March 28, 2013

Mr. Teo Grochowski, Chief Executive Officer
Robatel Technologies, LLC
5115 Bernard Drive
Suite 304
Roanoke, VA 24018

SUBJECT: APPLICATION FOR CERTIFICATE OF COMPLIANCE NO. 9365 FOR THE MODEL NO. RT-100 PACKAGE – REQUEST FOR ADDITIONAL INFORMATION

Dear Mr. Grochowski:

On October 9, 2012, Robatel Technologies, LLC, submitted an application for approval of the Model No. RT-100 package as a Type B(U)-96 package. The staff performed an acceptance review of your application and, by letter dated November 30, 2012, you responded to our request for supplemental information letter dated November 15, 2012. On December 6, 2013, the staff accepted your application for detailed technical review.

In connection with our detailed technical review, we need the information identified in the enclosure to this letter. We request that you provide this information by May 15, 2013. If you are unable to meet this deadline, you must notify us in writing no later than April 30, 2013, of your submittal date and the reasons for the delay. The staff will then assess the impact of the new submittal date and notify you of a revised schedule.

Please reference Docket No. 71-9365 and TAC No. L24686 in future correspondence related to this request. The staff is available to meet with you to discuss your proposed responses. If you have any questions regarding this matter, I may be contacted at (301) 492-3408.

Sincerely,

/RA/

Pierre Saverot, Project Manager
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9365
TAC No. L24686

Enclosure: Request for Additional Information

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REQUEST FOR ADDITIONAL INFORMATION
FOR THE
MODEL NO. RT-100 PACKAGE

DOCKET NO. 71-9365

On October 9, 2012, Robatel Technologies, LLC, submitted an application for approval of the Model No. RT-100 package as a Type B(U)-96 package. The NRC staff completed an acceptance review of this application on November 15, 2013. On November 30, 2013, Robatel Technologies, LLC, submitted responses to staff's request for Supplemental Information.

This Request for Additional Information (RAI) identifies information needed by the staff in connection with its review of the Model No. RT-100 package application. The requested information is listed by chapter number and title in the application. The staff reviewed the application using the guidance in NUREG 1609, "Standard Review Plan for Transportation Packages for Radioactive Material."

Each individual RAI section describes information needed by the staff to complete its review of the application and to determine whether the applicant has demonstrated compliance with the regulatory requirements.

Chapter 1 General Information

1-1 Provide clarification on the authorized contents described in Section 1.2.2 of the application. Regarding the chemical and physical form, indicate whether the contents are limited to solids and whether powdered or dispersible solids will also be present.

The physical and chemical forms of the contents are described in Section 1.2.2. However, based on the information provided, it is unclear whether the contents will include dispersible solids.

This information is required by the staff to determine compliance with 10 CFR 71.33(b)(3).

1-2 Clarify items listed in the NUREG classification table in Chapter 1.

a) Explain the different ASME subsection choice for the Helicoil M48 x 2D (listed as ITS, category A per ASME III Subsection NF) and O-ring (listed as ITS, category A per ASME III Subsection ND).

b) Typically the NUREG classification table is listed in the licensing drawings to form part of the licensing basis.

This information is required by the staff to determine compliance with 10 CFR 71.33.

Licensing Drawings

1-3 Provide the scale model test procedure, drawings and reports for the as-built and tested Model No. RT-100 packaging components. Describe and justify the deviations between the scale model and the proposed design.

Provide References 3 (RT-100 Drop Test Program), 4 (102885 PE 2001 Revision B, *RT-100 scale model general assembly drawing),* 5 *(*102885 NM 2001 Revision B, *RT-100 scale model bill of material*), 6 (102885 MD 2021-06 Revision D, *RT-100 scale model Foam drawing),* 7 *(*RT100 scale model Impact limiters foam CoC and inspection reports, General Plastics report), and 8 (102882 DFR 001 Revision A, RT100 scale model fabrication document package) of the Robatel Model RT-100 Drop test report, Project number 102885, RES 001, Revision C.

These documents are necessary to ensure that the as-built and tested (3/10) scale RT-100 is representative of a full scale Model No. RT-100 package. If there are deviations between the scale model and the proposed design, describe and justify the deviations.

The $3/10^{th}$ scale model test article and test procedure is described in the Robatel Package Model RT-100 Drop Test Report by reference to the (i) RT-100 Drop Test Program, (ii) RT-100 Scale Model General Assembly Drawing, (iii) RT-100 Scale Model Bill of Material, and (iv) the RT-100 Scale Model Foam Drawing. These references are required in order to confirm the correlation between the scale model and the proposed design.

Staff also notes that RSI 2.2e response states that the assembly drawings for the scale model were provided, whereas staff believes they were not.

Staff also notes that page 2-161 of the application mentions that the dimensions and weight of the 3/10 scale model cask were obtained from 3/10 scale cask drawings and test report.

This information is required by the staff to determine compliance with 10 CFR 71.41(a), 71.51(a), and 71.73.

1-4 Provide the RT-100 impact limiter drawings illustrating the foam assembly and fabrication details.

Drawings RT100 PRS 1031 and RT100 PRS 1032 include section cuts (A-A) to show several foam components. Also, page 8-2 of the application states that the Model No. RT-100 package is fabricated in accordance with drawings listed in the Certificate of Compliance. Therefore, the drawing(s) related to the impact limiter foam pieces should be provided as part of the design.

Staff requires additional drawing(s) and descriptions that clearly illustrate and describe all the impact limiter pieces and orientation of foam for fabrication.

This information is required by the staff to determine compliance with 10 CFR 71.33.

1-5 Provide the basis for the O-ring compression and O-ring groove dimensions in the licensing drawings. Provide corresponding manufacturer data sheets.

a) As stated on page 8-2 of the application, there are two seals associated with each of the primary lid, secondary lid, and quick-disconnect valve cover plate. Although some details of the groove dimensions and compression were provided on page 2-230, the basis for the O-ring compression and O-ring groove dimensions, such as from manufacturer data sheets, should be provided for the six seals.

b) Provide the manufacturer and part number of the six O-rings on the licensing drawings.

c) The drawings should indicate both the dimensions and tolerances of the groove dimensions and the O-rings to ensure compression of the O-rings.

This information is required to determine compliance with 10 CFR 71.33, 71.43(f), and 71.51.

Chapter 2 Structural Evaluation

2-1 Clarify which materials are acceptable for use as (i) secondary containers, (ii) metal housings, and (iii) for shoring. Alternatively, indicate the critical characteristics of these materials, e.g., melting or sublimation temperature, radiation resistance, nobility, etc., necessary to ensure that no inadvertent chemical reactions will occur. Justify the loading restriction that indicates that materials that change phase at temperatures less than 177ºF, not including water, are not included in the contents. Update Section 2.2.2 of the application to assess these allowable materials for chemical, galvanic, or other reactions. This RAI is, in part, a follow-up to RSI 1.1.

A requirement for the use of secondary containers is stated in the application, but acceptable materials to be used for this purpose are not adequately described. It is important to clarify which materials are acceptable for this purpose to ensure that unacceptable chemical reactions do not ensue. The materials must be described with enough detail to make this determination and cannot rely solely on the shipper's judgment. There is a loading condition that states that materials that change phase at temperatures less than 177ºF are not included in the contents; however, this temperature does not appear to correspond to the maximum temperatures stated in Chapter 3 of the application.

This information is required by the staff to determine compliance with 10 CFR 71.33(b)(3) and 71.43(d).

2-2 Provide further justification that explains how and why the foam crush strength data, in the "densification region" for strains beyond 60%, is used. This is a follow-up to RSI 2.2. Explain how lock-up is considered and evaluated in the analysis.

In response to RSI 2.2, the applicant indicated that the extrapolated values used are considered to be conservative and yielded a conservative deceleration value when

compared to the drop test results. In addition to this justification, also provide an explanation of why a deviation from the manufacturer's recommended properties is required and appropriate. This deviation may be important in the analytical effort that considers variations in the package design that were not present in the scale model drop test.

This information is needed by the staff to determine compliance with 10 CFR 71.51(a)(2) and 71.73

2-3 Clarify or correct Table 2.2.1-1 of the application, "Cask Temperature-Dependent Material Properties" to address the following items:

a. Clarify the column labeled "Membrane Allowable (S_m)." It appears that the values listed in this column are from ASME B&PV Code, Section II, Part D, Subpart 1, Table 2A, Table 5A, and Table 3, for UNS No. S30403, UNS No. S31803, and ASTM A354 Grade BD, respectively. Table 2A provides design stress intensity values, S_m; Table 5A provides Maximum Allowable Stress Values, S_m; and Table 3 provides Maximum Allowable Stress Values, *S*.

b. Justify the use of values from ASME B&PV Code, Section II, Part D, Subpart 1, Table 3 for ASTM A-354 Grade BD. Table 3 provides Section III, Classes 2 and 3; Section VIII, Divisions 1 and 2; and Section XII maximum allowable stress values, *S,* for Bolting Materials. The design stress intensity value, S_m, is required to support the analysis effort.

c. Justify the use of values from ASME B&PV Code, Section II, Part D, Subpart 1, Table 5A for ASTM A-240 (UNS No. S31803). Table 5A provides Section VIII, Division 2 Maximum Allowable Stress Values, S_m. The design stress intensity value, S_m, is required to support the analysis effort.

d. Correct the Young's Modulus values listed for ASTM A-240 (UNS No. S31803). The values listed appear to be from ASME B&PV Code, Section II, Part D, Subpart 1, Table TM-1 for Material Group G. However, UNS No. S31803 is classified under Material Group H.

e. Clarify the source and units of the coefficient of thermal expansion values for UNS No. S30403, UNS No. S31803, and ASTM A354 Grade BD.

Table 2.2.1-1 of the application includes material property data that is used in the Model No. RT-100 package structural analysis. It is important that the data used in the structural analysis and the allowable values that are compared against to determine margins are consistent with the licensing strategy proposed in the application. The package is being fabricated per Section III, Division 1, Subsection ND – Class 3 Components, and analyzed per Section III, Division 1, Subsection NB – Class 1 Components. As such, the design stress intensity values are needed to support the analysis effort.

In some cases, materials that appear in the Subsection ND material property tables do not appear in the Subsection NB materials property tables in the ASME B&PV Code. In

this case, the applicant can propose and justify the design stress intensity values that will be used in the analysis, or choose materials that are consistent with Subsections ND and NB.

This information is required by the staff to determine compliance with 10 CFR 71.31(c), 71.71 and 71.73.

2-4 Identify the source of the density values provided in Table 2.2.1-2, "Cask Temperature-Independent Material Properties." Clarify whether an alternative to the values provided in the ASME B&PV Code is being proposed, and justify the alternative, as applicable.

The density values provided in Table 2.2.1-2 appear to be inconsistent with the values provided in ASME B&PV Code, Section II, Part D, Subpart 1, Table PRD.

This information is required by the staff to determine compliance with 10 FR 71.31(c), 71.71 and 71.73.

2-5 Justify the susceptibility of the package external surface to chloride-containing salt, as noted in Section 2.2.2.1.1 of the application.

The application notes that the external surfaces of the package may be susceptible to degradation due to chloride-containing salts. In addition to the pitting phenomenon indicated in the application, these surfaces could also be susceptible to stress corrosion cracking. These surfaces may also be susceptible when dry salts are deposited on the surface (in addition to salt spray). The maximum transportation period and routine and/or periodic maintenance should clearly address this degradation mechanism.

This information is required by the staff to determine compliance with 10 CFR 71.43(d).

2-6 Clarify whether the impact limiter shell will be welded after the polyurethane foam blocks are in place. Assess any potential reactions that may occur as a result of this process, as applicable.

Chemical, galvanic, and other reactions of the cellular polyurethane foam are noted in Section 2.2.2.1.5 of the application. It is noted in this section that the foam is cured prior to installation and, therefore, no potential reactions associated with the foam exist. However, if the impact limiter shell is welded after the foam blocks are placed within the impact limiter, the temperature of the foam may be such that chemical reactions, including outgassing, may occur. Potential reactions that may occur during the fabrication process should be assessed.

This information is required by the staff to determine compliance with 10 CFR 71.43(d).

2-7 Justify the use of non-ASME B&PV Code properties in Table 3.2-2, including the properties incorporated in the analysis at temperatures greater than 750ºC.

ASME B&PV Code, Section II, Part D, Tables PRD and TCD contain density, thermal conductivity and thermal diffusivity values. For materials that are fabricated to the ASME B&PV Code, it is expected that the material properties will be in accordance with the

code values. However, it appears that the values used in the thermal analysis came from another source. The ASME B&PV code only lists thermal conductivity and specific heat data up to 750ºC.

This information is required by the staff to determine compliance with 10 CFR 71.31(c).

2-8 Justify the discrepancy between the Design and Fabrication Codes for the package containment system.

Sections 2.1.2 and 2.1.4 of the application identify the RT-100 containment system codes of construction. ASME Section III, Division 1, Subsection NB was used for design and ASME Section III, Division 1, Subsection ND was used for the fabrication of the containment system. Per NCA-2120 and NCA-2133 (applicable to Section II, Divisions 1 and 2) of the ASME Code, all activities (i.e. Design, Fabrication, Acceptance Testing, etc.) should follow the same subsection of code according to the class of code (per NCA-2131). Therefore, as it has been done for the Model No. RT-100 package containment system, it may not be appropriate to jump from different subsections of the code.

Staff also noted that both Section 2.6.7.1 of the application (and Section 6 of Calculation Package ST-0402) state that the Model No. RT-100 package is designed in accordance with ASME, Section III, Subsection ND, which is different from the statement in Section 2.1.2 of the application.

This information is required by the staff to determine compliance with 10 CFR 71.31(c).

2-9 Provide/justify that the containment boundary final geometrical configuration (using a validated model) from the post normal conditions of transport (NCT) free drop and hypothetical accident conditions (HAC) tests correspond to the containment analysis assumptions.

Per RSI 4.2 response, there will be "minor" inelastic deformation on the inner shell (containment boundary).

Section 2.5.7 of NUREG-1609 states that “inelastic deformation is generally unacceptable for the containment evaluation.” Also, Section 4.5.3.2 of NUREG-1609 states that the containment boundary, seal region, and closure bolts should not undergo any inelastic deformation.

RSI 4.2 response and Appendix 2.14 of the application discuss analysis of the closure bolts but do not provide complete insight regarding containment integrity (must remain elastic or the final geometry must correlate to the N14.5 containment analysis).

Staff notes the following statements in RSI 4.2 response: "While some localized areas of the inner shell have minor inelastic deformation, the stresses do not exceed the ultimate strength of the material. Therefore, the ability of the inner shell to maintain positive containment is not compromised." Staff does not agree with this approach, unless the final geometrical configuration is less severe than the assumptions included in the containment analysis.

This information is required by the staff to determine compliance with 10 CFR 71.51.

2-10 Justify the lack of torque specifications for the impact limiter attachment bolts.

Per drawing RT100 PE 1001-1, there is no torque specification for the impact limiter attachment bolts. The lack of a defined specification will affect the packages tamper indication features and the package's response during NCT and HAC tests.

This information is required by the staff to determine compliance with 10 CFR 71.31, 71.43, 71.71, and 71.73.

2-11 Justify the discrepancy between the drop test cover page and the drop test report.

The signed cover page (signed by Teofil Grochowski Jr. and dated 30 November 2012), states that, "This report provides 1/3 scale model drop test methodology…" and was done under contract "in accordance with criteria of Robatel Technologies, LLC Part 71 Quality Assurance (QA) Program Approval No. 0952, Rev. 0.

However, Section 3.3 of Project number 102885, RES 001, Rev. C, states that, "the upper and lower impact limiter designs are representative of the RT-100 package at a 3/10th scale." There appears to be a discrepancy between this statement and the cover page of the report done in accordance with the Robatel Technologies Part 71 QA program.

This information is required by the staff to determine compliance with 10 CFR 71.39.

2-12 Clarify the containment system hydrostatic pressure testing.

Describe how the acceptance criteria (leakage per ND-6224) is verified for the containment boundary (drawing PE 1001-1 1011 components 1011-01, 1011-02, and 1011-03, etc.) in a steel, lead, steel body construction.

Also, clarify that the "during hold time" primary lid and secondary lid closure leakage examination is done in addition to the hydrostatic (with 10 minute hold time) pressure test.

This information is required by the staff to determine compliance with 10 CFR 71.85.

2-13 Provide validation of the finite element analysis used for the NCT and HAC test analyses.

Staff noted that the application, dated November 30, 2012, was revised to address RSI 2.5. However, there were no changes to the technical reports referenced ST-402 and ST-403, dated October 7, 2012.

Section 2.6.7.2.1 of the application was revised to address the below issues queried in RSI 2.5: "Of particular interest, but not limited to, the reviewer is interested in the applicant's selection of elements and the meshing scheme. Sensitivity analyses should

be incorporated in the element selection/meshing methodology. Also, the applicant needs to benchmark the "ability of the code" and their "use of the code" against a physical drop or other established test. Note that these studies may be applicable to some drop/load cases, and not to others, e.g., side drop vs. lid down end drop."

The applicant needs to provide a report to (i) resolve the issues that were discussed in RSI 2.5 and (ii) justify the information provided in section 2.6.7.2.1 of the revised application. For example, the applicant explains that "the cask outer shell was meshed using the sweep method and the element size was varied until there was a sufficient number of elements across the shell thickness. The element ratio was reviewed to ensure adequate results;" however, the applicant does not explain the acceptance criterion for element selection/mesh refinement, which is independent for each finite element model/part and specific element selection, in a sensitivity study.

Each model and test scenario result needs to be compared to a physical representation (which may be simplified with assumptions and justification) to validate the results. The report should include this information.

Staff recommends, where possible, validation and comparison using the $3/10^{th}$ scale drop test results to the cask body finite element results.

This information is required by the staff to determine compliance with 10 CFR 71.31(a)(2), 71.31(b), and 71.35(a).

2-14 Justify and modify the assembled package lifting analysis.

The detailed assembled package lifting analysis is provided in Section 7.7 of report RTL-001-CALC-ST-0201 and Section 2.5.1.3.1 of the application.

As required by 10 CFR 71.45(a), any lifting attachment must be designed with a minimum safety factor of three against yielding, when used to lift the package in the intended manner.

Per ASME Section III, Division 1, Subsection NF-3323.2, the allowable (corresponding to yield for pure shear) for pure shear stress is $0.6S_m$. When considering this value, the new "yielding" or allowable is less than the S_y/f_{sy} value used.

Section 7.2 of ANSI standard 14.6 (ST-0201 reference 3.12), "Radioactive Materials – Special Lifting Devices for Shipping Containers Weighing 10000 Pounds (4500 kg) or More," requires a dynamic load factor for the design of critical load lifting. Therefore, the applicant shall provide an analysis using an appropriate dynamic load factor and justify the value used.

It also appears that the analysis is not the same between the calculation package referenced ST-0201 and the application. For example the lifting pocket tear out stress safety margin is calculated to be 4.9 in the application, but only 1.27 in ST-0201. Also, the lifting pocket bearing stress is calculated in the application (safety margin of 1.73), but not in ST-0201.

Ensure consistency between all technical reports, e.g., ST-0201 and the application.

This information is required by the staff to determine compliance with 10 CFR 71.45.

2-15 Justify the 9m HAC corner drop test case being bound by the 9m end and side drop cases.

The applicant claims, in Section 2.7.1.3, that the 9m end and side drop HAC tests bound the 9m corner drop test. Appendix 2.13.3.4.1 of the application develops the impact limiter time history response for the 9m HAC corner drop case, and the impact limiter methodology was verified in Section 2.13.4.1 against a scaled NUPAC-125B package (Single Foam - Series FR3700 with a density of 12 pcf). However, the construction of the Model No. RT-100 package impact limiter design is fundamentally different from the NUPAC-125B design.

Per Table 2.13.4.2.1.3-2, the calculated crush depth is 534mm whereas the maximum crush depth is 544mm, which gives only a 10 mm margin. Also, Appendix F of the RT-100 3/10 scale drop test report, referenced 102885 RES 001, does not provide a final impact limiter crush depth for the corner drop. See also RAI 2-17.

This information is required by the staff to determine compliance with 10 CFR 71.41, and 71.73.

2-16 Justify the 9m HAC oblique drop test case being bound by the 9m end and side drop cases.

Section 2.7.1.4 states the following: “Based on the impact limiter analysis provided in Appendix 2.13, the oblique drop configuration is bounded by the end and side drop analyses. Therefore, no further analysis is required.” However, Appendix 2.13 of the application does not provide a justification for the bounding of the oblique drop orientation by the 9m end and side drop cases. Staff also notes that there was no physical data comparison for the oblique test orientation in the NUPAC-125B or RT-100 scale tests.

Justify how the statement in section 2.7.1.4 of the application was derived and verified.

This information is required by the staff to determine compliance with 10 CFR 71.41, 71.71, and 71.73.

2-17 Justify and/or correct the impact limiter test report 102885 RES 001.

Staff is unable to make determinations of the drop test report as it appears that the notation of “n” which refers to the drop test condition is misused with the notation “c” which refers to the impact limiter marking/identification, in the write-up of the test report.

For example, Appendix F.III of the RT-100 scale drop test incorrectly labels the n3 drop as corner, where the n3 drop per Section 6.3 is a side drop. It is believed that the F.III reports n2 drop and c3 impact limiter.

Rewrite the test report to ensure that the information is reported consistently and in an understandable and comprehensive manner.

Provide a table of values and write-up of the final crush/deformations and maximum allowable in Section 7 of the 102885 RES 001 report. See also RAI 2-16.

Also, provide a discussion on the foam property scaling and how it may influence the deformation and maximum decelerations.

This information is required by the staff to determine compliance with the requirements of 10 CFR 71.41, 71.71, and 71.73.

Chapter 3 Thermal Evaluation

3-1 Explain why a constant solar insolation is not used in NCT and HAC analyses.

The applicant described the solar insolation modeling in Section 6.5 of Calc. No. RTL-001-CALC-TH-0201, converted insolation from 400 and 800 g-cal/cm^2 to 388 and 776 W/m^2, respectively, per a 12-hour time period for both curved and horizontal flat surfaces, and then simulated insolation with the periodic sin(t x π/12) function. However, the insolation with the periodic function sin(t x π/12) should be modified.

Instead of simulating the solar insolation as a periodic heat flux, the applicant should directly apply the constant insolation of 388 W/m^2 for the curved surface and 776 W/m^2 for the flat surface in the model (without the sin(t x π/12) function). Application of a constant insolation is a regulatory requirement.

This information is required by the staff to determine compliance with 10 CFR 71.35, 71.71 and 71.73.

3-2 Correct the radiation emissivity of the stainless steel used in the post-fire cooldown and re-analyze the HAC fire accident.

Table 3.2-1 “Temperature-Independent Material Properties” shows that a radiation emissivity of 0.9 for the stainless steel 304 is used for both the fire transient and the post-fire cooldown. To evaluate the heat flux under the HAC fire, the applicant should use an emissivity of 0.9 or greater for a 30-minute fire transient and an emissivity of 0.8 or less for the post-fire cooldown (see March 6, 2012, Meeting Summary, included in Appendix 6 of the application, ADAMS Accession No.: ML12075A026).

This information is required by the staff to determine compliance with 10 CFR 71.35 and 71.73.

3-3 Demonstrate that there is no phase change, melting, or auto-ignition of the contents under NCT and HAC.

The applicant predicted a maximum temperature of 265°C (or 509°F) for the inner shell of the package under HAC. The staff reviewed the model description and identified that the maximum inner shell temperature of 265°C (or 509°F) is used to represent the

maximum “local” gas/content temperature. Therefore, the applicant needs to provide the melting points and the auto-ignition temperatures of the allowed contents to assure that the contents (e.g., resin, filter), allowed in the Model No. RT-100 package, will not auto-ignite, melt, or change phase at a temperature below 265°C (or 509°F) under NCT and HAC.

This information is required by the staff to determine compliance with 10 CFR 71.43(d), 71.71, and 71.73.

3-4 Explain why the HAC fire analysis does not start with the results from the NCT steady-state analysis.

The applicant used the same approach and models from NCT to evaluate HAC, and identified a time within the total run period of the NCT normal hot case, at which the inner shell temperature reaches its maximum, to serve as the starting time for the HAC fire analysis.

The staff does not find this approach to be conservative. The time at which the inner shell temperature reaches its maximum may not be the instant that other important-to-safety components, e.g., lead shielding and O-ring seal, reach their maximums. Instead of identifying a time to start HAC analysis, the applicant should perform the steady state analysis of NCT and start the HAC fire analysis with the applicable steady-state results. This steady state analysis of NCT provides the most conservative evaluation for all components in the package.

This information is required by the staff to determine compliance with 10 CFR 71.35 and 71.73.

3-5 Explain the temperature fluctuations of the components, shown in Figures 3.3.1.3-1, 3.4.2.2-3 and 3.4.2.2-6 of the application as well as in Figures 9, 29, 30, 32, 34, 44, 45, 47, 48, and 50 of the report RTL-001-CALC-TH-0201, under NCT and HAC.

The applicant analyzed the NCT and HAC thermal performance of the Model No. RT-100 package and predicted the components’ temperatures which fluctuate with time under NCT and HAC. To clarify the uncertainties in the thermal model, and evaluate the thermal performance of the package, explain the phenomena which cause the temperature fluctuations for both NCT and HAC analyses.

This information is required by the staff to determine compliance with 10 CFR 71.35, 71.71 and 71.73.

3-6 Provide the maximum component temperatures in Table 3.1.3-2 of the application, separately, for the top lid impact fire accident and the sidewall impact fire accident.

The applicant listed the maximum temperatures of the outer shell, inner shell, inner shell average, lids, base plate, lead, and seals, in Table 3.1.3-2 (page 3-6 of the application) without identifying or categorizing the results from the top lid impact fire accident or the sidewall impact fire accident. The applicant is required to separately list the component temperatures in Table 3.1.3-2 for the top lid impact fire accident and the sidewall impact

fire accident.

This information is required by the staff to determine compliance with 10 CFR 71.35 and 71.73.

3-7 Explain the inconsistency in the times to reach the maximum lead temperature for the side impact fire accident in Figure 3.4.2.2-3, and the maximum O-ring seal temperature for the top impact fire accident in Figure 3.4.2.2-6.

a. The applicant showed a time of 2077 seconds, which projects to ≈1830 seconds in the X Coordinate of Figure 3.4.2.2-3 (Close-up View), to reach the maximum lead temperature under the side impact fire accident.

b. The applicant also showed a time of 1957 seconds, which projects to ≈2160 seconds in the X Coordinate of Figure 3.4.2.2-6 (Close-up View), to reach the maximum O-ring seal temperature under the top impact fire accident.

The applicant should clarify this inconsistency, as mentioned in a. and b).above. The applicant should plot the temperature history starting from 0 minute (into the fire) to 300 minutes in the close-up views of Figures 3.4.2.2-3 and 3.4.2.2-6.

This information is required by the staff to determine compliance with 10 CFR 71.35 and 71.73.

Chapter 4 Containment Evaluation

4-1 Demonstrate that the release calculations are bounding:

a) The containment analysis focused on the activity associated with the resin as a powder, and its corresponding airborne release and respirable fractions. However, there is no discussion of the activity associated with the gases and volatiles of the void, or “head space,” within the package. The effect of the content isotopes’ volatiles and gases, including their quantities, activities, and higher release fractions compared to the solid content, should be detailed and included in the NCT and HAC containment discussion.

b) The calculations in Sections 4.2.2 and 4.3 of the application should be expanded to show all of the potential sources of releasable activity, such as the gases/volatiles (from isotopes and their daughter products) and those leached out (from moisture content) and evolved at NCT and HAC temperatures, in addition to the sources associated with the solid resins and filters.

c) Sections 4.2.2 and 4.3 should provide an additional explanation to justify the appropriateness of the airborne release and respirable fraction calculation methodology and how the resin and filter contents are bounded by it. The density of powder aerosol from NUREG/CR-6487 already takes into account the material

suspended in air; thus, including the airborne release fraction (ARF) counts twice the aerosol-effect.

This information is required by the staff to determine compliance with 10 CFR 71.43(f), and 71.51.

4-2 Discuss the form of the resin bead and filter contents

The analysis in Section 4.2.2 assumes a powder content form ("density of powder aerosol", etc.) but does not provide details of the resin bead and filter, such as the range of bead diameter, the powder size classification, etc.

This information is required by the staff to determine compliance with 10 CFR 71.33 and 71.51.

4-3 Provide a clearer picture and description of the containment boundary; the image and red line in Figures 4.1.2-1 and 4.1.2-2 on page 4-3 of the application do not clearly show the extent of the containment boundary in the upper right hand side figure.

The resolution of the line and image in Figures 4.1.2-1 and 4.1.2-2 is insufficient to clearly understand the containment boundary. A clearer image and description of the containment boundary should be provided.

This information is required by the staff to determine compliance with 10 CFR 71.33.

4-4 Clarify that the caps associated with the primary lid, secondary lid, and vent port cover plate are listed on the Bill of Materials.

It is unclear from the application's Bill of Materials whether the caps associated with the primary lid, secondary lid, and vent port cover plate are listed on the Bill of Materials in the drawings or not; this should be clarified.

This information is required by the staff to determine compliance with 10 CFR 71.33.

4-5 Confirm the extent of the containment boundary for the fabrication helium leakage test.

Section 4.4 references ANSI N14.5 when discussing the fabrication, maintenance, periodic and pre-shipment leak test. ANSI N14.5 indicates that the entire containment boundary, which includes welds, joints, base material, valves, etc., is part of the fabrication helium leakage test. The extent of the containment boundary that is helium leak tested should be stated in Section 8.1.4 of the application.

This information is required by the staff to determine compliance with 10 CFR 71.43, 71.51 and 71.85.

4-6 Confirm that the vent port cover plate's bolts are at the appropriate torque to maintain proper compression of the vent port cover plate's O-rings.

Section 2.14 provides the closure bolt evaluation for the primary and secondary lid.

Similar calculations should be provided for the vent port cover plate's bolts.

This information is required by the staff to determine compliance with 10 CFR 71.43(f), and 71.51.

4-7 Justify that combustible gases generated in the package during the shipping period do not exceed 5%, by volume, of the free gas volume.

Section 1.2.2.6 states that the shipper must ensure that the hydrogen concentration within the container will be below 5%, by volume. In addition, page 1-8 states that the moisture content is limited to no more than 1% free water by volume. A bounding calculation of combustible gases that could form, based on the approved contents with their respective alphas, betas, etc., should be provided.

This information is required by the staff to determine compliance with 10 CFR 71.43(d).

4-8 Clarify where the information related to the EPDM O-rings is discussed.

Page 4-3 states that the EPDM O-rings are addressed in Section 0. This appears to be in error; please provide the appropriate section.

This information is required by the staff to determine compliance with 10 CFR 71.33.

4-9 Clarify the calculation used to determine the leakage rate of helium in Calc No. RTL-001-CN-CALC-0101 and provide further explanation for applying Section 4.4.1 calculations, Figure 4.4.1-1, and Figure 4.4.1-2.

a) It appears from the Calc No. RTL-001-CN-CALC-0101 calculation sheet that a "Dmax" is calculated for helium at NCT and HAC conditions. Per ANSI N14.5, however, the determination of leakage rates other than actual conditions is based on using the diameter calculated at the actual condition (e.g., air at NCT or HAC) as an input to the leakage rate calculation. The reasoning for the calculation presented in "Calc No. RTL-001-CN-CALC-0101" should be clarified.

b) Further explanation of Section 4.4.1 calculations and when/how Figures 4.4.1-1 and 4.4.1-2 would be used in practice should be provided.

This information is required by the staff to determine compliance with 10 CFR 71.33, and 71.51.

Chapter 5 Shielding Evaluation

5-1 Clarify if the secondary container is required to support a safety function and, if required, provide both the drawings and the detailed operating procedures for the secondary container and its shoring device. Clarify also the term "standard devices."

Page 1-8 of the application states: "All contents will be packaged in a secondary container (liner)." Section 7.1.2.1 of Chapter 7 of the application requires the use the

secondary liner and a shoring device. In addition, the operating procedures instruct the user of the package to use a "process liner as necessary and cap the liner using standard devices." However, the licensing drawings do not include the design of the secondary container and there appears to be conflicting information through different sections of the application.

It is not clear whether a secondary container, together with its shoring device, is required or not in all cases. Further, it is not clear what the term "standard devices" means in the context of this item. If the secondary container/liner is required, the applicant needs to provide licensing drawings for the secondary container/liner and its shoring devices, and also clarify the use of the secondary container/liner along with a specific description of the "standard devices."

This information is required by the staff to determine compliance with 10 CFR 71.47, 71.51, and 71.89.

5-2 Confirm that the packaging is used to ship only wastes with a uniform source distribution and that sources with a "point source" geometry are not authorized as contents at this time. Provide specific operating procedures that can determine and assure the uniform distribution of the source in the contents.

The application indicates that (i) the Model No. RT-100 package is designed for shipping general wastes from reactors, (ii) the radioactive sources are assumed to be uniformly distributed, and (iii) the contents are restricted in terms of Curie/gram concentration to assure homogeneity. For these reasons, the application does not provide any shielding analysis for concentrated sources and indicates that the sources will be defined in terms of Curie per gram of content. However, the application does not include clear guidance and/or operating procedures regarding the appropriate determination of authorized contents.

The applicant needs to both confirm the intended contents and develop loading procedures that can determine the eligibility of the contents based on the source concentration (i.e., Curie/gram or Becquerel/gram). The applicant also needs to develop operating procedures to determine the maximum and minimum allowed density of the contents. With respect to the density limits, an average density obtained by dividing the total weight by the total volume should not be used because this method cannot provide information on the uniformity of the contents and of the source in the package cavity. The same principle applies to the source term distribution in the contents, i.e., the user must be given specific instructions to assure uniform distribution of the source in the contents as well.

This information is required by the staff to determine compliance with 10 CFR 71.47, 71.51, and 71.89.

5-3 Explain the basis for assuming the additional 1 mm annular air gap between the lead shield layer and the shells housing the lead layer of the Model No. RT-100 package; justify the adequacy of the subsequent 2.478 cm lead slump assumption; recalculate the lead slump if necessary, and provide an updated loading table for various contents based on the updated lead slump.

The application indicates that lead slump was considered in the HAC shielding analysis. On pages 26-27, the applicant calculated the lead slump for both side and end drop impacts. However, the basis for the air gap formed by the lead slump is unclear. In its response to RSI 5-1, the applicant did not provide any basis for its determination and simply replaced the axial 1.62 mm with a lead slump gap of 2.478 cm in the application. In addition, the applicant characterized the gap as manufacturing tolerance.

It is unclear if the manufacturing tolerances include lead shrinkage. More importantly, it is unclear if the stainless steel shells housing the lead layer have the same tolerances. If so, the space available for lead slump will be much larger when the tolerances move in opposite directions. Further, the staff was unable to find any update to the maximum allowable design basis contents, Table 5.4.4-4, for a package under HAC as a result of this change. The maximum allowable contents in this table are identical to what was presented in Revision 0 of the application.

The staff requests the applicant to provide: (1) a justification for the assumed lead gaps under both NCT and HAC, (2) correct the data if necessary, and (3) recalculate the dose rates for the package under both NCT and HAC.

This information is required by the staff to determine compliance with 10 CFR 71.47 and 71.51.

5-4 Provide justification for the use of material density of 1.13 g/cm^3 for dose rate calculations for package under HAC and revise the analysis with a conservative material density, if necessary

From Figure 5.3.1-4 of the application, it seems that a material density of 1.13 g/cm^3 was used in the model for the package under HAC. However, it is unclear that the assumed material density is conservative for shielding calculations. Page 5-17 of the application states: “This density is based on the random packing fraction (~0.65) for polystyrene spheres (beads) which has a theoretical density of ~ 1 g/cm^3. Under HAC, the material is conservatively assumed to compress to half its volume and double the source density. Thus under HAC, the contents maximum density increases to 1.13 g/cm^3 due to compression from the drop.” From these statements, it appears that 1.13 g/cm^3 was used for conservatism in dose rate calculations. However, this assumption may not be valid and conservative for shielding analysis. First of all, this density exceeds the theoretical density of the polystyrene resin which is the main authorized content. Second, shielding analysis models typically use material densities that are lower than the actual densities. Arbitrary increase in material density will increase the attenuation of the particles traversing the media; hence compaction of the media may underestimate the dose rate outside the package. Although the source was condensed accordingly in the model for a package under HAC, the evaluated configuration may not be the bounding. The applicant needs to examine this approach, demonstrate that the assumed configuration is bounding in terms of dose rates, and recalculate the dose rates for the package.

This information is required by the staff to determine compliance with 10 CFR 71.47 and 71.51.

5-5 Clarify if the package is transported with an enclosure or a personnel barrier. If neither of these devices are used, provide a justification for using the dose rate at 3219.2 mm from the cask centerline of the package for demonstration of compliance with 10 CFR 71.51(a)(1).

Page 5-3 of the application states: “During normal conditions of transport, shielding evaluations assume that the RT-100 is transported on a truck trailer that is 2438.4 mm and 12801.6 mm long with the cask tied downed in the center. Thus, the 2 meter radial surface is 3219.2 mm from the cask centerline and the distance to the cab, taking into account the trailer hookup and the distance to back of cab, is 8915.4 mm from the cask centerline.” Page 1-4 of the application states: “The RT-100 does not require the use of personnel barriers to meet 10 CFR 71 dose rate limits.” As shown on licensing drawing RT100 PE 1001-1, it appears that the diameter of the package body is 2060 mm. If there is no personnel barrier and the package is not transported in an enclosure, the requirements of 10 CFR 71.47(b)(1) apply. The dose rate at 2 meters from the package surface should be 2060/2 + 2000 = 3030 mm rather than 3219.2 mm from the centerline of the package. The applicant needs to clarify this design feature and provide updated shielding calculations and results if the package is not transported in an enclosure or with a personnel barrier.

This information is required by the staff to determine compliance with 10 CFR 71.47 and 71.51.

5-6 Demonstrate that the approach used to calculate the maximum allowable content is accurate and reliable for all actual contents.

Table 7.8.1-1 lists maximum allowable contents for each potential isotope in a typical resin waste composition. The application states that this approach is an inverse calculation approach and that the method attempts to determine the maximum allowable quantity for each isotope of interest for the given regulatory dose rate limits. Since a pure nuclide was used in each calculation, it is unclear if the results are applicable to a content that is a mixture of multiple nuclides. The applicant needs demonstrate that this approach is accurate and reliable for determining the maximum allowable content with consideration of the differences between the materials used in the model and the actual contents.

This information is required by the staff to determine compliance with 10 CFR 71.47 and 71.51.

5-7 Explain why only the Bremsstrahlung gamma flux at 2 mm from the inner surface, rather than in the entire range of the inner steel shell, was computed and used in the subsequent shielding analysis, and recalculate the contribution of Bremsstrahlung gamma to the total dose rates, if necessary.

The applicant used an indirect method to compute the dose rate contributed by the Bremsstrahlung reactions that occur while high energy beta particles traverse heavy metals such as lead and steel. However, it is unclear why only the Bremsstrahlung gamma flux at 2 mm was computed and used in the subsequent shielding analysis

rather than all the gamma particles produced in the entire range of the inner steel shell.

This information is required by the staff to determine compliance with 10 CFR 71.47 and 71.51.

5-8 Provide justification for including the S(α, β) reaction for the up-scattering treatment of thermal neutrons in the neutron shielding analysis.

The applicant applied the S(α, β) reaction modification to the material cards in its MCNP shielding models. However, it is unclear why such a modification is necessary for the shielding analyses. The applicant needs to provide discussions on the meaning of the S(α, β) reaction modification and why it is necessary to include this treatment in neutron shielding analyses.

This information is required by the staff to determine compliance with 10 CFR 71.47 and 71.51.

5-9 Clarify exactly what material density was used in the models for the impact limiter polyurethane foam and provide justification for the material property used in the analyses and updated results based on the new assessment.

Page 5-19 of the application states in Note 1 to Table 5.3.2-1 that "NCT model assumes the impact limiter polyurethane foam is reduced in density from 40 to 35 lbs/ft^3 and from 20 to 15 lbs/ft^3." The applicant needs to clarify exactly what material density (35 or 15 lbs/ft^3) was used in the models for the impact limiter polyurethane foam and provide (i) justification for the material property used in the analyses and (ii) updated results based on this new assessment.

This information is required by the staff to determine compliance with 10 CFR 71.47 and 71.51.

Chapter 7 Operating Procedures

7-1 Provide operating procedures and/or instructions for the user to calculate the maximum allowable contents for a mixture of some of the isotopes listed in Appendix 5 of the application.

The applicant provides a list of Gamma Nuclides with Greater than 1 Day Half Life, a list of Gamma Dose Rate Response (NCT) (5.6.2-1), a list of Gamma Dose Rate Response (HAC) (Table 5.6.2-2), and a list of Nuclide Maximum Ci/g Loading Limits (Table 5.6.3-1) in Appendix 5 of the application. However, the applicant did not provide any instructions regarding the use of this data to determine the maximum allowable quantity of contents that are typically mixtures of some of the nuclides. The applicant needs to develop operating procedures and/or instructions for the users to determine the maximum allowable quantity if the contents are mixtures of some of the nuclides.

This information is required by the staff to determine compliance with 10 CFR 71.87.

7-2 Clarify or modify the removal and replacement procedures for the impact limiters.

Following the procedures in sections 7.1.1.2 ("Lower Impact Limiter Removal") and 7.1.1.3 ("Upper Impact Limiter Removal") of the application, as sequentially written, it is unclear whether the impact limiters can be removed in this order. If the lower impact limiter can be removed prior to the upper impact limiter, indicate how the package will be lifted.

Section 7.1.1.1 "Package Removal from Trailer," directs to section 7.4 of the application. Staff notes that the first bullet on page 7-16 of the application states, "With or without the lower impact limiter attached, lift the RT-100 cask from the transport trailer (Figure 7.4-4)." Staff also notes that there is no reference to a specific set of procedures pertaining to the removal of the lower impact limiter in section 7.4 of the application.

This information is required by the staff to determine compliance with 10 CFR 71.87 and 71.111.

7-3 Confirm the appropriateness of leakage test procedures and leakage test personnel qualifications.

The leak testing discussion in Chapters 7 and 8 lacks details, as evidenced further in subsequent RAI comments. Confirm that appropriate leak test procedures (i.e., detailed procedures are found in lower tier documents, etc.) and test personnel qualifications (i.e., ASNT certified) are established, per quality assurance requirements.

This information is required by the staff to determine compliance with 10 CFR 71.85, and 71.87.

7-4 Clarify the appropriate periodic and maintenance leakage tests discussed in Chapter 7.

a) Sections 7.1.1.4, 7.1.1.5, 7.1.1.6, 7.1.2.2, 7.1.2.3, and 7.1.2.4 of the application appear to refer to the ANSI N14.5 periodic and maintenance leakage tests of the seals and containment. If so, these tests should be explicitly stated so that the appropriate components, acceptance criteria and sensitivity criteria are known to the test personnel.

b) These periodic and maintenance tests refer to a pressure rise leakage test found in Section 7.6 of the application. According to ANSI N14.5, the pressure rise test sensitivity is between 1E-1 to 1E-5 ref-cm3/sec, which is not sufficient to meet the 3.077E-6 ref-cm^2/sec sensitivity described on page 4-11 of the application. An appropriate leakage test procedure is required for the periodic and maintenance leakage tests.

This information is required by the staff to determine compliance with 10 CFR 71.43(f), and 71.51.

7-5 Clarify whether the leakage test described in Section 7.1.3 of the application represents the ANSI N14.5 pre-shipment leakage test.

Section 7.1.3 “Preparation for Transport” lists tasks to be performed “… prior to final assembly of the RT-100.” One listed task is leak rate testing. It should be clarified whether this leak rate testing refers to the ANSI N14.5 pre-shipment test, which occurs after the contents are loaded and the package is closed. The corresponding acceptance leakage rate and sensitivity criteria should also be provided.

This information is required by the staff to determine compliance with 10 CFR 71.43(f), and 71.51.

7-6 Clarify the use of fabrication, maintenance, periodic, and pre-shipment tests in Chapters 7 and 8.

a) Section 4.4 of the application references ANSI N14.5 when discussing the fabrication, maintenance, periodic, and pre-shipment tests. However, for completeness and as an aid to the test personnel, it also should be stated in Chapters 7 and 8 that “the fabrication, maintenance, periodic, and pre-shipment tests are performed in accordance with ANSI N14.5.”

b) The appropriate leakage rate test and sensitivity criteria should be listed in Chapters 7 and 8 for the fabrication, maintenance, periodic, and pre-shipment leakage tests.

This information is required by the staff to determine compliance with 10 CFR 71.43(f), and 71.51.

7-7 Confirm the appropriate use of the pressure rise leakage test.

a) Section 7.6 states that a pressure rise leakage test is performed on the containment seals for the primary lid, secondary lid, and quick-disconnect valve cover plate. Although the procedure applies to the primary lid, secondary lid, and quick-disconnect valve cover plate, the initial listed task is for the vacuum pump to be positioned on the primary lid leak test port. The drawings indicate that the primary, secondary, and quick-disconnect valve cover plate leak test ports are independent. Would not the vacuum pump be positioned on the appropriate port that is to be tested, i.e., primary, secondary, or quick-disconnect valve cover plate?

b) The fourth step of the procedure indicates that the vacuum pump should be isolated. It is recognized that a running vacuum pump can pull vacuum across “closed” valves. The procedure should also provide guidance to physically disconnect the pump from the arrangement and/or turn the pump off.

c) Explicit instruction should be provided as it relates to the pressure rise leakage test. Therefore, the following statement should be removed: “Another type of leakage rate testing is acceptable if it complies with the RT-100 design, and ensures every leakage testing requirement is met.”

This information is required by the staff to determine compliance with 10 CFR 71.43(f), 71.51, 71.85 and 71.87.

7-8 Discuss the need to prevent contamination during unloading.

a) The potential for release of radioactive gases, volatiles, etc., as well as combustible gases, from the package during unloading (such as a quick-disconnect valve failure, etc.) of contents should be discussed, especially in Sections 7.2.1 and 7.2.2.

b) If available, provide "field data" that shows the activity from the void/headspace from a package with the proposed contents.

This information is required by the staff to determine compliance with 10 CFR 71.43(d), (f), and 71.51.

7-9 Provide instructions in Chapter 7 that indicate contents are limited such that the concentration of combustible gases must be below 5%, by volume, at the end of the shipping period.

Chapter 7 should provide instructions to indicate that contents are limited such that the concentration of combustible gases must be below 5%, by volume, at the end of the shipping period. In addition, the shipping period should be explicitly stated.

This information is required by the staff to determine compliance with 10 CFR 71.43(d).

Chapter 8 Acceptance Tests and Maintenance Program

8-1 Clearly indicate the dimensions, materials used, design criteria, fabrication criteria, and acceptance tests required for all important to safety, non-standard materials and components. This is a follow-up to RSI 8.1.

The Bill of Materials indicates that several important to safety components are "commercial," or described based on a manufacturer description. Some of these components, such as O-Rings, are not detailed in the drawings. In order to adequately describe the proposed design, provide either the detailed drawing showing dimensions or the materials of construction of the component, or include a specific reference to the desired part. If a reference is provided, enough detail is needed to understand the design details of the specific component.

Further, an understanding of the data that is used to develop material properties, design allowable, and acceptance tests for these components is needed. Section 8.1.5 discusses the Commercial Grade Dedication (CGD) Plan that will be prepared to ensure that the material meets all specifications critical to safety. However, a description of those tests that are required to ensure the safety of the packaging is needed in Chapter 8 of the application. This can be accomplished by detailing the tests in Chapter 8. For example, for the impact limiter foam, a test matrix of the formulation, batch and pour tests required to ensure that the desired material properties are achieved could be provided. Acceptance tests may also be proposed for the seals and the carbon fiber

thermal shield. Alternatively, if this information is already contained in another document, such as a CGD Plan, that document can be referenced and provided as an appendix to Chapter 8.

This information is required by the staff to determine compliance with 10 CFR 71.31(c), 71.33(a)(5), 71.71, 71.73, and 71.85.

8-2 Clarify which components will be inspected during normal use and periodic maintenance. Clearly indicate the differences between the maintenance during normal use and the periodic maintenance every 12 months, as defined in Section 8.2.1 and 8.2.2 of the application, respectively.

A clear understanding of the maintenance approach is needed to verify that the packaging will continue to perform adequately during its licensed period. Based on the description provided, it is unclear whether, for example, the lid and lid seals are inspected each time the Model No. RT-100 package goes through a cycle of loading and unloading.

This information is required by the staff to determine compliance with 10 CFR 71.31.

8-3 Specify the details of an appropriate fabrication, periodic and maintenance leak test that meets the acceptable leakage criteria.

a) Sections 8.1.4 and 8.2.3.1 provide information on a leakage test. It appears that the leakage test method relies on sniffer or spray methods, which are qualitative techniques. These methods are not appropriate for leak-testing the entire containment boundary (welds, base material, seals, etc.) for a fabrication leak test or for the periodic and maintenance leak tests which must meet a quantifiable, allowable leak rate, as specified in Table 4.4-1 of the application. An appropriate leak test method should be specified.

b) Sections 8.1.4 and 8.2.3.1 state: "… or in accordance with other approved procedures using different leak detector gases." Explicit instruction should be provided as it relates to a leakage test. In addition, the different gases and resulting leak rate criteria should be specified.

c) Section 8.2.3 states: "The leakage rate testing is performed in accordance with Chapter 4 requirements." This sentence should be clarified with further discussion and details.

This information is required by the staff to determine compliance with 10 CFR 71.33, 71.43(f), 71.51, and 71.85.

8-4 Clarify the parts to be leak tested before each loading.

The General Notes included in page 8-2 of the application state the following: "… This test is conducted when the cask is breached at either the primary lid, secondary lid or

quick-disconnect valve cover. A leak test on these parts is not necessary if the secondary lid or quick-disconnect valve cover have not been opened." These sentences imply that a leak test of the primary lid, that has been opened, is not necessary if the secondary lid or quick-disconnect valve cover have not been opened. The intent of these sentences is unclear to staff and they should be re-written.

This information is required by the staff to determine compliance with 10 CFR 71.43(f), and 71.51.

8-5 Clarify that the pre-shipment leak test will be performed after loading of contents.

The General Notes included in page 8-2 of the application state that a leak test is performed before each loading. Page 8-9 states that a pre-shipment leakage test is required before each shipment of Type B material quantities. In order to prevent confusion between the tests described on pages 8-2 and 8-9, it should also be stated that the pre-shipment test is performed after the contents have been loaded, per ANSI N14.5, and as mentioned in Table 4.4-1.

This information is required by the staff to determine compliance with 10 CFR 71.43(f), and 71.51.

8-6 Provide additional details in Section 8.1.4.2 Leakage Test Procedure.

Additional details associated with the fabrication leakage test should be included in the procedure in order to provide appropriate guidance to the person performing the test. Some issues to address include the following:

a) The leakage test procedure stated that a substitute-sealed plate may be used if the cask lid(s) are unavailable. There is no mention of when the actual cask lid(s) [primary, secondary, quick disconnect cover plate] would be tested and how the leakage rates would be accounted for in the total package leakage rate.

b) The need to leak test the entire containment boundary must be explicitly stated so that the leak rate can be compared correctly to the acceptable leakage rate criteria.

c) The origin and intent of the "sealed metal cavity filler canister" was not adequately discussed. Further information on this canister should be provided in the section.

This information is required by the staff to determine compliance with 10 CFR 71.33, 71.43(f), and 71.51.

8-7 Clarify the seal replacement period discussed on pages 8-7 and 8-8 of the application.

a) Section 8.2.1 indicates that records should "… ensure that seals are within the 24 month replacement period." The replacement period should reflect the 12-month period described on page 8-8.

b) Provide the basis for the 50 cycle seal limited period stated on page 8-8.

This information is required by the staff to determine compliance with 10 CFR 71.43(f), and 71.51.