

SAFETY EVALUATION REPORT

Docket No. 71-9315
Model No. ES-3100 Package
Certificate of Compliance No. 9315
Revision No. 15

SUMMARY

By letter dated July 12, 2016, the Department of Energy (DOE or the applicant) requested a revision to Certificate of Compliance (CoC) No. 9315 for the Model No. ES-3100 package. DOE had previously consolidated its application by letter dated March 2, 2016.

There were no changes to the packaging design, but DOE requested to authorize air transportation of Uranium/Molybdenum metal alloy with not more than 408 grams of U-235.

CoC No. 9315 has been amended based on the statements and representations in the application, and staff agrees that the changes do not affect the ability of the package to meet the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71.

EVALUATION

The submittal was evaluated against the regulatory standards in 10 CFR Part 71, including the general standards for all packages, standards for fissile material packages, and performance standards under normal conditions of transport (NCT) and hypothetical accident conditions (HAC).

DOE requested to add 408 g of U-235 in the form of Uranium metal and alloys, in the form of broken metal, for air transport. Such content is already approved for non-air transport, as described in Condition No. 5(b)(1)(ii) of the CoC, with a criticality safety index (CSI) of 0.0, for up to 100% enriched U-235. The currently allowable U-235 is a higher quantity than what the applicant is requesting for air transport, i.e., 0.925kg U-235 per convenience can and 2.774 kg U-235 per package.

On June 28, 2007, staff issued Revision No. 4 of the CoC to authorize air shipment of TRIGA fuel components with a loading of up to 408 grams U-235 per package and a CSI of 0.0. This same content is authorized in Revision No. 14 of the CoC issued on June 8, 2016.

The applicant's basis for demonstrating compliance with 10 CFR Part 71 is a comparison of U/Mo alloy plates, with an enrichment of 19.75% and a total U-235 content of 408 grams per package, with the authorized TRIGA fuel components with a loading of up to 408 grams U-235 per package and a CSI of 0.0, to demonstrate that the criticality analysis of TRIGA fuel is bounding for the U/Mo alloy plates.

For air transport, 10 CFR 71.55(f) requires contents to be subcritical with an additional 20 cm reflection after additional tests. The applicant has described the criticality safety model for air transport in Section 6.3.1.4 of the application. The applicant did not perform any evaluation to demonstrate that the package or its contents would remain intact under the conditions of 10 CFR 71.55(f). The applicant did not credit the structural properties of the package or contents

and, for the criticality safety analysis, modeled it in a conservative worst case spherical geometry.

To support air transport of the TRIGA fuel content, the most reactive configuration was found to be Model 5, which has a homogenized sphere of U-235 and polyethylene mixed with water, blanketed by a Kaolite shell and reflected by 20 cm of water. The applicant showed that this configuration has a maximum k_{eff} below the USL. Staff evaluated and discussed this content in its safety evaluation report (ADAMS Accession No.: ML072350442).

The staff reviewed the air transport model in the application and found it applicable to the content described in Condition No. 5(b)(1)(ii) of the CoC, for 408 g U-235 metal and alloys in the form of broken metal. Therefore the staff finds air transport of this content in this amount acceptable for the Model No. ES-3100 package.

The CoC currently requires the mass of the non-uranium portion of alloys to be counted as U-235. For air transport, the mass is limited to 408 g of U-235 and an additional metal mass would not cause reactivity to increase if included in the air transport model; thus, the staff finds that it is not necessary to include the metal mass as part of the allowable mass of U-235.

Based on the statements and representations in the application, and the conditions listed in the CoC, the staff concludes that the design has been adequately described and evaluated, and meets the requirements of 10 CFR Part 71.

CONDITIONS

The following changes are included in Revision No. 15 to Certificate of Compliance No. 9315:

Condition No. 12 has been revised to read: "Transport by air is not authorized, except for shipment of (a) unirradiated TRIGA fuel pellets, as described and limited in Condition No. 5(b)(4), and (b) U metal and alloys in the form of broken metal as described in Condition No. 5(b)(1)(ii) with a limit of 408 grams U-235 and a CSI of 0.0. For air transport of metal alloy, the U-235 mass limit is not required to include the non-uranium portion of the alloy."

Condition No. 15 was modified to authorize the use of Revision 14 of this certificate until July 31, 2017.

The expiration date of the certificate is not changed.

The July 12, 2016, amendment request letter is referenced in the Reference Section of this certificate.

CONCLUSION

Based on the statements and representations in the application, and the conditions listed above, the staff concludes that the Model No. ES-3100 package design has been adequately described and evaluated and that these changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9315, Revision No. 15,
on July 27, 2016.