

September 6, 2007

James M. Shuler
Manager, Packaging Certification Program
Safety Management and Operations
Office of Environmental Management
Department of Energy
Washington, DC 20585

SUBJECT: REVISION 5 OF CERTIFICATE OF COMPLIANCE NO. 9315 FOR THE MODEL
NO. ES-3100

Dear Dr. Shuler:

As requested by your letter dated January 31, 2007, as supplemented June 27 and August 8, 2007, enclosed is Certificate of Compliance (CoC) No. 9315, Revision No. 5, for the Model No. ES-3100 package. You requested the revision to the definition of allowable pyrophoric forms of uranium for this package. Changes made to the enclosed certificate are indicated by vertical lines in the margin. The staff's Safety Evaluation Report is also enclosed.

The additional request, in your letter dated August 8, 2007, to add "only trace amounts of carbon in oxides" as authorized contents in condition 5.(b)(2) of the CoC contained no supporting information. Staff will review this change, if needed, when an application is received with a supporting safety analysis.

Those on the attached list have been registered as users of the package under the general license provisions of 10 CFR 71.17 or 49 CFR 173.471. This approval constitutes authority to use the package for shipment of radioactive material and for the package to be shipped in accordance with the provisions of 49 CFR 173.471. Registered users may request, by letter, to remove their names from the Registered Users List.

If you have any questions regarding this certificate, please contact me or Kim Hardin of my staff at (301) 492-3294.

Sincerely,

/RA/

Robert A. Nelson, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9315

TAC No. L24063

Enclosures: 1. Certificate of Compliance
No. 9315, Rev. No. 5
2. Safety Evaluation Report
3. Registered Users

cc w/encls 1 and 2: R. Boyle, Department of Transportation
Registered Users

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SAFETY EVALUATION REPORT
Docket No. 71-9315
Model No. ES-3100 Package
Certificate of Compliance No. 9315
Revision No. 5

SUMMARY

By application dated January 31, 2007, as supplemented June 27 and August 8, 2007, the Department of Energy (DOE or the applicant) requested Revision No. 5 to Certificate of Compliance (CoC) No. 9315, for the Model No. ES-3100 package. This revision will support safe shipment of highly enriched uranium (HEU) to support the Naval Reactor Program.

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). Staff reviewed the application using the guidance in NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Material."

Based on the statements and representations in the application, as supplemented, 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.

GENERAL INFORMATION

By application dated January 31, 2007, DOE requested the revision of the definition of allowable pyrophoric forms of uranium in the ES-3100 shipping package.

The CoC gives the definition of broken metal in paragraph 5.(b)(1)(ii), as follows:

"For metal or alloy defined as broken metal, mass limits are specified in Table 2. Uranium metal and alloy pieces must have a surface-area-to-mass ratio of not greater than 1.00 cm²/g or must have a mass not less than 50 g, whichever is most restrictive. Powders, foils, turnings, wires, and incidental small particles are not permitted, unless they are restricted to not more than 1 percent by weight of the content per convenience can, and they are either in a sealed, inerted container or are stabilized to an oxide prior to shipment."

To make this definition more operationally feasible, the applicant proposed operational limits rather than the 50 g mass limit and the 1 percent by weight of the can content. These limits are further discussed below

MATERIALS EVALUATION

The applicant is proposing a change to the CoC to clearly define the conditions and quantities of uranium metal pieces that could be shipped in an air or inert atmosphere in the ES-3100

transportation package. The change is based on the premise that only pieces with a surface area to mass ratio (SA/M) $< 1 \text{ cm}^2/\text{g}$ would be shipped in air.

Two calculations and two operational limits were evaluated to support this position. The calculations evaluated were: 1) Even under hypothetical accident conditions (HAC), the maximum temperature of the cask will never reach the pyrophoric ignition temperature of the uranium metal, and 2) Even if ignition did occur, the limited available oxygen would limit the amount of uranium that could combust and the quantity that could burn to an insignificant quantity.

The ignition temperature of uranium is not an intrinsic value of the material but is a function of the SA/M and previous storage history. After evaluating the supporting documentation and input values, the staff agrees with the applicant that the maximum temperature that will be reached in a canister filled with uranium metal having an SA/M $< 1 \text{ cm}^2/\text{g}$ is below the ignition temperature. The staff has reasonable assurance that an uncontrolled pyrophoric reaction will not occur. This conclusion is further supported by the calculation indicating that the canister would not reach the maximum projected temperature due to the limited quantity of oxidant.

The staff agrees that the SA/M $< 1 \text{ cm}^2/\text{g}$ is the controlling factor for safety, and the 50 g limit can be removed. The applicant proposed to meet the required limit of SA/M $< 1 \text{ cm}^2/\text{g}$ by use of a screening process using a screen with a 3/8 inch mesh grid. Staff reviewed the screening process so that long stringers (wires, rods, shavings) that can intertwine and have a large enough diameters such that they not pass through the sieve are not accidentally shipped. They may appear to meet the SA/M criterion, but, in fact, do not. The applicant clearly states in the SAR that if the loading personnel find any piece that can be pushed through the grid in any direction that it is to be considered pyrophoric. In addition, it is stated that any intertwined pieces shall not be considered a solid but rather should be separated and considered individually. As indicated in the change to the SAR and referenced in the CoC, all material not meeting the SA/M criterion will be shipped in a sealed, inert atmosphere with a moisture level less than 5 ppm. The staff also agrees that the 1% by weight can content limit is meaningless if wires, powders, etc., are transported in an inert atmosphere.

The staff reviewed the fact that insufficient data was known about the pyrophoric properties of uranium metal that had been stored or come in contact with water. The SAR and CoC clearly states that any uranium metal that has come in contact with or been stored in water will not be shipped in this package.

Operational limits added to Chapter 7 of the SAR and referenced in the CoC consist of: 1) a screening procedure by trained operators that would ensure that any material with SA/M greater than $1 \text{ cm}^2/\text{g}$ would only be shipped in a sealed container in an inert atmosphere, and 2) uranium material or alloy which has been stored in or come in contact with water is not authorized to be shipped in this package.

Although the pyrophoric ignition of the uranium metal by an impact is not addressed in this application, the analysis and operational limits provides assurance that there is insufficient oxygen available to sustain combustion. Staff agrees that spark ignition is not a feasible pyrophoric issue in this cask.

Based on the statements and representations in the application, as supplemented, 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 CoC has been revised as follows:

Condition No. 5.(b)(1)(ii):

The revision changes the definition for allowable pyrophoric forms of uranium to be used in the ES-3100 transportation package.

Condition No. 14:

Allows the use of Revision 4 of this certificate for one year.

CONCLUSION

The Certificate of Compliance is revised to clearly define the conditions and quantities of uranium metal pieces authorized to be shipped in an air or inert atmosphere in the ES-3100 transportation package.

This change does 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. 5 on September 6, 2007.