

July 31, 2009

Mr. Troy Hedger, CEO  
Alpha-Omega Services, Inc.  
9156 Rose Street  
Bellflower, CA 90706

SUBJECT: APPLICATION FOR CERTIFICATE OF COMPLIANCE NO. 9316 FOR THE  
MODELS NO. AOS-025, AOS-050, AOS-100, AND AOS-165 PACKAGES,  
DOCKET NO. 71-9316 – REQUEST FOR SUPPLEMENTAL INFORMATION

Dear Mr. Hedger:

By letter dated June 19, 2009, you submitted an application for the AOS Transport Packaging System which encompasses four packages, the AOS-025, AOS-050, AOS-100, and AOS-165. We performed an acceptance review to determine if the application contained sufficient scope and depth of information to allow the staff to complete a detailed technical review.

This letter is to advise you that the application does not contain sufficient technical information to begin a detailed technical review for the AOS-025, AOS-050 and AOS-100 packages. The information needed to continue our review is described as Requests for Supplemental Information (RSIs) in Attachment 1 to this letter. We have not completed our acceptance review for the AOS-165 package and will document the completion of that acceptance review in a separate letter. We also included observations to allow you to start earlier on items with the potential to be asked at a later date. Responses to observations are not required for us to begin a detailed technical review. In order to schedule our technical review, the RSI responses should be provided by August 17, 2009. If the RSI responses are not received by this date, the application may not be accepted and the staff will discontinue any further review.

This letter also confirms our phone call of July 30, 2009, with respect to the supplemental information needed for the AOS-025, AOS-050 and AOS-100 packages, the status of our acceptance review for the AOS-165 package, and the projected date of August 17, 2009 for your submittal. If you have any questions regarding this matter, please contact Pierre Saverot of my staff at (301) 492-3408.

Sincerely,

**/RA/**

Eric Benner, Chief  
Licensing Branch  
Division of Spent Fuel Storage and Transportation  
Office of Nuclear Material  
Safety and Safeguards

Docket No. 71-9316  
TAC No. L24353

Enclosure: Attachment 1: Requests for Supplemental Information and Observations

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Enclosure: Attachment 1: Requests for Supplemental Information and Observations

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ALPHA-OMEGA SERVICES, INC.

DOCKET NO. 71-9316

MODEL NOS. AOS-025, AOS-050, AOS- 100 PACKAGES

ATTACHMENT 1

REQUESTS FOR SUPPLEMENTAL INFORMATION AND OBSERVATIONS

**Requests for Supplemental Information (RSIs)**

**Chapter 1: General Information**

**RSI 1-1:** Provide key dimensions and tolerances in the Drawings. For example, dimensions and tolerances of the shielding does not appear to be present (see RSI 5-2). Also, staff was not able to find the bottom plate thickness, among other dimensions, for the AOS-50 package.

The drawings should be consistent with the guidance in NUREG/CR5502 :Engineering Drawings for 10 CFR Part 71 Package Approvals”.

A summary materials data sheet or Bill of Materials should be included in the Drawings which will be included as reference in the Certificate of Compliance.

This information is needed to determine compliance with 10 CFR 71.31.

**RSI 1-2:** The description of the contents should be more detailed and include the chemical composition, type, size and shape of solid, e.g. large ball or shredded matter, etc.

This information is needed to determine compliance with 10 CFR 71.33(b)(3).

**Chapter 2: Structural Evaluation**

**RSI 2-1:** Reevaluate all load combinations to ensure that Regulatory Guide 7.8 “Load Combinations for the Structural Analysis of Shipping Casks for Radioactive Material” is being properly applied to determine the load combinations. Justify the evaluation and selection of load combinations.

For example, to create the hot environment load combination for NCT, from the applicant’s load cases, the staff should see a combination that includes load cases 102, 201, and 211. The staff does not specifically see this load combination in Tables 2-159, 2-226, or 2-292.

The staff also notes that load case 102 includes maximum solar insolation whereas load case 101 does not.

This information is needed to determine compliance with 10 CFR 71.33(b)(3) and 71.43(d).

**Chapter 3: Thermal Evaluation**

**RSI 3-1:** Provide impact limiter foam temperatures and the associated temperature limit for all models in Table 3-4 of the application.

It appears that the temperature limit during NCT may be exceeded considering the glass transition temperature of 279°F (137°C), as reported in the “Design Guide for Last-A-Foam FR-3700 for Crash & Fire Protection of Radioactive Material Shipping Containers”. This could affect the performance of the package in HAC and NCT drop conditions.

This information is needed to determine compliance with 10 CFR 71.71 and 71.73.

**RSI 3-2:** Provide information justifying the Ci/Watt values for all nuclides, the energy and type of emissions for each nuclide as well as a reference for the values.

Based on preliminary calculations performed to verify the Ci/Watt values for certain nuclides, the staff believes that many of the Ci/Watt values used by the applicant may be non-conservative, including (but not limited to) Zr/Nb-95, Ho-166, Se-75, Sm-153, and Yb-169.

The staff compared the applicant’s Ci/Watt values to those in ICRP Publication 38, Radionuclide Transformations Energy and Intensity of Emissions, 1983 as well as those from the Microshield 5 Code (Grove Engineering).

This information is needed to determine compliance with 10 CFR 71.31 and 71.33.

**RSI 3-3:** Correct discrepancies noted in particular between the decay heat appendix of the application which mentions that 200 Watts were analyzed for the Model No. AOS 50, while Table 3-4 of the application reports that the analysis was performed for 100 Watts.

Correct also the analysis results and ensure that such errors do not appear in the analysis of other AOS package models.

This information is needed to determine compliance with 10 CFR 71.31.

**RSI 3-4:** Justify the validation of information provided for the LIBRA code.

Table 3-94 of the SAR, “Comparison of Heat Test GE Model 2000 and LIBRA Results” shows that the LIBRA code consistently and significantly underpredicts the cask cavity temperature compared to the results of the heat test. It is not clear how these temperature differences are justified and addressed in the validation of the code.

This information is needed to determine compliance with 10 CFR 71.31.

**RSI 3-5:** Review all unit conversions in the application and associated analysis files and correct and report any discrepancies found.

Table 3-7 has an incorrect unit conversion for thermal conductivity, an incorrect unit conversion for specific heat as well as an incorrect unit label.

This information is needed to determine compliance with 10 CFR 71.31.

**RSI 3-6:** Provide descriptions, including drawings, of the internal basket assemblies used in the various designs in Section 3.3.1 of the application. Describe the thermal interactions of the payload with the internal surfaces of the inner canister. Demonstrate that the decay heat generated by the contents is appropriately modeled in relation to the interior of the package

The assumption that the heat on internal surfaces is evenly distributed may not be conservative. The temperature distribution within the inner cavity will be dependent on the arrangement of the contents. While the overall decay heat generated may be represented, the distribution of this heat load is not captured by applying it uniformly on the inner surface of the canister.

The demonstration that the decay heat is appropriately modeled is required so that softening of the basket does not occur if an aluminum basket is used in some AOS models.

This information is needed to determine compliance with 10 CFR 71.33(a)(5)(v).

**RSI 3-7:** Justify that the maximum temperatures have been provided in Table 3-4 for all AOS models. Demonstrate that maximum temperatures have been provided for package components based upon the entire set of nodes in the analysis

It appears that samples of nodes were chosen from the thermal analysis and then the temperature of those nodes was monitored to provide maximum temperatures.

This information is needed to determine compliance with 10 CFR 71.35.

**RSI 3-8:** Include a summary of the results of thermal stress evaluation under NCT and HAC in sections 3.3 and 3.4, respectively. Include an evaluation of thermal stresses caused by constrained interfaces among package components resulting from temperature gradients and differential thermal expansion.

This evaluation should be provided for both NCT and HAC.

This information is needed to determine compliance with 10 CFR 71.71 and 71.73.

**RSI 3-9:** Clarify the inconsistency between the elastomeric seal temperature limit on page 2-20 and the value provided in Table 3-4. Clarify if there are two different types of metallic seals regarding footnote No. 1 in Table 2-3. Provide all seal NCT limits if these limits are different from HAC limits, as it appears to be the case in Table 2-3 of the application.

This information is needed to determine compliance with 10 CFR 71.33, 71.73 and 71.7.

**RSI 3-10:** Provide the maximum initial pressure and temperature conditions for each of the AOS model configurations in Table 3-3 and Table 2-63 of the application.

Section 7.3.5.3 step a. of the application states that the cask cavity will be pressurized with 104 kPa (15.1 psia) or 208 kPa (15.5 psig). The staff notes that the design pressure for the AOS-025 is 30 psia which would be exceeded during NCT and HAC if an initial pressure of 208 kPa (15.5 psig) were used. It appears that an initial condition of 30 psia and 78°F was given on page 3-6, but it is not clear what initial pressure and temperature were used to calculate pressures in Table 3-3 and Table 2-63

This information is needed to determine compliance with 10 CFR 71.71 and 71.73.

**RSI 3-11:** Justify the discrepancy between the thermal conductivity values for Last-a-foam in Table 3-8 of the SAR in comparison with the thermal conductivity values in the “Design Guide for Last-A-Foam FR-3700 for Crash & Fire Protection of Radioactive Material Shipping Containers.”

This information is needed to determine compliance with 10 CFR 71.71 and 71.73.

**RSI 3-12:** Ensure each of the isotope activity limits is not exceeding the analyzed decay heat. Confirm if each isotope will be transported individually in a package or if more than one type of isotope could be transported in the same package.

The activity limits for some of the isotopes in Table 1-6 appear to exceed the analyzed decay heat. This includes (but may not be limited to) Co-60, Zr/Nb-95, Se-75, Sm-153, Yb-169, Yb-175.

This information is needed to determine compliance with 10 CFR 71.31, 71.33, and 71.51.

**RSI 3-13:** Provide all thermal input/output files and all Autocad inventor files on DVDs or CDs rather than referencing the ftp site.

This information is needed to determine compliance with 10 CFR 71.31 and 71.33.

#### **Chapter 4: Containment Evaluation**

**RSI 4-1:** Justify the selection and the use of the seals for the AOS packages.

It appears that seals, used in certain AOS configurations, exceed their rated temperatures for NCT and/or HAC conditions.

This information is needed to determine compliance with 10 CFR 71.51 (a)(1) and 10 CFR 71.51 (a)(2).

**RSI 4-2:** Provide a detailed description of the leakage tests performed on the AOS packages.

The general description, included in Section 4.4 of 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.

This information is needed to determine compliance with 10 CFR 71.71.

**RSI 4-3:** Define the seals that are considered as primary seals to be relied upon for the containment of the package contents.

The containment boundary of the AOS series of packages is described and illustrated in Section 4.1.1. The illustration of the containment boundary does not clearly define which seals are considered as primary seals to be relied upon for containment of the package contents. Such clarification is required for the evaluation of the containment performance and leak testing of the package.

This information is needed to determine compliance with 10 CFR 71.51.

**RSI 4-4:** Provide an additional explanation of the placement of the seals using four small screws, as mentioned on page 4-9 of the application.

It is unclear from the application whether or not the use of screws is a standard configuration for securing the seals.

This information is needed to determine compliance with 10 CFR 71.31 (b) and 71.51.

**RSI 4-5:** Include a description of the test provided for the seals in Appendix 4.5 and demonstrate that the seals installed on the AOS packages meet the ANSI N14.5 leaktight criteria.

It is not clear how the test flange used in the helium leak test is indicative of the AOS cask design closure, and if the seals tested are indicative of the seals that will be utilized for the AOS packages.

This information is needed to determine compliance with 10 CFR 71.31 (b) and 71.51.

## **Chapter 5: Shielding Evaluation**

**RSI 5-1:** Verify which values in Table 1.6 were used in the shielding evaluations as well as which values were used to determine the decay heat for each nuclide. Identify the maximum radioactivity of radioactive constituents.

The activity values for TBq and Curies (Ci) are not equivalent in Table 1.6 when using the conversion factor  $3.7 \times 10^{10}$  Bq/Ci. The staff notes also that if the values are converted to equivalent units, then the values listed for Ci are higher than those for TBq.

This information is needed to determine compliance with 10 CFR 71.33(b)(1).

**RSI 5-2:** Justify the use of the point source method for shielding calculations. Provide limiting dimensions for the source material.

The staff notes that there can be deficiencies associated with using a point source method. These are discussed in NUREG/CR-6802 "Recommendations for Shielding Evaluations for Transport and Storage Packages."

The staff does not have any information about the geometry of the source material and therefore cannot determine if the distance between the point source and the detector points is sufficient to justify a point source approximation.

This information is needed to determine compliance with 10 CFR 71.33(b)(3) 10 CFR 71.47(a).

**RSI 5-3:** Ensure that the dimensions for the cask cavity, cask cavity shell, and radial and axial shields along with tolerances are included in the following drawings: 166D8143, 166D8137, 105E9719, 105E9708, and 105E9712. Drawings must include appropriate dimensions and acceptance criteria for all design parameters.

This information is needed to determine compliance with 10 CFR 71.7(a) and 10 CFR 71.111.

## **Chapter 7 – Package Operations Evaluation**

**RSI 7-1:** Provide key steps of the leakage tests performed on the AOS packages in the Operating Procedures (See RSI 4-2).

This information is needed to determine compliance with 10 CFR 71.71.

## **Chapter 8 – Acceptance Tests and Maintenance Program Evaluation**

**RSI 8-1:** Provide additional explanations on the placement and installation of the seals during maintenance operations.

This information is needed to determine compliance with 10 CFR 71.31 (b).

## **Observations**

**Observation 1:** The location of the center of gravity shown in Table 1-1 is in contradiction with the locations shown in Figure 1-2.

**Observation 2:** Handbooks supplied for tungsten and the impact limiter foam contain a lot of irrelevant material to this review. Direction to selected parts of the handbooks where relevant information can be found would save review time.

**Observation 3:** Provide clear documentation to indicate that the impact limiter and the personnel barrier will remain intact for NCT. Justify and clarify if the dose points at the personnel barrier are appropriate for NCT.

**Observation 4:** The drawing in Figure 5-4 appears inconsistent with the description in Section 5.4.4.2 in the application. Figure 5-4 shows the dose points at the personnel barrier surface and at 1 meter from the personnel barrier surface. Section 5.4.4.2 states that the dose points used are at the personnel barrier and 1 meter from the cask surface.