

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES**

1.	a. CERTIFICATE NUMBER	b. REVISION NUMBER	c. DOCKET NUMBER	d. PACKAGE IDENTIFICATION NUMBER	PAGE	PAGES
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2. PREAMBLE

- This certificate is issued to certify that the package (packaging and contents) described in Item 5 below meets the applicable safety standards set forth in Title 10, Code of Federal Regulations, Part 71, "Packaging and Transportation of Radioactive Material."
- This certificate does not relieve the consignor from compliance with any requirement of the regulations of the U.S. Department of Transportation or other applicable regulatory agencies, including the government of any country through or into which the package will be transported.

3. THIS CERTIFICATE IS ISSUED ON THE BASIS OF A SAFETY ANALYSIS REPORT OF THE PACKAGE DESIGN OR APPLICATION

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| a. ISSUED TO (<i>Name and Address</i>)

Alpha-Omega Services, Inc.
9156 Rose Street
P.O. Box 789
Bellflower, CA 90706 | b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION

AOS application, Revision J-4, dated September 19, 2024 |
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4. CONDITIONS

This certificate is conditional upon fulfilling the requirements of 10 CFR Part 71, as applicable, and the conditions specified below.

5.

(a) Packaging

- Model Nos.: AOS-025A, AOS-050A, AOS-100A, AOS-100B, and AOS-100A-S
- Description

A cylindrical stainless steel packaging, designed to transport Type B quantities of encapsulated solid materials or solid metals meeting Normal or Special Form criteria. The packaging is available in three model sizes – AOS-025, AOS-050, and AOS-100. Tungsten alloy is used as shielding material in model numbers with the suffix A, while carbon steel is the shielding material for model numbers with the suffix B. The Model No. AOS-100A-S has a double-ended opening configuration to be either loaded or unloaded from either end of the package. All models use a double O-ring arrangement seal in the lid joint.

The packaging includes an outer shell, a cavity, a shielding cylinder and shielding plugs, a bottom plate, a lid and lid plug. The outer shell and the cavity cylinder interlock to encase the shielding cylinder, made of either tungsten or carbon steel. A weldment attaches the upper portion of the cavity to its lower portion encasing the shielding. At the cavity's closed end, the shielding plug is encased between the cavity bottom wall and the packaging bottom plate. The shielding plug encased in the lid plug is of the same size and material (tungsten or carbon steel) as the one encased at the bottom of the packaging. The lid consists of a flat disk, with recessed areas concentric with the bolt holes on the top surface, to protect the bolts from impact loads.

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5.(a)(2) Description (Continued)

The packaging may use either elastomeric or metallic lid seals: the Model Nos. AOS-025A and AOS-050A elastomeric seal has two O-rings and one flat metal retainer ring, while the Model No. AOS-100 has two O-rings and two SS300 series flat retainer rings. The metallic seal for all models is a double "C" cross section seal.

The packaging may require the use of a liner, axial shielding plates, and/or cavity spacer plates, depending on the model, for shipment of some contents, as stated in Tables 3, 4, and 5 of this certificate. Additional packaging components include lid bolts and port plugs with their threaded pipe plugs, O-ring seals, port plug covers, and a pair of trunnions with their attachment bolts.

The impact limiters consist of a thin-walled stainless steel cylindrical shell, filled with polyurethane foam, with a dish head at one end and a flat disk at the other end. At the dish-head end, another recess is provided to reduce the area available for impact during a head-on drop event. Twelve (12) squared ribs are attached to the inner wall of the cylindrical recess section of the flat disk end. Eight (8) of these ribs extend beyond the flat disk plate and are used as turnbuckle attachment points. The turnbuckles join the impact limiters and partially enclose the packaging. For the Model No. AOS-025 package, the turnbuckles are replaced with "J" hooks. The package is transported in the upright position, using a shipping cage and a pallet. The Model Nos. AOS-50 and AOS-100 may include a lifting bar with the shipping cage; the lifting points are disabled during transport when the shipping cage lifting bar is included.

The maximum weights of the package shall not exceed the values listed in Table 1 below:

Table 1: Package Dimensions and Weights

Model	Width in a transport configuration (in.)	Height ^(a) in a transport configuration (in.)	Packaging OD (in.)	Packaging Height (in.)	Cavity OD (in.)	Cavity Height (in.)	Maximum Package Weight (lbs.)
AOS-025A	18.00	21.38	7.00	9.00	1.62	5.00	220
AOS-050A	35.75	38.63 ^a	14.00	18.00	3.25	10.00	1,500
AOS-100A	61.02	75.40 ^a	28.00	36.00	6.50	20.00	12,500
AOS-100B	61.02	75.40 ^a	28.00	36.00	6.50	20.00	11,000
AOS-100A-S	61.02	75.40 ^a	28.00	36.00	6.50	20.00	12,500

(a): the height specified in a transport configuration includes the optional lifting bar on the shipping cage.

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5(a)(3) Drawings

The packaging is constructed and assembled in accordance with the following drawings:

Table 2: Packaging Drawings

Model	Assembly	Rev	Impact Limiter	Rev	Packaging	Rev	Liner/Axial Shielding Plates	Rev	Cavity Spacer Plates	Rev
AOS-025A	166D8142	K	105E9722	J	166D8143	K	183C8485	H	-	-
AOS-050A	105E9718	K	166D8138	I	166D8137	K	183C8519	A	-	-
AOS-100A	105E9711	L	105E9713	J	105E9712 G001	P	183C8491	I	183C8518	B
AOS-100B	105E9711	L	105E9713	J	105E9712 G002	P	-	-	-	-
AOS-100A-S	105E9711	L	105E9713	J	105E9719	P	183C8491	I	183C8518	B

5.(b) Contents

(1) Type and form of material

Activation product radioactive materials as Normal or Special Form. Special Form materials shall have a current certificate. Dispersible Normal Form materials shall be enclosed in an inner container. The inner container is considered to be a "shoring device."

Any radioactive material with a melting point less than 900°F shall be in Special Form.

(2) Maximum quantity of material per package

- Maximum decay heat: 10 watts for Model No. AOS-025A; 100 watts for Model No. AOS-050A; 400 watts for Model Nos. AOS-100A, AOS-100A-S, and AOS-100B.
- Maximum weight of contents: 10 lbs for Model No. AOS-025A; 60 lbs. for Model No. AOS-050A; 500 lbs. for Model Nos. AOS-100A, AOS-100A-S, and AOS-100B. Maximum weight includes any shoring devices and any additional shielding plates.
- Neutron emitting nuclides, fissile materials, and irradiated fissile materials containing fission products are prohibited. Free-standing liquid is not authorized.
- Maximum activities are listed in Tables 3 and 4, with the following exceptions:

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- (1) When transported by exclusive use, the increased maximum activities listed in Table 5 are applicable for the Model Nos. AOS-100A and AOS-100A-S.
- (2) When transporting mixtures of isotopes including low energy gamma and/or beta emitters (i.e., any isotope with all gamma and/or beta emissions, including those from their progeny, ≤ 0.3 MeV), compliance with package dose rate and decay heat limits is determined per the procedure provided in Appendix 7.5.1.

Table 3- Activity Limits All Isotopes except Ir-192 and Ir-194 (TBq)

Isotope	Decay Heat Watt/Ci	AOS-025	AOS-050	AOS-100A AOS-100A-S	AOS-100B
Co-60	$1.55 \cdot 10^{-2}$	$4.92 \cdot 10^{-3}$	$2.76 \cdot 10^{-2}$	10.1	0.366
Co-60-B	$1.55 \cdot 10^{-2}$	-	-	30.5	-
Co-60-C	$1.55 \cdot 10^{-2}$	-	-	356	-
Cs-137	$4.99 \cdot 10^{-3}$	0.370	0.636	1300	19.6
Hf-181	$4.33 \cdot 10^{-3}$	-	2.83	3410	146
Zr/Nb-95 ⁽¹⁾	$1.62 \cdot 10^{-2}$	-	$9.84 \cdot 10^{-2}$	130	2.43
Yb-169	$2.55 \cdot 10^{-3}$	145	287	-	-
Shipping Configuration		Use of Liner Required. Drawing 183C8485	No additional shielding required	Co-60-B quantities require axial shielding plates per drawing 183C8491 Co-60-C quantities require both axial shielding plates and cavity spacer plates per drawing Nos. 183C8491 and 183C8518.	No additional shielding required

(1): Only Nb-95 resulting from the decay of Zr-95 is allowed.

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Table 4 – Activity Limits for Ir-192 and Ir-194 (TBq)

Model	Decay Heat Watt ⁽¹⁾	Ir-192 limit (TBq)	Ir-194 impurity limit (TBq)	Shipping Configuration
AOS-025A	0.44	2.62	0.0185	Use of Liner Required. Drawing 183C8485
	0.40	2.33	0.0740	
	0.37	2.10	0.1110	
AOS-050A	6.24	37.33	0.37	Use of Axial Shielding Plates Required. Drawing 183C8519
	5.87	34.78	0.74	
	5.13	29.67	1.48	
	4.39	24.60	2.22	
	3.66	19.49	2.96	
	2.92	14.39	3.70	
AOS-100A	400	2,286.37	148.00	No Additional Shielding Required
AOS-100A-S	400	2,094.42	370.00	
AOS-100B	13.87	80.51	3.70	No Additional Shielding Required.
	12.39	67.37	8.51	

(1) Ir-192 and Ir-194 generate 6.13×10^{-3} Watt/Ci and 5.30×10^{-3} Watt/Ci, respectively.

Table 5 - AOS-100A/A-S Activity Limits When Shipped As Exclusive Use (TBq)

Isotope	Decay Heat Watt/Ci	AOS-100A/A-S
Co-60	1.55×10^{-2}	17.0
Co-60-B	1.55×10^{-2}	58.5
Co-60-C ⁽¹⁾	1.55×10^{-2}	954
Cs-137	4.99×10^{-3}	2090
Hf-181	4.33×10^{-3}	3410
Ir-192	6.13×10^{-3}	2410
Ir-194	5.30×10^{-3}	1480
Zr/Nb-95 ⁽²⁾	1.62×10^{-2}	215
Shipping Configuration	Co-60B quantities require axial shielding plates per drawing 183C8491. Co-60-C quantities require both axial shielding plates and cavity spacer plates per drawing Nos. 183C8491 and 183C8518	

(1) For Co-60-C quantities, the maximum allowable specific activity is 350 Ci/g

(2) Only Nb-95 resulting from the decay of Zr-95 is allowed

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6. In addition to the requirements of Subpart G of 10 CFR Part 71:
- (a) The package must be prepared for shipment and operated in accordance with the Operating Procedures of Chapter No. 7 of the application, and
 - (b) Each packaging must meet the Acceptance Tests and Maintenance Program of Chapter No. 8 of the application.
7. For transport by air, quantities are limited to the lesser of Tables 3, 4, or 5 of this certificate or 3,000 A₂.
8. For contents meeting Normal Form requirements, the package must be leak-tested to 10⁻⁷ std cm³/sec prior to the first use of the package, and prior to each subsequent use.
9. When contents are loaded under water, or if water is introduced in the cavity of the package, the package must be vacuum dried prior to shipment, and the cavity of the package filled with helium, dry air or other inert gas for such shipments.
10. The sealing surfaces of the package must be inspected. The metallic seal shall be replaced prior to each shipment for normal form material. A new, or previously used, elastomeric cask lid seal or new, or previously used, cask lid metallic seal can be used for Special Form material.
11. The inner container, by design or with additional shoring, shall be immobilized to prevent both radial and axial movements during normal conditions of transport. Shoring devices must be comprised of materials compatible with the radioactive contents and the cask cavity material. All structural shoring materials within the cavity must have a melting point greater than (i) 600°F for Co-60 in metallic form and Cs-137 in the form of cesium chloride and (ii) 900°F for all other contents.
12. Torque values for the lid bolts and the connectors of the impact limiters must be as follows:

Model	Lid Bolt (ft-lb), lubricated	Impact limiter connector (ft-lb), lubricated
AOS-025A	29 - 35	10
AOS-050A	62.5 - 68	3
AOS-100A	400 - 500	70
AOS-100B	400 - 500	70
AOS-100A-S	400 - 500	70

13. The weight of the foam in each impact limiter must be measured and its average density calculated based on the known volume of foam fill.
14. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.
15. Revision Nos. 11 and 12 may be used until December 31, 2025.
16. Expiration date: July 31, 2026.

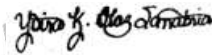
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REFERENCES

Radioactive Material Transport Packaging System Safety Analysis Report for Model AOS-025, AOS-050, and AOS-100 Transport Packages, Rev. J-4

FOR THE U.S. NUCLEAR REGULATORY COMMISSION



Signed by Diaz-Sanabria, Yaira
on 12/16/24

Yaira K Diaz-Sanabria, Chief
Storage and Transportation Licensing Branch
Division of Fuel Management
Office of Nuclear Material Safety
and Safeguards

Date: December 16, 2024





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

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. 13**

SUMMARY

By application dated September 9, 2024, (Agencywide Documents Access and Management System [ADAMS] Accession No. ML24253A154), Alpha-Omega Services, Inc. (AOS) submitted an amendment request to clarify the design, use and replacement schedule for the elastomeric and metallic cask lid seals for all the Model Nos. AOS-25A, AOS-50A, AOS-100A, AOS-100B, and AOS-100A-S packages.

The applicant submitted a list of changes to the application and Revision J4 of the safety analysis report (SAR) "Radioactive Material Transport Packaging System Safety Analysis Report for Model AOS-025, AOS-050, and AOS-100 Transport Packages" AOS-FM9054, dated September 9, 2024. As part of this amendment request, AOS updated the lid seal tolerances on drawings 105E9712G001, 105E9712G002, and 105E9719.

The U.S. Nuclear Regulatory Commission staff reviewed the application using the guidance in NUREG-2216.

Based on the statements and representation in the application and the conditions listed below, the staff concludes that the revised design, use and replacement schedule for cask lid seals do not affect the ability of the package to meet the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71.

EVALUATION

The family of AOS transportation packages consists of the AOS-025A, AOS-050A, AOS-100A, AOS-100B, and AOS-100A-S. The "A" designation refers to a tungsten shield, and the "B" designation refers to a carbon steel shield. The "S" designation on the AOS-100A-S means that the cask is double ended and there is a lid on each end of the cask. All the packages have the same geometric shape, with the AOS-025A and AOS-050A having all dimensions scaled down to 25 percent and 50 percent (respectively) of the dimensions of the AOS-100 package.

CONTAINMENT EVALUATION

The objective of the review is to verify that the containment performance of the AOS Radioactive Material Transport Packaging System has been adequately evaluated for the tests specified under both normal conditions of transport (NCT) and hypothetical accident conditions (HAC) of transport and that the package design satisfies the containment requirements of 10

CFR Part 71. CoC Revision 13 clarifies the design, use and replacement schedule for the elastomeric and metallic cask lid seals.

The AOS transport package containment boundary consists of the following components: cask cavity shell, containment penetrations or port plug sub-assemblies, and cask lid elastomeric and metallic seals. Revision 13 includes the following seal replacement schedule:

Metallic seal

- Normal form material – single use only.
- Special form material – once every 12 uses or every 12 months, whichever comes first, or if the seal is damaged.

Elastomeric seal – once every 12 uses –or– every 12 months, whichever comes first, or if damaged.

For the shipment of special form material, a new, or previously used, cask lid elastomeric seal or new, or previously used, cask lid metallic seal may be used for the following cases:

- When the radioactive contents are certified as special form sources and containment is provided by the sealed source.
- After a pre-shipment leak test has been performed in accordance with American National Standards Institute (ANSI) N14.5-2014, “American National Standard for Radioactive Materials - Leakage Tests on Packages for Shipment.”

The changes included in this amendment request do not affect the previous cask containment evaluation during NCT or HAC. Therefore, the staff finds these changes acceptable.

Based on review of the statements and representations in the application, the NRC staff concludes that the AOS Radioactive Material Transport Packaging System has been adequately described and evaluated to demonstrate that it satisfies the containment requirements of 10 CFR Part 71, and that the package meets the containment criteria of ANSI N14.5.

OPERATING PROCEDURES EVALUATION

The applicant made several changes regarding the detailed inspection of the cask and lid seal surfaces. In particular, if the cask lid metallic seal is replaced, prior to the shipment of normal form material, a maintenance test must be performed in accordance with ANSI N14.5. However, for the shipment of special form material, a previously used cask lid elastomeric seal or previously used cask lid metallic seal may be used after a pre-shipment leak test has been performed.

It is to be noted that for shipments of special form materials, a maintenance leak test is not necessary after the replacement of a cask lid elastomeric or metallic seal, if the periodic leak test has been performed on the cask's containment system within the past 12 months.

The applicant has explained the different types of pre-shipment leak tests in Section 7.1.3.3 of the application depending on the contents to be shipped and the cask lid seal type.

ACCEPTANCE TESTS AND MAINTENANCE PROGRAMS EVALUATION

The applicant clarified that a maintenance leak test is not necessary after replacement of a cask lid elastomeric seal or reused cask lid metallic seal, provided that a periodic leak test has been performed on the cask's containment system within the past 12 months and a pre-shipment leak test was performed (Test A1 or A2 for special form content or Test B for normal form contents) in accordance to Section 7.1.3.3 of the SAR.

Changes to Certificate of Compliance

The following changes are included in Revision No. 13 to Certificate of Compliance No. 9316:

Item No. 3.b was revised to reference the updated safety analysis report.

Condition No. 5(a)(3) was revised to reference the updated licensing drawings.

Condition No. 10 was revised to state that a new, or previously used, elastomeric cask lid seal or new, or previously used, cask lid metallic seal may be used for shipment of special form material.

Condition No. 15 was revised to authorize the use of the Revision No. 11 of the certificate until December 31, 2025, due to prior scheduling of international shipments with Revision No. 11 as a basis for the U.S. Department of Transportation Certificate of Competent Authority Revision No. 7. Also, the same Condition No. 15 allows for Revision No. 12 to be used until approximately 1 year after issuance of Revision No. 13 of this Certificate.

The expiration date of the certificate was not changed.

The References section of the certificate was updated to identify the most recent application dated September 9, 2024.

CONCLUSION

Based on the statements and representations contained in the application, as supplemented, and the conditions listed above, the staff concludes that the design of the Model Nos. AOS-25A, AOS-50A, AOS-100A, AOS-100B, and AOS-100A-S packages has been adequately described and evaluated.

The staff concludes that the changes indicated do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9316, Revision No. 13.