



## Department of Energy

Washington, DC 20585

NR:RR:WASandman G#11-03126

July 27, 2011

Catherine Haney  
Director, Office of Nuclear Material Safety and Safeguards  
Nuclear Regulatory Commission  
Washington, DC 20555

**M-140 SPENT FUEL SHIPPING CONTAINER - NUCLEAR REGULATORY  
COMMISSION CERTIFICATE OF COMPLIANCE USA/9793/B(U)F-85; REQUEST  
FOR RENEWAL**

**Background:** M-140 shipping containers are used to ship the Navy's spent nuclear fuel from servicing facilities to the Naval Reactors Facility in Idaho. The M-140 container is certified as a Type B package for shipment of fissile and highly radioactive material. Nuclear Regulatory Commission (NRC) Certificate of Compliance (CoC) USA/9793/B(U)F-85, which authorizes the shipment of various spent fuel modules in the M-140 container, expires on October 31, 2011.

**Discussion**

a. This letter requests renewal of the NRC CoC for the M-140 shipping container. Naval Reactors has reviewed the safety and operational documentation for the fleet of 24 M-140 shipping containers, and there have been no operational experiences or container modifications that would preclude continued use of these containers. The enclosure to this letter provides a draft revision 11 to the DOE-Naval Reactors CoC for your review. The only technical change to the DOE-NR CoC is the removal of D1G Core 2 from the list of authorized contents for the container. All D1G Core 2 reactors have been defueled, and there are no planned future shipments of the D1G Core 2 configuration.

b. Naval Reactors notes that the containment chapter of the M-140 Core-Independent Safety Analysis Report for Packaging is currently in the process of being revised. Naval Reactors plans to submit the revised chapter to the NRC for review and concurrence in October 2011. The revised SARP pages were not ready in time to submit with this request for renewal; however, Naval Reactors has reviewed the technical basis for the revised

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containment chapter and concludes that it demonstrates an acceptable containment posture while providing ample margin to the requirements in Title 10, Code of Federal Regulations, Part 71. The containment chapter is being revised to incorporate recent descale data from decommissioned Naval cores. The descale data showed a higher crud activity deposition on some cores than was previously assumed in the containment analysis. Using very conservative parameters, the revised containment analysis demonstrates a large margin to the requirements for normal conditions of transport and hypothetical accident conditions. The bounding activity release for the hypothetical accident conditions is less than 10% of an A<sub>2</sub> quantity in one week.

**Request for NRC Action:** The NRC is requested to renew Certificate of Compliance USA/9793/B(U)F-85 for the M-140 Spent Fuel Shipping Container. If you have any questions, please do not hesitate to call me at (202) 781-6166.



B. K. Miles  
Naval Reactors

Enclosure: (1) DOE-NR CERTIFICATE OF COMPLIANCE FOR THE M-140  
SPENT FUEL SHIPPING CONTAINER, USA/9793/B(U)F-85,  
REVISION 11 (DRAFT)

Copy to:

V. Ordaz, Director, Spent Fuel Storage & Transportation, NMSS, NRC  
D. Weaver, Licensing & Inspection Directorate, SFST, NMSS, NRC  
C. Staab, LID, SFST, NMSS, NRC  
General Manager, Bettis  
Manager, Refueling Engineering and Operation (REO), Bettis  
Manager, Shipping Container (SC), REO, Bettis  
Manager, Shipping Container Analysis, SC, REO, Bettis  
J. J. Pastor, Shipping Container Analysis, SC, REO, Bettis  
KAPL ADSARS  
NRLFO-P

ENCLOSURE (1)

DOE-NR CERTIFICATE OF COMPLIANCE FOR THE M-140 SPENT FUEL  
SHIPPING CONTAINER, USA/9793/B(U)F-85, REVISION 11 (DRAFT)

Enclosure (1) to  
Ser 08G#11-03126

U. S. DEPARTMENT OF ENERGY  
**CERTIFICATE OF COMPLIANCE**  
For Radioactive Materials Packages

1a. Certificate Number USA/9793/B(U)F-85 (DOE-NR)	1b. Revision No. 1011 (DRAFT)	1c. Package Identification No. USA/9793/B(U)F-85 (DOE-NR)	1d. Page No. 1	1e. Total No. Pages 5
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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): Bettis Atomic Power Laboratory P. O. Box 79 West Mifflin, PA 15122-0079  Knolls Atomic Power Laboratory P. O. Box 1072 Schenectady, NY 12301-1072	(2) Title and Identification of report or application: (See Contents List) Spent Fuel in the M-140 Shipping Container Safety Analysis Report for Packaging	(3) Date February 1991
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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: <b>March 4, 2010</b>	6b. Expiration Date: <b>October 31, 2011</b>
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**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)  S. J. Trautman Deputy Director, Naval Reactors
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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, poison rods, and core structurals. Shipments of a different configuration other than that assumed in the SARP or of less than a full container's 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) D1G Core 2: See applicable safety analysis report for maximum allowable quantity of fuel modules, removable fuel assemblies, and control rods.~~
- (34) 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.
- (45) A1G: See applicable safety analysis report for maximum allowable quantity of fuel modules, control rods, poison rods, and cell support housings.
- (56) S6W: See applicable safety analysis report for maximum allowable quantity of fuel modules and control rods.
- (67) 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 = 100
- ~~(3) D1G Core 2: CSI = 100~~
- (34) D2W: CSI = 0
- (45) A1G: CSI = 0
- (56) S6W: CSI = 100
- (67) S9G: CSI = 0

5. (Continued)

d. Restrictions

- (1) M-140 shipment is subject to both shielding and thermal 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. Other core specific restrictions are also listed.
- (2) Shipments shall be made in a dry condition, except for residual water.
- (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. Module grapple adapters serve as poison shipping rod holddown devices for refueling shipments.
- d) The core age must be at least 4,000 Logging-Corrected Full Power Hours.

(5) S8G

- a) Shielding: Shipment shall be made no earlier than 70 days after shutdown.
- b) Thermal: Container draining shall occur no earlier than 157 days after shutdown or at a time after shutdown as determined from applicable safety analyses. The decay heat level shall not exceed 45,713 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) D1G Core 2~~

- ~~a) Shielding: Shipment shall be made no earlier than 90 days after shutdown.~~
- ~~b) Thermal: See applicable safety analysis report to determine minimum wet hold time required. Note that applicability of the safety analysis report is dependent on the design of internals used.~~
- ~~c) Control rod holddown devices must be installed on rodded modules. The universal grapple adapters serve as the control rod holddown devices.~~

(67) D2W Type 3 Cores

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

5. (Continued)

- b) **Thermal:** Container draining shall occur no earlier than 100 days after shutdown or at a time after shutdown as determined from applicable safety analyses. The total core decay heat level shall not exceed 68,390 BTU/hr at the time of container draining. The total core decay heat level shall not exceed 66,550 BTU/hr when the container is shipped.
- c) Control rod holddown devices must be installed on rodded modules. The universal grapple adapters serve as the rod holddown devices.

(78) D2W Type 5 Core

- a) **Shielding:** Shipment shall be made no earlier than 150 days after shutdown.
- b) **Thermal:** Container draining shall occur no earlier than 100 days after shutdown or at a time after shutdown as determined from applicable safety analyses. The total core decay heat level shall not exceed 62,210 BTU/hr 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.

(89) A1G

- a) **Shielding:** For a shipment of fuel clusters or a shipment of cell support housings, shipment shall be made no earlier than 50 days after shutdown.
- b) **Thermal:** For a shipment of fuel clusters, the thermal analysis in the A1G in M-140 SARP does not specify a minimum wet hold time, but instead includes thermal limit design curves. As each core is defueled, these thermal limit design curves will be used in conjunction with the specific power history for that core to determine the minimum wet hold time for fuel clusters from that core.
- c) For a mixed shipment of fuel clusters and cell support housings, the minimum hold time for a shipment of all fuel clusters governs.
- d) For fuel clusters, grapple adapters (at the upper end) and support stands (at the lower end) must be installed.
- e) For cell support housings, grapple adapters (at the upper end) and bottom spacers (at the lower end) must be installed.
- f) All fuel clusters must be shipped with either control rods or poison shipping rods.
- g) All fuel clusters must be shipped with rod holddown devices installed.
- h) The core age must be at least 1,000 Effective Full-Power Hours.

(940) S6W Shipboard and Prototype

- a) **Shielding:** Shipment shall be made no earlier than 50 days after shutdown.
- b) **Thermal:** Container draining shall occur no earlier than 300 days after shutdown for a shipboard core or 450 days after shutdown for a prototype core or at a time after shutdown as determined

5. (Continued)

from applicable safety analyses. The decay heat level per M-140 container shall not exceed 46,011 BTU/hr for a shipboard core or 47,160 BTU/hr for the prototype core at the time of container draining.

- 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.

(1044) 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.

Nuclear Regulatory Commission review of the SARP for shipment of D1G Core 2 spent fuel in the M-140 shipping container is contained in their memoranda IMTB:NLO 71-9793 dated June 8, 1993 and Docket No. 71-9793 dated July 3, 1997. D1G Core 2 spent fuel is no longer on the list of authorized contents for the container.

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 22 February, 2010.

Nuclear Regulatory Commission review of the SARP for shipment of A1G spent fuel and A1G cell support housings in the M-140 shipping container is contained in their memorandum Docket No. 71-9793 dated February 27, 1997.

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

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.