was also revised to state that maintenance on the containers is performed as necessary to remove the implication of a periodic inspection.

Based on these findings listed above, the staff has reasonable assurance that that these changes do not affect the ability of the Model No. Inner HFIR Unirradiated Fuel Element Shipping Container, and Outer HFIR Unirradiated Fuel Element Shipping Container package to meet the requirements of 10 CFR Part 71.

CONDITIONS

The following changes were made to the CoC:

Condition No. 5(a)(3) was modified to reflect the updated ORNL drawings M-20978-EL-002E as Rev. F, M-20978-EL-003E as Rev. G, and M-20978-EL-008E as Rev. D.

Condition No. 5(b)(1) was modified for the latest revision of the Oak Ridge National Laboratory Drawing Nos.: M11524-OH-106, Rev. 5, and M11524-OH-107, Rev. 5, respectively.

Condition No. 11 was updated to extend the use of Revision No. 22 of the CoC by approximately one more year.

Condition No. 12 reflects the renewal of the certificate with the expiration date of October 31, 2027.

The References section of the certificate was updated to include the Safety Analysis Report for Packaging the ORNL HFIR Unirradiated Fuel Element Shipping Container, ORNL/TM-11656, Volumes 1 and 2, Revision 14 (page-changes), dated June 2022.

CONCLUSION

Based on the statements and representations in the application, the staff finds that these changes do not affect the ability of the Model No. Inner HFIR Unirradiated Fuel Element Shipping Container, and Outer HFIR Unirradiated Fuel Element Shipping Container package to meet the requirements of 10 CFR Part 71.

Issued with CoC No. 5797, Revision No. 23.