DEPARTMENT OF ENERGY
NATIONAL NUCLEAR SECURITY ADMINISTRATION
1000 INDEPENDENCE AVENUE SW
WASHINGTON DC 20585-1000

NR:RR:ASHunt G#C21-04011
August 26, 2021

CONFIDENTIAL – Unclassified upon removal of Enclosures (1) and (2).

John Lubinski
Director, Office of Nuclear Material Safety and Safeguards
Nuclear Regulatory Commission
Washington, DC 20555

M-140 SPENT FUEL SHIPPING CONTAINER - SAFETY ANALYSIS REPORT FOR PACKAGING S3G-3 SPENT NUCLEAR FUEL; REQUEST FOR NUCLEAR REGULATORY COMMISSION REVIEW AND CONCURRENCE (U)

Background:

a. M-140 shipping containers are used to ship the Navy's submarine spent nuclear fuel, including S3G-3 fuel, from servicing facilities to the Naval Reactors Facility at the Idaho National Laboratory. The M-140 shipping container is certified as a Type B package for shipment of fissile and highly radioactive material.

b. The S3G-3 reactor core is installed in both Moored Training Ship (MTS) DANIEL WEBSTER (MTS 626) and MTS SAM RAYBURN (MTS 635). There are minor modifications to the upper fuel module structure of some modules in each MTS that differ from standard S3G-3 modules. MTS 626 and 635 are scheduled for inactivation, with the MTS 635 inactivation beginning in late 2022.

Discussion:

a. Naval Reactors revised the S3G-3 spent fuel in the M-140 shipping container safety analysis report for packaging (SARP) and included an addendum to support shipment of spent fuel from MTS 626 and 635. The addendum supplements analyses in the SARP to account for the minor differences in the MTS cargo when compared to the previously evaluated S3G-3 cargo.

b. Enclosure (1) provides a summary of the SARP changes and Enclosure (2) provides the SARP. Enclosure (3) provides draft revision 17 of the DOE-NR Certificate of Compliance. Naval Reactors considers that the Enclosure (2) SARP demonstrates package compliance with the requirements of 10CFR71. Naval Reactors notes that a separate request to amend and renew the NRC certificate of compliance for the M-140 shipping container was provided in NR letter G#C21-00922 dated March 23, 2021.

Request for Action: NRC review and concurrence is requested for changes to the S3G-3 spent fuel in the M-140 shipping container SARP, provided in Enclosure (2). Final concurrence is requested by August 2022 to support submarine inactivation schedules.

If you have any questions, please do not hesitate to call or email me at (202) 781-6034 or nicholas.plate@navy.mil.

N. S. Plate
Naval Reactors

Enclosure: (1) SUMMARY OF CHANGES TO S3G-3 SPENT FUEL IN THE M-140 SAFETY ANALYSIS REPORT FOR PACKAGING
(2) S3G-3 SPENT FUEL IN THE M-140 SAFETY ANALYSIS REPORT FOR PACKAGING
(3) DOE-NR CERTIFICATE OF COMPLIANCE FOR THE M-140 SPENT FUEL SHIPPING CONTAINER, USA/9793/B(U)F-85 REVISION 17 (DRAFT)

Copy to (Prime Contractor):
KAPL ADSARS
NRLFO
NRLFO-Transportation Division [M. Salamon]

Director, Division of Fuel Management, NMSS, NRC, [A. Kock]
Chief, Storage and Transportation Licensing Branch, DFM, NMSS, NRC [J. McKirgan]
Senior Project Manager, STLB, DFM, NMSS, NRC [B. White]

General Manager, NNL [G. Lubinsky]
Manager, Reactor Servicing, NNL [V. Pantloni]
Manager, Reactor Servicing Systems, RS, NNL [M. Drewen]
Manager, Shipping Containers, RSS, RS, NNL [S. Fiscus]
Manager, Shipping Container Analysis, SC, RSS, RS, NNL [C. Haslett]

ENCLOSURE (3)

DOE-NR CERTIFICATE OF COMPLIANCE FOR THE M-140 SPENT FUEL SHIPPING CONTAINER, USA/9793/B(U)F-85 REVISION 17 (DRAFT)

DOE F 5822.1
(5-85)
(Formerly EV-618)

U. S. DEPARTMENT OF ENERGY

CERTIFICATE OF COMPLIANCE

For Radioactive Materials Packages

OMB Approval No. 1910-2000

1a. Certificate Number	1b. Revision No.	1c. Package Identification No.	1d. Page No.	1e. Total No. Pages
USA/9793/B(U)F-85 (DOE-NR)	~~16~~17 (draft)	USA/9793/B(U)F-85 (DOE-NR)	1	4

2. PREAMBLE

2a. This certificate is issued under the authority of 49CFR Part 173.7(d).

2b. The packaging and contents described in item 5 below meets the safety standards set forth in subpart E, "Package Approval Standards," and subpart F, "Package, Special Form, and LSA-III Tests," Title 10, Code of Federal Regulations, Part 71.

2c. 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

(1) Prepared by *(Name and address)*:	(2) Title and Identification of report or application:	(3) Date
Naval Nuclear Laboratory P. O. Box 79 West Mifflin, PA 15122-0079	(See Contents List) Spent Fuel in the M-140 Shipping Container Safety Analysis Report for Packaging	February 1991

4. **CONDITIONS**
This certificate is conditional upon the fulfilling of the applicable Operational and Quality Assurance requirements of 49CFR Parts 100-199 and 10CFR Part 71, and the conditions specified in item 5 below.

5. Description of Packaging and Authorized Contents, Model Number, Criticality Safety Index, Other Conditions, and References:
M-140 Spent Fuel Shipping Container

a. Description of Packaging

The M-140 Spent Fuel shipping container is a right circular cylinder with an overall height of 194 inches and a 126-inch maximum outer diameter. The container body consists of a 304 stainless steel forging with 14-inch-thick finned side walls and a 12-inch-thick bottom plate on which a 5-inch-high set of covered concentric cylinders (which act as an energy absorber) are welded. The 13-inch-thick (minimum) closure head is held in place by a wedge closure system consisting of 36 wedge assemblies and is sealed via concentric O-rings. The body has an inside diameter of 70 inches and an inside height of 146 inches. An access opening, closed by a bolted shield plug, is provided in the closure head for loading and unloading of spent fuel. During transport, a stainless steel protective dome, which fits into a groove in the upper body flange, covers the closure head. This dome is bolted to the container body.

Spent fuel is positioned within the M-140 shipping container by use of an internals assembly. The internals assembly is composed of stacked spacer plates, which have openings for the spent fuel modules. The internals assembly has a top plate or top plate subassembly which is preloaded by springs against a retaining ring fitted in a groove in the cask wall. Various internals assemblies are used to ship different types of spent fuel in the M-140 shipping container.

6a. Date of Issuance:	6b. Expiration Date: September 30, 2026
FOR THE U.S. DEPARTMENT OF ENERGY	
7a. Address *(of DOE Issuing Office)* Naval Reactors U. S. Department of Energy Washington, DC 20585	7b. Signature, Name and Title *(of DOE Approving Official)* C. W. Taylor Deputy Director, Naval Reactors

5. (Continued)

The M-140 vessel has penetrations for cooling water circulation, venting, and thermocouples. These penetrations are used only during loading and unloading operations and are sealed during shipment. The container is supported by a support ring mounted to the outside of the cooling fins. The support ring is bolted to a specially-designed well-type railcar. The shipping weight of a loaded M-140 container is about 375,000 pounds.

b. Authorized Contents

The contents of the container consist of fissile material, fission products, activated corrosion products, structural parts, and some residual water (about 6 gallons except as noted below) assumed to be contaminated with activated corrosion products. Maximum quantities per container for particular cores are as follows:

(1) S3G-3: See applicable safety analysis report for maximum allowable quantity of fuel modules, control rods, and core structurals. Shipments of a different configuration other than that assumed in the SARP or of less than a full container worth of modules must be evaluated on a case basis.

(2) S8G: See applicable safety analysis report for maximum allowable quantity of fuel modules and control rods.

(3) D2W: See applicable safety analysis report for maximum allowable quantity of fuel modules and control rods. Shipments may contain up to 11 gallons of residual water.

(4) S6W: See applicable safety analysis report for maximum allowable quantity of fuel modules and control rods.

(5) S9G: See applicable safety analysis report for maximum allowable quantity of fuel modules and control rods.

c. Criticality Safety Index (CSI)

The minimum CSI for criticality control of an M-140 shipping container loaded with each authorized cargo is as follows:

(1) S3G-3: CSI = 100
(2) S8G: CSI = 0
(3) D2W: CSI = 0
(4) S6W: CSI = 0
(5) S9G: CSI = 0

d. Restrictions

(1) M-140 shipment is subject to shielding, thermal, and containment limits. The M-140 container shall not be shipped until the container is drained and the shielding hold time is satisfied. Container draining is governed by the thermal limits specified below. Based on containment assumptions, shipments shall be made no earlier than 150 days after shutdown. Other core specific restrictions are also listed.

(2) Shipments shall be made in a dry condition, except for residual water.

5. (Continued)

(3) Transport by air of fissile material is not authorized.

(4) S3G-3

a) Shielding: Shipment shall be made no earlier than 120 days after shutdown.

b) Thermal: Container draining shall occur no earlier than 130 days after shutdown or at a time after shutdown as determined from applicable safety analyses. The decay heat level shall not exceed 62,300 BTU/hr per M-140 container at the time of container draining.

c) Control rod holddown devices must be installed on defueling shipment cells which have control rods.

d) The core age must be per Section 1.2.3.8 of the S3G-3 SARP (with its Addendum).~~at least 4000 Logging Corrected Full Power Hours.~~

(5) S8G

a) Shielding: Shipment shall be made no earlier than 89 days after shutdown.

b) Thermal: Container draining shall occur no earlier than 105 days after shutdown or at a time after shutdown as determined from applicable safety analyses. The decay heat level shall not exceed 47,050 BTU/hr per M-140 container at the time of container draining.

c) Full and partial fuel modules may be shipped in any combination, but all modules must be shipped with control rods.

d) Control rod holddown devices must be installed on the cells. Module grapple adapters serve as control rod holddown devices.

(6) D2W

a) Shielding: Shipment shall be made no earlier than 150 days after shutdown.

b) Thermal: Container draining shall occur no earlier than 148 days after shutdown for middle-of-life shipboard cores or at a time after shutdown as determined from applicable safety analyses. For all other shipboard cores, container draining should occur no earlier than 163 days after shutdown or at a time after shutdown as determined from applicable safety analyses. The decay heat level shall not exceed 45,000 BTU/hr per M-140 container at the time of container draining.

c) Control rod holddown devices must be installed on rodded modules. The universal grapple adapters serve as the rod holddown devices.

(7) S6W

a) Shielding: Shipment shall be made no earlier than 50 days after shutdown.

b) Thermal: Container draining shall occur no earlier than 340 days after shutdown or at a time after shutdown as determined from applicable safety analyses. The decay heat level shall not exceed 41,712 BTU/hr per M-140 container at the time of container draining.

5. (Continued)

c) All S6W spent fuel modules must have control rods, control rod restraints, and grapple adapters installed. A lower pedestal must be installed in each module holder port.

(8) S9G

a) Shielding: Shipment shall be made no earlier than 100 days after shutdown.

b) Thermal: Container draining shall occur no earlier than 164 days after shutdown or at a time after shutdown as determined from applicable safety analyses. The decay heat level shall not exceed 55,002 BTU/hr per M-140 container at the time of container draining.

c) All S9G spent fuel modules must have control rods, control rod holddown devices, and grapple adapters installed.

e. References

None.

f. Additional Information

Nuclear Regulatory Commission review of the SARP for shipment of S3G-3 spent fuel in the M-140 shipping container is contained in their memorandum SGTB:NLO 71-9793 dated October 2, 1991.

Nuclear Regulatory Commission review of the SARP for shipment of S8G spent fuel (both shipboard and prototype) is contained in their memorandum SGTB:NLO 71-9793 dated April 30, 1992, and Docket No. 71-9793 dated November 4, 2014.

Nuclear Regulatory Commission review of the SARP for shipment of D2W spent fuel in the M-140 shipping container is contained in their memorandum Docket No. 71-9793 dated September 3, 1995 and Docket No. 71-9793 dated February 22, 2010.

Nuclear Regulatory Commission review of the SARP for shipment of S6W spent fuel in the M-140 shipping container is contained in their memorandum Docket No. 71-9793 dated August 10, 1998 and Docket No. 71-9793 dated September 26, 2017.

Nuclear Regulatory Commission review of the SARP for shipment of S9G spent fuel in the M-140 shipping container is contained in their memorandum Docket No. 71-9793 dated June 25, 2003.