ENERGYSOLUTIONS

7 April 2011
EL&P-008-11

Mr. Pierre Saverot
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: Amendment Request for Certificate of Compliance No. 9168 for the Model 8-120B Package - Request for Supplemental Information
Docket No. 71-9204
TAC No. L24514

Dear Mr. Saverot:

As discussed at the meeting of March 31, Energy*Solutions* provides the attached response to the request for supplemental information (RSI). If there are questions concerning any of the individual responses, please contact us.

As indicated in the response, Energy*Solutions* will provide a revised request for amendment of the certificate addressing each of the RSI items. The revised Safety Analysis Report will be submitted no later than June 30, 2011. Following review of our response, we request that you suspend your review of our request until receipt of this revision.

Should you or members of your staff have any additional questions about the response, please contact me at (803) 758-1898.

Sincerely,

MS Whittaker

Mark Whittaker
Health Physicist, Radiological Services

Attachment: Response to RSI

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Response to RSI for the Model 8-120B Package

RSI-1 Justify that the package complies with the "-96" requirements in 10 CFR Part 71.

Attachment 1 provided with the application is unclear and fails to positively show that the package is in compliance with 10 CFR Part 71, particularly 10 CFR 71.61 that requires all Type B packages to be subjected to (deep sea immersion) 2MPa (290psi) for a period of not less than 1 hour.

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

Response:
The SER for a recent (April, 2009) Type B package approval states "In evaluating the package for a Type B designation, the applicant did not include an evaluation of the package against the requirements of 10 CFR 71.61 "Special requirements for Type B packages containing more than 10^5 A2." As a result, the maximum quantity of material per package has been limited to no more than 10^5 A2." Since we did not address 71.61 in the 8-120B application, we expected a similar condition in the CoC.

RSI-2 Categorize all components listed in the Bill of Materials on the licensing drawings following the guidance of NUREG/CR-6407. Clarify their safety classification and acceptance criteria (if applicable) used to characterize the components.

All components should have their safety category indicated on the Bill of Materials, according to NUREG/CR-6407 (i.e. Category A, B, or C for components important to safety; or not important to safety). The term "Critical Components" listed on Note 14 of Sheet 1 of Licensing Drawing C-110-E-007, Rev. 14 is ambiguous and has no regulatory meaning.

This information is required by the staff to determine compliance with 10 CFR Part 71.33(a)(5).

Response:
Note 14 identifies the NDTT of the "fracture critical components" of the cask. This is unrelated to the safety category of the components. The safety category of components, in accordance with NUREG/CR-6407, will be added to the Bill of Materials.

RSI-3 Provide, in Section No. 1.2.2 of the application, a detailed description of the characteristics of each type and form of permitted contents of the package, including the identification of the main isotopes and radioactive constituents.

For example, Section No. 1.2.2, "Contents of Packaging," gives only a general description of the contents of the package, i.e., solid or powdered materials, and does not include any technical or numerical data.

Section No. 1.2.2.3, "Loading Restrictions," provides limitations on the contents of the package, but the package's contents themselves are not clearly defined. Furthermore, Section No. 1.2.2.3 implies that water can be present in the package contents. This inconsistency needs to be addressed.

In addition, the application, as submitted, does not address important aspects such as the type of radionuclides in the contents. The shielding evaluation only addresses a

small Cobalt-60 source and states that the contents do not contain significant sources of neutron radiation. However, it is not clear that the currently proposed contents descriptions in the CoC preclude materials containing significant sources of neutron radiation. Thus, the application should (i) describe the radionuclides proposed to be shipped in the package and provide evaluations for these radionuclides, and (ii) justify why powdered solids and irradiated hardware are the most limiting chemical and physical forms of the contents.

The staff also notes that no credit can be given to the secondary containers used to hold the radioisotopes for containment, as these containers are not described in the application. Contents that have the capacity to induce stress corrosion cracking of the containment boundary or degrade the elastomer seals must be prohibited.

This information is required by the staff to determine compliance with 10 CFR 71.31(a), 71.33(b), 71.35(a), 71.47, and 71.51.

Response:
The 8-120B cask is a general purpose waste packaging. As such, a detailed description of each type and form of contents is not available. Limitations on the contents will be provided that will allow determination that a particular contents meeting these restrictions can be safely transported, such as prohibition of explosives, pyrophorics, and corrosives, as was recently approved for the 3-60B and 10-160B packagings. A method for determining acceptable radionuclides and maximum quantities will be provided as part of the shielding evaluation.

RSI-4 Provide a demonstration of the determination of flammable gas concentrations for various waste types and contents. Provide this analysis for each package configuration including specific procedures used to determine combustible gas contents. Alternatively, provide an example of a bounding hydrogen analysis, as referenced in Section No. 1.2.2.3, to restrict the maximum shipment time of the package. Also provide a justification, in Section No. 3.3.2 of the application, for the value presented in Section No. 1.2.2.3, i.e., “no more than 0.063 g-moles/ft^3 at 14.7 psia and 70°F.”

The staff cannot evaluate the restrictions of gas generation, as defined in 10 CFR 71.4(3)(iii), since the contents of the package are not listed.

Section No. 1.2.2.3 of the application provides only general statements on the need for a determination of gas generation by tests or measurements. The application should demonstrate that hydrogen and other flammable gases comprise less than 5% of the free gas volume in any confined region of the package.

This information is required by the staff to determine compliance with 10 CFR 71.33(b)(5) and 71.43(d).

Response:
The basis for the value presented in 1.2.2.3 is taken from the 8-120B SER Rev. 0:

COMBUSTIBLE GAS MIXTURES

(a) Conditions have been imposed for packages containing water and/or organic substances to limit the accumulation of radiolytically generated gases over the shipping period to preclude the possibility of significantly reducing the packaging effectiveness due to explosion. The conditions require a representative package be prepared as for shipment, and a determination by tests and measurements be made to show that the limiting conditions are met over a time period of twice the expected shipping period. The contents are held in a secondary container prior to and during shipment. Tests and measurements are to be performed on secondary containers as they will be representative of the packages for this purpose.

The limiting conditions proposed are:

"(i) The hydrogen generated must be limited to a molar quantity that would be no more than 5% by volume at STP (or equivalent limits for other inflammable gases) of the secondary container gas void (i.e., no more than 0.063 g-moles/ft^3 at 14.7 psia and 70°F; or

Section 3 will be revised to provide either a bounding hydrogen calculation or a method for determining the hydrogen concentration by waste type and radionuclide content.

RSI-5 Provide a justification for the following statements in Section Nos. 1.2.2.3 and 3.3.2 of the application, respectively.

"For any package containing materials with radioactivity concentration not exceeding that for LSA and shipped within 10 days of preparation, or within 10 days of venting the secondary container, the gas generation determination above need not be made and the shipping time restriction does not apply." "Per the limitation on the contents specified in 1.2.3.3, the maximum amount (in volume percent) of gases produced by radiolysis will be 5% hydrogen and, correspondingly, 2.5% for oxygen.

The application should demonstrate that hydrogen and other flammable gases comprise less than 5% by volume of the total gas inventory within any confined region of the package.

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

Response:
The LSA limitation was provided by NRC staff in the SER to Rev.0 of the CoC. Demonstration of hydrogen volume will be provided as noted above.

RSI-6 Provide a justification for the applicability and the use of the Finite Element Analysis (FEA) model using computer codes ANSYS/LSDYNA. Also provide discussions of deviations from the guidelines delineated in ISG-21, "Use of Computational Modeling Software."

The applicant has used computer codes ANSYS/LSDYNA to demonstrate the adequacy of the impact limiters of the package during the regulatory drop evaluations under NCT and HAC. The applicant has not identified deviations from staff's guidance provided in

ISG-21. Explain in detail the FEA model and justify the use of that model. Include in the explanations why more accurate and current versions of the computer codes were not used to demonstrate the adequacy of the impact limiters of the package during the regulatory drop evaluations under NCT and HAC.

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

Response:
The FEA analyses performed to evaluate the 8-120B cask for the NCT and HAC drop tests are based on Energy*Solutions* developed methodology that utilizes the LS-DYNA code. The methodology was developed after a considerable amount of research and parametric studies. These studies included the choice of elements, mesh density, material damping, hourglass control, and, solution parameters and controls, etc. The methodology was successfully validated against the test results and is fully documented in an Energy*Solutions* proprietary document ST-551. This document has been provided in the submittal as one of the reference documents (Reference 2-5). The methodology has also been used in a recently approved NRC cask package (3-60B) where the effect of mesh refinement, as required by ISG-21, has been studied in the Energy*Solutions* document ST-596. This reference will be included in Section 2 of the SAR.

RSI-7 Clarify and specify the mandatory stress-strain properties of the polyurethane foam under impact loading rates at temperatures bounded by HAC conditions. The critical characteristics of the foam and all of the acceptance tests of the foam must be specified in such a way that they are incorporated into the CoC by reference. The stress-strain characteristics of the foam used in the structural analysis should be unambiguous.

Neither the stress-strain plot of Figure No. 2-3 nor Figure No. 2-4 matches the stress strain plot listed in Appendix A of the application. It is unclear what loading rates were used to determine any of the stress strain curves. The test temperature used to generate the stress-strain plot in Appendix A is not specified.

This information is required by the staff to demonstrate compliance with 10 CFR 71.33(a)(5), and 10 CFR 71.73(c)(1).

Response:
The foam used in the construction of the impact limiters is specified by Energy*Solutions* specification ES-M-175, which has been provided as Appendix 1 in Section 8 of the SAR. The specification provides a nominal foam density and the stress-strain properties at room temperature (70°F) perpendicular-to-rise direction of the test sample that the supplier needs to conform to. These properties must be obtained using ASTM D-1621 standard. The baseline properties have been established using the General Plastics' FR-3700 foam with the nominal density of 25 lb/ft^3.

Please note that the stress-strain properties shown in Figures 2-3 and 2-4 are derived properties at -20°F and 100°F, which are the temperature extremes for various NCT and HAC load combinations. They are presented in this section to show the temperature dependence of the properties – not for procurement specification.

This specification ES-M-175 can be referenced in the CoC.

RSI-8 Describe how the 200 W decay heat given in Section No. 3.1.2 of the application has been determined and is bounding, based on the type and form of material and the maximum quantity of material per package.

The staff also notes the 200 W decay heat is not in agreement with the previously approved SER.

This information is required by the staff to determine compliance with 10 CFR 71.33(b)(7).

Response:
A decay heat of 200 watts is set as an upper bound based on the thermal evaluation, which shows that this amount of decay heat will not result in a surface temperature greater than the regulatory limit nor exceed the acceptable temperature for an of the cask components. Contents with a decay heat greater than 200 watts are not permitted.

RSI-9 Provide the impact limiter foam temperature limits during NCT and HAC in Table Nos. 3-1 and 3-2 of the application. Also, describe how the foam will be affected by the HAC fire temperatures in Section No. 3-4 of the application, and explain if the foam in the thermal model is replaced with air during the HAC post-fire.

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

Response:
The analyses presented in the current SAR are the reproduction of the original FEM analyses of the approved SAR of the 8-120B cask. The foam in the impact limiters has not been exclusively modeled in the FEM analyses. Instead it has been represented by fully-insulated boundary conditions. Therefore, the foam temperatures during the NCT and HAC events are not available for reporting.

During the NCT events the foam temperature can be conservatively considered to be equal to the cask inside temperature. For the acceptability of the foam temperature during the HAC fire test please see the explanation provided in response to RSI-18.

The response provided here and that for RSI-18 will be included in the SAR Section 3-4.

RSI-10 Revise Table No. 3-1 of the application to include the following components: primary lid, secondary lid, baseplate, primary lid seal, secondary lid seal, primary lid vent seal, and impact limiter foam.

Also include any additional components that are part of the containment boundary. Note that the containment boundary is not clearly defined in Chapter No. 4 of the application.

This information is required by staff to determine compliance with 10 CFR 71.71.

Response:
The requested information in Table 3-1 will be added. Reference 3-8 will be revised and will be included in the next submittal. A figure showing the cross section of the containment boundary will be added to Chapter 4.

RSI-11 Revise Table No. 3-2 of the application to include the following components: primary lid, secondary lid, baseplate, primary lid vent seal, and impact limiter foam. Also include any additional components that are part of the containment boundary.

Table No. 3-2 also needs to include the maximum component temperatures during the fire and during the post-fire.

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

Response:
The requested information in Table 3-2 will be added. Reference 3-10 will be revised and included in the next submittal.

RSI-12 Provide outer surface material absorptivity values during NCT and HAC conditions in Section No. 3-2 of the application. Also, demonstrate how the values used for HAC conditions meet 10 CFR Part 71.73(c)(4).

This information is required by staff to determine compliance with 10 CFR 71.35(a).

Response:
The complete details of the radiation heat transfer are provided in the Energy*Solutions* document TH-027 for the NCT and TH-028 for the HAC. These documents are referenced as Ref 3-8 and 3-10, respectively. They have been provided for the NRC review in their entirety with other references on the non-proprietary CD/DVD. As with previously approved submittals, Energy*Solutions* provides the details in referenced documents and summarizes the results and conclusions in the SAR Section.

RSI-13 Provide appropriate justification that all components meet the minimum allowable service temperature which is less than or equal to -40°C (-40°F) in Section No. 3.2.2 of the application.

This information is required by staff to determine compliance with 10 CFR 71.71(a)(2).

Response:
The 8-120B cask is fabricated from steel, lead, elastomer and polyurethane foam materials. These materials are specified as follows:

- The metallic components are made with ASTM specified steel.
- The seals used in the package are specified to be elastomer, 60-75 Durometer, usable temperature range that meets or exceeds the range required to meet the Normal Conditions of Transport (minimum= -40ºF, maximum= +250ºF) and meets or exceeds the temperature required to meet the Hypothetical Accident Conditions (+350ºF for 1 hour).
- Lead is specified to be ASTM B-29 commercial grade. The melting temperature is 622°F.
- Polyurethane foam used in the impact limiters are specified by ES-M-175 (see Appendix 1, Section 8). All the pertinent thermal properties are included in this specification.

All these materials have history of usage in the cask and have operating range well below the specified regulatory value of -40°F.

RSI-14 Provide the methods and calculations used in the package thermal evaluation, describe and justify assumptions used in the analysis. Also, describe models and modeling details in Section No. 3.3. of the application.

Regulatory Guide 7.9 provides examples of information that should be included in an application, e.g., modeling software, type of package symmetry modeled, number of nodes, types of elements for various components, discussion of any gaps between components, heat transfer methods, models and equations used.

This information is required by staff to determine compliance with 10 CFR 71.35(a).

Response:
The complete modeling details following the guidelines of Reg. Guide 7.9 are provided in the Energy*Solutions* document TH-027 for the NCT and TH-028 for the HAC. These documents are referenced as Ref 3-8 and 3-10, respectively. They have been provided for the NRC review in their entirety with other references on the non-proprietary CD/DVD. As with previously approved submittals, Energy*Solutions* provides the details in referenced documents and summarizes the results and conclusions in the SAR Section.

RSI-15 Describe how solar insolation is applied to the thermal models during NCT and how the application meets the regulations of 10 CFR 71.71(c)(1) in Section No. 3.3 of the application.

Also, describe how solar insolation is applied to the thermal models during the HAC post-fire and how the application meets the regulations of 10 CFR 71.73(c)(4) in Section No. 3.4 of the application.

The application of solar insolation should be in agreement with the transport configuration of the package that should be described in the application.

This information is required by staff to determine compliance with 10 CFR 71.35(a), 71.71(c)(1), and 71.739c)(4).

Response:
The complete details of the solar insolation are provided in the Energy*Solutions* document TH-027 for the NCT and TH-028 for the HAC. These documents are referenced as Ref 3-8 and 3-10, respectively. They have been provided for the NRC review in their entirety with other references on the non-proprietary CD/DVD. As with previously approved submittals, Energy*Solutions* provides the details in referenced documents and summarizes the results and conclusions in the SAR Section.

RSI-16 Demonstrate compliance with 10 CFR 71.43(g) requirements.

Section No. 3.3.1 of the application should explicitly show that the package meets the maximum surface temperature requirements specified in 10 CFR 71.43(g).

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

Response:
Under the NCT conditions, the cask maximum temperature occurs at the fire-shield. This temperature is calculated as 160.6°F which lower than 10 CFR 71.43(g) value of 185°F. This is shown in Table 3-1. In order to present it more clearly, a statement in Section 3.3.1 will be added.

RSI-17 Discuss the rationale for using a maximum decay heat instead of a zero decay heat for the cold environment and normal cold conditions in Section No. 3.3.1 of the application.

This information is required by staff to determine compliance with 10 CFR 71.71(c)(2).

Response:
The temperature distributions in the cask under various conditions are used in the structural analyses presented in Section 2. Under the cold conditions with minimum (zero) heat loading the body temperature reaches the ambient temperature in steady state. Therefore, no thermal analyses for this case are needed. On the other hand, with any amount of heat load, there exist temperature gradients in various parts of the cask. To capture these two effects, the evaluation of the cask in Section 2 has been performed for the two cold conditions one with the maximum internal heat load and another with minimum (zero) heat load. These two load cases envelope the conditions of maximum and minimum temperature gradient through the cask body.

The write-up in both Section 2 and 3 will be updated to state this more clearly.

RSI-18 Describe the effects of the HAC drop and puncture tests in Section No. 3.4.1 of the application and any dimensional modifications made to the thermal model as a result of these tests.

The staff needs to have a clear understanding of the potential modifications of the thermal model after the HAC drop and puncture tests.

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

Response:
As explained in the response to RSI-9 the impact limiter foam is not exclusively included in the FEM analyses. The impact limiters have been represented by fully-insulated boundary conditions at the interface of the impact limiter and the cask body. The effect of other drop tests prior to the fire test can be summarized as follows:

The impact limiters of the 8-120B package have been shown to remain attached to the cask body during the free drop tests. The effect of these drops is a local crushing of the foam, and possible rupture of the impact limiter skin. The puncture drop on the impact limiters will crush the foam and may also rupture the skin in the vicinity of the impact location. The local crushing of the foam during the drop and puncture tests will increase the foam density which will enhance the thermal insulation of the foam. Therefore, the boundary conditions used in the analysis are still valid.

The rupture of the impact limiter skin after the drop and puncture tests may expose the polyurethane foam material to the fire. However, the polyurethane fire retardant

characteristics will mitigate the effect of the direct exposure to fire due to formation of intumescent char. The following is a quote from the General Plastics sales brochure.

"The primary fire retardant mechanism of FR-3700 is the production of an intumescent char when thermally degraded. The foam acts much like the small pallets children light on the fourth of July which grows a long worm when burning. The intumescent char has the ability to seal large voids which could be caused by the impact damage. The char also provides a secondary thermal barrier which breaks down very slowly at 2000 to 2200°F."

The 5-gallon bucket tests performed by General Plastics where the open face of the bucket is exposed to direct fire show the formation of the char that prevents the fire from extending into the underlying foam. These tests also indicate that for the 11¾" foam thickness in the test, the effect of 30-minute fire has a minimal effect on the end opposite the exposed end. These tests were performed for various density foams and it was shown that the effectiveness of the foam is enhanced with the increasing foam density. With 25 lb/ft^3 foam density and a minimum foam thickness of 11" in the 8-120B cask package, the effect of exposure of a small portion of foam due to rupture during the drop and puncture test will not have a significant effect on the impact limiter performance during the fire.

The direct impact of the puncture bar on the sidewall of the cask will remove the air gap provided between the fire-shield and the cask body. The fire shield may come in contact with the cask body near the impact location. During the HAC fire test extra amount of heat will be input to the cask body locally near the impact point. However, since these locations are away from the critical components of the cask (e.g. bolting ring, seals, and the endplate joint), the extra heat input will not have any significant difference in the maximum temperatures of these components. The cask shells and the lead at these locations will see a significant temperature difference which will result in secondary (thermal) stresses. These stresses are self-limiting and would not have any effect on the overall performance of the package.

The explanation provided above will be included in Section 3.4 of the SAR.

RSI-19 Provide all ANSYS NCT and HAC thermal analysis input and output files.

This information is needed to verify the results shown in the application.

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

Response:
The input and output files for all the thermal analyses have been provided in the Non-Proprietary Reference document CD/DVD. The folders in this disc include the listing of the models, the database, the results and all the post-processing files. All the thermal analyses can be totally recreated using these files on any PC.

RSI-20 Provide a clear and detailed figure showing the entire cross section of the containment boundary in Chapter No. 4 of the application.

Figure No. 2-2 of the application does not provide an adequate or immediately clear depiction of the entire containment boundary. This figure should have a dotted line depicting the entire containment boundary with additional figures, if necessary, showing

how the containment boundary crosses the containment boundary inner seals and the vent/drain ports. The containment boundary and its components should be shown in a figure in Chapter No. 4. This figure should be consistent with the containment boundary description and named components leak tested as described in Chapter Nos. 1, 7 and 8 of the application, Section No. 4.1 of the application, and the named components on the licensing drawings.

This information is required by staff to determine compliance with 10 CFR 71.33(a)(4).

Response:
The containment boundary components are shown on Sheet 5 of the cask drawing, C-110-E-0007. A figure showing the cross section of the containment boundary will be added to Chapter 4.

RSI-21 Provide specific information missing from Chapter Nos. 1, 7, and 8, Section No. 4.1, and licensing drawings. Any use of lid, seals, or vent/drain port should be specifically designated as to be associated with the primary or secondary lid to provide a clear understanding and avoid potential confusion.

Also clarify if there is a vent/drain port, vent port and drain port, only an optional drain port, or only a vent port and modify the application accordingly. Chapter No. 4 of the application mentions a vent port and occasionally a drain port.

This information is required by staff to determine compliance with 10 CFR 71.33(a)(4).

Response:
The cask, as shown in Drawing C-110-E-0007, has only a vent port. Any conflicting language will be deleted from the SAR.

RSI-22 Address the following assumption from Section No. 4.2.2, “Assume the mass (M) of the powdered solids is 60 grams and the activity (A) is 3000 A_2,” by showing how the assumed values are (i) bounding based on the description of the contents and (ii) conservative for the calculations subsequently presented in that section of the application.

Remove all references to an A_2 limit to define authorized contents. An A_2 limit is directly linked to the structural robustness of the package, classified as a Category II package in accordance with NUREG/CR-3019, “Recommended Welding Criteria for use in the Fabrication of Shipping Containers for Radioactive Materials.”

This information is required by staff to determine compliance with 10 CFR 71.51(a)(1).

Response:
In accordance with ISG-20, the containment calculation is based on the 3000 A_2 activity limit from Regulatory Guide 7.11. A minimum gram quantity is assumed to determine the maximum specific activity, which is required for the containment calculation. This minimum gram quantity will be included in the contents specification.

RSI-23 Perform a structural evaluation or provide reference to the structural section of the application that shows that the containment boundary, seal region, and closure bolts do not undergo any inelastic deformation.

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

Response:
The design of the 8-120B cask is based on the recommendations of the USNRC Regulatory Guide 7.6. The acceptance criteria are based on elastically calculated stresses in the cask for both NCT and HAC events. It is recognized that the materials of construction of the cask have sufficient ductility so that a slight inelastic deformation will not be detrimental to the performance of the cask. Therefore, allowable stress intensity (SI) values larger than the yield stress of the material are allowed by the Regulatory Guide. For example, the accident condition membrane SI allowable is smaller of $2.4S_m$ and $0.7S_u$. For a typical carbon steel material (S_y=38,000 psi, S_u=70,000 psi, S_m=20,000 psi) this value is 48,000 psi which is larger than the yield stress of 38,000 psi. To require that the containment boundary, seal region and the closure bolts do not undergo any inelastic deformation is beyond the recommendations of Regulatory Guide. Since complying with the design criteria of the Regulatory Guide are an acceptable means of satisfying the requirements of 10 CFR 71, Energy*Solutions* believes that the requirements of 10 CFR 71.51 have been adequately complied with by the analyses provided in the SAR.

RSI-24 Justify the differences in L_R between Section No. 4.4 and Section Nos. 4.5 and 4.6 of the application. Update subsequent calculations. This value should be consistent throughout the application.

In Section No. 4.4 of the application, $L_R = 2.2*10^{-6}$ ref*cm^3/sec, while Section Nos. 4.5 and 4.6 base calculations on a less conservative value $L_R = 2.3*10^{-6}$ ref*cm^3/sec.

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

Response:
The value listed for L_R in Sections 4.5 and 4.6 is incorrect and will be corrected in the revised submittal. All the calculations of allowable leak rate use the correct value from Section 4.4, i.e., $L_R = 2.3*10^{-6}$ ref*cm^3/sec.

RSI-25 Address the fabrication leakage rate test and maintenance leakage rate test acceptance criterion and respective sensitivities in Section No. 4.8 of the application.

The application should include both fabrication and maintenance leakage rate test acceptance criteria in addition to the periodic leakage rate test acceptance criterion and sensitivity.

This information is required by staff to determine compliance with 10 CFR 71.51 and 71.93(b).

Response:
As defined in ANSI N-14.5, the acceptance criterion and sensitivity for the fabrication, maintenance, and periodic leakage tests are the same. Thus, the calculations in

Chapter 4 provide the acceptance criteria and sensitivity for all three tests, as specified in Chapter 8.

RSI-26 Provide a shielding evaluation for both NCT and HAC conditions that adequately supports the contents proposed to be shipped in the package, as described in the CoC, including the items described in this question. The CoC description of the contents should be modified as necessary.

The CoC indicates that the contents are to be 2000 times a Type A quantity. There is no limit as to the radionuclides to be shipped. The current evaluation provides dose rates for a 47 Curie Cobalt-60 source, that is modeled as a small steel cylinder. This source represents only about 4 times a Type A quantity for Cobalt-60. Thus, neither the NCT nor the HAC evaluations support the contents proposed in the CoC for this package.

Such evaluations must account for all radionuclides proposed to be shipped in the package and address different source configurations (i.e., point sources and distributed sources, including sources that are not uniformly distributed within the package). The evaluations should account for tolerances on all features important for shielding. Any assumptions regarding the contents properties should be adequately justified. This extends to any credit for shoring. Some assumptions may necessitate the inclusion of additional conditions in the CoC and/or additional descriptions in Chapter No. 7 "Package Operations" of the application that ensure the validity of those assumptions for actual packages.

Staff noticed a statement in Section No. 1.2.1.11 of the application that indicates the contents will be such as to ensure the presence of radiation shielding equivalent to 4.5" of lead. This statement should be clarified as to its meaning and how this is done. Also, the applicant should clarify if and how this shielding is credited in the shielding evaluation, justifying the appropriateness of the assumed configuration of the contents with respect to this shielding. As already noted, assumptions regarding this shielding may necessitate additional descriptions in Chapter No. 7 of the application (or a CoC condition) regarding contents loading to include this shielding and verify its presence and configuration in the package.

Staff also recognizes there is guidance that indicates a representative loading may be used for the NCT evaluations. The current evaluation, however, does not constitute a representative loading for the contents as proposed in the current CoC.

These evaluations are needed to confirm compliance with 10 CFR 71.31(a)(2), 71.35(a), 71.47 and 71.51.

Response:
The shielding evaluation will be revised to include activity limits by gamma energy thus providing a method for determining the maximum gamma activity that can be transported in the cask. The methodology for calculating the limit will be added to Chapter 7.

RSI-27 Provide an evaluation for the effects of lead slump.

The current evaluation states that lead slump does not affect the shielding capabilities of the package. The application refers to the evaluations for the NuPac 125 package.

However, nothing is provided to justify the applicability of that evaluation to the Model No. 8-120B.

This evaluation is needed to confirm compliance with 10 CFR 71.31(a)(2), 71.35(a) and 71.51.

Response:
The amount of lead slump will be provided in Section 2-7 of the SAR and its effect on the shielding will be evaluated in Section 5.

RSI-28 Modify the licensing drawings to show the tolerances for the features important to the shielding performance of the package.

The tolerances in the shielding evaluation should be consistent with the tolerances provided in the drawings. NUREG/CR-5502 states (see Section 3.3.1) that appropriate tolerances should be included on the package dimensions. Tolerances are important on those features affecting the package's shielding performance.

This information is needed to confirm compliance with 10 CFR 71.31(a)(1) and 71.33(a).

Response:
The cask drawing, C-110-E-0007, General Note 10, provides the tolerance on dimensions, "unless otherwise noted". The lead shield layer dimension of the cask is specified as a minimum, i.e., a negative tolerance of 0. The other cask components important to shielding are steel plate procured to the ASTM standard mill specification, negative 0.01". This tolerance will be provided on the drawing.

RSI-29 Provide surface dose rates in the NCT shielding evaluation for the surface of the secondary top lid.

The surface of the secondary top lid is not covered by the impact limiter. Thus, this lid's surface constitutes part of the package's external surface that must meet the dose rate limits in 10 CFR 71.47(b)(1). The shielding evaluation should therefore, for NCT, demonstrate that the surface dose rates at this location will meet the limits in 10 CFR 71.47.

This information is needed to confirm compliance with 10 CFR 71.31(a)(2), 71.35(a), and 71.47(b)(1).

Response:
The impact limiter is totally enclosed in metal including metal sheet covering the foam void above the top lid. This metal surface is the outermost external surface of the cask for NCT. The drawing will be modified to clarify this

RSI-30 The package operations for cask loading and preparation for shipment should be modified to clearly indicate that dose rates will be measured to ensure compliance with the limits of 10 CFR 71.47 and contamination levels meet limits stated in 10 CFR 71.87(i).

Paragraph 7.1.19.3 is unnecessarily ambiguous as to the operations being performed and the limits/acceptance criteria being used to ensure that the package as configured for shipment can be transported. Some of those criteria are the dose rate limits in 10 CFR 71.47, for which compliance is verified by dose rate measurements.

This information is needed to confirm compliance with 10 CFR 71.87(i) and (j).

Response:
Energy*Solutions* feels it is inappropriate to cite a portion of the regulatory requirements in the operating section as this implies the items identified are the only requirements that apply. For example, 10 CFR 71.17 also contains requirements a shipper must comply with. It would also be inappropriate to include 10 CFR 71 in its entirety.

RSI-31 Clarify the following regarding the proposed contents in the CoC and provide appropriate evaluations for the contents.

a. The proposed contents described Condition No. 5.(b)(1)(i) are intended to include powdered and dispersible solids

b. The proposed contents described in Condition No. 5.(b)(1)(ii) are placed in a secondary container as described in Section 1.2.2.1 of the application.

This information is needed to confirm compliance with 10 CFR 71.31(a), 71.33, 71.35(a), and 71.87.

Response:
The proposed contents are intended to include powdered or dispersible solids. All contents are required to be contained in a secondary container. Chapter 1 will be revised to clarify and provide additional details.

RSI-32 Provide an evaluation for the effects of the HAC puncture test.

The shielding evaluation for HAC only neglects the impact limiters. It does not account for other damage to the package such as from puncture testing. In a puncture test, similar packages have experienced deformation at and around the impact area that affects the shielding. Evaluations for these packages have included analyses with the shielding thickness reduced by the amount of deformation in the area at and around the puncture test's impact area and placing the contents as a point source next to the impact area.

This information is needed to confirm compliance with 10 CFR 71.35(a) and 71.51.

Response:
Structural analyses will be performed to evaluate the permanent deformation in the cask body, lid and baseplate area during the HAC drop tests. This evaluation will be included in Section 2-7 of the SAR and its effect on shielding will be included in Section 5.

RSI-33 Show on Drawing No. C-110-E-0007 the changes made to the drawing since the currently approved CoC drawing revision number (revision 13).

The currently approved revision of the drawing has only 3 sheets whereas the revision with the new submittal has 5 sheets. It is not clear from the drawings where changes have been made to the drawings from the previous revision, including the reason for the revised drawing to include 5 sheets now versus 3 sheets in the currently approved revision. Staff notes that guidance related to engineering drawings for 10 CFR Part 71 packages (see NUREG/CR-5502, Section 2.2) also indicates that revised drawings should include descriptions of the changes made in the revision.

This information is needed to confirm compliance with 10 CFR 71.31(a)(1), 71.31(b) and 71.33(a).

Response:
An explanation of the changes in the design will be provided. Changes are required in the fabrication sequence and in certain welds to allow the required fabrication leak testing to be performed.

RSI-34 Address in detail the issues related to inerting or remove the inerting process from the application.

Staff does not agree with the nitrogen inerting operations, as shown and planned in Section No. 7.4 of the application, because:

a. The applicant did not clearly show that the inerting process will prevent the development of flammable gas mixtures in any confined area of the package throughout the entire transport period.

b. The applicant did not provide a detailed evaluation or analysis to demonstrate that there are no flammable gas mixtures (considering the worst case concentrations of hydrogen or any other flammable gases, and oxygen) during shipment.

c. The applicant did not provide a detailed configuration of the secondary container to ensure that the nitrogen could be introduced effectively, e.g., injection path, port orientation, to the innermost packaging or other confined areas within the containment system of the Model No. 8-120B package.

d. The applicant did not demonstrate that the inert gas either effectively occupies the containment cavity or is in uniform concentration through the cavity. Likewise, the applicant did not discuss how the concentrations of combustible gases would be quantitatively analyzed nor did the applicant provide detailed information on the different steps of the inerting process in Section No. 7.4.

The applicant also states in Section No. 7.4.1.2 of the application that "If a leak path can develop between the secondary container and the cask, the cask will also be inerted." It is not clear how the leak path between the secondary container and the package is defined in the operating procedure and the applicant did not show that both the secondary container and the package cavity can be properly inerted prior to shipment.

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

Response:
The inerting process will be fully evaluated to demonstrate its effectiveness in preventing the formation of a flammable mixture in any confined area within the package or inerting will be removed.

RSI-35 Describe the surface temperature survey in Section No. 7.1 of the application.

The application should show and staff needs to be able to verify that limits specified in 10 CFR 71.43(g) are not exceeded.

This information is necessary to determine compliance with 10 CFR 71.87(k).

Response:
The thermal analysis shows that with the maximum allowed decay heat, the requirement of 10 CFR 71.43(g) is met. No temperature survey is required.

RSI-36 In reference to Section No. 7.2 of the application, describe how "packages containing quantities of radioactive material in excess of Type A quantities specified in 10 CFR 20.1906(a)" are determined.

The current description of contents, even though inaccurate and incomplete, does not refer to "material in excess of Type A quantities specified in 10 CFR 20.1906(a)."

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

Response:
In Item 1.2.2.2 Maximum quantity of material per package: the first listing is "Type B quantity of material". A Type B quantity is a quantity of material in excess of a Type A quantity. A shipper must quantify the amount radioactive material in a shipment and will know if it exceeds a Type A quantity.

RSI-37 Provide additional information regarding the preparation of an empty package in Section No. 7.3 of the application.

According to NUREG-1609, such preparation procedures should, at a minimum, verify that the package is empty, ensure that external and internal contamination levels meet the requirements of 49 CFR 173.443 and 49 CFR 173.428, and describe the package closure requirements. Such information has not been described in Section No. 7.3.

Also, revise Section No. 7.3 of the application to include an operation to verify that the package meets DOT regulations limits for transportation of empty packages. The current description indicates that no special preparation is necessary for an empty package. This statement is not quite accurate. The requirements and limits described in 49 CFR 173.428 for dose rates and contamination must be met in order to be able to ship the package as an empty package. Optionally, empty packages may be transportable under 49 CFR 173.415(b), provided the applicable limits/criteria are met.

Thus, the package operations described in Section No. 7.3 should be revised to include descriptions of operations for demonstrating compliance with the appropriate regulation, citing the regulation, prior to shipment.

This information is required by the staff to determine compliance with 10 CFR 71.31(a) and 71.87.

Response:
Section 7.3 will be revised to include verification of the items specified in NUREG-1609.

RSI-38 Remove option b. from Section No. 7.4 and the entire Section No. 7.4.2 from the application.

Section No. 4.5.2.3 of NUREG-1609 states that, "No credit should be taken for getters, catalysts, or any other recombination devices."

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

Response:
Section 7.4 will be revised to remove references to a gas suppression process as a method for flammable gas control.

RSI-39 Justify and explain the reason for the lack of thermal acceptance tests to demonstrate the heat transfer capability of the Model No. 8-120B packaging after fabrication and during the service life of the package as described in Chapter No. 8. Also explain the reason for the lack of thermal tests to be performed as part of the maintenance program.

Thermal tests may be needed to confirm that heat transfer performance is consistent with the thermal analyses given uncertainties in calculations, fabrication, or aging of the package during its service life. The staff needs to verify that the maintenance program remains adequate to assure packaging effectiveness for the Model No. 8-120B package. If thermal tests are performed, the application should indicate the frequency, method of testing, and the equipments used in the tests.

This information is required by the staff to determine compliance with the requirements of 10 CFR 71.33(b)(7), 71.71(c), 71.73(c), and 71.85.

Response:
The 8-120B cask package was qualified for the regulatory hypothetical fire accident by analyses using ANSYS finite element computer program. The program is well benchmarked and validated by the developer for variety of experimental and theoretical works. It has been accepted by the NRC for thermal analyses of the transportation and storage packages.

Like a vast majority of the licensed packages that have used similar analyses techniques, the 8-120B package was not physically tested to confirm the analyses results. The validity of the analyses results is implied by the fact that a few transportation packages that have been tested have demonstrated good agreement with the analyses. These analysis techniques were similar to those used for the 8-120B analyses. Following is a partial list of the casks packages that have used the analyses and verified the results with the test data.

- UX-30 used SINDA/FLUINT to analyze the package for fire accident
- RH-TRU-72B used SINDA/FLUINT to analyze the package for fire accident
- CASTOR V/21 fuel storage cask used ANSYS to analyze the fuel basket

The finite element techniques, used in ANSYS, and the finite difference techniques, used in SINDA/FLUINT, have been validated against each other in various studies. Therefore, these two techniques are considered similar except for some modeling ease in one technique versus the other.

RSI-40 Describe in detail the maintenance leak testing procedures of the package.

Maintenance leak testing should be described, according to ANSI N14.5, in Section No. 8.2.2 of the application.

This information is required by staff to determine compliance with 10 CFR 71.51 and 71.93(b).

Response:
Section 8.2.2 describes, in detail, the process for periodic leak testing. As noted in the response to RSI-25, periodic leak testing is maintenance leak testing.

RSI-41 Provide the allowable test leakage and allowable test leakage sensitivity equations as a function of temperature, in Section No. 4.5 of the application, to allow the staff to verify the results presented in Figure Nos. 4.1 through 4.5 of the application.

The staff notes that the equations as a function of temperature have been provided for Figure Nos. 4.6 and 4.7 of the application.

This information is required by staff to determine compliance with 10 CFR 71.51(a)(1).

Response:
Chapter 4 will be revised to provide the equations as requested.

Observations

1. Modify Chapter No. 7 of the application (which is incorporated in the CoC by reference) to explicitly indicate the transport configuration of the package.

   This information is required by the staff to determine compliance with 71.31(a) and 71.87(f).

   Response:
   The 8-120B is transported on a conveyance in a vertical orientation with tie-downs meeting the load conditions of the DOT regulations. This is the only transport configuration. The procedure provided in Chapter 7 describes the steps in opening the cask, loading or unloading the contents, and preparing the cask for shipment in this configuration.

2. Justify the use of surface detectors, and not point detectors, and their use as described in the shielding evaluation and sample inputs, especially given that contents may not be uniformly distributed within the package.

   Analyses used to demonstrate compliance should use appropriate methods for calculating dose rates and include justification for the selected methods. Staff notes that

the evaluation indicates that some point detectors were used in some cases; however, the sample inputs in Section No. 5.6 of the application all show 'nod = 0'. This input means that point detectors are not used. Staff also noted that the section heading indicates the inputs are for the 10-160B package. Thus, the applicant should ensure the application includes sample input files that are for the 8-120B package and modify the section heading.

This information is required by the staff to determine compliance with 10 CFR 71.35(a), 71.47 and 71.51.

Response:
Point detectors are used when the activity is non-uniformly distributed, particularly in the HAC cases. Surface detectors are always subdivided into small areas so non-uniform dose rate distributions can be identified. Revised input files will be provided that show the use of point detectors where it is appropriate.

3. Clarify if there are steel ribs that extend between the package inner and outer shells, and evaluate them as necessary.

   It is not clear from the licensing drawings if there are no steel ribs in this area. The existence of such ribs would constitute streaming paths through the lead shielding that would need to be addressed by the shielding evaluation.

   This information is required by the staff to determine compliance with 10 CFR 71.31(a), 71.33(a), 71.35(a), 71.47, and 71.51.

   Response:
   There are no ribs between the inner and outer shells. The annular space between the two shells is filled with molten lead. Therefore, it is completely filled with lead with no streaming path.

4. Drawing number referenced in Section No. 7.1.3.1.1 of the application should be corrected to give the correct licensing drawing.

   The current reference is to Drawing No. C-110-E-007. The correct drawing number is C-110-E-0007.

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

   Response:
   Section 7.1.3.1.1 will be revised to list the correct drawing number.

5. Describe how shoring is placed in the package to keep the radioactive contents in place (prevent movement) during NCT if the package is only opened via the secondary lid. Also, clarify the meaning of the description provided in paragraph 7.1.9A in the application.

   Shoring is important to keep the contents from shifting during NCT. It appears the shielding evaluation relies upon this shoring; thus, the package operations in the application should clearly describe how the shoring is to be placed in the package for the different contents when different lids are used to access the package cavity.

This information is required by the staff to determine compliance with 10 CFR 71.31(a), 71.35(a) and 71.87.

Response:
Shoring is placed in the cask as needed by removing the primary lid prior to loading the radioactive contents, even if the radioactive contents will be loaded through the secondary lid. Shoring is normally placed in the cask by Energy*Solutions* prior to delivery of the cask to a shipper for loading of the radioactive contents.

6. Justify the need for inclusion of the phrase "fabricated after January 1, 2011" in Chapter No. 8 of the application, removing it in instances where it is not needed.

   It is not clear why this phrase was added in different places, e.g., Section Nos 8.1 and 8.1.4 of this chapter of the application. The applicant should justify the need to include this phrase, indicating the differences in packages already in use versus those that would be fabricated under the currently proposed revision of the CoC.

   The applicant should note that Chapter No. 8 should be written to address all packages fabricated and/or used under this CoC, not just new packages.

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

   Response:
   There are several 8-120B casks, currently in service, that were fabricated and accepted per previous revisions of the CoC and SAR. The acceptance tests have been revised in this revision and apply only to casks fabricated to this revision. Thus, an applicability date is included to differentiate the acceptance tests that are performed on new casks from the acceptance tests performed on previously fabricated and accepted casks.

7. References to the licensing drawings in Chapter Nos. 7 and 8 of the application should be clarified to point to the licensing drawing (including revision number) in the CoC.

   There are references, such as the one in the first paragraph of Section No. 8.1.1, that refer to the "current revision" of the licensing drawing. References to the drawings should be clear and direct the reader to the revision of the drawings in the (current) CoC.

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

   Response:
   Chapters 7 and 8 will be revised so that references to drawings are clearly stated as the drawings in the current CoC.

8. Clarify how the acceptance criteria for the shielding test in Section No. 8.1.6 are consistent with ensuring the minimum thickness of lead specified in the licensing drawing, and modify the acceptance test for shielding as necessary. Also clarify the test as requested below.

   It is not clear that the acceptance criteria for the shielding acceptance test ensure the minimum lead thickness specified in the drawing. It seems that the criteria would allow

for less lead to be acceptable. However, a package that does not meet the specifications in the drawings cannot be used for shipments.

The test criteria should be consistent with the drawing specifications; the application should show the criteria are consistent with the drawings. The applicant should also explain the differences between the test methods (gamma scan and gamma probe) and add that all statements regarding tests using the scan method apply to the tests using the probe method.

This information is required by the staff to determine compliance with 10 CFR 71.31(a) and 71.85.

Response:
The fabrication technique used for the 8-120B, molten lead poured into a pre-measured gap between the inner and outer shells, with the lead thickness specified as a minimum, precludes minor discrepancies in lead thickness. The gamma scan is intended to identify any significant voids that may occur and these will be clearly identified by the 10% discrepancy. Section 8.1.6 will be revised to specify a gamma scan as the test method.

9. Provide the version of SCALE (SAS4) used in the shielding evaluation and justify the appropriateness of using that version of the code.

It is not clear from the application what version of the SCALE SAS4 code is used. The cover letter for the application indicates that the shielding evaluation has been updated for new methods and codes; however, SAS4 is a fairly old code. Thus, the applicant should also justify the appropriateness of using SAS4 and the selected version of this code considering the potential changes to the code and the cross-sections with newer versions as well as the availability of other shielding codes that enable more accurate shielding and dose rate analyses.

This information is required by the staff to determine compliance with 10 CFR 71.35(a), 71.47, and 71.51.

Response:
SCALE 5.1 was used in the shielding evaluation. Benchmarking results will be evaluated and included in a justification for use of the code, which will be included in a revision of Chapter 5. If a sufficient justification cannot be provided, a different code will be used.

10. Provide a detailed description of the steps performed when leak testing the package for the contents.

The application provides only an overview of the testing that is planned to be done, but a more detailed discussion is needed to ensure that the package can be effectively tested by the package user for the authorized contents.

This information is required by the staff to determine compliance with 10 CFR 71.93(b).

Response:
The cask user performs the pre-shipment leak test after the cask is loaded with the contents. Section 8.2.2.2 provides a description of the steps for performing the pre-shipment leak test.

11. Decrease the maximum ductility transition temperature of the ASTM E208 tests mentioned on Sheet 1 of Licensing Drawing C-110-E-0007, Rev. 14, to -20°F, or lower.

The current nil-ductility transition temperatures for the ASTM E208 tests do not sufficiently guarantee adequate ductility of the material under HAC conditions.

This information is required by the staff to determine compliance with 10 CFR 71.33(a)(5).

Response:
Fracture toughness requirements specified in Regulatory Guide 7.11 (Reference 2-6) and NUREG/CR-1815 (Reference 2-18) are used to establish the requirements of Nil Ductility Transition Temperature. For the Category II fracture critical components of casks that utilize impact limiters a temperature shift of 70°F is allowed from the full dynamic loading for material having yield stress less than 60 ksi.

Section 2.6.2 of the SAR establishes the T_{NDT} for various thicknesses of the material based on the lowest service temperature of -20°F using the guidelines of the above sited references. These values are listed in the license drawing.

12. Specify the acceptance criteria for safety-related base material, welds, and fasteners which demonstrates adequate ductility of the material under HAC.

All safety-related structural components susceptibility to brittle fracture at -20°F should have adequate ductility such that the package will meet the requirements of 10 CFR 71 following drop testing.

This information is required by the staff to determine compliance with 10 CFR 71.73(c)(1).

Response:
The material of construction of the cask is ASTM A-516 Gr. 70 which by specification must show an elongation of 21% in the standard 2 inch coupon. The material must also conform to fine austenitic grain size requirement. Thus the material has sufficient ductility to preclude brittle fracture. The welding procedures for the welds conform to the ASME/AWS qualification criteria. Per NUREG-1815 the bolting is not considered to be fracture critical because of the redundant path.

13. Remove Note 20 on Sheet 1 of Licensing Drawing C-110-E-0007, Rev. 14.

Specific equivalent materials must be reviewed by the NRC staff to make a safety determination.

This information is required by the staff to determine compliance with 10 CFR 71.73(c)(1).

Response:
The note on the license drawing about the equivalency of the material allows the engineers to accept materials that have same or better properties. The properties examined for determining the equivalency include the yield stress, the ultimate strength and the ductility of the material.

14. Clarify Note 5 on Sheet 1 of Licensing Drawing C-110-E-0007, Rev. 14.

It is not clear where non-penetration welds are located on the package and if any of these welds are important to safety.

This information is required by the staff to determine compliance with 10 CFR 71.33(a)(5).

Response:
All the welds in the cask package are shown in the license drawing. If the weld symbol shown in the drawing does not specify a size it is implied that the weld is a full-penetration weld. If the size is given, it is not a full-penetration weld, e.g. the weld between the two plates of the lid shown in location C-7 of Sheet 3 of the license drawing. The note is to clarify the above.

15. Explicitly describe and dimension the sealing surface and O-ring groove.

Note 9 on Sheet 1 of Licensing Drawing C-110-E-0007, Rev. 14 mentions the sealing surface on the package, but the O-ring groove is not described in necessary detail on the licensing drawings.

This information is required by the staff to determine compliance with 10 CFR 71.33(a)(5).

Response:
This information is normally given in the fabrication drawing. Additional detail will be included in the license drawing of the revised submittal.

16. Provide an updated thermal analysis demonstrating that the maximum temperature of the package contents (assuming that the contents are in a secondary container with bounding insulating properties) surrounded by the "metal cavity filler" mentioned in Section No. 8.1.4.2 or the "shoring" mentioned in Section No. 1.2.3.3. Specify an approximate description and bounding dimensions of the "metal cavity filler" and "shoring" mentioned on the licensing drawings.

Temperature limits on the phase changes of the contents (which are prohibited in Section No. 1.2.2.3, "Loading Restrictions" of the application) should be dictated by a thermal analysis of the contents assuming the most conservative scenario.

This information is required by the staff to determine compliance with 10 CFR 71.73(c)(4).

Response:
The thermal analysis will be updated to include determination of the temperature of the package contents, including shoring as appropriate. The “metal cavity filler” is only placed in the cask during performance of the periodic leak test to minimize the volume of test gas required for the test. The cavity filler is removed before the cask is used to transport radioactive material.

17. Justify the statement in Section No. 2.2.3 of the application that the elastomeric O-ring and foam, along with the contents, "exhibit no measurable degradation of their mechanical properties under a radiation field produced by the contained radioactivity."

The shielding analysis provided by the applicant gives no indication of the maximum radiation dose received by the polymeric materials.

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

Response:
The shielding analysis will be modified as necessary to provide radiation doses at the seal and impact limiter foam. The potential damage to these materials will be provided in Section 2.2.3 as justification for the degradation statement.

18. Clarify the exact elastomers used in the package for maintaining containment, e.g., manufacturer, compound number, etc. Alternatively, provide an industrial standard, e.g., ASTM D2000 that describes the elastomer material and include specific acceptance criteria for high-temperature testing, e.g., maximum permissible compression sets that are applicable to the NCT and HAC conditions.

The generic references to butyl rubber or silicone rubber on the licensing drawings are not sufficient to make a safety evaluation.

This information is required by the staff to determine compliance with 10 CFR 71.33(a)(5).

Response:
Additional information will be provided including a standard that describes the material and the specific acceptance criteria for the various characteristics important to the performance of the material.

19. Remove or justify the reference to the AA-59588A specification from Section No. 8.1.5 of the application.

The thermal tests described in AA-59588A are limited to 70 hours, which are not reflective of potential transportation times.

This information is required by the staff to determine compliance with 10 CFR 71.71(b).

Response:
Per our o-ring vendor, who supplies nearly all the safety critical elastomer seals for the nuclear industry, the industry standard for thermal tests has a duration of 70 hours. This is the thermal test duration in ASTM D2000 as well as AA-59588A. AA-59588A will be used as the specification for silicone seals.

20. Remove silicone rubber from the use of potential seal materials (including the use of AA-59588A from Section No. 8.1.5) if helium leak-testing is to verify the leakage rate of the package.

Silicone rubber is highly permeable to helium and is not acceptable for the leak-testing of transportation casks in conjunction with helium.

This information is required by the staff to determine compliance with 10 CFR 71.51(a)(1).

Response:
The SAR will be revised to specify that silicone rubber o-rings will not be used when helium is used as a test gas.

21. Specify an appropriate Code of Construction on Note 4 on Sheet 1 of Licensing Drawing C-110-E-007, Rev. 14, e.g., Section III, Division I Subsection ND of the ASME Code.

Section IX of the ASME Code is used to qualify welders and welding procedures, it does not specify essential welding variables, heat-treatments or acceptance criteria for welds.

This information is required by the staff to determine compliance with 10 CFR 71.31(3)(c).

Response:

Note 4 on the license drawing refers to the inspection of the welds after the load test and their acceptance criteria. The comment above does not seem to apply to this note. If it applies to Note 5 the response is as follows.

As stated in Section 2.3.1 of the SAR the “fabrication of the 8-120B containment components will be based on ASME B&PV Code, Section III, Subsection ND and that of the non-containment components will be based on ASME B&PV Code, Section III, Subsection NF”. The welding specifications that will be used in fabrication of the 8-120B Cask have been developed by Energy*Solutions* that conforms to the aforementioned codes. These specifications list the welding variables sited in the comment.

The qualification of the welders and welding procedure is based on ASME Code Section IX (Note 5) and the acceptance criteria is based on ASME Section III Div. 1 Subsection ND-5000 for containment boundary components (Note 1), and ASME Section III Div. 1 Subsection ND-5000 or NF-5000 for non-containment boundary components (Note 2)

22. Clarify the material of construction listed on Bolt Ring Plate on Sheet 1 of Licensing Drawing C-110-E-0007, Rev. 14. There are two materials of construction specified for this material, ASME A516 Gr 70 and ASTM A514.

It is unclear if both materials are intended for use as the Bolt Ring Plate.

This information is required by the staff to determine compliance with 10 CFR 71.33(a)(5).

Response:
The bolting ring plate was initially approved with A-514 material specification. Energy*Solutions* fabricated one cask with this material. Later NRC approved the material change to A-516 Gr.70 and other casks were fabricated from this material. To cover all the existing casks both the materials have been specified for the bolting ring plate. In future all the casks will be fabricated with A-516 Gr.70 specifications.

23. Specify the maximum permissible moisture content of the "dry air" in Section No. 8.2.2.2, "Pre-Shipment Leak Test" used to fill the containment boundary after loading.

The term "dry air" is not quantitative and the staff cannot make a safety evaluation regarding the corrosiveness of the air in containment.

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

Response:
The air used in the pre-shipment leak test does not fill the containment boundary. It is introduced into the test cavity between the o-rings, which is outside the containment boundary. After the 15 minute test, the cavity is open to the ambient air as the manifold is removed so the “dry air” is replaced by ambient air.

24. Specify a visual inspection of accessible welds in Section No. 7 of the application as part of the pre-loading procedure.

Fatigue cracking of the package welds can occur over time, affecting the package's safety function.

This information is required by the staff to determine compliance to demonstrate compliance with 10 CFR 71. 71 and 71.33(a)(5).

Response:
All Energy*Solutions* casks are subject to an annual inspection, which includes visual examination of accessible cavity welds and external welds. Historical results indicate that performance of an inspection on an annual basis is sufficient to detect fatigue cracking of package welds. Visual inspection of accessible welds will be added as an explicit requirement in Section 8.2.3.