Safety Evaluation Report for the NAC-LWT, Legal Weight Truck Cask System Revisions 12A, 12B, and 12C, U.S. DOE

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OVERVIEW

This Safety Evaluation Report (SER) documents the Department of Energy (DOE) Packaging Certification Program (PCP) review of the Safety Analysis Report for Packaging (SARP) for the *NAC-LWT Legal Weight Truck Cask System, Revisions 12A, 12B and 12C,*[1, 2, & 3] for compliance with the requirements of 10 CFR 71[4]. The DOE PCP review determined the safety performance of the NAC-LWT with the intended payloads meets the requirements of 10 CFR 71.

Background

The NAC International Legal Weight Truck Cask System (NAC-LWT) is designed in accordance with the requirements of 10 CFR 71 and 49 CFR 173[5] to provide a safe means of transporting various fuel assemblies, fuel elements, and fuel rods. The current DOE Certificate of Compliance (CoC) USA/9225/B(U)F-96(DOE), Revision 8, was issued in March 2012[6], based on the consolidated SARP for the NAC-LWT, Revision 2, June 2011.

NAC submitted SARP Revisions 12A, 12B and 12C to the current SARP (Revision 2) to include Irradiated U_3O_8 monoliths generated through the Commonwealth Edison Uranium Solidification Project (CEUSP). In accordance with NAC's administrative practice, once a certificate is issued by DOE, the SARP page revisions (e.g., 12A, 12B and 12C) will be incorporated into the subsequent SARP revision (i.e., Revision 3) at the time of the next scheduled SARP consolidation. Therefore, this SER documents the PCP staff review of the page changes associated with Revisions 12A, 12B and 12C to Revision 2 of SARP. The review was performed using the methods outlined in the Packaging Review Guide for Reviewing Safety Analysis Reports for Packaging[7] (PRG), as applicable.

DOE PCP has concluded the reviewed changes have no impact on the safety performance of the LWT-NAC shipping cask and the performance with the intended contents meets the requirements of 10 CFR 71. Reviews of each SARP Chapter are provided below.

1. GENERAL INFORMATION REVIEW

A review and evaluation of Chapter 1 of the SARP, Revisions 12A, 12B and 12C was performed by DOE PCP staff with respect to the requirements in 10 CFR 71. The application is for the approval of shipment of CEUSP-generated U_3O_8 monoliths stored in CEUSP Canisters. This chapter of the review addresses the design description and defining engineering drawings provided in Chapter 1 of the NAC-LWT SARP and the contents as described in SARP Section 1.2.3.11.

1.1 Areas of Review

The areas of review were not limited.

1.2 Regulatory Requirements

The requirements of 10 CFR 71 applicable to the General Information review of the NAC-LWT SARP are those cited in the Packaging Review Guide, as applicable.

1.3 Review Procedures

The purpose of the Applicant's submittal is clearly stated in the accompanying transmittal letters. The application is for the approval of the CEUSP material as an authorized content. The SARP includes a list of revised engineering drawings for the NAC-LWT packaging and page changes.

1.4 Findings

Based on review of the statements and drawings provided in the application, DOE PCP concludes this revision has no impact on the safety performance of the NAC-LWT. In addition, eight of eight comments identified in Consolidated SARP Review Questions/Responses, S-SARQ-G-00022[8] have been incorporated in to NAC LWT SARP, Revision 12A page changes (Note – Incorporation of these comments was a condition of approval in the previous SER).

1.5 Conditions of Approval

The conditions of approval for the NAC-LWT shipping cask have not changed. The SARP pages change Revisions 12A, 12B and 12C must be incorporated in the next revision (Rev 3) of the SARP.

2. STRUCTURAL REVIEW

A review and evaluation of Chapter 2 of the SARP, Revisions 12A, 12B and 12C was performed by DOE PCP staff with respect to the requirements in 10 CFR 71. The application is for the approval of shipment of CEUSP-generated U_3O_8 monoliths stored in CEUSP Canisters.

2.1 Areas of Review

The new configuration for the shipment of the CEUSP material was reviewed.

2.2 Regulatory Requirements

The requirements of 10 CFR 71 applicable to the Chapter 2 review of the NAC-LWT SARP are those cited in the Packaging Review Guide, as applicable.

2.3 Review Procedures

No structural changes to the NAC-LWT were required for the CEUSP configuration. The CEUSP Basket and Sleeve are designed, analyzed, fabricated, inspected, and accepted in accordance with ASME Section III, Subsection NG. The CEUSP canisters, although analyzed to the ASME Code, are not a credited packaging component.

2.4 Findings

Based on review of the statements and representations given in Chapter 2 of the NAC-LWT SARP, DOE PCP concludes the revision has no impact on the safety performance of NAC-LWT and that the requirements of 10 CFR 71 for normal conditions of transport (NCT) and hypothetical accident conditions (HAC) are satisfied.

2.5 Conditions of Approval

The conditions of approval for the NAC-LWT have not changed.

3. THERMAL REVIEW

A review and evaluation of Chapter 3 of the SARP, Revisions 12A, 12B and 12C was performed by DOE PCP staff with respect to the requirements in 10 CFR 71. The application is for the approval of shipment of CEUSP generated U_3O_8 monoliths stored in CEUSP Canisters.

3.1 Areas of Review

The new configuration for the shipment of the CEUSP material was reviewed.

3.2 Regulatory Requirements

The requirements of 10 CFR 71 applicable to the Chapter 3 review of the NAC-LWT SARP are those cited in the PRG, as applicable.

3.3 Review Procedure

There is no need to specify review procedures for the current review.

3.4 Findings

Based on review of the statements and thermal models and results presented in Chapter 3 of the NAC-LWT SARP , DOE PCP concludes there is no impact on the safety performance of NAC-LWT and that the requirements of 10 CFR 71 for NCT and HAC are satisfied.

3.5 Conditions of Approval

The conditions of approval for the NAC-LWT have not changed.

4. CONTAINMENT REVIEW

A review and evaluation of Chapter 4 of the SARP, Revisions 12A, 12B and 12C was performed by DOE PCP staff with respect to the requirements in 10 CFR 71. The application is for the approval of shipment of CEUSP-generated U_3O_8 monoliths stored in CEUSP Canisters.

4.1 Areas of Review

The new configuration for the shipment of the CEUSP material was reviewed.

4.2 Regulatory Requirements

The requirements of 10 CFR 71 applicable to the Chapter 4 review of the NAC-LWT SARP are those cited in the PRG, as applicable.

4.3 Review Procedures

There is no need to specify review procedures for the current review.

4.4 Findings

Based on review of the statements and representations provided in Chapter 4 of the NAC-LWT SARP, DOE PCP concludes the revision has no impact on the safety performance of NAC-LWT and that the requirements of 10 CFR 71 for NCT and HAC are satisfied.

4.5 Conditions of Approval

The conditions of approval for the NAC-LWT have not changed.

5. SHIELDING REVIEW

A review and evaluation of Chapter 5 of the SARP, Revisions 12A, 12B and 12C was performed by DOE PCP staff with respect to the requirements given in 10 CFR 71. The application is for the approval of shipment of CEUSP generated U_3O_8 monoliths stored in CEUSP Canisters.

5.1 Areas of Review

The new configuration for the shipment of the CEUSP material was reviewed.

5.2 Regulatory Requirements

The requirements of 10 CFR 71 applicable to the Chapter 5 review of the NAC-LWT SARP are those cited in the PRG, as applicable.

5.3 Review Procedures

Chapter 5 of the NAC-LWT SARP includes the information needed for a shielding evaluation: design features, modeling description, packaging material specifications (densities and compositions), radiation source material compositions, and determination of radiation source spectra and strengths. The DOE PCP staff reviewed the dose rate analysis (shielding evaluation) for the CEUSP material provided in the NAC-LWT SARP for completeness and consistency with regulations. DOE PCP staff also performed confirmatory calculations of the source terms.

Table 5.3-1 of this SER summarizes the Applicant's calculated maximum external dose rates for the NAC-LWT with CEUSP material under both NCT and HAC as reported in the SARP. The NAC-LWT with CEUSP material may be shipped as non-exclusive use.

Table 5.3-1 Summary Table of Maximum External Radiation Dose Rates

Transport Condition	Dose Rate Location	Calculated Dose Rate [mrem/hr]	FSD	Dose (Including 3σ) [mrem/hr]	Limit [mrem/hr]
NCT	Side - Surface of Cask	11.18	0.5%	11.34	200
	Side - 1m (Transport Index)	1.38	0.4%	1.40	10
HAC	Side - 1m	4.49	0.2%	4.52	1000

5.4 Findings

- The DOE PCP staff review verified that the review items listed in Sections 5.3.1 through 5.3.5 of the PRG have been addressed adequately.
- Confirmatory calculations of the source term for the CEUSP material were in agreement with the Applicant's analysis.
- As stated in the SARP, significant margin is present for the normal condition surface, normal condition 1-meter, and accident condition 1-meter dose rate limits.
- As stated in Section 7.1.15 of the SARP, NAC-LWT radiation dose rates must be measured prior to shipment.
- Based on review of the statements and representations in the SARP, DOE PCP concludes that the shielding design has been described adequately and evaluated conservatively, and that the package meets the external radiation requirements of 10 CFR 71 for NCT and HAC.

5.5 Conditions of Approval

Section 5 of the CoC must contain the restriction that the NAC-LWT be constructed as specified on the engineering drawings given in the SARP. The CoC must also contain the following restriction.

- As stated in the SARP, the shipper must measure radiation dose rates from the loaded NAC-LWT prior to shipment.

6. CRITICALITY REVIEW

A review and evaluation of Chapter 6 of the SARP, Revisions 12A, 12B and 12C was performed by DOE PCP staff with respect to the requirements given in 10 CFR 71. The application is for the approval of shipment of CEUSP generated U_3O_8 monoliths stored in CEUSP Canisters.

6.1 Areas of Review

The new configuration for the shipment of the CEUSP material was reviewed.

6.2 Regulatory Requirements

The requirements of 10 CFR 71 applicable to the Chapter 6 review of the NAC-LWT SARP are those cited in the PRG, as applicable.

6.3 Review Procedures

Chapter 6 of the NAC-LWT SARP includes the information essential for a criticality evaluation, including package description (detailed in the Packaging General Arrangement Drawings provided in Chapter 1,) identification of packaging materials and their densities and compositions, and the fissile/fissionable material forms, masses, and isotopic compositions. DOE PCP staff reviewed the SARP criticality information for completeness and compliance with regulatory requirements.

Of particular note is that the NAC-LWT undergoes minimal geometric distortion under the various accident conditions. Hence, the primary influence of the HAC in criticality behavior is the assumed presence of water within various parts of the NAC-LWT and its payload as a moderator at optimized densities.

6.3.1 Description of Criticality Design

6.3.1.1 Design Features

Sections 1.2 and 1.2.3.11 of the NAC-LWT SARP provide detailed descriptions of the NAC-LWT design and the CEUSP Canister Assembly. As noted in the SARP, the primary design features important for criticality safety are the geometrical controls provided by the packaging, the CEUSP canisters, and the CEUSP Sleeves. No neutron absorbing (poison) materials are incorporated into the packaging design. The NAC-LWT may contain three CEUSP Sleeves, each containing up to seven CEUSP canisters per sleeve.

Descriptions of the NAC-LWT design features and the models used in the criticality calculations are consistent with the drawings and the detailed package description is provided in Section 1.2 of the SARP. The NAC-LWT conforms to the general standards for packages as prescribed by 10 CFR 71 [e.g., §71.31(a), §71.31(a)(2), §71.31(c), §71.33, §71.35(a)].

The NAC-LWT SARP has assigned a proper Criticality Safety Index (CSI) of 100 to the NAC-LWT with the proposed payloads (i.e., only one NAC-LWT may be shipped on a transport vehicle).

6.3.1.2 Codes and Standards

Codes and standards related to construction and materials of the NAC-LWT are not addressed directly in Chapter 6. However, construction and choice of materials for the NAC-LWT are affected by the codes and standards called out in other chapters (i.e., General Information, Structural, and Thermal). The material compositions the Applicant used in the criticality analysis are representative of the actual materials specified for the NAC-LWT in those chapters.

6.3.1.3 Summary Table of Criticality Evaluation

Table 6.3-1 of this SER is a compilation of the calculation results (from Tables 6.9-13 and 6.9-14 of the SARP) for the NAC-LWT with the CEUSP contents. The analysis summarized in Table 6.3-1 of this SER is consistent with the derived CSI of 100 (i.e., a single NAC-LWT per transport vehicle). The Applicant's calculation results show that the NAC-LWT with the

CEUSP contents is subcritical under single package conditions (10 CFR §71.55(b), (d), and (e),) within an array of packages under NCT [§71.59(a)(1)] and as a single damaged package under HAC [§71.59(a)(2)]. For each configuration modeled, the maximum value of the effective multiplication factor (k_{eff}) is less than the Upper Safety Limit value (USL) of 0.9171.

Table 6.3-1 Summary Table of Maximum Reactivity and CSI

Geometry	k_{eff}	σ□	k_{eff}+2 σ	# Casks	CSI
Normal Conditions per 10 CFR 71.55(b)	0.9091	0.0009	0.9109	1	N/A
Accident Conditions per 10 CFR 71.55(e)	0.9092	0.0009	0.9110	1	N/A
Normal Condition Array per 10 CFR 71.59(a.1)	0.2154	0.0006	0.2166	Infinite	0
Accident Condition Array per 10 CFR 71.59(a.2)	0.9092	0.0009	0.9110	1	100

6.3.2 Fissile Material and Other Contents

The fissile material contents evaluated for shipment in the NAC-LWT is CEUSP material. Chapter 1 and Chapter 6 of the SARP specify CEUSP material characteristics in detail. The NAC-LWT may accommodate up to 21 CEUSP containers.

6.3.3 General Considerations for Criticality Evaluations

6.3.3.1 Model Configuration

The Applicant's Monte Carlo N-Particle (MCNP) models used for criticality analyses represent accurately all major design features of the package and contents.

6.3.3.2 Material Properties

The fissile materials modeled in the criticality analyses include payload material compositions and forms specified in Chapter 1 (based on facility specifications for the payload materials). Section 6.9.3 of the SARP provides materials density and composition details.

The Applicant's construction materials for the NAC-LWT, the CEUSP canister assembly, and the CEUSP Sleeve are standard materials, primarily various forms of stainless steel. Section 6.9.3.2 of the SARP provides material composition details. Other materials modeled in the NCT cases were several densities of water representing moderator, pure aluminum, lead, and water/glycol.

6.3.3.3 Demonstration of Maximum Reactivity

The NAC-LWT SARP examined multiple conditions for each payload configuration to determine the optimum moderator combination for the HAC cases, including variation of moderator density throughout the various regions of the NAC-LWT, the CEUSP container assembly, and the CEUSP U_3O_8 material. Modeled variations in moderator within the CEUSP

assembly (e.g., different regions of the CEUSP fissile material matrix with water at different densities) are not all physically possible, but bound possible configurations relative to system reactivity. Table 6.3-1 of this SER summarizes the Applicant's calculations of k_{eff} for the various configurations, demonstrating that a single NAC-LWT with any of the allowed payloads will remain subcritical under all regulatory conditions.

6.3.3.4 Computer Codes and Cross-Section Libraries

The criticality studies reported in the SARP used the MCNP 5 computer code[9] with the continuous energy ENDF/B-VI cross-section library. For elements (e.g., iron, chromium, and nickel) not available in the continuous energy ENDF/B-VI cross-section library, the analyses used the older continuous energy ENDF/B-V cross-section library. MCNP 5 and the associated cross-section libraries are appropriate for the criticality calculations. As stated in Chapter 6 of the SARP, the USL of 0.9171 was determined on the basis of a benchmark analysis and incorporated the combined effects of code computational bias, uncertainty in the bias based on both benchmark-model and computational uncertainties and an administrative margin. The results of the benchmark analyses showed that the Applicant's USL is adequate to ensure subcriticality of the NAC-LWT.

The SARP criticality study used a range of neutron histories to obtain k_{eff} values with statistical uncertainties ranging from 0.0018 to 0.0006. The number of neutron histories is adequate to assure that each fissile system analyzed was sampled in a statistically acceptable manner.

The SARP includes no output listings, but the Applicant provided these separately for review. Appendix 6.6.12 of the SARP provides examples of MCNP input files including proper entry of model input parameters, material densities and cross sections.

6.3.4 Single Package Evaluation

DOE PCP staff concludes that the NAC-LWT conforms to the criticality requirements as prescribed by 10 CFR 71, i.e., §71.43(f), §71.51(a), §71.55(b), §71.55(d), §71.55(e).

6.3.4.1 Configuration

The SARP determined that the maximum reactivity of a single NAC-LWT with optimized geometry and moderation conditions as required in §71.55(b) occurs from a payload of CEUSP canisters. This corresponded to a loaded NAC-LWT under HAC, but with optimized internal water flooding in which water densities varied in various inner components to maximize the interaction between CEUSP canisters.

6.3.4.2 Results

The NAC-LWT design under NCT meets the additional requirements from 10 CFR 71.55(d)(2) through §71.55(d)(4). The Applicant's criticality analysis results for the most reactive single-package case are presented in Table 6.3-1 of this SER.

6.3.5 Evaluation of Undamaged-Package Arrays (NCT)

The SARP states that the NAC-LWT is designed, constructed, and prepared for shipment so that there will be no significant reduction in the criticality safety of the package during NCT. The NAC-LWT meets the NCT criticality requirements for arrays of fissile material packages in 10 CFR 71.59(a)(1) and §71.59(a)(3).

6.3.5.1 Configuration

The SARP documents evaluation of NCT configurations for the NAC-LWT payloads with the CEUSP Canister Assembly. For the NCT array configuration, the package interior is dry. The SARP documents evaluation of an infinite array of NAC-LWTs with the CEUSP Canister Assembly. The analyses include varied relative positions of the CEUSP Canister Assembly in addition to variations of the reflector around the NAC-LWT.

The most reactive NCT payload is single-package model (21 CEUSP canisters). No credit is taken for separation provided by the impact limiters.

DOE PCP staff confirmed the validity of the Applicant's analysis configurations of the NAC-LWT.

6.3.5.2 Results

Table 6.3-1 of this SER presents the Applicant's maximum reactivity results. An infinite NCT array of NAC-LWTs with the CEUSP Canister Assembly is subcritical. The most reactive array condition for the NAC-LWT occurs with no water between the packages, because this condition maximizes communication between the packages. DOE PCP staff analyses confirm the validity of the Applicant's criticality analyses of the NAC-LWT.

6.3.6 Evaluation of Damaged-Package Arrays (HAC)

The NAC-LWT conforms to the HAC criticality requirements for all packages given in 10 CFR 71.59(a)(2) and §71.59(a)(3).

6.3.6.1 Configuration

The Applicant evaluated only a single NAC-LWT under HAC. The most reactive single package configuration is the HAC configuration.

6.3.6.2 Results

As noted above, the worst-case single package configuration is equivalent to the HAC configuration, as shown in Table 6.3-1 of this SER. DOE PCP staff analyses confirm the validity of the Applicant's criticality analyses of the NAC-LWT.

6.3.7 Criticality Safety Index for Nuclear Criticality Control

The Applicant assigned a minimum Criticality Safety Index (CSI) of 100 to the NAC-LWT. HAC calculations show that only a single package in any configuration has a multiplication factor plus bias and uncertainties that is less than the USL of 0.9171. The CSI value is consistent with that reported in Chapter 1 of the SARP. DOE PCP staff concurs that this CSI value is appropriate for the NAC-LWT with the specified payloads.

6.3.8 Benchmark Evaluations

The SARP used the same criticality computer code, hardware, and cross-section library sets to determine the bias values from benchmark experiments as those used to calculate the multiplication factors for the NAC-LWT configurations. Section 6.9 of the SARP provides additional benchmark information.

6.3.8.1 Applicability of Benchmark Experiments

The benchmark experiments cited by the Applicant were taken from various volumes of the *International Handbook of Evaluated Criticality Safety Benchmark Experiments* (ICSBEP Handbook) [10] and are referenced appropriately. This collection of benchmark experiments is the accepted standard in the criticality community.

6.3.8.2 Bias Determination

Contributions from uncertainties in experimental data are included for all benchmark experiments reported in the ICSBEP Handbook. Also, a sufficient number of appropriate benchmark experiments are analyzed and the results of these benchmark calculations are used to determine an acceptable bias for the payload. These bias values are then used in the calculation of a safe multiplication factor for the package payloads. The statistical and convergence uncertainties of the benchmark calculations and package evaluations are essentially consistent, and do not significantly affect the determination of bias values.

The SARP determined an acceptable value for the bias for the CEUSP material. Acceptable statistical analyses demonstrate that this value is accurate, but conservative. DOE PCP staff concurs that the benchmark experiments and corresponding bias value are applicable and conservative as applied to the NAC-LWT.

6.3.9 Appendices

Appendix 6.6.12 lists the input file for the worst-case single package (HAC) models (with the CEUSP Canister Assembly).

6.4 Findings

Based on review of the statements and evaluations presented in Chapter 6 of the application, DOE PCP concludes that the nuclear criticality safety design of the NAC-LWT packaging has been described and evaluated adequately, and that the NAC-LWT packaging meets the subcriticality requirements of 10 CFR 71 for an infinite array of NAC-LWT packages under both NCT and HAC conditions.

6.5 Conditions of Approval

The conditions of approval for the NAC-LWT have not changed.

7. PACKAGE OPERATIONS REVIEW

A review and evaluation of Chapter 7 of the SARP, Revisions 12A, 12B and 12C was performed by DOE PCP staff with respect to the requirements given in 10 CFR 71. The application is for the approval of shipment of CEUSP-generated U_3O_8 monoliths stored in CEUSP Canisters.

7.1 Areas of Review

The new configuration for the shipment of the CEUSP material was reviewed.

7.2 Regulatory Requirements

The requirements of 10 CFR 71 applicable to the Chapter 7 review of the NAC-LWT SARP are those cited in the PRG, as applicable.

7.3 Review Procedures

There is no need to specify review procedures for the current review.

7.4 Findings

Based on the review of the statements and representations presented in the application, DOE PCP concludes that NAC-LWT operating procedures meet the requirements of 10 CFR 71 and the procedures are adequate to assure the package will be operated in a manner consistent with its evaluation for approval.

7.5 Conditions of Approval

The conditions of approval for the NAC-LWT have not changed.

8. ACCEPTANCE TESTS AND MAINTENANCE PROGRAM REVIEW

A review and evaluation of Chapter 8 of the SARP, Revisions 12A, 12B and 12C was performed by DOE PCP staff with respect to the requirements given in 10 CFR 71. The application is for the approval of shipment of CEUSP-generated U_3O_8 monoliths stored in CEUSP Canisters.

8.1 Areas of Review

The new configuration for the shipment of the CEUSP material was reviewed.

8.2 Regulatory Requirements

The requirements of 10 CFR 71[1] applicable to the Chapter 8 review of the NAC-LWT SARP are those cited in the PRG, as applicable.

8.3 Review Procedures

There is no need to specify review procedures for the current review.

8.4 Findings

Based on the review of the statements and representations given in the application, DOE PCP concludes that the Acceptance Tests for the NAC-LWT meet the requirements of 10 CFR 71, and that the Maintenance Program is adequate to assure regulatory-compliant packaging performance during its service life. DOE PCP also concludes that the information provided for the Acceptance Tests and Maintenance Program is adequate.

8.5 Conditions of Approval

The conditions of approval for the NAC-LWT have not changed.

9. REFERENCES

Section 9.0 of the SARP lists the documents, papers, and reports that are referenced in the SARP for the NAC-LWT cask.

10. QUALITY ASSURANCE REVIEW

A review and evaluation of Chapter 10 of the SARP, Revisions 12A, 12B and 12C was performed by DOE PCP staff with respect to the requirements given in 10 CFR 71. The application is for the approval of shipment of Commonwealth CEUSP-generated U_3O_8 monoliths stored in CEUSP Canisters.

10.1 Area Reviewed

The new configuration for the shipment of the CEUSP material was reviewed.

10.2 Regulatory Requirements

The regulatory requirements for quality assurance (QA) are 10CFR 71, Subpart H. The DOE PCP staff review was aided by consulting the US NRC Regulatory Guide 7.10 [11] and the PRG.

10.3 Review Procedures

The QA program responsibilities, documentation, and approvals were adequately identified and clearly delineated in the SARP. Use of the NAC-LWT cask for transport of CEUSP material does not require any design modification to the NAC-LWT packaging. The additions to Chapter 10 for the CEUSP contents include:

- The quality level list (Q-List) for the activities and services for the packaging and transport of the CEUSP basket and the CEUSP material are contained in Table 10A-2c. The Q-List of the specially designed systems, structures and components to be procured, fabricated and delivered for the packaging and transport of the CEUSP contents is provided in SARP Table 10A-3d.
- SARP Table 10A-1c lists the CEUSP Content-Related License Drawings.
- SARP Table 10A-3b identifies the level of QA effort listed by quality (Q) categories for the CEUSP canister, sleeve and basket assemblies.
- CEUSP Sleeve and Basket Assembly and Spacer Fabrication Acceptance.
- Critical dimensions for the CEUSP sleeve assembly, basket assembly, and spacer are shown on license drawings 315-40-162, 315-40-161, and 315-40-163 respectively. License drawing 315-40-160 depicts the transport cask assembly configuration for the CEUSP contents. The applicable design codes and standards are identified on the applicable license drawings.
- SARP Section 1.2.3.11, *CEUSP Canister Assembly Contents and Transport Configuration Description*, contains all relevant details of the CEUSP sleeve, basket and spacer.
- SARP Section 10A.3.4.3 was added to include the Procurement Document Control (10 CFR 71.109) requirements for the CEUSP Content Related Hardware.
- The materials for the CEUSP sleeve and the CEUSP basket assemblies, as well as for the CEUSP spacer shall meet the identified material specifications and the material requirements of the American Society of Mechanical Engineers (ASME) Code, Section III, Subsection NG, Article NG-2000, except that the materials need not be supplied by an ASME-authorized Material Supplier.
- Examination of Quality Category A and B materials for CEUSP sleeves and baskets shall be examined and repaired in accordance with ASME Code, Section III, Subsection NG, Sub-Article NG-2500 requirements. Nondestructive examination (VT and PT) shall be

performed on all welds in accordance with ASME Code, Section V, Articles 1 and 9, and Articles 1 and 6 as applicable. Acceptance criteria shall be per ASME Code, Section III, Subsection NG, Article NG-5360 and Article NG-5350, respectively.

- Each completed CEUSP sleeve assembly shall be load tested in accordance with DOE STD-1090, Chapter 11 (*Wire Rope and Slings*) and Chapter 14 (*Structural and Mechanical Lifting Devices*), as appropriate. CEUSP sleeve cavity and CEUSP basket lodgment shall be tested and verified by gauging.
- References for the CEUSP content were added to Chapter 9, Section 9.3 of the SARP.

10.4 Findings

Based on review of the statements and representations in the SARP, DOE PCP concludes NAC's QA program has been adequately described in the SARP and meets the QA requirements of 10 CFR 71 Subpart H.

10.5 Conditions of Approval

Any organization involved in the design, procurement, fabrication, handling, shipping, storage, cleaning, assembly, operation, inspection, testing, maintenance, repair, modification, and use of the NAC-LWT shall maintain and follow an appropriate QA program compliant with the requirements specified in 10 CFR 71, Subpart H.

References

[1] NAC International, Safety Analysis Report for Packaging for the NAC-LWT Legal Weight Truck Cask System, Revision 12A, May 2012.

[2] NAC International, Safety Analysis Report for Packaging for the NAC-LWT Legal Weight Truck Cask System, Revision 12B, August 2012.

[3] NAC International, Safety Analysis Report for Packaging for the NAC-LWT Legal Weight Truck Cask System, Revision 12C, September 2012.

[4] Title 10, Code of Federal Regulations, Part 71 (10 CFR 71), Packaging and Transportation of Radioactive Materials.

[5] Title 49, Code of Federal Regulations, Part 173 (49 CFR 173), Shippers General Requirements for Shipments and Packagings.

[6] US Department of Energy, Certificate of Compliance, Certificate Number 9225, Revision 8, Date of Issuance March 13, 2012.

[7] A.A. DiSabatino, et al., Packaging Review Guide for Reviewing Safety Analysis Reports for Packagings, UCID-21218, Revision 3, Lawrence Livermore National Laboratory (February 2008).

[8] England, J. L, Consolidated SARP Review Questions/Responses, S-SARQ-G-00022, NAC LWT SARP, Revision 2.

[9] MCNP – A General Monte Carlo N-Particle Transport Code, Version 5, LA-UR-03-1987, April 24, 2003

[10] *International Handbook of Evaluated Criticality Safety Benchmark Experiments*, ICSBEP Handbook, Nuclear Energy Agency, distributed by Idaho National Laboratory

[11] U.S. Nuclear Regulatory Commission Establishing Quality Assurance Programs for Packaging Used in the Transport of Radioactive Material, Regulatory Guide 7.10, Revision 2, Washington, DC (March 2005)