



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

February 28, 2017

Mr. Richard W. Boyle, Chief
Sciences Branch
Division of Engineering and Research
Office of Hazardous Materials Safety
U.S. Department of Transportation
1200 New Jersey Ave., S.E.
Washington, D.C. 20590

SUBJECT: REVALIDATION OF THE ARGENTINIAN CERTIFICATE OF APPROVAL
NO. RA/0103/B(U)F-96 FOR THE MODEL NO. LEUPA PACKAGE

Dear Mr. Boyle:

This is in response to your letter dated July 9, 2015 (Agencywide Documents Access and Management Systems (ADAMS) Accession No. ML15222B182 and ADAMS Package Accession No. ML15222B189) and as supplemented on July 14, 2015 (ADAMS Accession No. ML15229A150), August 11, 2015 (ADAMS Accession No. ML15243A105), and September 22, 2015 (ADAMS Package Accession No. ML15267A048); and March 17, 2016 (ADAMS Package Accession No. ML16097A051), August 19, 2016 (ADAMS Accession No. ML16245A725), August 31, 2016 (ADAMS Package Accession No. ML16245A549), and September 28, 2016 (ADAMS Package Accession No. ML16272A166), requesting our assistance in evaluating the Model No. LEUPA, Type B(U) fissile package, authorized by the Argentinian Certificate of Approval No. RA/0103/B(U)F-96.

Our review is based on the statements and representations contained in the documents submitted as the application for the Model No. LEUPA package.

For the reasons stated in the enclosed safety evaluation report, we recommend revalidation of the Argentinian Certificate for the Model No. LEUPA package with the following conditions:

1. Plastic moderating material is prohibited for air shipment.
2. The acceptance criteria for components in drawing Nos. 0908-LE01-3AEIN-015-A, 0908-LE01-3AEIN-017-A, 0908-LE01-3AEIN-018-A, and 0908-LE01-3AEIN-019-A, are described in the "Acceptance criteria table," document No. 0908-LE00-3BEIN-026-B, "Inspection and Maintenance Manual." The staff proposes the following conditions related to the acceptance criteria in document No. 0908-LE00-3BEIN-026-B:
 - a. "There must not be any signs of corrosion."
 - b. Package labels must be legible at all times.
 - c. No cracks are allowed in any weld(s).

3. In addition to the operation steps described in document No. 0908-LE00-3BEIN-017, "Operation Manual," Section 7.2.8, "Transport of Empty Package," for shipments of empty packages, the package user shall confirm that the empty package meets the limits for internal non-fixed contamination specified in TS-R-1, 2009 Edition, paragraph 425(c) for empty packagings.
4. In addition to the operation steps described in document No. 0908-LE00-3BEIN-017, "Operation Manual," Section 7.2.7, "Transport," Step 1.f, for shipments of loaded packages, the package user shall verify that the transport index (TI) does not exceed 10.
5. In addition to the operation steps described in document No. 0908-LE00-3BEIN-017, "Operation Manual," Section 7.2.2, "Loading of Fissile Substances in Inner Cans," per TS-R-1, paragraph 506, and the radioactive and fissile properties, any other dangerous properties of the contents of the package, such as explosiveness, flammability, pyrophoricity, chemical toxicity and corrosiveness, shall be taken into account. Therefore:
 - a. For uranium metal powder, granules, swarf (chips, turnings, filings, or shavings), pieces and/or chunks:
 - i. each "inner container" (inner can) as shown in document No. 908-LE01-3AEIN-007-A must be maintained in a vacuum dry and inert atmosphere, to prevent the presence of oxygen or flammable gas prior or during shipment.
 - ii. the "container of the inner containers" as shown in document No. 908-LE01-3AEIN-10-A and 908-LE01-3AEIN-005-A, "Packaging Main Body," must be maintained in a vacuum dry and inert atmosphere to prevent the presence of oxygen or flammable gas during shipment.
 - b. Plastic in any form, potentially producing flammable gas (e.g., hydrogen) and/or water vapor by thermolysis and/or radiolysis, is prohibited for shipment.

R. Boyle

- 3 -

If you have any questions regarding this matter, please contact Norma García Santos of my staff at (301) 415-6999.

Sincerely,

/RA/

John McKirgan, Chief
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-3090
CAC Nos. L25036 and A33010

Enclosures:

1. Safety Evaluation Report
2. Translation of the Argentinian Certificate of Approval in English

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This closes CAC No. L25036.

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SAFETY EVALUATION REPORT

**Model No. LEUPA Package
Argentine Certificate of Approval No. RA/0103/B(U)F-96
Docket No. 71-3090**

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NUCLEAR REGULATORY COMMISSION**
WASHINGTON, D.C. 20555-0001

**SAFETY EVALUATION REPORT
Model No. LEUPA Package
Argentinian Certificate of Approval No. D/4365/AF-96
Docket No. 71-3090**

SUMMARY

The U.S. Department of Transportation (DOT) requested that the U.S. Nuclear Regulatory Commission (NRC) staff review the Model No. LEUPA (LEUPA package or LEUPA shipping container), Type B fissile package, as authorized by the Argentinian Certificate of Approval No. RA/0103/B(U)F-96, and provide a recommendation concerning the revalidation of the certificate for import and export use. The DOT submitted a request by letter dated July 9, 2015 (Agencywide Documents Access and Management Systems (ADAMS) Accession No. ML15222B182 and ADAMS Package Accession No. ML15222B189) and supplemented its initial submittal on the following dates:

- 1) July 14, 2015 (ADAMS Accession No. ML15229A150),
- 2) August 11, 2015 (ADAMS Accession No. ML15243A105),
- 3) September 22, 2015 (ADAMS Package Accession No. ML15267A048);
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- 5) August 19, 2016 (ADAMS Accession No. ML16245A725),
- 6) August 31, 2016 (ADAMS Package Accession No. ML16245A549), and
- 7) September 28, 2016 (ADAMS Package Accession No. ML16272A166).

The staff evaluated the design of the packaging Model No. LEUPA against the standards in the International Atomic Energy Agency (IAEA) Safety Standards Series No. TS-R-1, "Regulations for the Safe Transport of Radioactive Material," 2009 Edition. Appendix A includes a summary of the documents submitted by the applicant as part of this review. Since the package is designed and approved to be a Type B(U)F package, the staff did not consider the impacts of the Type C package tests included in the application as part of its review. The only exception, as noted in Section 6.0, "Shielding Evaluation," of this Safety Evaluation Report (SER), was for analyses of accident dose rates. Furthermore, while the package contents are less than a Type A quantity, the staff reviewed the application against the requirements for a Type B package, since the Argentine Competent Authority approved this package as a Type B package.

Based upon the statements and representations contained in the SAR and supplemental information, and for the reasons stated below, the staff recommends that the DOT revalidate the Argentinian Certificate of Approval No. RA/0103/B(U)F-96 with the following conditions:

1. Plastic moderating material is prohibited for air shipment.
2. The acceptance criteria for components in drawing Nos. 0908-LE01-3AEIN-015-A, 0908-LE01-3AEIN-017-A, 0908-LE01-3AEIN-018-A, and 0908-LE01-3AEIN-019-A, are described in the "Acceptance criteria table," document No. 0908-LE00-3BEIN-026-B, "Inspection and Maintenance Manual." The staff proposes the following conditions related to the acceptance criteria in document No. 0908-LE00-3BEIN-026-B:
 - a. "There must not be any signs of corrosion."
 - b. Package labels must be legible at all times.
 - c. No cracks are allowed in any weld(s).
3. In addition to the operation steps described in document No. 0908-LE00-3BEIN-017, "Operation Manual," Section 7.2.8, "Transport of Empty Package," for shipments of empty packages, the package user shall confirm that the empty package meets the limits for internal non-fixed contamination specified in TS-R-1, 2009 Edition, paragraph 425(c) for empty packagings.
4. In addition to the operation steps described in document No. 0908-LE00-3BEIN-017, "Operation Manual," Section 7.2.7, "Transport," Step 1.f, for shipments of loaded packages, the package user shall verify that the transport index (TI) does not exceed 10.
5. In addition to the operation steps described in document No. 0908-LE00-3BEIN-017, "Operation Manual," Section 7.2.2, "Loading of Fissile Substances in Inner Cans," per TS-R-1, paragraph 506, and the radioactive and fissile properties, any other dangerous properties of the contents of the package, such as explosiveness, flammability, pyrophoricity, chemical toxicity and corrosiveness, shall be taken into account. Therefore:
 - a. For uranium metal powder, granules, swarf (chips, turnings, filings, or shavings), pieces and/or chunks:
 - i. each "inner container" (inner can) as shown in document No. 908-LE01-3AEIN-007-A must be maintained in a vacuum dry and inert atmosphere, to prevent the presence of oxygen or flammable gas prior or during shipment.
 - ii. the "container of the inner containers" as shown in document No. 908-LE01-3AEIN-10-A and 908-LE01-3AEIN-005-A, "Packaging Main Body," must be maintained in a vacuum dry and inert atmosphere to prevent the presence of oxygen or flammable gas during shipment.
 - b. Plastic in any form, potentially producing flammable gas (e.g., hydrogen) and/or water vapor by thermolysis and/or radiolysis, is prohibited for shipment.

The following sections include the staff evaluation to address the revalidation request from the DOT.

1.0 GENERAL INFORMATION

The LEUPA package is designed to ship the following materials:

- 1) UO₂ in powder, pellets, or other;
- 2) metal uranium in powder, grains, chips, or other;
- 3) U₃Si₂ in powder, chips, or other;
- 4) U_xAl_y in powder, chips, or other;
- 5) UN in powder, pellets, or other; and
- 6) U₃O₈ in powder, pellets, or other.

The contents are limited to solid forms of these uranium compounds. The LEUPA package can ship a maximum of 50 kg of unirradiated uranium in solid form with a maximum enrichment of 20 weight percent (wt.%) of uranium-235 (²³⁵U). The maximum mass of the contents will vary based on the densities of the contents (see Table 1 of document No. 0908-LE00-3BEIN-023, "Safety Report") but will not exceed a uranium mass of 50 kg. The maximum weight of the empty package is 430 kg as described in document No. 0908-LE00-3BIEN-023-C, "Safety Report." The package can be transported by land, barge, or air (plastic material is prohibited for shipment of the contents by air).

Table 1.0. General Requirements for all Packaging and Packages

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Evaluation
807	An application for approval shall include: (a) a detailed description of the proposed <i>radioactive contents</i> ...; (b) a detailed statement of the <i>design</i> , including complete engineering drawings ...; (c) a statement of the tests which have been done and their results, or evidence ...; and (d) the proposed operating and maintenance instructions for the use of the <i>packaging</i> ...	Requirement met.
813	An application for approval shall include all information necessary to satisfy the competent authority that the design meets the requirements of paragraph 671, ...	Requirement met.

2.0 STRUCTURAL EVALUATION

The staff reviewed the application of the LEUPA package as well as responses to requests for additional information (RAIs) to determine the structural sufficiency against the standards in the IAEA Safety Standards Series No. TS-R-1, 2009 Edition. A summary of the staff's structural evaluation is provided below.

Table 2.0. Structural Evaluation Considering General Requirements for all Packaging and Packages

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Structural Evaluation
606	<i>Package</i> mass, volume and shape shall be such that it can be easily and safely transported. In addition, the <i>package</i> needs to be properly secured in or on the <i>conveyance</i> during transport.	Requirement met. The staff reviewed document No. 0908-LE01-3AEIN-004-B and verified that the package can be transported safely in or on a conveyance.
607	Any lifting attachments on the <i>package</i> will not fail when used in the intended manner and that, if failure of the attachments should occur, the ability of the <i>package</i> to meet other requirements of these regulations would not be impaired. Take account of appropriate safety factors to cover snatch lifting.	Requirement met. The staff reviewed document Nos. 0908-LE01-3AEIN-004-B, 0908-LE01-3AEIN-010-A, 0908-LE01-3BEIN-012-B, and 0908-LE00-3BEIN-023-C. The staff verified that the package is designed to be lifted using a mechanical lifting device through two of the four shackle support provided. The staff found that all stresses were significantly below the allowable stresses.
608	Attachments and any other features on the outer surface of the <i>package</i> which could be used to lift it shall be designed either to support its mass in accordance with the requirements of paragraph 607 or shall be removable or otherwise rendered incapable of being used during transport.	Requirement met. The staff reviewed document Nos. 0908-LE01-3AEIN-004-B and 0908-LE01-3BEIN-012-B. The staff verified that there are no other attachments or other features that could reasonably be used to lift the package. The hook devices to lift the package are designed to sustain the total mass of the package. (Also see paragraph 607 of this SER.)
610	As far as practicable, the outer layer of the <i>package</i> shall be so designed as to prevent the collection and the retention of water.	Requirement met. The staff reviewed document Nos. 0908-LE01-3AEIN-004-B and 0908-LE01-3AEIN-010-A and verified that the outer surface of the package complies with the requirement of avoiding collection and retention of water.
612	The <i>package</i> shall withstand the effects of any acceleration, vibration, or vibration resonance which may arise under routine conditions of transport without any deterioration in the effectiveness of the closing devices on the various receptacles or in the integrity of the	Requirement met. The staff reviewed document Nos. 0908-LE01-3AEIN-004-B, and 0908-LE01-3AEIN-010-A, and 0908-LE01-3BEIN-025-B. The staff verified that the nuts,

Table 2.0. Structural Evaluation Considering General Requirements for all Packaging and Packages

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Structural Evaluation
612 (Continue)	<i>package</i> as a whole. In particular, nuts, bolts, and other securing devices shall be so designed as to prevent them from becoming loose or being released unintentionally, even after repeated use.	bolts, and other securing devices were designed to prevent from becoming loose. Therefore, the staff concludes that the package, including the inner packages, will withstand the vibration incident to transport.
617	For <i>packages</i> to be transported by air, the temperature of the accessible surfaces shall not exceed 50 degrees Celsius (°C) at an ambient temperature of 38°C, with no account taken for insolation.	Requirement met. The staff reviewed document No. 0908-LE00-3BEIN-023-C and verified that the accessible surfaces of the package would not exceed the limit of 50°C.
619	<i>Packages</i> containing <i>radioactive material</i> , to be transported by air, shall be capable of withstanding, without leakage, an internal pressure that produces a pressure differential of not less than the <i>maximum normal operating pressure</i> plus 95 kilopascals (kPa).	Requirement met. The staff reviewed document No. 0908-LE00-3BEIN-023-C. The staff verified that the external pressure used in the analysis is only 5 kPa at 800°C for a reduced pressure condition when this package is transported by air.

Table 2.1. Structural Evaluation Considering Requirements for Type A Packages

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Structural Evaluation
633	<i>Type A packages</i> shall be designed to meet the requirements specified in paragraphs 606 to 616 and, in addition, the requirements of paragraphs 617 to 619 (if carried by air) and paragraphs 634 to 649.	Requirement met. See paragraphs 606 to 619 and 634 to 649 of this SER.
634	The smallest overall external dimension of the <i>package</i> shall not be less than 10 centimeters (cm).	Requirement met. The staff reviewed document Nos. 0908-LE00-3BEIN-023-C and 0908-LE01-3AEIN-004-B. The minimum dimension of the package is 34cm, which is greater than 10cm.

Table 2.1. Structural Evaluation Considering Requirements for Type A Packages

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Structural Evaluation
635	The outside of the <i>package</i> shall incorporate a feature such as a seal, which is not readily breakable and which, while intact, will be evidence that it has not been opened.	Requirement met. The staff reviewed document Nos. 0908-LE00-3BEIN-023-C 0908-LE01-3AEIN-004-B. The staff verified that a tamper seal is attached to the clamp ring.
636	Any tie-down attachments on the <i>package</i> shall be so designed that, under normal and accident conditions of transport, the forces in those attachments shall not impair the ability of the <i>package</i> to meet the requirements of these regulations.	Requirement met. The shackles described in paragraph 607 also serve as tie down devices. The staff reviewed the analysis and test results presented in document Nos. 0908-LE00-3BEIN-023-C and 0908-LE01-3BEIN-025-B. The applicant analysis showed that the tie-down devices (e.g., cable, tensor, wedges, bolts, etc.) can withstand a lateral acceleration of 10g, with stress in any material of the package less than its relevant yield strength.
643	The <i>containment system</i> shall retain its <i>radioactive contents</i> under a reduction of ambient pressure to 60kPa.	See paragraph 729 of this SER.
646	A <i>package</i> shall be so designed that if it were subjected to the tests specified in paragraphs 719 to 724 ...	Requirement met in terms of the structural evaluation. The staff reviewed document No. 0908-LE00-3BEIN-023-C and verified that the package has been subjected to, and the results described for, the tests specified in paragraphs 719 to 724. For evaluation of compliance with paragraphs 646(a) and (b), see the containment and shielding sections, respectively, in this SER.

Table 2.2. Structural Evaluation Considering Requirements for Packages Containing Fissile Material

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Structural Evaluation
675	The <i>package</i> , after being subjected to the tests specified in paragraphs 719 to 724, must prevent the entry of a 10-cm cube.	Requirement met. The staff reviewed document No. 0908-LE02-3BEIN-008-B. Per the applicant, as shown in Figures 18 and 19 of the test final report, during the penetration test, the maximum penetration diameter as measured was 14 cm. This 14-cm diameter penetration progressively decreased towards the middle, which prevents a 10-cm cube to enter the external hull.

Table 2.3. Structural Evaluation for Test Procedures

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Structural Evaluation
701	Demonstration of compliance with the performance standards required in Section VI shall be accomplished by any of the methods listed below or by a combination thereof. See TS-R-1 paragraph 701 for details. (See previous page for a complete description.)	Requirement met. The staff reviewed document No. 0908-LE00-3BEIN-023-C. The staff verified that: (1) tests were performed on the prototype of the LEUPA package, and (2) compliance with the applicable performance standards was accomplished.
702	After the specimen, prototype or sample has been subjected to the tests, appropriate methods of assessment shall be used to ensure that the requirements of this section have been fulfilled in compliance with the performance and acceptance standards prescribed in Section VI of TS-R-1.	Requirement met. (See document No. 0908-LE00-3BEIN-023-C.)
713	All specimens shall be inspected before testing in order to identify and record faults or damage including the following: (a) divergence from the <i>design</i> ; (b) defects in manufacture; (c) corrosion or other deterioration; and (d) distortion of features.	Requirement met. (See document No. 0908-LE00-3BEIN-023-C.)

Table 2.3. Structural Evaluation for Test Procedures

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Structural Evaluation
714	The <i>containment system</i> of the <i>package</i> shall be clearly specified.	See evaluation for paragraph 641 of this SER.
715	The external features of the specimen shall be clearly identified in order to simply and clearly reference any part of such specimen.	Requirement met. (See document No. 0908-LE00-3DEIN-018-C.)
716(a)	After each of the applicable tests specified in paragraphs 718 to 737: (a) Faults and damage shall be identified and recorded;	Requirement met in terms of the structural evaluation. The staff reviewed document No. 0908-LE00-3BEIN-023-C. The staff verified that the applicant identified the tests and recorded the resulting faults and damages to the package.
717	The target for the drop test is specified in paragraphs 705, 722, 725(a), 727, and 735. The surface shall be a flat and horizontal surface of such a character that any increase in its resistance to displacement or deformation upon impact by the specimen would not significantly increase damage to the specimen.	Requirement met. The staff reviewed document No. 0908-LE02-3BEIN-002-B. The target was at the CNEA facilities in province of Rio Negro and consisted of a concrete cube of a 4-m length on each side, set on a rocky ground. A 5-cm flat carbon steel plate was firmly set on the concrete, making the target essentially an unyielding surface.
719	The tests are: the water spray test, the free drop test, the stacking test, and the penetration test. Specimens of the <i>package</i> shall be subjected to the free drop test, the stacking test and the penetration test, preceded in each case by the water spray test. One specimen may be used for all the tests, provided that the requirements of paragraph 720 are fulfilled.	Requirement met. The staff reviewed document No. 0908-LE02-3BEIN-008-B. (See evaluation for paragraph 722 (free drop test), paragraph 723 (stacking test), and paragraph 724 (penetration test).)
720	The time interval between the conclusion of the water spray test and the succeeding test: See TS-R-1 paragraph 720 for details.	Requirement met. The applicant performed the water spray test. (See paragraph 721 in this SER.)
721	<i>Water spray test</i> - The specimen shall be subjected to a water spray test that simulates exposure to rainfall of approximately 5 cm per hour (5 cm/hr.) for at least one hour.	Requirement met. The applicant included the description of the water spray test in document No. 0908-LE02-3BEIN-008-B. There was more than 5cm of water inside the container. However, the specimen did not suffer any alteration in its external structure.

Table 2.3. Structural Evaluation for Test Procedures

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Structural Evaluation
722 (a), (b), (c)	<i>Free drop test</i> - The specimen shall drop onto the target so as to suffer maximum damage in respect of the safety features to be tested. See TS-R-1 paragraph 722 (a), (b), and (c) for details.	Requirement met. The applicant performed a full-scale physical testing of the LEUPA package, with an approximate mass of 480 kg. The height of the drop test was 1.2 m and the nature of the target complied with the applicable requirements. Paragraphs 722 (b) and (c) are not applicable because this package is not constructed with
723(a)	<i>Stacking test</i> - See TS-R-1 paragraph 723 for details.	Paragraph 723 (a) requirement is met. (Paragraph 723 (b) is not applicable.) The staff reviewed document No. 0908-LE02-3BEIN-008-B. The applicant applied a compressive load of approximately 2,400kg (an equivalent of five times the approximate mass of the package of 480 kg) for a period of 24 hours during the full-scale test.
724	<i>Penetration test</i> - See TS-R-1 paragraph 724 for details.	Requirement met. The staff reviewed document No. 0908-LE02-3BEIN-002-B. The applicant used the same full-scale of the prototype package for the normal condition free drop test and the required penetration test. A steel bar of a 3.2 cm diameter and a mass of 6 kg with hemispherical end was dropped from a height of 1m and impacted the center of the side of the package. After the penetration test, the applicant documented the damage status to the package. The staff noted that the bar left a small mark (3-mm deep). However, the inner container remained fully secured. Since the penetration test did not reduce the overall effectiveness of the package, the staff concludes that requirements of paragraphs 724(a) and (b) are met.

Table 2.3. Structural Evaluation for Test Procedures

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Structural Evaluation
726	The specimen shall be subjected to the <i>cumulative effects of the tests</i> specified in paragraph 727 and paragraph 728, in that order. Following these tests, either this specimen or a separate specimen shall be subjected to the effect(s) of the water immersion test(s) as specified in paragraph 729 and, if applicable, paragraph 730.	Requirement met. The staff reviewed document Nos. 0908-LE02-3BEIN-002-B and 0908-LE02-3BEIN-008-B. The staff verified that the package was subject to the cumulative effects of the tests specified in paragraphs 727 and 728 in that order, and subsequently the same prototype was subjected to the water immersion test described in paragraph 729. Therefore, the staff concludes that requirements of paragraph 726 are met.
727	<i>Mechanical test</i> - The mechanical test consists of three different drop tests. Each specimen shall be subjected to the applicable drops as specified in paragraph 656 or paragraph 682. For details of Drop I, II, and III, see TS-R-1, paragraph 727.	The staff reviewed document Nos. 0908-LE02-3BEIN-008-B and 0908-LE02-3BEIN-002-B. The mechanical tests described as Drop I, Drop II, and Drop III (as specified in TS-R-1 paragraph 727) were conducted as required. After all the drops, the applicant performed a visual inspection and observed that slight flattening occurred at the area of impact, and a small release of insulating material through the pressure release holes. Based on the description of the damage subsequent to these tests, the staff concludes that the requirements of this paragraph are met.
729	<i>Water immersion test</i> - The specimen shall be immersed under a head of water of at least 15 m for a period of not less than eight hours in the attitude which will lead to maximum damage. For demonstration purposes, an external gauge pressure of at least 150 kPa shall be considered to meet these conditions.	Requirement met. The staff reviewed document No. 0908-LE02-3BEIN-008-B and verified that this test was performed using specimen No. LEUPA 02 (LEUPA 02) of the package. Subsequent to the test, the applicant observed and documented that the cover of the container of the inner cans were not wet, and both the inner cans as well as their payload were in acceptable state.

Table 2.3. Structural Evaluation for Test Procedures

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Structural Evaluation
730	Enhanced water immersion test for Type B (U) and Type B (M) packages containing more than $10^5 \times A_2$ and Type C packages: Enhanced water immersion test: The specimen shall be immersed under a head of water of at least 200 m for a period of not less than one hour. For demonstration purposes, an external gauge pressure of at least 2 MPa shall be considered to meet these conditions.	Requirement met. Per the document Nos. 0908-LE02-BEIN-002-B and 0908-LE02-3BEIN-004-A, the LEUPA specimen was modeled using the finite element method applying an external pressure of 2 MPa. The staff reviewed the documents submitted by the applicant and verified that the connection/flange of the internal container did not suffer any deformities.
731, 732, and 733	Water leakage test for packages containing fissile material. See TS-R-1 paragraphs 731 732, and 733 for details.	Requirement of paragraph 733 are met, as there was no leakage out of the inner cans, regardless of the content.
734 and 735	Specimens shall be subjected to the effects of each of the following test sequences in the orders specified: (a) the tests specified in paragraphs 727(a), 727(c), 735 (<i>puncture/tearing test</i>) and 736; and (b) the test specified in paragraph 737. Separate specimens are allowed to be used for each of the sequences (a) and (b).	Requirement met. See evaluation for paragraph 727 of this SER.

Table 2.4. Structural Evaluation for Approval and Administrative Requirements.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Structural Evaluation
807	An application for approval shall include: (a) a detailed description of the proposed <i>radioactive contents</i> with reference to their physical and chemical states and the nature of the radiation emitted; (b) a detailed statement of the <i>design</i> , including complete engineering drawings and schedules of materials and methods of manufacture; (c) a statement of the tests which have been done and their results, or evidence based on calculative methods or other evidence that the <i>design</i> is adequate to meet the applicable requirements; (d) the proposed operating and maintenance instructions for the use of the <i>packaging</i> ;	The staff reviewed document No. 0908-LE00-3BEIN-023-C. Requirements related to paragraph 807 a), b), c) and d) are met in terms of the structural evaluation.

2.1 Conclusion

Based on review of the statements and representations in the application, the staff concludes that the LEUPA package meets the structural requirements of the applicable IAEA TS-R-1 regulations, 2009 Edition.

3.0 MATERIALS EVALUATION

The staff reviewed the adequacy of the packaging materials of the Model No. LEUPA. The shipping rack of the LEUPA shipping container is welded construction of tubes and flat sections made of austenitic stainless steel. The pellet box and the lid are made of austenitic steel plate. The applicant states in its "Safety Report" that the packaging materials will be able to withstand the tests under normal and accident conditions of transport.

A summary of the applicable TS-R-1 requirements related to the materials performance of the package, and the ability of the package design to meet such requirements, is provided below.

Table 3.0. Summary of Materials Evaluation

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Materials Evaluation
501(c)	Requirement before first shipment - For packages containing fissile material, where, in order to comply with the requirements of paragraph 671, neutron poisons are specifically included as components of the package, checks shall be performed to	The staff verified in applicant's document No. 0908-LE01-3BEIN-024-B that fissile substances will be packed in polyethylene bags or the similar in

Table 3.0. Summary of Materials Evaluation

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Materials Evaluation
<p>501(c) (Continue)</p>	<p>confirm the presence and distribution of those neutron poisons.</p>	<p>preparation for transportation. The package, is a single-inseparable set with enclosure systems and thermal insulation. Linked to the container is a cylindrical stainless steel double wall. The space between walls is filled with neutron absorbent material (i.e., casted high purity cadmium). The flanged cover of the container also has a double wall filled with cadmium.</p> <p>The LEUPA package is designed to transport non-irradiated low enriched uranium.</p>
<p>506</p>	<p>In addition to the radioactive and fissile properties, any other dangerous properties of the contents of the package, such as explosiveness, flammability, pyrophoricity, chemical toxicity and corrosiveness, shall be taken into account in the packing, labelling, marking, placarding, storage and transport in order to be in compliance with the relevant transport regulations for dangerous goods of each of the countries through or into which the materials will be transported, and, where applicable, with the regulations of the cognizant transport organizations, as well as these Regulations.</p>	<p>The staff reviewed the operation steps described in document No. 0908-LE00-3BEIN-017, "Operation Manual," Section 7.2.2, "Loading of Fissile Substances in Inner Cans," and the Certificate issued by the Argentinian Competent Authority that describes the contents to be transported in the Model No. LEUPA. The staff did not find an analysis considering:</p> <p>(1) possible the pyrophoricity of uranium metal powder, granules, swarf (chips, turnings, filings, or shavings), pieces and/or chunks.</p> <p>Therefore , the staff is recommending a condition to ship these materials in an inert</p>

Table 3.0. Summary of Materials Evaluation

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Materials Evaluation
<p>506 (Continue)</p>		<p>atmosphere, and (2) possible reactions between uranium metal and plastic material (See Section 3.1 below for additional information).</p>
<p>507, 613, 642</p>	<p>Materials of the packaging and any components or structures shall be physically and chemically compatible with each other and with the radioactive contents. Account shall be taken of their behavior under irradiation. The design of any component of the containment system shall take into account, where applicable, the radiolytic decomposition of liquids and other vulnerable materials and the generation of gas by chemical reaction and radiolysis.</p>	<p>The staff verified in the applicant's document No. 0908-LE01-3BEIN-013-B that all components (which could become in contact with the radioactive contents) are made of stainless steel. The materials used for the components of the packaging are physically and chemically compatible with each other and with its radioactive contents. Stainless steel components, Type 304L/316L, are pickled and passivated.</p> <p>Also, document No.0908-LE00-3BEIN-023-C includes a description of the materials of construction of the inner container, inner cans, inner cover, external cover, intermediate cover (contains Kaolite), external cover of the container of inner cans, and the thermal insulator (Kaolite 1600 chamber). The thermal insulator is fixed to the package by M12 bolts. The cadmium chamber would be able to resist pressures up to 150 psi. the containment system is divided into three parts: 1) container of inner cans, 2) cadmium chamber, and</p>

Table 3.0. Summary of Materials Evaluation

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Materials Evaluation
<p>507, 613, 642 (Continue)</p>		<p>3) Kaolite chamber, which withstand temperatures up to 871°C. Elastomeric (nitrile) joints serve to seal the package with the intermediate and external covers and to protect the load from dirt and humidity. The graphite spiral gasket seals the internal and external load pressures.</p>
<p>607</p>	<p>Specifies that the design shall be such that any lifting attachment on the package will not fall when used in the intended manner and that, if failure of the attachments should occur, the ability of the package to meet other requirements of these regulations would not be impaired. The design shall take account of appropriate safety factors to cover snatch lifting.</p>	<p>Requirement met. There are no special attachments on the package.</p>
<p>615, 618, 637</p>	<p>The design of the package shall take into account temperatures ranging from -40°C to 70°C for the components of the packaging. Attention shall be given to freezing temperatures for liquids and to the potential degradation of packaging materials within the given temperature range.</p>	<p>The staff verified in the applicant's document No. 0908-LE00-3BEIN-023-C that the LEUPA shipping container components are designed for a temperature range from -40°C to 70°C. The joint between both is sealed by means of a graphite spiral gasket that can work with a limit temperature of up to 450°C. The thermal insulator is called in the market Kaolite 1600, a vermiculite cementitious composite in powder that must be prepared mixing it with water, and can be used at 1,600°F (871°C). The joint to be used in the container is a spiral gasket, with a "V" stainless steel strip and a graphite filling. The rubber gasket to be used in the</p>

Table 3.0. Summary of Materials Evaluation

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Materials Evaluation
615, 618, 637 (Continue)		intermediate cover and external cover are built from a rubber plate of nitrile.
638	The design and manufacturing techniques shall be in accordance with national or international standards, or other requirements, acceptable to the competent authority.	Requirement met. The staff verified in the applicant's document No. 0908-LE01-3BEIN-013-B that the design and fabrication of the Model No. LEUPA are in accordance with the American Society of Testing and Materials (ASTM), American National Standards Institute (ANSI), International Organization for Standardization (ISO), and American Society of Mechanical Engineers (ASME), national/internationally recognized consensus standards.

3.1 Additional Information Related to the Materials Evaluation

Per TS-R-1, paragraph 506, in addition to the radioactive and fissile properties, any other dangerous properties of the contents of the package, such as explosiveness, flammability, pyrophoricity, chemical toxicity and corrosiveness, shall be taken into account. Regarding paragraph 506 of TS-R-1, the staff notes the following:

- a. specific area is the amount of surface area per unit weight of a material,
- b. specific surface area is the ratio of reactive surface area to the mass of the material,
- c. increasing the material mass and/or decreasing its surface area will decrease the material specific surface area that will suppress its pyrophoric characteristics.
- d. for spherical particles, the specific surface area is inversely proportional to the particle diameter, therefore, specific surface area increases as the particle diameter decreases.

The staff reviewed the application for the Model No. LEUPA including document No. 0908-LE00-3BEIN-017, "Operation Manual," Section 7.2.2, "Loading of Fissile Substances in Inner Cans," as well as the Certificate issued by the Argentinian Competent Authority that describes the contents to be transported in the Model No. LEUPA. The applicant did not provide an analysis considering:

- a. pyrophoricity for oxides, and
- b. generation of gases in contact with plastic material - Plastic in any form may potentially produce flammable gas (e.g., hydrogen) and/or water vapor (moisture) by thermolysis

and/or radiolysis. Radiolysis may release oxygen from water molecule breakage if moisture is present.

Therefore, the staff is recommending the following condition in order to achieve compliance with TS-R-1, paragraph 506:

“In addition to the operation steps described in document No. 0908-LE00-3BEIN-017, “Operation Manual,” Section 7.2.2, “Loading of Fissile Substances in Inner Cans,” per TS-R-1, paragraph 506, in addition to the radioactive and fissile properties, any other dangerous properties of the contents of the package, such as explosiveness, flammability, pyrophoricity, chemical toxicity and corrosiveness, shall be taken into account. Therefore:

- a. For uranium metal powder, granules, swarf (chips, turnings, filings, or shavings), pieces and/or chunks:
 - i. each “inner container” (inner can) as shown in document No. 908-LE01-3AEIN-007-A must be maintained in a vacuum dry and inert atmosphere, to prevent the presence of oxygen or flammable gas prior or during shipment.
 - ii. the “container of the inner containers” as shown in document No. 908-LE01-3AEIN-10-A and 908-LE01-3AEIN-005-A, “Packaging Main Body,” must be maintained in a vacuum dry and inert atmosphere to prevent the presence of oxygen or flammable gas during shipment.
- b. Plastic in any form, potentially producing flammable gas (e.g., hydrogen) and/or water vapor by thermolysis and/or radiolysis, is prohibited for shipment.”

3.2 Conclusion

The staff finds that the LEUPA shipping container is composed of materials with a service proven history of use. Based on review of the statements and representations in the application, in addition to the recommended condition, the staff concludes that the materials aspects of the packaging design meets the IAEA requirements of TS-R-1, 2009 Edition.

4.0 THERMAL EVALUATION

The staff reviewed the thermal properties of the materials used for the Model No. LEUPA package and the description of the thermal analysis against the standards in the IAEA Safety Standards Series No. TS-R-1, 2009 Edition. A summary of the applicable TS-R-1 requirements related to the thermal performance of the package and the ability of the package design to meet such requirements is provided below.

Table 4.0. Summary of Thermal Evaluation

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Thermal Evaluation
637	The design of the package shall consider temperatures ranging from -40°C to 70°C for the components of the packaging. Attention shall be given to freezing temperatures for liquids and to the potential degradation of packaging materials within the given temperature range.	Requirement met, based on the following documents: (1) LEUPA's safety analysis report (SAR), Section 4.3, (2) document No. 0908-LE01-3BEIN-011-B, (3) March 15, 2016, RAI response, and (4) July 2016 RAI response.
642	The design of any component of the containment system shall consider, where applicable, the radiolytic decomposition of liquids and other vulnerable materials and the generation of gas by chemical reaction and radiolysis.	Requirement met per LEUPA's SAR, Section 4.3. Based on the Argentinian certificate, fresh fuel contents have negligible decay heat. Therefore, there should not be significant radiolysis and gas generation due to the contents shipped in the LEUPA package.
643	The containment system shall retain its radioactive contents under a reduction of ambient pressure to 60 kPa.	Requirement met, per the following documents: (1) LEUPA's SAR, Section 4.3, (2) March 15, 2016, RAI response, and (3) July 2016 RAI response.
728(a) and (b)	(a) Exposure of a specimen for a period of 30 minutes to a thermal environment with a minimum average flame emissivity coefficient of 0.9, an average temperature of 800°C, fully engulfing, and that the surface absorptivity coefficient is 0.8. (b) Exposure of the specimen to an ambient temperature of 38°C.	Requirement met. Per document No. 0908-LE00-2BEIN-015-B, the applicant assumed in its thermal analysis ambient/surface temperatures at nearly 900°C for 60 minutes. The negligible decay heat would tend to result in decreasing temperatures once the high temperature "fire" conditions were removed. (See also the fire test described in document No. 0908-LE02-3BEIN-008-B.)

4.1 Additional Information Related to the Thermal Evaluation

The conclusion of meeting the requirements within this table is based on the information provided in the application, as noted, and the fact that the content is unirradiated fuel. The methods and analyses presented in the application would have to be reviewed again as to their adequacy for other content, such as high decay heat or with high activity. The staff confirmed that the LEUPA thermal design meets the requirements for thermal performance outlined in IAEA TS-R-1, 2009 Edition, for the transportation of the proposed contents. The staff has reasonable assurance that the package will perform as designed for shipments made in accordance with the applicable certificate issued by the applicable competent authority.

4.2 Conclusion

The staff finds that the thermal evaluation provided by the applicant for the Model No. LEUPA package is acceptable. Based on review of the statements and representations in the application, the staff concludes that the applicant adequately described the thermal analysis related to this design and the packaging meets the IAEA requirements of TS-R-1, 2009 Edition.

5.0 CRITICALITY SAFETY EVALUATION

The staff reviewed the application for the LEUPA package as well as responses to RAIs to determine if the package design met the subcriticality limits set forth in the IAEA's regulations TS-R-1, 2009 Edition. The review included the evaluation and verification of the applicant's criticality calculations contained in the criticality analysis as well as descriptions of the design for the LEUPA shipping container as a Type B package. A summary of the applicable TS-R-1 requirements related to the criticality safety of the package, and the ability of the package design to meet such requirements, is provided below.

Table 5.0. Requirements for the Criticality Safety Review of the DOT Revalidation.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Criticality Safety Evaluation
501 (c)	Sets requirements that must be fulfilled before the first shipment of any package... For packages containing fissile material, where, in order to comply with the requirements of paragraph 671, neutron poisons are specifically included as components of the package, checks shall be performed to confirm the presence and distribution of those neutron poisons.	Requirement met. The container that houses the four inner cans of fissile material is surrounded by a cadmium tube-shaped plate used as a neutron absorber. However, the applicant demonstrated that, even with the absence of cadmium, the package remains well below subcritical conditions. Although the applicant did not specifically identify acceptance tests in the application, the applicant did provide acceptance criteria in response to an RAI.
502(g)	For packages containing fissile material, measurements of isotopic composition (if burnup credit is allowed) and tests of	This is a package for transporting fresh fuel, therefore, burnup credit is not allowed. In-

Table 5.0. Requirements for the Criticality Safety Review of the DOT Revalidation.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Criticality Safety Evaluation
502(g) (Continue)	the closure of the package (if special features are used to avoid in-leakage of water) shall be performed.	leakage of water has been evaluated to the most reactive extent.
523	The criticality safety index (CSI) for each consignment shall be determined as the sum of the CSIs of all the packages contained in that consignment.	CSI for a given consignment is determined at time of shipment. The minimum CSI for the Model No. LEUPA package is 0.69.
524	... nor shall the CSI of any package or overpack exceed 50 except for consignments under exclusive use.	Requirement met. The CSI does not exceed 0.69.
671(a)	Maintain subcriticality during normal and accident conditions of transport, in particular, the following contingencies shall be considered: water leaking into or out of packages; the loss of efficiency of built-in neutron absorbers or moderators; rearrangement of the contents either within the package or as a result of loss from the package; reduction of spaces within or between packages; packages becoming immersed in water or buried in snow; and temperature changes; and	Requirement met. The applicant's analysis includes consideration of: (1) water leakage into the package, including the effects of preferential flooding due to features that may restrict water flow into or from different void spaces within the package, (2) variation of moderator, and (3) effects of tolerances on the fuel contents and eccentric positioning of the contents. Based upon its review of the applicant's evaluation and independent confirmatory analyses, the staff finds the applicant's evaluation to be acceptable and it demonstrates that the package remains subcritical.
677(a)	For a package in isolation, it shall be assumed that water can leak into or out of all void spaces of the package, including those within the containment system. However, if the design incorporates special features to prevent such leakage of water into or out of certain void spaces, even as a result of error, absence of leakage may be assumed in respect of those void spaces. Special features shall include the following: ... Multiple high standard water barriers,	Requirement met. The package does not incorporate special features to prevent in-leakage of water. The criticality analysis assumes flooding of all package voids.

Table 5.0. Requirements for the Criticality Safety Review of the DOT Revalidation.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Criticality Safety Evaluation
677(a) (Continue)	each of which would remain watertight if the package were subject to the tests prescribed in paragraph 682(b), a high degree of quality control in the manufacture, maintenance and repair of packagings and tests to demonstrate the closure of each package before each shipment.	
678	It shall be assumed that the confinement system shall be closely reflected by at least 20 cm of water or such greater reflection as may additionally be provided by the surrounding material of the packaging. However, when it can be demonstrated that the confinement system remains within the packaging following the tests prescribed in paragraph 682(b), close reflection of the package by at least 20 cm of water may be assumed in paragraph 679(c).	Requirement met. The applicant assumed 30 cm water reflection in the criticality safety analyses.
679	The package shall be subcritical under the conditions of paragraphs 677 and 678 with the package conditions that result in the maximum neutron multiplication consistent with: (a) routine conditions of transport (incident free); (b) the tests specified in paragraph 681(b); and (c) the test specified in paragraph 682(b).	Requirement met. The applicant demonstrated that the maximum reactivity associated with the package under routine conditions of transport or hypothetical accident conditions, is adequately subcritical, per the applicant's criticality analysis.
680	For packages to be transported by air: (a) the package shall be subcritical under conditions consistent with the tests prescribed in paragraph 734 assuming reflection by at least 20 cm of water but no water in-leakage; and (b) allowance shall not be made for special features of paragraph 677 unless, following the tests specified in paragraph 734 and, subsequently, paragraph 733, leakage of water into or out of the void spaces is prevented.	Requirement met. The applicant assumed that the entire contents reconfigured into a homogeneous sphere without water moderation and reflected it by 30 cm water. Because the applicant did not include any moderating material in this model, plastic moderating material is prohibited for air shipment.

Table 5.0. Requirements for the Criticality Safety Review of the DOT Revalidation.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Criticality Safety Evaluation
681	A number "N" shall be derived, such that five times "N" shall be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:	Requirement met (N = 72). The applicant performed criticality array calculations assuming a 8×8×6 array (i.e., 384), which exceeds the 5×N (i.e., 360) array requirements.
681(a)	There shall not be anything between the packages, and the package arrangement shall be reflected on all sides by at least 20 cm of water, and...	Requirement met. The applicant modeled packages with no interspersed moderation and assumed reflection by 30 cm of water surrounding the array.
681(b)	The state of the packages shall be their assessed or demonstrated condition if they had been subjected to the test specified in paragraphs 719 to 724.	The criticality evaluation assumes that the package will maintain its integrity.
682	A number "N" shall be derived, such that two times "N" shall be subcritical for the arrangement and package conditions that provide the maximum neutron multiplication consistent with the following:...	Requirement met (N = 72). The applicant performed criticality calculations for accident conditions assuming a 6×6×4 array (i.e., 144), which equals the 2×N (i.e., 144) array requirements.
682(a)	Hydrogenous moderation between packages, and the package arrangement reflected on all sides by at least 20 cm of water; ...	Requirement met. The applicant placed packages in a 6×6×4 array, reflected by 30 cm of water and varied the moderation between packages from a density of ~0 to 1g/cm ³ .
682(b)	The tests specified in paragraphs 719 to 724 followed by any of the following, if the more limiting: the tests specified in paragraph 727(b) and, either paragraph 727(c) for packages having a mass not greater than 500 kg and an overall density not greater than 1,000kg/m ³ based on the external dimensions, or paragraph 727(a) for all other packages; followed by the test specified in paragraph 728 and completed by the tests specified in paragraphs 731 to 733; or the test specified in paragraph 729;	Requirement met. The applicant performed nuclear safety analyses for the package under hypothetical accident conditions assuming the damaged package is geometrically similar to the intact package.
682(c)	Where any part of the fissile material escapes from the containment system following the tests specified in paragraph 682(b), it shall be assumed	No fissile material escaped after the tests specified in paragraph 682(b), therefore, this paragraph does not apply.

Table 5.0. Requirements for the Criticality Safety Review of the DOT Revalidation.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Criticality Safety Evaluation
682(c) (Continue)	that fissile material escapes from each package in the array and all of the fissile material shall be arranged in the configuration and moderation that results in the maximum neutron multiplication with close reflection by at least 20 cm of water.	
683	The CSI for packages containing fissile material shall be obtained by dividing the number 50 by the smaller of the two values of N derived in paragraphs 681 and 682. The value of the CSI may be zero, provided that an unlimited number of packages are subcritical.	Requirement met. The derived CSI value is 0.69. This is consistent with the value of N equal to 72 used for the array of transport packages calculations for normal conditions of transport and hypothetical accident conditions.
716	After each of the applicable tests specified in paragraphs 718 to 737: (c) For <i>packages containing fissile material</i> , it shall be determined whether the assumptions and conditions used in the assessments required by paragraphs 671 to 682 for one or more <i>packages</i> are valid.	Requirement met. See the staff's findings described in the remainder of the tables for this section of the SER and the text following the tables.
731	Packages for which water in-leakage or out-leakage to the extent which results in greatest reactivity has been assumed for purposes of assessment under paragraphs 677 to 682 shall be excepted from the test.	Requirement met. Water in-leakage was assumed to the most reactive extent for all evaluations.
733	The specimen shall be immersed under a head of water of a least 0.9 m for a period of not less than eight hours and in the attitude for which maximum leakage is expected.	Requirement met. Water in-leakage was assumed to the most reactive extent for all evaluations.
807	Provides the requirements for the information which must be contained in an application for approval for Type B (U) and Type C packages.	See evaluation of each requirement in this paragraph pertaining to criticality in subsections 807(a), 807(b), 807(c), 807(d), and 807(f).
807(a)	An application for approval shall include: A detailed description of the proposed radioactive contents with reference to their physical and chemical states and the nature of the radiation emitted;	Requirement met. The applicant adequately described the contents to the extent necessary to evaluate its criticality safety.
807(b)	An application for approval shall include: A detailed statement of the design,	Requirement met. The applicant provided the engineering

Table 5.0. Requirements for the Criticality Safety Review of the DOT Revalidation.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Criticality Safety Evaluation
807(b) (Continue)	including complete engineering drawings and schedules of materials and methods of manufacture;	drawings of the Model No. LEUPA and specified the materials important to criticality safety.
807(c)	An application for approval shall include: A statement of the tests which have been done and their results, or evidence based on calculative methods or other evidence that the design is adequate to meet the applicable requirements;	Requirement met. The criticality evaluations were based on calculative methods, which were clearly stated in the application.
807(d)	An application for approval shall include: The proposed operating and maintenance instructions for the use of the packaging.	Requirement met. The staff reviewed document No. 0908-LE00-3BEIN-017-C, "Operation Manual," and finds that the procedures are adequate to ensure criticality safety.
810 (c)	A statement relative to any restrictions on the mode of transport and to any special loading, carriage, unloading or handling procedures; and	The applicant included handling procedures and these procedures are acceptable in terms of preventing a criticality. The package is acceptable for any mode of transport (road, rail, sea, or air). Since no moderator was assumed in the air transport analysis, the applicant has stated that plastic moderating material would be prohibited from being present during air transport.
813	An application for approval shall include all information necessary to satisfy the competent authority that the design meets the requirements of paragraph 671, and a specification of the applicable quality assurance program as required in paragraph 306.	Requirement met. The package meets the requirements in paragraph 671.

5.1 Additional Information Related to the Criticality Safety Evaluation

5.1.1 Criticality Design

The applicant controls criticality in the Model No. LEUPA package by limiting the amount of fissile material present in the package. The criticality analysis assumed metal uranium, which is the most reactive form of uranium because it has the highest concentration of uranium atoms per volume.

5.1.2 Normal Conditions of Transport

The applicant performed criticality analyses for the undamaged LEUPA package. For a single package, the applicant's assumed a 20-cm water reflector surrounding the package. For the array calculations, the applicant analyzed a 8×8×6 array of packages surrounded by 30 cm of water. The maximum k_{eff} for this configuration, assuming a single package, is 0.26095 and 0.45798 for an array.

5.1.3 Hypothetical Accident Conditions

For accident conditions, the applicant assumed that the damaged package is geometrically similar to the undamaged package. The results of the drop tests support this assumption. As a result of the fire accident condition, the applicant also determined that the cadmium absorber remains intact.

The applicant performed a criticality analysis for a single package surrounded by 20cm of water and for a 6×6×4 array of packages surrounded by 30cm of water. The applicant assumed variations in the quantity of water in the thermal insulator, inner cans, empty spaces, and cadmium chamber (including loss of cadmium in the cadmium chamber). The maximum k_{eff} for this configuration (for a single package) is 0.70805 and 0.81548 for an array.

5.1.4 Air Transport

The applicant requests that the LEUPA package be transported by air and therefore addresses criticality regulations pertaining to Type C packages. The applicant modeled a 50 kg homogeneous sphere of metal uranium with no moderating material and a 30 cm water reflector. The maximum k_{eff} in this geometry is 0.69758. The applicant indicated in a response to staff questions that the contents may be wrapped in plastic moderating material. For all other modes of transport this is bounded by the water moderation calculations. However, since the applicant did not assume the presence of plastic moderator material in the air transport analysis, the applicant stated that plastic moderating material would be prohibited from being present during air transport.

5.2 Conclusion

The applicant's criticality calculations result in a k_{eff} below the upper subcriticality limit (USL) of 0.9350. Based on this and the staff's evaluation as summarized above, the staff concludes that the LEUPA package meets the TS-R-1 regulations, 2009 Edition, with respect to criticality. The staff has reasonable assurance that the package will be subcritical during all normal and hypothetical accident conditions of transport.

6.0 SHIELDING EVALUATION

The staff reviewed the application to determine if the package design met the dose rate limits set forth in the IAEA’s regulations for the transportation of radioactive materials, TS-R-1, 2009 Edition. The review included the staff’s evaluation and verification of the applicant’s shielding evaluation contained in the English translation of the “Safety Report” and the “Dose Rate Calculations” for the LEUPA, issued in June 2015 and July 2016, respectively, as well as descriptions of the design contained in that “Safety Report” and the design drawings.

A summary of the applicable TS-R-1 (2009 Edition) requirements related to the shielding evaluation of the package, and the ability of the package design to meet these requirements, is provided below.

Table 6.0. Requirements for the Shielding Review of the DOT Revalidation – Requirements Before Each Shipment.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Shielding Evaluation
501(b)	<p>Before a packaging is first used to transport radioactive material ...</p> <p>For each Type B(U), Type B(M,) and Type C package and for each package containing fissile material, it shall be ensured that the effectiveness of its shielding and containment and, where necessary, the heat transfer characteristics and the effectiveness of the confinement system, are within the limits applicable to or specified for the approved design.</p>	<p>The staff reviewed the acceptance tests and maintenance programs described in both the “Manufacture Specifications” document and the “Inspection and Maintenance Manual.”</p> <p>The staff finds that the acceptance tests and maintenance programs are acceptable, with the following condition for revalidation:</p> <p>The acceptance criteria for drawings Nos. 0908-LE01-3AEIN-015-A, 0908-LE01-3AEIN-017-A, 0908-LE01-3AEIN-018-A, and 0908-LE01-3AEIN-019-A (listed in the acceptance criteria table in “Inspection and Maintenance Manual,” document No. 0908-LE00-3BEIN-026-B) should be modified to reflect that “There must not be any signs of corrosion ...” (bold indicates the modified text).</p>
502 (a) and (c)	<p>Before each shipment of any package, all the requirements specified in the approval certificates specified in the relevant provisions of these Regulations shall be satisfied for packages requiring competent authority approval.</p>	<p>The staff reviewed the package operations descriptions in the “Operation Manual.” The staff finds that the package operations descriptions are acceptable and sufficient to meet these</p>

Table 6.0. Requirements for the Shielding Review of the DOT Revalidation – Requirements Before Each Shipment.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Shielding Evaluation
502 (a) and (c) (Continue)	See previous page for complete description.	requirements, with the following conditions: (1) In addition to the operation steps described in document No. 0908-LE00-3BEIN-017-C, “Operations Manual,” Section 7.2.8, “Transport of Empty Package,” for shipments of empty packages, the package user shall confirm that the empty package meets the limits for internal non-fixed contamination specified in TS-R-1, 2009 Edition, paragraph 425(c) for empty packagings. (2) In addition to the operation steps described in document No. 0908-LE00-3BEIN-017-C, “Operations Manual,” Section 7.2.7, “Transport,” Step 1.f, for shipments of loaded packages, the package user shall verify that the TI does not exceed 10. Both of these conditions are needed to ensure the package operations adequately comply with the respective requirements.

Table 6.1. Requirements and Controls for Contamination of Leaking Packages.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Shielding Evaluation
507, 507(a) and (b), and 508	Under routine conditions of transport, the non-fixed contamination on the external surfaces of any package shall not exceed the following limits (over any averaged area of 300 cm ² of any part of the surface of the package) (a) 4 Bq/cm ² for beta and gamma emitters and low toxicity alpha emitters; and (b) 0.4 Bq/cm ² for all other alpha emitters	Requirements met. In the “Operation Manual” (document No. 0908-LE00-3BEIN-017-C), the applicant includes operational steps for ensuring that the non-fixed contamination on the external surfaces of the package does not exceed the limits of this paragraph. The staff finds these steps acceptable.
509	If it is evident or suspected that a package is damaged or leaking, access to the	Requirement met. The applicant provided information to address

Table 6.1. Requirements and Controls for Contamination of Leaking Packages.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Shielding Evaluation
509 (Continue)	package shall be restricted and a qualified person shall assess the extent of contamination and radiation level...in order to minimize its consequences...	this requirement in document No. 0908-LE00-3DEIN-018-C, "Transport Manual."
510	Packages which are damaged or leaking radioactive contents in excess of allowable limits for normal conditions of transport shall not be moved until "repaired," "reconditioned," or "decontaminated."	Requirement met. The applicant provided information to address this requirement in "Transport Manual," document No. 0908-LE00-3DEIN-018-C.

Table 6.2. Requirements and Controls for Transport of Excepted Packages.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Shielding Evaluation
515	"The radiation level at any point on the external surface of an excepted package shall not exceed 5 mSv/h..."	Requirement met. The "Operation Manual" includes an operation procedure to ensure a LEUPA package being shipped as an empty package will not exceed this limit. The staff finds this to be acceptable.

Table 6.3. Determination of Transport Index.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Shielding Evaluation
521	Determination of Transport Index (TI)	Requirement met. The determination of the TI is done at the time of shipment. The package's "Operation Manual" includes a procedure to determine the package's TI. The staff finds this to be acceptable as it is consistent with the TS-R-1 requirement. The applicant also calculated a TI for the proposed contents. The staff finds the applicant used the correct method for determining the TI.
524	Except for consignments under exclusive use, the TI of any package or overpack shall not exceed 10...	Requirement met. Based on the applicant's analysis and the staff's confirmatory evaluation, the staff finds that the TI for a package containing the allowable contents will not

Table 6.3. Determination of Transport Index.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Shielding Evaluation
524 (Continue)		exceed a TI of 10 and will not require exclusive use shipment for radiation shielding purposes.
525	Except for packages or overpacks transported under exclusive use by rail or by road under the conditions specified in paragraph. 569(a), or under exclusive use and special arrangement by vessel or by air under the conditions specified in paragraphs 571 or 575, respectively, the maximum radiation level at any point on the external surface of a package or overpack shall not exceed 2 mSv/h.	Requirement met. Based on the applicant's analysis and the staff's confirmatory evaluation, the staff finds that the package surface dose rates will not exceed a surface dose rate of 2 mSv/hr.
526	"The maximum radiation level at any point on the external surface of a package or overpack under exclusive use shall not exceed 10 mSv/h."	Requirement met. As stated above, the package will not exceed a dose rate of 2 mSv/hr at the package surface.
569, 571, 575	Radiation levels for exclusive use consignments Packages with surface radiation levels greater than 2 mSv/hr for transport by vessels Packages with surface radiation levels greater than 2 mSv/hr for transport by air	Based on the applicant's analysis and the staff's confirmatory evaluation, the package meets the limits for consignments under non-exclusive use. Therefore, the staff did not review the package against the requirement in paragraph 569, and the requirements in paragraphs 571 and 575 do not apply.
609	As far as practicable, the <i>packaging</i> shall be so designed and finished that the external surfaces are free from protruding features and can be easily decontaminated.	This requirement has been met for purposes of the shielding evaluation. The external surface of the package has protruding parts (i.e., structural angles) designed to ease handling the packaging during the manufacturing process. Per document Nos. 0908-LE01-3AEIN-004-B and 0908-LE01-3AEIN-010-A, there are four attachments welded to the outside of the package. Per the applicant, these attachments can be easily decontaminated, if necessary.

Table 6.3. Determination of Transport Index.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Shielding Evaluation
646(b)	A package shall be so designed that if it were subjected to the tests specified in paragraphs 719 to 724, it would prevent: (b) Loss of shielding integrity which would result in more than a 20% increase in the radiation level at any external surface of the package.	The applicant provided an analysis for this requirement. The analysis applies the damage from the Type B package accident puncture test (Paragraph 727(b)) to the entire package surface. The change in dose rates for the damaged package versus the as-designed package is less than 5%, which meets this requirement. The staff has reasonable assurance that the analyzed conditions adequately bound the impacts of the normal conditions tests based on the normal conditions test results and the accident puncture test conditions. Given this assurance and based on the applicant's analysis and the staff's confirmatory analysis, the staff finds that the package design meets this requirement.
651	A package shall be so designed that, under the ambient conditions specified in paragraphs 654 and 655, heat generated within the package by the radioactive contents shall not, under normal conditions of transport, as demonstrated by the tests in paragraphs 719–724, adversely affect the package in such a way that it would fail to meet the applicable requirements for ... shielding if left unattended for a period of one week...	Based on the information provided in the application, the staff has reasonable assurance that the package design meets this requirement for shielding purposes.
657(b)	The tests specified in paragraphs 726, 727(a) - (b), 728 and 729...	Based on the applicant's analysis and the staff's confirmatory evaluation, the staff finds that the package dose rates will not exceed the limits in paragraph 657(b).
716	After each of the applicable tests specified in paragraphs 718 to 737: (b) It shall be determined whether the integrity of the ... shielding has been retained to the extent required in Section VI for the package under test	Requirement met. See the tables in this SER section as well as the text that follows the tables for the staff's evaluation of the tests, analyses, and results in regard to the shielding

Table 6.3. Determination of Transport Index.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Shielding Evaluation
716 (Continue)		performance of the package.
807(a)	A detailed description of the proposed radioactive contents ...	The staff reviewed the information in the application and finds that it adequately characterized the radiation source in the package for the proposed contents.
807(b)	A detailed statement of the design, including complete engineering drawings and schedules of materials and methods of manufacture.	The staff reviewed the information in the application and finds that it is adequate to meet this requirement and to completely describe the package design for purposes of the shielding evaluation.
807(c)	A statement of the tests which have been carried out and their results, or evidence based on calculative methods or other evidence that the <i>design</i> is adequate to meet the applicable requirements;	The staff reviewed the information in the application and finds that it is adequate to meet this requirement for purposes of the shielding evaluation for the contents to be shipped with this package.
807(d)	The proposed operating and maintenance instructions for the use of the <i>packaging</i> ;	The staff reviewed the information in the application and finds that it is adequate, for purposes of the shielding design and evaluation, to meet this requirement and to ensure the package is operated and maintained in a manner consistent with the package design described and evaluated in the application.

6.1 Shielding Design Evaluation and Confirmatory Analysis Model Considerations

As part of its review, the staff looked at the impacts of the tests specified in TS-R-1 paragraphs 719 to 724 and paragraphs 726, 727(b), 728, 729, and 727(a). The staff also performed independent evaluations of the source term and dose rates for:

- 1) the as-designed package,
- 2) a package that had undergone the tests specified in paragraphs 719 to 724, and
- 3) a package that had undergone the remaining tests listed above.

Because some of the accident tests required for a Type B package were not performed and the applicant performed a Type C package test instead, the staff performed a very conservative evaluation of the package. Otherwise, the staff did not evaluate or consider the Type C package tests in the application.

The staff also considered streaming paths and dose rates at the axial ends of the package. Given the configuration and design of the package, the staff determined that an analysis of dose rates on the package's radial side would be sufficient to characterize the maximum bounding dose rates for the package. This is because the shielding configuration at the axial ends and the dimensions of the package in the axial direction are such that the distances from the source to the package surfaces are larger while having similar or greater amounts of materials that can function as shielding. In terms of streaming, the staff evaluated the locations where:

- 1) the shielding was not uniform (e.g., flange area of the inner container), and
- 2) gaps could be present (e.g., between the inner container flange and the lid).

The staff determined that the gaps would be too small to result in a significant streaming path of concern given the anticipated gap size and the amount of packaging materials and distance between this area and the package surface. In addition, the staff finds that the differences of materials in the inner container flange area are adequately compensated by the additional thickness of the materials that are present in this area and the longer distance between the source and the package surface.

The staff did not consider tolerances, which it expects to be small given the dimensioning of the packaging, because of the allowable contents and the very large margins to the dose rate limits. The staff did consider the possible source from the activation of the packaging's cadmium material, which does activate upon absorption of neutrons. The staff made conservative assumptions with regard to the neutron source and the amount of activation that would occur in the cadmium based on simple hand calculations and analysis using the ORIGEN-S code in the SCALE code system.

6.2 Applicant and Staff Confirmatory Dose Rate Estimates

The staff used MicroShield to estimate the gamma dose rates from the activated cadmium and the package contents. MicroShield cannot calculate neutron dose rates. However, the staff used hand calculations to estimate neutron dose rates, considering conservative geometries and neglecting any absorption in the packaging materials.

The staff calculated dose rates for the as-designed package and a package that had experienced the tests described in TS-R-1, paragraphs 719-724. Based on the impacts of those tests, the staff conservatively estimated that the package damage would be equal to the damage seen from the corner drop (~ 4 cm of crush; the rim of the package was nearly flattened, and this rim has a height of a little under 4 cm). Based on the comparison of the dose rates for the as-designed package and the tested package and considering the conservatism in the staff's analysis method, the staff's analysis indicated that the package dose rates will not increase by more than 20% due to the impacts of the normal conditions tests. As noted previously (see tables in Section 6.0 of this SER), the applicant applied the impacts of the accident conditions puncture test to the whole package (a 3.0 cm crush) to analyze the change in dose rates due to the normal conditions tests. As noted in the tables, the staff finds the use

of the impacts from this test to be acceptable for this evaluation. The results of this analysis also indicate that the package dose rates will not increase by more than 20%. Therefore, the staff has reasonable assurance that the package design meets the requirement in TS-R-1, paragraph 646(b).

The staff also calculated dose rates for a package that had experienced the tests specified in TS-R-1 paragraphs 726, 727, 728, and 729. Since the applicant did not perform some of the tests (e.g., the thermal test in paragraph 728), the staff had to consider the effects of some of the Type C tests (i.e., the paragraph 735 puncture-tearing test and the paragraph 736 enhanced thermal test) to identify an acceptable, bounding model for the Type B package accident conditions tests' impacts. The staff's model only accounted for the innermost container shell wherein the four inner containers are placed and kept in the package. The dose rates in this analysis indicated very significant margins to the dose rate limits. The applicant also analyzed the dose rates for the packaging materials external to the cadmium shell being lost (i.e., the cadmium shell was the outermost shielding layer in the model). Even though it is not clear what if any impacts the Type C tests had on the cadmium, the staff finds that (based on the significant margins to the accident dose rate limits) even if the cadmium is removed, the applicant's model is acceptable. Based on the applicant's analysis and the staff's confirmatory calculations, the staff finds that the package will not exceed the accident dose rate limit in paragraph 657(b)(ii), with significant margins.

The staff also notes that it is not clear that the tests performed by the applicant are the most challenging, or damaging, to the package in terms of shielding impacts. However, the staff finds the tests are sufficient to demonstrate that the package can meet the requirements related to shielding and radiation protection based on:

- 1) the package's contents,
- 2) the margins to the limits, and
- 3) the conservatisms in the models of both the applicant and in the staff's confirmatory analysis

6.3 Conclusion

Based on review of the statements and representations in the application and the staff's independent and confirmatory evaluations, the staff finds reasonable assurance that the package with the added conditions noted above meets the shielding and radiation requirements in TS-R-1, 2009 Edition.

7.0 CONTAINMENT EVALUATION

The staff reviewed the application to determine if the package design met the containment requirements set forth in the IAEA's regulations for radioactive materials transportation, TS-R-1, 2009, edition. The review included NRC staff's evaluation as well as descriptions of the design contained in the application for the LEUPA Type B-package.

A summary of the applicable TS-R-1 requirements related to the containment of the package, and the ability of the package design to meet such requirements, is provided below.

Table 7.0. Requirements for the Containment Evaluation of the DOT Revalidation.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Containment Evaluation
501	Before a packaging is first used to transport radioactive material, ...	See information in this table and document No. 0908-LE00-3BEIN-017-C, "Operation Manual."
501(b)	For each Type B(U), Type B(M,) and Type C package and for each package containing fissile material, it shall be ensured that the effectiveness of its shielding and containment and, where necessary, the heat transfer characteristics and the effectiveness of the confinement system, are within the limits applicable to or specified for the approved design.	Requirement met as it related to the containment evaluation. (See document No. 0908-LE00-3BEIN-017-C, "Operation Manual.")
502 (a) and (c)	Before each shipment of any package, all the requirements specified in the approval certificates specified in the relevant provisions of these Regulations shall be satisfied for packages requiring competent authority approval	Requirements met as it related to the containment evaluation. (See document No. 0908-LE00-3BEIN-017-C, "Operation Manual.")
502(e)	For each Type B and Type C package, inspections or tests are required to ensure that all closures, valves and other openings of the containment system are properly closed and sealed.	Requirement met. (Section 7.2.4 of document No. 0908-LE00-3BEIN-017-C, "Operation Manual.")
614	All valves through which the radioactive contents could otherwise escape shall be protected against unauthorized operation.	This requirement is not applicable, since there is no valve (LEUPA's "Safety Report" (document No. 0908-LE00-3BEIN-023-C), page 14 of 29 and 17 of 29).
618	Packages to be transported by air shall be so designed that, if they were exposed to ambient temperatures ranging from -40°C to 55°C, the integrity of containment would not be impaired.	Requirement met, per LEUPA's "Safety Report," Section 4.2, page 14 of 29.
619	Packages containing radioactive material to be transported by air shall be capable of withstanding, without leakage, an internal pressure which produces a pressure differential of not less than maximum normal operating pressure plus 95 kPa.	Requirement met per LEUPA's "Safety Report," Section 4.2, and document No. 0908-LE01-3BEIN-011-B (design pressure of 700 kPag with a hydraulic pressure of 875 kPag.)
637	The design of the package shall take into account temperatures ranging from -40°C to 70°C for the components of the packaging. Attention shall be given to freezing temperatures for liquids and to the potential degradation of	Requirement met per LEUPA's "Safety Report," Section 4.3, document No. 0908-LE01-3BEIN-011-B, March 15 2016 RAI

Table 7.0. Requirements for the Containment Evaluation of the DOT Revalidation.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Containment Evaluation
637 (Continue)	packaging materials within the given temperature range.	response, and July 2016 RAI response.
639	The design shall include a containment system securely closed by a positive fastening device which cannot be opened unintentionally or by a pressure which may arise within the package.	Requirement met per LEUPA's "Safety Report," Section 4.3.
641	If the containment system forms a separate unit of the package, it shall be capable of being securely closed by a positive fastening device which is independent of any other part of the packaging.	Requirement met per LEUPA's "Safety Report," Section 4.3.
642	The design of any component of the containment system shall take into account, where applicable, the radiolytic decomposition of liquids and other vulnerable materials and the generation of gas by chemical reaction and radiolysis.	Requirement met per LEUPA's "Safety Report," Section 4.3. Per the Argentinian certificate, the fresh fuel contents have negligible decay heat. Therefore, there should not be significant radiolysis and gas generation.
643	The containment system shall retain its radioactive contents under a reduction of ambient pressure to 60 kPa.	Requirement met per LEUPA's "Safety Report," Section 4.3, March 15, 2016 RAI response, and July 2016 response.
646	A package shall be so designed that if it were subjected to the tests specified in paragraphs. 719-724 [Type A package tests], it would prevent:	Requirement met, per LEUPA's "Safety Report," Section 4.3.
646(a)	TYPE A only loss or dispersal of the radioactive content; and	Requirement met, per LEUPA's "Safety Report," Section 4.3. Test under normal conditions of transport and hypothetical accident conditions are described in document No. 0908-LE02-3BEIN-008-B.
651	A package shall be so designed that, under the ambient conditions specified in paragraphs. 653 and 654, heat generated within the package by the radioactive contents shall not, under normal conditions of transport, as demonstrated by the tests in paragraphs. 719-724, adversely affect the package in such a way that it would fail to meet the applicable requirements for containment and shielding if left unattended for	Requirement met for containment, per LEUPA's "Safety Report," Section 4.4, which mentions that the fresh fuel content has negligible decay heat.

Table 7.0. Requirements for the Containment Evaluation of the DOT Revalidation.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Containment Evaluation
651 (Continue)	period of one week. Particular attention shall be paid to the effects of heat, which may:	
651(a)	Alter the arrangement, the geometrical form or the physical state of the radioactive contents or, if the radioactive material is enclosed in a can or receptacle (for example, clad fuel elements), cause the can, receptacle or radioactive material to deform or melt...	Requirement met, per LEUPA's "Safety Report," Section 4.4, which says the fresh fuel content has negligible decay heat.
657	Containment release requirements.	Requirement met, per LEUPA's "Safety Report," Section 5.1.4; contents have unlimited A ₂ .
659	Compliance with the permitted activity release limits shall depend neither upon filters nor upon a mechanical cooling system.	Requirement met (negligible decay heat, per LEUPA's "Safety Report," Section 5.1.4).
660	A package shall not include a pressure relief system from the containment system which would allow the release of radioactive material to the environment under the conditions of the tests specified in paragraphs. 719-724 and 726-729.	Requirement met, per LEUPA's "Safety Report," Section 5.1.4.
661	A package shall be so designed that if were at the maximum normal operating pressure and it were subjected to the tests specified in paragraph 719-724 and 726-729 the level of strain in the containment system would not adversely affect the package.	Requirement met, per LEUPA's "Safety Report," Section 5.1.4, and document No. 0908-LE02-3BEIN-008-B.
807(a)	a detailed description of the proposed radioactive contents with reference to their physical and chemical states and the nature of the radiation emitted;	Requirement met for purposes of containment, per Argentina certificate.
807(b)	a detailed statement of the design, including complete engineering drawings and schedules of materials and methods of manufacture;	Requirement met for purposes of containment, per the LEUPA's "Safety Report" and document Nos. 0908-LE01-3BEIN-013-A, 0908-LE00-3BEIN-017-C, 0908-LE00-3DEIN-018-C.
807(c)	a statement of the tests which have been done and their results, or evidence based on calculative methods or other evidence that the design is adequate to meet the applicable requirements;	Requirement met for purposes of containment, per LEUPA's "Safety Report" and document No. 0908-LE01-3BEIN-008-A.
807(d)	the proposed operating and maintenance instructions for the use of the packaging	Requirement met for containment purposes, per LEUPA's "Safety Report"

Table 7.0. Requirements for the Containment Evaluation of the DOT Revalidation.

TS-R-1 Regulation Number	TS-R-1 Regulation Summary	Containment Evaluation
807(d) (Continue)		and document No. 0908-LE00-3BEIN-017-C.

7.1 Additional Information Related to the Containment Evaluation

The conclusion of meeting the requirements within this table is based on the information provided in the application, as noted, and the fact that the content is unirradiated fuel. The methods and analyses presented in the application would have to be reviewed again as to their adequacy for another content. The staff confirmed that the containment design of the Model No. LEUPA meets the requirements outlined in IAEA TS-R-1, 2009 Edition, for the transportation of the proposed contents. The staff has reasonable assurance that the package will perform as designed for shipments made in accordance with the applicable certificate issued by the applicable competent authority.

7.2 Conclusion

The staff finds that the containment evaluation provided by the applicant for the Model No. LEUPA package is acceptable. Based on review of the statements and representations in the application, the staff concludes that the applicant adequately described the containment analysis related to this design and the packaging meets the IAEA requirements of TS-R-1, 2009 Edition.

CONCLUSION

Based on the review of the statements and representations contained in the application, as supplemented, the staff finds that the Model No. LEUPA package meets the standards in IAEA Safety Standards Series No. TS-R-1, 2009 Edition. The staff recommends that the DOT revalidate the Argentinian Certificate of Approval No. RA/0103/B(U)F-96, for import and export use, with the conditions noted in the "Summary" Section of this SER.

Issued with letter to Richard W. Boyle, U.S. Department of Transportation, on 2/28/2017.

Appendix A. Documents Related to the Application for the Review of the Revalidation Request for the LEUPA Package.

Brief Description	APPLICANT'S SUBMITTALS AND DOCUMENT IDENTIFICATION NOS.			
	Initial Submittal		RAI Response No. 1	RAI Response No. 2
	July to September 2015		April 2016	August 2016
	English Translation	Spanish Version	English Translation	English Translation
<i>Competent Authority's Approval Certificate</i>	1	001 Certificado de Aprobación de la Autoridad Competente	1	23
CALCULATIONS				
<i>Database for the Design of LEUPA Package.</i>	---	---	020 0908-LE00-EBEIN-001-A	019 0908-LE00-EBEIN-001-A
<i>Analysis of the LEUPA Package External Pressure.</i>	---	---	018 0908-LE02-3BEIN-004-A	017 0908-LE02-3BEIN-004-A
<i>Independent Review of Doc 0908-LE01-3BEIN-024-B: LEUPA - Criticality Analysis.</i>	---	---	021 0908-LE02-3BEIN-007-A	020 0908-LE02-3BEIN-007-A
<i>Calculation Report</i>	011 0908-LE01-3BEIN-011-A	011 0908-LE01-3BSIN-011-D – Memoria de Cálculo	010 0908-LE01-3BEIN-011-B	009 0908-LE01-3BEIN-011-B
DRAWINGS				
<i>Indenter for Testing - According Paragraph 724.</i>	---	---	00O 0908-LE02-3AEIN-003-A	00O 0908-LE02-3AEIN-003-A
<i>Indenters for Testing According To Paragraphs 727 b) & 735 b).</i>	---	---	00P 0908-LE02-3AEIN-004-A	00P 0908-LE02-3AEIN-004-A
<i>Low Enriched Uranium Package (LEUPA) – Package – General Assembly</i>	0908-LE01-3ASIN-004	---	00A 0908-LE01-3AEIN-004-A	00A 0908-LE01-3AEIN-004-B
<i>Plates For Test</i>	00A 0908-LE02-3ASIN-005-A	00A 0908-LE02-3ASIN-005-A –Placa de Ensayos	00Q 0908-LE02-3AEIN-005-A	---
<i>Low Enriched Uranium Package (LEUPA) – Container of Inner Cans</i>	0908-LE01-3ASIN-005	---	00B 0908-LE01-3AEIN-005-A	00B 0908-LE01-3AEIN-005-A
<i>Disposition of the Indenters on the Target.</i>	---	---	00R 0908-LE02-3AEIN-006-A	00R 0908-LE02-3AEIN-006-A
<i>Low Enriched Uranium Package (LEUPA) – Package – Main Body – Cadmium Chamber</i>	0908-LE01-3ASIN-006	---	00C 0908-LE01-3AEIN-006-A	00C 0908-LE01-3AEIN-006-A

Brief Description	APPLICANT'S SUBMITTALS AND DOCUMENT IDENTIFICATION NOS.			
	Initial Submittal		RAI Response No. 1	RAI Response No. 2
	July to September 2015		April 2016	August 2016
	English Translation	Spanish Version	English Translation	English Translation
<i>Low Enriched Uranium Package (LEUPA) – Inner Can</i>	0908-LE01-3ASIN-007	---	00D 0908-LE01-3AEIN-007-A	00D 0908-LE01-3AEIN-007-A
<i>Low Enriched Uranium Package (LEUPA) – Package – Intermediate Cover</i>	0908-LE01-3ASIN-008	---	00E 0908-LE01-3AEIN-008-A	00E 0908-LE01-3AEIN-008-A
<i>Low Enriched Uranium Package (LEUPA) – Package – External Cover</i>	0908-LE01-3ASIN-009	---	00F 0908-LE01-3AEIN-009-A	00F 0908-LE01-3AEIN-009-A
<i>Low Enriched Uranium Package (LEUPA) – Package – Main Body</i>	0908-LE01-3ASIN-010	---	00G 0908-LE01-3AEIN-010-A	00G 0908-LE01-3AEIN-010-A
<i>Quick Release Hook For Drop Test</i>	00F 0908-LE02-3ASIN-012-A	00F 0908-LE02-3ASIN-012-A - Gancho de Liberación Rápida	00T 0908-LE02-3AEIN-012-A	00T 0908-LE02-3AEIN-012-A
<i>Fixing Elements Anchorage.</i>	---	---	00U 0908-LE02-3AEIN-013-A	00U 0908-LE02-3AEIN-013-A
<i>Fixing Elements Wedge.</i>	---	---	00V 0908-LE02-3AEIN-014-A	00V 0908-LE02-3AEIN-014-A
<i>Low Enriched Uranium Package (LEUPA) – Package - Main Body – Type “A” And “B” Plates</i>	0908-LE01-3ASIN-015	---	00H 0908-LE01-3AEIN-015-A	00H 0908-LE01-3AEIN-015-A
<i>Fixing Elements Clamping Cover.</i>	---	---	00W 0908-LE02-3AEIN-015-A	00W 0908-LE02-3AEIN-015-A
<i>Low Enriched Uranium Package (LEUPA) – Package – Main Body – Flange</i>	0908-LE01-3ASIN-016	---	00I 0908-LE01-3AEIN-016-A	---
<i>Packaging – Main Body Warning Plate</i>	00B 0908-LE01-3ASIN-017-B	00B 0908-LE01-3ASIN-017-B - Placa de Advertencia	---	---
<i>Low Enriched Uranium Package (LEUPA) – Package – Main Body – Warning Plate</i>	0908-LE01-3ASIN-017	---	00J 0908-LE01-3AEIN-017-A	---
<i>Packaging – Main Body Nameplate</i>	00C 0908-LE01-3ASIN-018-B	00C 0908-LE01-3ASIN-018-B - Placa de Identificación	---	---

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<i>Transport Manual</i>	0908-LE00-3DEIN-018-A	004 0908-LE00-3DSIN-018-A – Manual de Transporte	013 0908-LE00-3DEIN-018-B	012 0908-LE00-3DEIN-018-C
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**ENGLISH TRANSLATION OF
ARGENTINIAN CERTIFICATE OF APPROVAL**

**Model No. LEUPA Package
Argentinian Certificate of Approval No. RA/0103/B(U)F-96
Docket No. 71-3090**