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DOE Packaging Certification Program

**Safety Evaluation Report for
Request to Amend Certificate of Compliance Number 9516
to Authorize Use of the Model 9516 Packaging for Limited
Shipments of Legacy F-5 General-Purpose Heat Source
Fueled Clad Assemblies**

Docket No. 20-13-9516

Prepared by: _____

Date: _____

James M. Shuler
Manager, Packaging Certification Program
Office of Packaging and Transportation

Approved by: _____

Date: _____

Julia C. Shenk
Headquarters Certifying Official
Director
Office of Packaging and Transportation

This Safety Evaluation Report (SER) documents the U.S. Department of Energy (DOE) Packaging Certification Program (PCP) independent technical review of the application submitted by the Idaho Operations Office (NE-ID) to amend DOE Certificate of Compliance (CoC) Number 9516 to authorize use of the Model 9516 packaging for limited shipments of 24 legacy F-5 General-Purpose Heat Source (GPHS) Fueled Clad Assemblies (FCA).

Evaluation

By email ^[1] dated December 12, 2019, NE-ID concurred and forwarded a request ^[2], with a technical justification ^[3] from their contractor, the Idaho National Laboratory (INL), to amend CoC 9516 to authorize use of the Model 9516 packaging for shipment of 24 legacy F-5 GPHS FCAs, with a maximum of four legacy F-5 GPHS FCAs per package. The request was supplemented ^[4, 5, & 6] by NE-ID on February 27, 2020 in response to a comment/question (Q1) ^[7] issued by DOE PCP on February 6, 2020.

The application, as referred to in this SER, consists of the following documents:

1. *Technical Justification for 9516 Certificate of Compliance Amendment To Ship Legacy GPHS Fueled Clad Assemblies*, TEV-3884, Rev. 0 (SER Reference 3) and
2. *Responses to Table of DOE PCP Q1s on the Content Amendment Request for Certificate No. 9516 (Docket# 20-13-9516)*, with *Attachment 1 Responses to Q1 Comments* (SER Reference 6).

Condition 2 of DOE CoC 9516, Rev. 5 (under timely renewal) or Rev. 6 (pending approval) limits the shipping period for various shipping configurations based on fuel age calculations to ensure the containment vessel (CV) pressure is not exceeded during normal conditions of transport (NCT). The shipping period/fuel age limits are derived from calculations in Section 3.3.2.2 of the Safety Analysis Report for Packaging (SARP) ^[8, 9] and are presented in SARP Table 3.13. The calculated fuel age limit for Shipping Configuration 2—GPHS Graphite Impact Shell (GIS) with up to four GPHS FCAs in the CV is 405 months at the end of planned shipping period.

Shipping Configuration 2—GPHS GIS with four legacy F-5 GPHS FCAs will not meet Condition 2 of the CoC. Using the assumptions and equations in SARP Section 3.3.2.2, the calculated fuel age is 468 months at the end of planned shipping period. Reducing the payload of legacy F-5 GPHS FCAs to two per CV and calculating a fuel age for this configuration would meet Condition 2 of the CoC Rev. 6 (pending approval), but double the number of packagings needed to ship this material from six to twelve.

In order to minimize the number of packagings needed to ship this material, the applicant proposed the following alternate assumptions to Section 3.3.2.2 of the SARP to calculate a fuel age limit for the four legacy F-5 GPHS FCAs per CV:

- a.) a helium release fraction of 90% instead of 100% ,
- b.) a gas fill temperature of 200°F instead of 70°F, and
- c.) inclusion of the product that can void volume and a graphite porosity of 5% into the total void volume.

Using these alternate assumptions and a thermal inventory of 62.5 W per FCA, the applicant's calculated maximum allowable fuel age is 45.22 years or 543 months (Ref. 3, page 17).

PCP staff reviewed the applicant's technical justification (Ref. 3) and generated one Q1 on February 6, 2020, for the applicant to justify using a decay constant of 0.00806/year for Pu-238 and a gas fill temperature of 200°F for the fuel age calculation. The applicant responded to the comment on February 27, 2020, to supplement the technical justification. The supplemental information (Ref. 6) was acceptable to staff.

PCP staff reviewed the alternate assumptions and fuel age calculations in the application and found them reasonable and acceptable. Staff also performed a confirmatory fuel age calculation and staff's results are in good agreement with application. Staff also confirmed by document review of the chapter-by-chapter safety evaluation in application against the SARP and CoC, that this content change do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

On the basis of the statements and representations in the application, and the staff's confirmatory evaluation as summarized in this SER, staff finds using the Shipping Configuration 2 in the SARP to ship the legacy GPHS FCAs acceptable, and that it will provide reasonable assurance that the regulatory requirements of 10 CFR Part 71 have been met.

Condition of Approval

The following changes to the conditions are required to implement the Letter of Authorization:

1. The contents must be packaged in the Containment Vessel(CV) based on CoC Shipping Configuration 2 – GPHS Graphite Impact Shell (GIS) as follows:
 - a. Two 5.75 inch tall liners, with each liner containing one product can and one graphite support block, and a graphite filler block between the two liners.

- b. Each product can would contain one GPHS GIS with two legacy F-5 GPHS FCAs, bringing the total per CV to two GPHS GISs, each with 2 legacy F-5 GPHS FCAs.
2. CoC Condition 2 is superseded by the following: Shipments of F-5 GPHS FCAs must be completed before the age of the processed plutonium dioxide (PuO₂) exceeds 540 months from the time of processing the PuO₂ to ensure the CV pressure limit is not exceeded during the Normal Conditions of Transport.
3. This authorization shall expire on March 31, 2022.
4. All other conditions of certificate Revision 5 or 6 apply to this authorization.

Conclusion

Based on the statements and representations in the application and the PCP staff's confirmatory evaluation as summarized in this SER and the conditions listed above, staff finds use of the Model 9516 packaging for shipment of legacy F-5 GPHS FCAs acceptable, and that it will provide reasonable assurance that the regulatory requirements of 10 CFR Part 71 have been met.

References

- [1] Email, *FW: Amendment of DOE CoC Shipment of Legacy FCs*, Carl Friesen (NE-ID) to James Shuler (EM-4.24) and cc: PCP Docket Manager, dated December 12, 2019, 4:34 PM.
- [2] *Contract No. DE-AC07-05ID14517 - Request for Amendment of DOE Certificate of Compliance No. 9516 for Shipment of Legacy General-Purpose Heat Source Fueled Capsule Assemblies*, CCN 246037, Letter from Stephen G. Johnson (INL) to Carl Friesen (NE-ID), dated December 10, 2019, with enclosure.
- [3] G.A. Hula, Gerald D. Nelson, *Technical Justification for 9516 Certificate of Compliance Amendment To Ship Legacy GPHS Fueled Clad Assemblies*, TEV-3884, Rev. 0, Idaho National Laboratory, December 10, 2019 (enclosure for Reference 2).
- [4] Email, *Q-1 Response_F-5 Fuel Age Letter*, Jessica Winkler (INL) to Carl Friesen (NE-ID) and cc: James Shuler, dated February 27, 2020 1:29 PM, with attachment.
- [5] *Contract No. DE-AC07-05ID 14517 - Response to Q 1 Comment from Department of Energy Packaging Certification Program Independent Review of Content Amendment Request, Docket 20-13-9516*, CCN 246561, Letter from Stephen G. Johnson (INL) to Carl Friesen (NE-ID), dated February 26, 2020 (attachment for Reference 4), with enclosure.

- [6] *Responses to Table of DOE PCP Q1s on the Content Amendment Request for Certificate No. 9516 (Docket# 20-13-9516), with Attachment 1 Responses to Q1 Comments, February 26, 2020 (enclosure for Reference 5).*
- [7] *Q1 Comment from Department of Energy Packaging Certification Program Independent Review of Content Amendment Request, Memorandum from Dr. James Shuler to Carl Friesen (NE-ID), dated February 6, 2020.*
- [8] *Safety Analysis Report for Packaging (SARP) for the 9516 Package, R1033-0062-ES, Rev. 1, October 2009.*
- [9] *Safety Analysis Report for Packaging (SARP) for the 9516 Package, R1033-0062-ES, Rev. 2, January 2020.*