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DOE Packaging Certification Program

Safety Evaluation Report for Request to Revise 9975 Certificate to Authorize Use of Large-Bore Lead Pig in the Packaging for Shipments of Content Envelope C.9 and 5-Year Renewal of the Certificate

Dockets No. 17-11-9975 and 18-30-9975

Prepared by: James M. Shuler Date: 8/6/18

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

Approved by: Joanne D. Lorence Date: 08/06/2018

Joanne D. Lorence
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 and confirmatory analysis of the application, as supplemented, submitted by the Savannah River Operations Office (SR) requesting an amendment to DOE Certificate of Compliance (CoC) Number 9975, Revision 13 to authorize use of a Large-Bore Lead Pig convenience container in the Model 9975 packaging for shipments of U-233 metal or oxide per Content Envelope C.9, and subsequent request by SR to renew the CoC.

Summary

By memorandum [1] dated February 15, 2017, as supplemented [2] June 27, 2018, SR submitted a request to the DOE PCP to amend CoC 9975, Rev. 13, to authorize use of a Large-Bore Lead Pig (LBLP) convenience container configuration in the Model 9975 packaging for shipments of U-233 metal or oxide per Content Envelope C.9 (C.9), where the mass of U-232 is not to exceed 0.004 grams). Docket 17-11-9975 was opened by DOE PCP for this task.

The overall dimensions, cavity length, and materials of construction of the LBLP are the same as the currently authorized *U-233 Lead Pig* (CoC Drawing R-R4-G-00047, Rev. 1), except the LBLP body has a larger inner diameter (i.e., 2.125 inches vs the 1.625 inches) and reduced lead wall-thickness (i.e., 0.85 inch vs. 1.10 inches of lead).

The applicant evaluated the proposed changes in an addendum, *Justification for Use of Large Bore Shielded-Pig Convenience Container* [3] to supplement the *Safety Analysis Report for Packaging Model 9975* (SARP) [4] and to demonstrate compliance with 10 CFR Part 71. The addendum incorporates, by reference, the *U-233 Large Bore Lead Pig* (Drawing R-R4-G-00166, Rev. 0), as well as supplemental thermal and shielding analyses.

In addition, by memorandum [5] dated March 8, 2018, SR requested renewal of the CoC with no additional changes to the package design based Rev. 13 of the CoC. The expiration date of the CoC is June 30, 2018; however, based on the SR request, the CoC is under timely renewal in accordance with DOE Order 460.1D, *Hazardous Materials Packaging and Transportation Safety*. Docket 18-30-9975 was opened by DOE PCP for this task.

The changes related to Docket 17-11-9975 are evaluated and addressed in this SER. Only the changes in the Conditions section of this SER are applicable to Docket 18-30-9975 for the renewal request.

Based on the statements and representations in the SARP and addendum, PCP staff agrees that these changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

This SER will hereinafter refer to the currently approved *U-233 Lead Pig* as the “Lead Pig” and the proposed *U-233 Large Bore Lead Pig* as the “LBLP”, and *Justification for Use of Large*

Bore Shielded-Pig Convenience Container as the "SARP Addendum", unless otherwise specified.

Evaluation

The current DOE CoC authorizes use of a Lead Pig (CoC Drawing R-R4-G-00047, Rev. 1) for C.9 when the mass of U-232 is greater than 0.0018 grams and not to exceed 0.0101 grams. The Lead Pig is supplemental radiation shielding for C.9 to ensure that the dose rate at the surface of the package does not exceed 200 mrem/hour.

DOE users needed a pig design with a larger bore diameter than the Lead Pig, so the LBLP was design was developed to meet that need. The overall dimensions, cavity length, and materials of construction of the LBLP are the same as the currently authorized Lead Pig, except the LBLP body has a larger inner diameter (i.e., 2.125 inches vs. 1.625 inches) and reduced wall-thickness (0.85 inch vs. 1.10 inches of lead). The aluminum container (CoC Drawing R-R4-G-00048, Rev 1) and spacer (CoC Drawing R-R4-G-00051, Rev 3) are required for both configurations.

Based on the reduced wall-thickness in the LBLP body, the applicant performed a supplemental shielding analysis that limited the U-232 mass for C.9 for the LBLP configuration to the following values to ensure that the package surface dose rate does not exceed 200 mrem/hour:

1. Metal form: 0.0052 grams of U-232 when the total U mass is greater than 10 grams, and 0.0044 grams when the total U mass is less than 10 grams; or
2. Oxide form: 0.0048 grams of U-232 when the total U mass is greater than 10 grams, and 0.0044 grams when the total U mass is less than 10 grams.

However, for operation's convenience and simplicity, the Applicant is limiting the mass of U-232 for the LBLP configuration to 0.004 grams.

In addition, the Applicant performed a supplemental thermal analysis of both the Lead Pig and LBLP configurations for the C.9 at 0.15 Watts (heat source) to determine the maximum temperature of the pig configurations under normal conditions of transport (NCT). The higher wattage resulted in a maximum pig temperature of approximately 160-degrees F for both designs. The previous thermal analysis for the Lead Pig (SARP Appendix 3.21) was performed with a heat source of 0.007 watts.

Finally, the SARP Addendum supplements Chapter 9 of the SARP to address the LBLP specific quality assurance requirements and for consistency with current Quality Assurance Program Approval issued by DOE to the Applicant (https://rampac.energy.gov/docs/default-source/qa/approval_0025_r0.pdf).

PCP staff reviewed the SARP and SARP Addendum to assess the impact, if any, on the entire SARP (i.e., Chapters 1-9), and to confirm the addendum demonstrates compliance with 10 CFR Part 71. Staff's review is addressed below in this SER.

1.0 General Information

1.1 Packaging Description

There are no changes to the existing Model 9975 packaging design or operational features authorized in the CoC.

The LBLP is a new packaging component (Drawing R-R4-G-00166, Rev. 0) that is based on the design of the *U-233 Lead Pig* (CoC Drawing R-R4-G-00047). The overall dimensions, cavity length, and materials of construction of the LBLP are the same as the Lead Pig, except the LBLP has a larger inner diameter (i.e., 2.125 inches vs. 1.625 inches) and reduced wall-thickness (0.85 inch vs. 1.10 inches of lead).

The LBLP configuration consists of the *U-233 Large Bore Lead Pig* (Drawing R-R4-G-00166, Rev. 0), the aluminum *U-233 Container* (CoC Drawing R-R4-G-00048, Rev 1), and aluminum *U-233 Spacers* (CoC Drawing R-R4-G-00051, Rev 3). Both the LBLP and Lead Pig configurations are shown in Figures A.1.9 and A.1.8 of the SARP Addendum, respectively. The weight of the LBLP body and lid is approximately 30 pounds. For comparison, the weight of the Lead Pig body and lid is approximately 33 pounds. The weights of the aluminum Container (body and lid) and Spacers (top and bottom) are 2.5 and 1.9 pounds, respectively.

The purpose of the LBLP configuration is to provide supplemental shielding to the packaging for C.9, shielding of the contents prior to loading in the packaging containment system, and convenience handling.

1.2 Contents

The current configurations authorized in the CoC for C.9 (U-233 Metal and Oxide) are Food-Pack Cans or Lead Pig (with aluminum Container and Spacers). The Lead Pig configuration is used when the mass of U-232 exceeds 0.0018 grams and is not to exceed 0.0101 grams, or if required by dose measurements.

The Applicant also clarified the description of the U-233 oxide form, for the Food-Pack Can configuration, as follows, “The oxide materials were calcined between 600°C and 800°C prior to encapsulation by compaction into SS (*stainless steel*) sleeves that were welded shut. The exterior of the tubes were then decontaminated to acceptable levels. If the SS tubes could not be decontaminated, they were nickel plated to fix the contamination.” The Applicant proposes to include the calcined temperature range as a requirement in the CoC for C.9 oxides. The calcine description was included in the Applicant’s initial application in 2008 (Docket 08-19-9975) to add C.9, but it was not included in the SARP or CoC as a requirement.

The LBLP configuration is proposed for C.9 items that do not fit in the Lead Pig and whose mass of U-232 is not to exceed 0.004 grams, or if required by dose measurements.

1.3 Criticality Safety Index

The addition of the LBLP configuration does not change the fissile loading of the package for C.9. The calculated Criticality Safety Index (CSI) is 2.0.

1.4 Radiation Level and Transport Index

PCP staff confirmed that the radiation transport index (TI) is less than 10, which is the TI limit in 10 CFR 71.47(a) for non-exclusive use shipment. The actual TI of the package will be determined by measurement prior to shipment.

1.5 Conclusion

Based on a review of the statements and representations in the SARP, SARP Addendum, and PCP staff's confirmatory evaluation, staff concludes that the LBLP configuration in the package as described in the addendum has been described in sufficient detail to provide an adequate basis for its evaluation under 10 CFR Part 71.

2.0 Structural Evaluation

PCP staff reviewed the SARP and SARP addendum for the use of LBLP configuration for C.9 and concluded that this configuration does not affect the structural evaluation of the package.

The Applicant used an analysis-by-comparision of the LBLP configuration with the Lead Pig configuration for the structural evalaution, due to the nearly identical designs.

2.1 Materials, Fabrication, and Examination

The LBLP design uses the same material properties and specifications as those used in the Lead Pig design. In addition, the LBLP (with contents) is inserted within the same aluminum convenience Container and loaded in the primary containment vessel with the same aluminum bottom and top Spacers as the Lead Pig. Since there is no new material introduced by using the LBLP in the package, the §71.43(d) material evaluation in the SARP remains valid.

The fabrication and examination, acceptance test, quality category designation, and quality assurance requirements of the LBLP are likewise the same as the Lead Pig.

2.2 Normal Conditions of Transport

The Applicant demonstrated compliance of the Lead Pig configuration to §71.71(c)(7) by analysis (SARP Section 2.6.7 and Appendix 2.8), and in turn demonstrated compliance of the LBLP configuration by comparison. The package NCT free-drop configuration only consisted Lead Pig configuration in the Primary Containment Vessel (PCV): all components external to the PCV were omitted from the analysis. The analysis estimated that the radial wall thickness of the Lead Pig body was reduced by 6% due to deformation from the NCT free-drop. The Applicant assumed the same deformation results for the LBLP body and applied them in supplemental shielding evaluation of the LBLP configuration in support of Chapter 5 of the SARP Addendum.

2.3 Hypothetical Accident Conditions

The Applicant did not perform a structural evaluation of the LBLP configuration under Hypothetical Accident Conditions (HAC) because internal shielding (i.e., Lead Pig or LBLP) is not a credited safety component under HAC.

2.4 Evaluation Findings

Based on the statements and representation in the SARP, SARP Addendum, and PCP staff's confirmatory evaluation, staff concludes that the structural design and performance of the LBLP configuration described in the addendum does not affect the ability of the package to meet the requirements of 10 CFR Part 71.

3.0 Thermal Evaluation

PCP staff reviewed the SARP and SARP Addendum for use of the LBLP configuration for C.9 and concluded that this configuration does not affect the thermal evaluation of the package (i.e., maximum decay heat of 19 Watts for the package).

The maximum possible decay heat load for C.9 is 0.927 Watts (SARP Appendix 3.20).

The current thermal evaluation for the Lead Pig configuration was modeled by the Applicant with C.9 decay heat of a 0.007 Watts (SARP Appendix 3.21). The Applicant increased the content decay heat to 0.15 Watts in the supplemental thermal evalution in the SARP Addendum for models of both the Lead Pig and the LBLP configurations.

3.1 Material Properties and Component Specification

The LBLP design uses the same material properties and component specifications as those used in the Lead Pig design. In addition, the LBLP (with contents) is inserted within the same aluminum convenience Container and loaded in the PCV with the same aluminum bottom and top Spacers as the Lead Pig. Since there is no new material introduced by using the LBLP in the package, the material properties (i.e., heat transfer) and component specification (i.e., allowable service temperature and pressure) evaluation in the SARP remains valid.

3.2 Normal Conditions of Transport

The Applicant performed a supplemental thermal evaluation of both the Lead Pig and LBLP configurations for C.9 at 0.15 Watts (decay heat source) to determine the maximum temperature of the pig configurations under NCT. The higher wattage resulted in a maximum temperature of approximately 160-degrees F for both configurations.

PCP staff found material properties, boundary conditions, heat loading, and solution method in the supplemental thermal evaluation are adequate. For both pig configurations the results show that the maximum temperature of the lead is under 160-degrees F with a 0.15 Watt decay heat load, which is significantly below the melting point of lead (622-degrees F). Staff also verified

the detailed implementation of the Applicant's NCT thermal simulations for both the Lead Pig and LBLP configurations with the 0.15 Watt decay heat load.

To demonstrate a large margin of safety, the Applicant evaluated a decay heat load of 8 Watts to demonstrate the pig configuration temperature will remain below 200-degrees F, which is the service temperature limit for the Containment Vessel O-rings and upper limit for the lead temperature used in the structural evaluation (SARP, Appendix 2.8, and Section 2.3).

Finally, since the maximum decay heat wattage of C.9 (i.e., less than 1 Watt) is still significantly less than the maximum decay heat limit of 19 Watts for the package, and no additional gas generating materials are included, the maximum normal operating pressure for C.9 remains bounded by Content Envelope C.4 (SARP Table 3.3).

3.3 Hypothetical Accident Conditions

The Applicant did not perform a thermal evaluation of the LBLP configuration under Hypothetical Accident Conditions (HAC) because internal shielding (i.e., Lead Pig or LBLP) is not a credited safety component under HAC.

3.4 Evaluation Findings

Based on the statements and representation in the SARP, SARP Addendum, and PCP staff's confirmatory evaluation, staff concludes that the thermal design and performance of the LBLP configuration described in the addendum does not affect the ability of the package to meet the requirements of 10 CFR Part 71.

4.0 Containment

PCP staff reviewed the SARP and SARP Addendum for use of the LBLP configuration for C.9 and concluded that this configuration does not affect the containment evaluation or performance of the package.

4.1 Evaluation Findings

Based on the statements and representation in the SARP, SARP Addendum, and PCP staff's confirmatory evaluation, staff concludes that the LBLP configuration described in the addendum does not affect the ability of the package's containment design and performance to meet the requirements of 10 CFR Part 71.

5.0 Shielding Evaluation

PCP staff reviewed the SARP and SARP Addendum for use of the LBLP configuration for C.9 and concluded that this configuration does not affect the shielding evaluation or performance of the package.

Staff reviewed the engineering calculation of the LBLP configuration described in Reference 5.11 (N-CLC-G-00168, Revision 1) of the SARP Addendum. The calculation analyzed the dose

rates for shipping U-233 mixed with U-232 or other uranium isotopes using the LBLP configuration. The objective was to determine the amount of U-232 that can be shipped without exceeding the regulatory dose rate limit at the surface of the package (200 mrem/hr.). Revision 0 of the calculation analyzed contents of 10 grams or greater of total uranium and Revision 1 extended the analysis to include 1 gram of U-238 as metal or oxide mixed and varying amounts of U-232.

5.1 Shielding Design

There were no changes to the Model 9975 shielding design as described in Section 5.1 of the SARP for the LBLP configuration. The Lead Pig and LBLP configurations provide supplemental shielding to the nominal ½-inch of lead shielding in the package (CoC Drawing R-R2-F-00020, Rev. 11).

5.2 Source Specification

The photon and neutron spectra were calculated for 1 gram of U-232 and for 1 gram of U-238. The photon and neutron spectra were described with 20 and 27 energy groups, respectively. The total source strengths were calculated for sources containing 1 gram of U-238 and varied amounts of U-232 ranging from 2.0 to 5.5 milligrams. The radiation sources for the different U-238/U-232 contents were modeled as spheres located at the bottom center and at the bottom side of the PCV (in contact with the inner surface of the PCV). The applicant calculated the source terms with ORIGEN-ARP Version 6.1 and PCP staff used ORIGEN (SCALE 6.2.2).

5.3 Shielding Model

The shield regions, materials, dimensions, and densities for NCT configurations used in the shielding model are described in Section 5.3 of the SARP Addendum and Section 5.1.1 of N-CLC-G-00168, Revision 1 (SARP Addendum Reference 5.11). The reduction in lead thickness under NCT is accounted for by reducing the thickness of the LBLP by 6% in all directions while maintaining the outer dimensions as shown on drawing R-R4-G-00166.

The HAC shielding configuration was not analyzed because the dose rate at 1 meter under HAC is bounded by the dose rate at the surface of the package under NCT.

5.4 Shielding Analysis Results

The Monte Carlo N-Particle Transport Code (MCNP 6.1) with the ENDF/B-VII.1 cross sections was used by the applicant and PCP staff for the shielding calculations. The ANSI/ANS-6.1.1-1977 photon and neutron Flux-to-Dose-Rate Factors were used to calculate personnel doses.

Table 5-1 (below) shows applicant's side dose rates with 1 gram of U-238 of metal or oxide and varying amounts of U-232 at the bottom of the PCV, from Table 6-3 of N-CLC-G-00168, Revision 1 (SARP Addendum Reference 5.5), and dose rates from PCP staff's confirmatory analysis. To produce the highest contact dose rates at the side of the package, PCP staff placed the source at the side wall of the PCV for staff's confirmatory analyses.

Table 5-1 Maximum Package Dose Rates with 1 Gram of U-238 and Varied Amounts of U-232

U-232 Mass (mg)	Side Dose Rate (mrem/hr)			
	U-238 Metal		U-238 Oxide	
	Applicant	Staff	Applicant	Staff
2.0	9.03E+01	8.97E+01	9.33E+01	9.24E+01
2.5	1.13E+02	1.12E+02	1.17E+02	1.16E+02
3.0	1.35E+02	1.35E+02	1.40E+02	1.39E+02
3.5	1.58E+02	1.57E+02	1.63E+02	1.66E+02
4.0	1.81E+02	1.79E+02	1.87E+02	1.84E+02
4.5	2.03E+02	2.02E+02	2.10E+02	2.08E+02
5.0	2.26E+02	2.24E+02	2.33E+02	2.30E+02
5.5	2.49E+02	2.47E+02	n/a	2.50E+02

Table 5-2 (below) shows the maximum U-232 mass (mg) for the LBLP configuration when the total uranium metal or oxide is less than 10 grams, based on the applicant's calculation in N-CLC-G-00168, Revision 1 (SARP Addendum Reference 5.5) and PCP staff's confirmatory analysis.

Table 5-2 Maximum U-232 Mass (mg) when Total Uranium is less than 10 grams

Uranium form	Allowed U-232 Mass (mg)	
	Applicant	Staff
Metal	4.4	4.4
Oxide	4.2	4.3

5.5 Evaluation Findings

Based on the statements and representations in the SARP, the SARP Addendum, and PCP staff's confirmatory evaluation, staff finds the shielding design and performance of the LBLP configuration in the package as described in the addendum adequate and will provide reasonable assurance that the regulatory requirements in 10 CFR 71 have been met.

6.0 Criticality Evaluation

PCP staff reviewed the SARP and SARP Addendum for use of the LBLP configuration for C.9 and concluded that this configuration does not affect the criticality evaluation of the package.

There was no change to the C.9 fissile mass loadings evaluated in the SARP (SARP Appendix 6.5 and SARP Addendum Reference 6.1) for the LBLP configuration. For C.9, the U-233 equivalent mass limit is 500 grams and therefore criticality is not a credible event.

6.1 Evaluation Findings

Based on the statements and representations in the SARP, the SARP Addendum, and PCP staff's confirmatory evaluation, staff concludes that the LBLP configuration described in the addendum does not affect the ability of the package's criticality safety design or performance to meet the requirements of 10 CFR Part 71.

7.0 Package Operations

PCP staff reviewed the SARP and SARP Addendum for use of the LBLP configuration for C.9 and concluded that this configuration does not affect the operation of the package.

The SARP Addendum supplements Section 7.2.1, Step 26 of the SARP to include the LBLP configuration for C.9 metal or oxide items with not to exceed 0.004 grams of U-232.

7.1 Evaluation Findings

Based on the statements and representations in the SARP, the SARP Addendum, and PCP staff's confirmatory evaluation, staff concludes that the change (supplemement) to the operating procedure for the LBLP configuration described in the addendum is adequate and will provide reasonable assurance for safe operation of the package in accordance with 10 CFR Part 71.

8.0 Acceptance Tests and Maintenance Program

PCP staff reviewed the SARP and SARP Addendum for use of the LBLP configuration for C.9 and concluded that this configuration does not affect the acceptance tests and maintenance of the packaging.

Acceptance of the LBLP configuration is the same as the Lead Pig configuration in accordance with Section 8.1.5 of the SARP; therefore, the SARP Addendum supplements Section 8.1.5 of the SARP to include the LBLP configuration.

8.1 Evaluation Findings

Based on the statements and representations in the SARP, the SARP Addendum, and PCP staff's confirmatory evaluation, staff concludes that the change (supplemement) to the acceptance tests and maintenance for the LBLP configuration as descibed in the addemdum is adequate and will provide reasonable assurance that the acceptance testing for the packaging is in accordance with 10 CFR Part 71 and that the maintenance program is adequate to ensure packaging performance during its service life.

9.0 Quality Assurance

PCP staff reviewed the SARP and SARP Addendum for use of the LBLP configuration for C.9 and concluded that this configuration does not affect the quality assurance (QA) requirements for the packaging.

Chapter 9 of the SARP Addendum included the QA program from *Management and Operations (M&O) Quality Assurance Program Document (QAPD), Packaging and Transportation Program for Type AF/B Packagings/Packages*, SRNS-RP-2014-00880, Revision 1, dated March 31, 2015 (approval date). This QAPD was approved by the DOE Headquarters Certifying Official (HCO) in DOE Quality Assurance Program Approval, Approval Number 0025, Revision 0, and dated May 22, 2015.

There are no changes to current packaging component QA requirements in Chapter 9 of the SARP. Table A.9.3 of the addendum supplements Table 9.3 of the SARP to add the safety classification (Quality Category A) and QA requirements for the LBLP.

Chapter 9 of the addendum also includes administrative changes (e.g., "SRS" has been changed to "SRNS") that will not reduce commitments in the program description as approved by the HCO.

9.1 Evaluation Findings

Based on the statements and representations in the SARP, the SARP Addendum, and PCP staff's confirmatory evaluation, staff concludes that the changes (supplemement) to the quality assurance program for the LBLP configuration as described in the addendum are adequate and will provide reasonable assurance that the regulatory requirements of 10 CFR 71, Subpart H have been met.

Conditions of Approval

The following changes to CoC Revision 13 are required to implement the LBLP configuration and renewal of the CoC.

1. Section 5(a)(2), Description, page 2, 4th paragraph – The *9975 Shielding Body Subassembly* (R-R2-F-00020-A, Rev 11) is no longer an authorized packaging component; only the *9975 Jacketed Shielding Body Subassembly* (R-R2-F-00020-C, Rev 11) is authorized for use in the packaging; consequently, this paragraph will be revised accordingly.
2. Section 5(a)(2), Description, page 3, 6th paragraph – Revised to authorize the use of the LBLP configuration, "In some cases for Content Envelope C.9, a small or large bore shielded-pig convenience container configuration is used for added shielding [see Drawings 5(a)(3)]. Both configurations consist of machined lead pig in an aluminum convenience can that is placed inside the PCV, between top and bottom aluminum honeycomb spacers, as shown in Figures A.1.8 and A.1.9 of S-SARA-G-00019, Rev. 1 [CoC supplement 5(e)(9)]."
3. Section 5(a)(2), Description, page 3, last paragraph – Deleted. The -85 version of the CoC was terminated June 30, 2015.
4. Section 5(a)(3) Drawings – Add note to Drawing R-R2-F-00020, "Note - Only R-R2-F-0020-C, 9975 Jacketed Shield Body Subassembly, is authorized; R-R2-F-0020- A, 9975 Shield Body Subassembly is prohibited."

5. Section 5(a)(3) Drawings – Add drawing, *U-233 Large Bore Lead Pig*, R-R4-G-00166, Rev. 0, for the LBLP configuration.
6. Section 5(b) Contents – Revise Table 1, Table Note cc, last sentence to,"0.0018 grams is the limiting mass of ^{232}U based on the 9975 package shielding. The ^{232}U mass limit increases to 0.004 grams if the large bore shielded-pig (Drawing R-R4-G-00166) is used or 0.0101 grams if the small bore shielded-pig (Drawing R-R4-G-00047) is used."
7. Section 5(b)(2)(i)(ix) For C.9:
    - Revise (c) to add the calcine information to the Food-Pack Can Configuration, "…Oxide contents must be calcined to at least 600°C and encapsulated in stainless steel or nickel alloy."
    - Revise (d) for the LBLP configuration, "If the mass of U-232 exceeds 0.0018 grams the small or large bore shielded-pig configurations may be used subject to the following: the large bore shielded-pig configuration may be used if the U-232 mass does not exceed 0.004 grams or the small bore shielded-pig configuration may be used the U-232 mass does not exceed 0.0101 grams."
8. Section 5(d) Conditions - – Revise to include the supplements in Section 5(e) of the CoC as follows,

    (1) "…Sections 1.2.3.1 and 1.2.3.2 of the SARP, as supplemented by 5(e) of this certificate."

    (7) "…requirements of Chapter 9 of the SARP, as supplemented by 5(e) of this certificate."
9. Section 5(d)(13) – Revised to allow the use of Rev 13 for 1-year from its current expiration date, "Revision 13 of this certificate may be used until June 30, 2019 for domestic shipments of 9975-96 packages. Revision 13 of this certificate may be used until June 30, 2019 …"
10. Section 5(d) Conditions – Boilerplate conditions added that are common to all DOE CoCs:
    (14) "Only DOE elements or persons working under contract to DOE elements shall consign the package for shipment."

    (15) "Nuclear Regulatory Commission (NRC) or Agreement State licensees shall not consign a DOE certified package for shipment, but can transfer the material on-site to DOE elements or persons working under contract to DOE elements for consignment of the package."
11. Section 5(e) References – changed "References" to "Supplements" for consistency with DOE/NRC CoCs and page 1 of the CoC.
12. Section 5(e)(1) – Changed to "Reserved" because the basis SARP is listed on page 1 of the CoC.
13. Section 5(e)(8) – Added for CoC 5-year renewal request, "Request for Five-Year Renewal of the Certificate of Compliance (CoC) for the Model 9975 Shipping Package, March 8, 2018"

14. Section 5(e)(9) – Added for LBLP addition, "Safety Analysis Report For Packaging Model 9975 --Addendum---Revision 1-Justification For Use Of Large Bore Shielded-Pig Convenience Container, S-SARA-G-00019, Revision 1, dated June 2018."

Conclusion

Based on the statements and representations in the SARP, SARP Addendum, and the PCP staff's confirmatory evaluation as summarized in this SER and the conditions listed above, staff finds LBLP configuration as described in the addendum is adequate and will provide reasonable assurance that the regulatory requirements of 10 CFR Part 71 have been met.

References

[1] *Submittal of the Safety Analysis Report for Packaging (SARP) Model 9975 – Addendum – Justification for Use of Large Bore Shielded-Pig Convenience Container (S-SARA-G-00019, Revision 0)*, Memorandum, AMNMS-17-0004, submitted to US Department of Energy Packaging Certification Program by the Savannah River Operations Office, with attachments, dated February 15, 2017.

[2] Email, *Re: 9975 Modified Pig Addendum S*, Maxine Maxted (DOE-SR) to Dan Leduc (SRNL) and cc: PCP Docket Manager, dated June 27, 2018, 2015 11:47 AM. DOE-SR concurrence with attachment S-SARA-G-00019, Revision 1.

[3] *Safety Analysis Report for Packaging Model 9975 -Addendum-Revision 1- Justification for Use of Large Bore Shielded-Pig Convenience Container*, S-SARA-G-00019, Revision 1, dated June 2018.

[4] *Safety Analysis Report for Packaging Model 9975*, S-SARP-G-00003, Revision 4, Revision 4, dated December 2015.

[5] *Request for Five-Year Renewal of the Certificate of Compliance (CoC) for the Model 9975 Shipping Package*, Memorandum, AMNMS-18-0000, submitted to US Department of Energy Packaging Certification Program, by the Savannah River Operations Office, dated March 8, 2018.