NRC FORM 618 (8-2000) 10 CFR 71	U.S. NUCLEAR REGULATORY COMMISSION

CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES

1. a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGE
9390	0	71-9390	USA/9390/B(U)F-96	1	OF 6

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

a. ISSUED TO *(Name and Address)*

NAC International, Inc.
3930 East Jones Bridge Rd.
Norcross, GA 30092

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION

NAC International Application dated November 12, 2021.

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.: OPTIMUS®-L

(2) Description

The OPTIMUS®-L packaging consists of (i) a Cask Containment Vessel (CCV), (ii) a CCV bottom support plate, (iii) an Outer Packaging (OP) assembly, and (iv) Shield Insert Assemblies (SIAs). The CCV bottom support plate is a free-standing coated carbon steel plate positioned at the bottom end of the CCV cavity below the contents. The CCV fits within the cavity of the OP. The packaging may also be configured with a Shield Insert Assembly (SIA) within the cavity of the CCV.

The CCV is the packaging containment system. It is a stainless-steel cylindrical vessel that includes a body weldment, bolted lid, bolted port cover, and elastomeric O ring seals. The CCV has an outer diameter of 34.5 inches, which expands to 39.0 inches at the bolt flange and lid, and an overall height of approximately 51.4 inches. The internal cavity of the CCV has a diameter of 32.5 inches and is 47.0 inches high. The CCV cylindrical shell and bottom plate have an identical thickness. The CCV lid is fastened to the CCV body by 1-inch diameter socket head cap screws. The CCV lid's inner plug fits inside the top opening of the CCV body.

The CCV bottom support plate is a free-standing coated carbon steel plate that is positioned at the bottom end of the CCV cavity below the contents.

5.(a)(2) Description (Continued)

The OP assembly consists of a base and lid assembly with a closed-cell polyurethane foam sealed inside the stainless-steel inner and outer shells. An insulation is bonded to the inner surface of the OP lid outer end plate to minimize heating of the OP lid foam from insolation. The OP has an outside diameter of 49.0-inch and is 70-inch high. The OP lid is secured to the OP base by high-strength steel bolts.

The SIA is a coated carbon steel container, placed inside the CCV cavity, which provides additional gamma shielding. The SIA configurations used in the OPTIMUS®-L packaging are either 1-inch thick or 2¼-inch thick. The internal cavity of the SIA has a diameter of 24.0 inches and is 35.25 inches high. The 1-inch thick SIA is used inside the CCV cavity. The 2¼-inch thick SIA used in the CCV cavity requires an annular spacer plate placed underneath the bottom of the 2¼-inch thick SIA to position it near the top of the CCV cavity to facilitate loading operations.

The cavity of the package has a diameter of 32.5 inches and is 47 inches long. The outer diameter (excluding tiedown arms) of the OPTIMUS®-L package is 49 inches and the outer height (excluding lifting lugs) is 70 inches. The maximum weight of the contents (including the CCV bottom support plate, SIA, dunnage or shoring) is 3,500 lbs and the maximum gross weight of the package is approximately 9,200 lbs.

(3) Drawings

The packaging is constructed and assembled in accordance with the following NAC International Drawing Nos.:

70000.14-502, Rev. 1	Packaging Assembly – OPTIMUS-L
70000.14-510, Rev. 6	CCV Assembly - OPTIMUS
70000.14-511, Rev. 9	CCV Body Weldment - OPTIMUS
70000.14-512, Rev. 8	CCV Lid - OPTIMUS
70000.14-513, Rev. 3	Port Cover - OPTIMUS
70000.14-514, Rev. 2	CCV Bottom Support Plate – OPTIMUS-L
70000.14-540, Rev. 1	Outer Packaging Assembly – OPTIMUS-L
70000.14-541, Rev. 5	Outer Packaging Base – OPTIMUS-L
70000.14-542, Rev. 4	Outer Packaging Lid – OPTIMUS-L
70000.14-550, Rev. 4	1-inch Shield Insert Assembly (SIA) - OPTIMUS
70000.14-551, Rev. 5	2 ¼ -Inch Shield Insert Assembly (SIA) - OPTIMUS
70000.14-553, Rev. 2	2 ¼ -Inch SIA Annular Spacer Plate – OPTIMUS-L

(b) Contents

(1) Type and Form of Material

(i) Byproduct, source, special nuclear material, non-fissile or fissile-excepted, as special form or non-special form in the form of process solids or resins, either dewatered, solid,

or solidified waste.

(ii) Dewatered, solid, or solidified transuranic-containing wastes (TRU), fissile, non-fissile, or fissile-excepted;

(iii) Neutron activated metals or metal oxides in solid form, in secondary containers;

(iv) Miscellaneous radioactive solid waste materials, including special form material;

(v) Irradiated fuel waste (IFW) consisting of low-enriched uranium (LEU) fuel and activated metal structural components (e.g., cladding, liners, baskets, etc.).

(2) Maximum quantity of material per package

(i) Maximum weight of contents: 3,500 pounds including radioactive waste, secondary containers, CCV bottom support plate, SIA, and shoring.

(ii) Maximum decay heat: 50 watts.

(iii) Fissile contents must not exceed the fissile gram equivalents (FGE) in Table 1 for the specified criticality configuration limits. Plutonium contents in quantities greater than 0.74 TBq (20 Ci) must be in solid form.

Table 1 - TRU Waste FGE Limits

Config. ID	FGE Criticality Configuration Description			FGE Limit (1)
	Machine Compacted(2)	Weight % Special Reflector(3)	Minimum ^{240}Pu Credit	^{239}Pu (^{235}U)
FGE-1		≤ 1		340 (528) g
FGE-2a		≤ 1	≥ 5 g	350 (544) g
FGE-2b		≤ 1	≥ 15 g	375 (583) g
FGE-2c		≤ 1	≥ 25 g	395 (614) g
FGE-3		> 1		121 (188) g
FGE-5	x	≤ 1		250 (388) g

(1) FGE conversion based on a ratio of subcritical mass limits in ANSI/ANS-8.1, Section 5.2 of 0.7 kg (1.5 lb) for ^{235}U and 0.45 kg (1.0 lb) for ^{239}Pu. FGE equivalents determined using Table 7-1 of the application.

(2) For uncompacted or manually compacted TRU waste, materials with hydrogen density up to that of water (0.1117 g/cm^3) are unlimited, but materials with hydrogen density greater than water are limited to the hydrogen density of polyethylene (0.1336 g/cm^3) and may not exceed 15% of the total contents by volume. For machine compacted contents, hydrogenous materials in the contents are limited to the hydrogen density of polyethylene (0.1336 g/cm^3) in an unlimited quantity.

(3) Special reflector materials are defined as beryllium, beryllium oxide, carbon (graphite), heavy water, magnesium oxide, and depleted uranium. The weight% of the special reflector materials is calculated as the mass of all special reflector materials present divided by the total mass of all waste material contents inside the secondary container. For FGE-3, these materials are unlimited.

(iv) IFW contents shall not exceed the Fissile Equivalent Mass (FEM) limits from Table 2 for the specified criticality configuration limits.

Table 2 - IFW Waste FEM Limits

Config. ID(1)	LEU Waste Criticality Configuration Description		
	Weight % Special Reflector (2)	Enrichment Limit, (wt.% ^{235}U)	Uranium Mass Limit, lbs. (kg)
FEM-1	≤ 1	≤ 0.90 wt.%	2500 (1134)

(1) IFW contents must be non-machine compacted. Materials with hydrogen density up to that of water (0.1117 g/cm^3) are unlimited, but materials with hydrogen density greater than water are limited to the hydrogen density of polyethylene (0.1336 g/cm^3) and may not exceed 15% of the total contents by volume.
(2) Special reflector materials are defined as beryllium, beryllium oxide, carbon (graphite), heavy water, magnesium oxide, and depleted uranium. The weight% of the special reflector materials is calculated as the mass of all special reflector materials present divided by the total mass of all waste material contents inside the secondary container.

(v) Contents shall not exceed the maximum activity limits in Tables 7.5-1 and 7.5-2 of the application using the procedure described in Attachment 7.5-1 of the application. Table 7.5-2 of the application applies to packages centered on the trailer and correspond to loadings with either no SIA, 1-inch SIA, or 2 ¼ inch SIA. Sample maximum loadings for key nuclides are in Table 3 for a package centered on the trailer.

Table 3 - TRU Waste and IFW Activity Limits for Key Isotopes

Isotope	Activity Limits (Ci) per package configuration		
	No SIA inside the CCV cavity	1-inch SIA inside the CCV cavity	2¼-inch SIA inside the CCV cavity
Co-60	8.197×10^{-2}	1.632×10^{-1}	4.284×10^{-1}
Cs-137	2.527×10^{2}	1.299×10^{3}	9.245×10^{3}
Ba-137m	3.846×10^{-1}	1.018	3.995
Cf-252	1.217×10^{-2}	1.289×10^{2}	1.469×10^{-2}
Cm-244	3.819×10^{2}	4.074×10^{2}	4.654×10^{2}

(vi) Explosives, corrosives, non-radioactive pyrophorics, and sealed items containing compressed and/or flammable gas (e.g., aerosol cans, lecture bottles, etc.) are prohibited. Pyrophoric radionuclides may be present only in residual amounts less than 1 wt.%. All nonradioactive pyrophoric material be reacted (or oxidized) and/or otherwise

rendered nonreactive prior to placement in a secondary container (e.g., drum).

(vii) Free liquids shall not exceed 1% of the CCV cavity volume.

(c) Criticality Safety Index (CSI): 5.0

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

   (a) The package must be loaded and prepared for shipment in accordance with the Package Operations in Section 7 of the application.

   (b) The package must be tested and maintained in accordance with the Acceptance Tests and Maintenance Program in Section 8 of the application.

7. The package must be transported under exclusive-use.

8. Shoring must be placed between loose fitting contents and the CCV cavity to prevent excessive movement during transport. The shoring material shall not react negatively with the packaging materials or contents and should have a melting temperature above 300°F to ensure shoring maintains its geometry under routine and normal conditions of transport.

9. All radioactive contents shall be packaged in secondary container(s) (e.g., drums, liners, specialty bags, etc.)

10. Hydrogen must be limited to a molar quantity that would be no more than 5% by the volume of the innermost layer of confinement during transport. The port of the CCV lid shall be plugged. Compliance with the hydrogen and other flammable gas limit must be demonstrated for each shipment.

11. Transport by air is not authorized

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

13. Expiration date: December 31, 2026.

REFERENCES

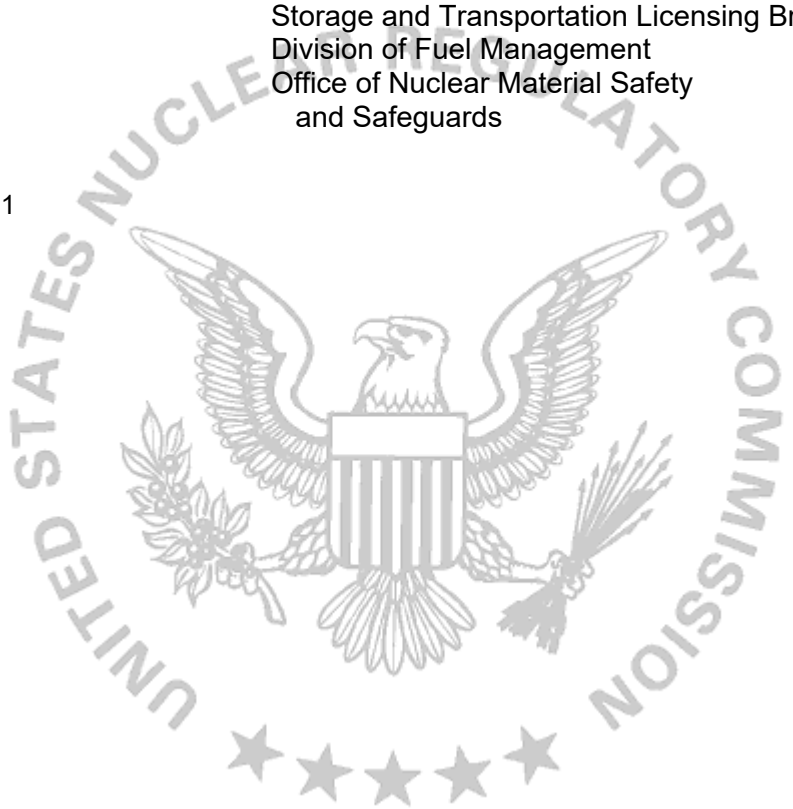
NAC International, Inc., Application – OPTIMUS-L OPTImal Modular Universal Shipping Cask Safety Analysis Report – Revision No. 0, dated November 12, 2021.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Signed by Diaz-Sanabria, Yoira
on 12/16/21

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

Date: December 16, 2021



CERTIFICATE OF COMPLIANCE NO. 9390, REVISION NO. 0, FOR THE MODEL NO. OPTIMUS-L
PACKAGE DATE December 16, 2021

DISTRIBUTION:
SHelton, NMSS/DFM
ADimitriadis, R-I/DNMS/DIRHB
BDesai, R-II/DRS/EB3
GWarnick, R-IV/DNMS/RIB
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DATE	Dec 12, 2021	Dec 12, 2021	Dec 12, 2021	Dec 12, 2021
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DATE	Dec 12, 2021	Dec 16, 2021		

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