



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

August 20, 2015

Mr. Troy Hedger
President
Alpha-Omega Services, Inc.
9156 Rose Street
P.O. Box 789
Bellflower, CA 90706

SUBJECT: CERTIFICATE OF COMPLIANCE NO. 9316, REVISION NO. 5, FOR THE
MODEL NOS. AOS-25A, AOS-50A, AOS-100A, AOS-100B, AND AOS-100A-S
PACKAGES

Dear Mr. Hedger:

Further to your Part 21 report dated August 5, 2015, as supplemented August 7 and 16, 2015, enclosed is Certificate of Compliance No. 9316, Revision No. 5, for the Model Nos. AOS-25A, AOS-50A, AOS-100A, AOS-100B, and AOS-100A-S packages. This Certificate supersedes in its entirety Revision No. 4, issued on June 25, 2015. The staff's safety evaluation report is also enclosed.

The approval constitutes authority to use the package for shipment of radioactive material and for the package to be shipped in accordance with the provisions of Title 49 of the *Code of Federal Regulations* (49 CFR) 173.471. Those on the attached list have been registered as users of the package under the general license provisions of 10 CFR 71.17 or 49 CFR 173.471.

If you have any questions regarding this certificate, please contact Pierre Saverot of my staff at (301) 415-7505.

Sincerely,

/RA/

Michele Sampson, Chief
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9316
TAC No. LA0129

Enclosures: 1. Certificate of Compliance
No. 9316, Rev. No. 5
2. Safety Evaluation Report
3. Registered Users

Upon removal of Enclosure 3, this
document is uncontrolled

cc w/encls. 1&2: R. Boyle, Department of Transportation
J. Shuler, Department of Energy, c/o L. Gelder

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Filename: G:/SFST/PART 71 CASEWORK/9316.R5.docx; 9316.R5.LETTER&SER.docx

ADAMS PKG: ML15238A683 ADAMS Letter No.: ML15238A721 CoC: ML15238A775

Enclosure 3: ML15238A817

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OFC	SFM	E	SFM	E	SFM	E	SFST	E	SFST	E
NAME	PSaverot		VWilson		MRahimi		MDeBose		MSamson	
DATE	08/18/2015		08/19/2015		08/19/2015		08/18/2015		8/20/15	

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SAFETY EVALUATION REPORT

Model Nos. AOS-025A, AOS-50A, AOS-100A, AOS-100B, and AOS-100A-S Packages
Certificate of Compliance No. 9316
Revision No. 5

SUMMARY

On August 5, 2015, as supplemented August 7 and 16, 2015, pursuant to Title 10 Code of Federal Regulations (10 CFR) 21.21(d)(3)(ii), Alpha-Omega Services, Inc. (AOS) provided the NRC staff with a written notification of the identification of a potential failure of the AOS packages to comply with 10 CFR 71.47 and/or 10 CFR 71.51 (ADAMS ML 15223B267, ML 15224A541, and ML 15230A284). AOS identified that the current safety analysis report (SAR) did not analyze the radiation levels on the exterior of the package when a point source is located in the bottom corner of the cavity of the package.

NRC staff has revised Certificate of Compliance (CoC) No. 9316 to address the potential safety issues identified by AOS. The regulation in 10 CFR 71.41(c) states that the NRC may authorize a package using environmental and test conditions different from those specified in either 10 CFR 71.71, "Normal Conditions of Transport," and 10 CFR 71.73, "Hypothetical Accident Conditions," if the controls proposed by the shipper are demonstrated to be adequate to provide the equivalent level of safety. The NRC has imposed administrative controls to ensure an equivalent level of safety for the Model Nos. AOS-025A, AOS-50A, AOS-100A, AOS-100B, and AOS-100A-S packages.

EVALUATION

The AOS SAR "Radioactive Material Transport Packaging System Safety Analysis Report for Model AOS-025, AOS-050, and AOS-100 Transport Packages" (Reference No. FM9054, Revision H, dated December 30, 2012) did not analyze a specific scenario in which contents could reconfigure adjacent to a streaming path (i.e., a small path between the tungsten shields where radiation could leak out) and could, if credible, lead to radiation levels exceeding the regulatory limits.

AOS has determined that the approved package design could potentially exceed the normal conditions of transport (NCT) dose rate limits in 10 CFR 71.47(a), if the source is relocated and all the activity is concentrated into a corner of the interior of the package. This is considered to be unlikely, but such a situation is not entirely precluded in the currently approved package design.

Although AOS did not identify any shipment where the source had actually reconfigured, there is a potential safety issue that shielding may fail to comply with 10 CFR 71.47(a). This is not a defect of the package, but rather an un-analyzed condition that could lead, if credible, to a safety hazard.

Four AOS-100A packages have been fabricated; three were certified for use prior to August 6, 2015, and one is currently not in service. There are also two AOS-050 packages which are on hold for completion of fabrication activities.

AOS has initiated a corrective action, and submitted a 10 CFR Part 21 report, along with supplementary information (ADAMS ML 15223B267, ML 15224A541, and ML 15230A284).

In order to ensure the safety of the shipments, while AOS performs a complete analysis of the potential condition that all of the activity could be condensed in a point source in the corner location of the cavity of the package, staff is putting administrative controls and compensatory measures in place to address the situation, lessen the likelihood of a potential relocation of the source that could reduce the effectiveness of the shielding of the package, and allow the package to be used with the intent of providing an equivalent level of safety during shipment:

- 1- Shoring must be placed between the inner container and the package cavity's walls to secure and immobilize the containers in the center of the cavity, and prevent both radial and axial movements during NCT.
- 2- Comprehensive radiation surveys must be performed at every location on the surface and 1 meter from the package surface (to determine the transportation index (TI)) paying particular attention to the areas around the corners of the package where the potential effects of radiation streaming would be seen.
- 3- Prior to shipment, the licensee must ensure all transport equipment has been inspected. The inspection is intended to prevent mechanical issues, increase the safety of the shipment, and reduce the likelihood of an accident or mitigate its consequences.

Specifying shoring components as required for transport would maintain a shielding source configuration toward the centerline of the cask cavity, and reduce the already very low probability of a source relocation that may challenge the shielding of this package. For the AOS family of packages, the dose rates are highest at the top and bottom of the package. Although there could be some streaming around the top and bottom of the radial shield, the greatest risk for an increased dose due to streaming is at the top and bottom of the package near the periphery outside of the axial shield. To decrease the risk of a dose rate increase due to streaming in these packages, materials must be shored towards the radial center.

AOS stated that the only sources that have been shipped in the AOS packages are Co-60 Elekta sources. AOS also stated that this is the only source intended to be shipped until new analyses can be submitted. AOS submitted the measurement data on all of the AOS packages that have been shipped to date. The shipped contents do not exceed 5,400 Ci Co-60 and all have very low dose rate measurements and transportation indices (TI), indicating large safety margins. Although the CoC allows shipment of up to 21,900 Ci of Co-60 with the axial shield plates, the data submitted is more representative of what would actually be shipped with the Elekta sources. AOS also submitted the shipping configurations that will be used for the Elekta sources that show that the sources are not point sources and that there is shoring to keep the contents centered in the cask cavity. Although the staff typically performs a full structural review of the shoring components to ensure that they are sufficient to stay intact during NCT, for this case, it is the staff's judgment that NCT would not cause these components to fail such that the source would reconfigure to the corner of the interior of the packaging. This is based on a review of the drawings and of the operating experience of the packages, in addition to the limited duration of this revised CoC.

The staff also notes that the SAR analyses were performed using a point source configuration, which is a very conservative source approximation. Realistic sources, including the Elekta source, do have dimensions.

In addition, AOS has proactively identified this issue and notified all package users who will take precautions to avoid the unanalyzed conditions. This further aids the staff in its judgment that a CoC requiring shoring, with a limited duration, is sufficient to prevent any dose rate increases beyond regulatory limits.

The applicant submitted the results of shielding analyses, considering the condition of the package following the hypothetical accident conditions tests (HAC). The analyses, performed using the same methods as those previously employed in the SAR, showed that a point source in the corner with 123 TBq (3,330 Ci) Co-60, the maximum Co-60 activity without the axial shielding plates, and 810 TBq (21,900 Ci) Co-60, the maximum Co-60 activity with the axial plates, still show a significant margin to the regulatory dose rate limits in 10 CFR 71.51(a)(2). The NRC staff performed independent evaluations confirming this result. Based on the analyses submitted by AOS, and staff's confirmatory model results, staff has reasonable assurance that, in the event of shoring failure during HAC, the dose rate limits of 10 CFR 71.51(a)(2) will be met.

The AOS CoC allows nuclides other than Co-60 and other packages besides the AOS-100-A (i.e., AOS-25, AOS-50, etc.). The staff does not find it necessary to modify the CoC to exclude these other nuclides and package configurations. By requiring shoring, these other nuclides will also be precluded from entering the configuration that exposes the streaming path. In general, this package has a significant margin to regulatory dose rate limits under HAC and, given the analyses with Co-60 described above, other nuclides would exhibit similar margins to HAC limits. In addition, as stated by AOS, the only configuration that has been used is the AOS-100-A package with Co-60 Elekta sources the only ones being shipped at this time.

AOS will be preparing an application, to address the unanalyzed condition, that may include (i) a revised structural evaluation accounting for the shoring devices as part of the package, (ii) an additional shielding analysis with a more realistic configuration, e.g., by distributing the source strength in the shielding analysis, (iii) an evaluation of the potential change in the axial and radial shield designs to increase the overlap and reduce the streaming paths between the cask body and the axial lids, and (iv) and new shielding analyses for this package design to account for such a potential reconfiguration. AOS will be seeking NRC approval within the one year period authorized by Revision No. 5 of the CoC.

CONDITIONS

The conditions specified in the certificate of compliance have been revised to incorporate the changes indicated below:

Condition No. 6 has been revised to provide for increased inspections of equipment and comprehensive radiation surveys to be performed at every location on the surface and 1 meter from the package surface with a particular attention to the areas around the corners of the package.

Condition No. 11 has been revised to add that shoring must be placed between the inner container and the package cavity's walls to secure and immobilize the containers, and prevent both radial and axial movements during transport.

Condition No. 15 has been revised to state that Revision No. 5 of this certificate supersedes all previous revisions of the certificate.

Condition No. 16 has been revised to state that the package authorized by this certificate is approved for use for one year from the date of issuance of this certificate.

CONCLUSION

Based on its review of a potential failure of the shielding, the assessment of compensatory measures, and the review of the transportation risk, the staff has reasonable assurance that the combination of administrative and compensatory measures and the package design provide an equivalent level of safety in accordance with regulatory requirements of 10 CFR 71.41(c).

In evaluating the equivalent level of safety, the staff considered available risk-related insights including (1) the very low probability of an accident involving the relocation of the source; (2) the additional reduction in probability and mitigation of potential consequences provided by the compensatory measures, such as shoring, as well as the limited time frame of this approval; (3) the proven performance of the package shipping the Elekta Co-60 sources, and (4) the expected performance of the package to comply with dose rates in normal conditions of transport.

The staff notes that this finding is only valid for the design of the AOS series of packages in combination with both the proposed administrative measures and the one year timeframe associated with this approval.

Based on the statements and representations provided by AOS, related to the reporting under 10 CFR Part 21 dated August 5, 7 and 16, 2015, and with the conditions listed above, the staff agrees that, with these changes, the package continues to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9316, Revision No. 5,
on August 20, 2015.