

**CERTIFICATE OF COMPLIANCE
FOR RADIOACTIVE MATERIAL PACKAGES**

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2. PREAMBLE

- a. 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."
- b. 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

- | | |
|---|---|
| a. ISSUED TO (<i>Name and Address</i>)
Croft Associates Limited
Building F4, Culham Science Centre
Culham, Abingdon
Oxfordshire, OX14 3BD, United Kingdom | b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION
Croft Associates Limited application dated
July 30, 2009, as supplemented. |
|---|---|

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

- (1) Model No.: 3979A
- (2) Description

The Model No. 3979A is a package for the transport of radioisotopes used in a wide range of therapeutic and diagnostic applications and research. The packaging consists of an outer stainless steel keg and an inner containment vessel surrounded by insulating cork packing. There are three specific inserts authorized for use in the Model No. 3979A, designated as Shielding Insert Design Nos. 3983, 3984, and 3986. The outer keg provides impact and thermal protection. Containment is provided by the containment vessel. Shielding is provided by the containment vessel and shielding insert.

The keg has a stainless steel outer shell and a stainless steel liner, between which insulating cork is fitted. The keg lid is attached to the body by 8 stainless steel studs and nuts, with a single O-ring weather seal. An inner cork liner is fitted between the keg liner and the top and sides of the containment vessel, consisting of a cork body and cork top, with no cork between the bottom of the containment vessel and the keg liner.

The containment vessel consists of a body and lid. The body has a stainless steel outer wall, base, and flange/cavity wall. The flange/cavity wall is welded to the outer wall to form a cavity into which

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

the lead shielding is cast. The base is then welded to the outer wall. The containment vessel lid top and lid shielding casing are stainless steel, with 22 mm of lead cast inside. The containment vessel lid is secured by eight, M-10x1.5x20, alloy steel recessed hexagon socket head cap screws. The containment system is sealed by two concentric ethylene propylene rubber O-rings, and the lid is equipped with a leak test port.

There are three Shielding Inserts designed for use in the Model No. 3979A packaging. Design No. 3983, LS-31x73-Tu, is a tungsten insert with inner cavity size of 31 mm diameter by 73 mm height. The approximate mass of the insert is 4.9 kg. Design No. 3984, LS-12x65-Tu, is a tungsten insert with inner cavity size of 12 mm diameter by 65 mm in height. The approximate mass of the insert is 5.8 kg. The third design, Design No. 3986, LS-50x103-SS, is a stainless steel insert with inner cavity size of 50 mm diameter by 103 mm height. The approximate mass of the insert is 1.0 kg.

The radioactive material may be enclosed in any convenient product container such as a quartz vial or aluminum capsule. Irradiated items may be carried in plastic or metal can or wrapping to minimize the contamination of the insert.

The approximate dimensions and mass of the package are:

Overall package outer diameter	424 mm
Overall package height	483 mm
Containment vessel outer diameter	175 mm
Containment vessel height	204 mm
Containment vessel cavity inner diameter	65 mm
Containment vessel cavity inner height	109 mm
Maximum package mass	65 kg

(3) Drawings

The packaging is constructed and assembled in accordance with Croft Associates Limited Drawing Nos:

1C-6040, Rev. H	Cover Sheet for Safkeg LS Design No. 3979A (Licensing Drawing)
0C-6041, Rev. C	SAFKEG LS Design No 3979A (Licensing Drawing)
0C-6042, Rev. F	Keg Design No. 3979 (licensing Drawing)
0C-6043, Rev. C	Cork Set for Safkeg LS (Licensing Drawing)
1C-6044, Rev. F	Containment Vessel Design No. 3980 (Licensing Drawing)
1C-6045, Rev. E	Containment Vessel Lid (Licensing Drawing)
1C-6046, Rev. E	Containment Vessel Body (Licensing Drawing)

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5.(a) (3) Drawings (Continued)

The shielding inserts are constructed and assembled in accordance with Croft Associates Limited Drawing Nos:

2C-6171, Rev. C LS-12x65-Tu Insert Design No. 3984 (Licensing Drawing)
2C-6172, Rev. C LS-31x73-Tu Insert Design No. 3983 (Licensing Drawing)
2C-6175, Rev. D LS-50X103-SS Insert Design No. 3986 (Licensing Drawing)

5.(b) Contents

(1) Type and form of material

Solid material must have melting point greater than 250° C.

- (i) Solid, normal form material, as limited in Table 1, within insert Design No. 3984.
- (ii) Solid, normal form material, as limited in Table 2, within insert Design No. 3983.
- (iii) Solid, normal form material, as limited in Table 3, within insert Design No. 3986.
- (iv) Krypton-79, and Xenon-133 gas, as limited in Table 4, within insert Design No. 3983.
- (v) Solid, normal form material or solid sealed sources that meet the requirements of special form radioactive material, as limited in Table 5, within insert Design No. 3986.

(2) Maximum quantity of material per package

Decay heat not to exceed 10 watts per package. The contents may include fissile materials provided the mass limits of 10 CFR 71.15, 71.22, or 71.23 are not exceeded. Mixtures of nuclides are allowed providing the sum of the proportionate amounts of each nuclide with respect to the quantities shown in the respective table does not exceed unity. The contents may include mixtures of activation products not listed in Tables 1-3, provided the mixture of activation products does not exceed $0.25 \times A_2$ and all other requirements in the certificate are met.

- (i) For the contents described in 5(b)(1)(i):

Total mass of contents and insert not to exceed 5.8 kg. Maximum mass of radioactive material, is 30 g.

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TABLE 1

Radionuclide	Maximum TBq	Radionuclide	Maximum TBq	Radionuclide	Maximum TBq
Ac-225	1.22E-01	I-131	1.34E+00	Re-188	5.74E-01
Ac-227	8.38E-01	In-111	1.42E+02	Rh-105	2.71E+02
Ac-228	1.07E-02	Ir-192	9.60E-01	Se-75	1.54E+02
Am-241	3.90E+00	Ir-194	2.58E-01	Sm-153	1.90E+02
As-77	1.95E+02	Lu-177	3.43E+02	Sr-89	1.07E+02
Au-198	2.33E+00	Mo-99	2.80E-01	Sr-90	1.62E+01
Ba-131	4.52E-01	Na-24	7.80E-04	Tb-161	3.19E+02
C-14	4.80E+00	Np-237	7.80E-04	Th-227	1.79E+00
Co-60	2.28E-03	P-32	1.90E-02	Th-228	2.53E-03
Cs-131	2.24E+03	P-33	8.15E+02	Tl-201	4.84E+02
Cs-134	2.24E-02	Pb-203	1.45E+01	W-187	1.96E-01
Cs-137	1.42E-01	Pb-210	8.40E+01	W-188	6.02E-01
Cu-67	2.30E+02	Pd-109	1.73E+02	Y-90	8.76E-03
Hg-203	1.86E+02	Ra-223	8.46E-01	Yb-169	1.47E+02
Ho-166	2.42E-01	Ra-224	3.33E-03	Yb-175	3.69E+02
I-125	1.06E+03	Ra-226	3.62E-03		
I-129	1.95E-04	Re-186	1.38E+02		

(ii) For the contents described in 5(b)(1)(ii):

Total mass of contents and insert not to exceed 5.3 kg. Maximum mass of radioactive material, is 200 g.

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TABLE 2

Radionuclide	Maximum TBq	Radionuclide	Maximum TBq	Radionuclide	Maximum TBq
Ac-225	8.35E-02	I-131	6.71E-01	Re-188	3.55E-01
Ac-227	4.70E-01	In-111	1.42E+02	Rh-105	2.71E+02
Ac-228	6.90E-03	Ir-192	4.30E-01	Se-75	1.54E+02
Am-241	1.13E+01	Ir-194	1.66E-01	Sm-153	1.90E+02
As-77	7.84E+01	Lu-177	3.43E+02	Sr-89	6.64E+01
Au-198	1.32E+00	Mo-99	1.52E-01	Sr-90	6.89E+00
Ba-131	2.56E-01	Na-24	5.66E-04	Tb-161	2.99E+02
C-14	3.20E+01	Np-237	5.20E-03	Th-227	1.01E+00
Co-60	1.53E-03	P-32	1.35E-02	Th-228	1.86E-03
Cs-131	2.24E+03	P-33	8.15E+02	Tl-201	4.84E+02
Cs-134	1.29E-02	Pb-203	7.34E+00	W-187	1.01E-01
Cs-137	7.09E-02	Pb-210	5.60E+02	W-188	3.72E-01
Cu-67	2.30E+02	Pd-109	1.73E+02	Y-90	6.41E-03
Hg-203	1.86E+02	Ra-223	4.74E-01	Yb-169	1.47E+02
Ho-166	1.66E-01	Ra-224	2.44E-03	Yb-175	3.65E+02
I-125	1.06E+03	Ra-226	2.54E-03		
I-129	1.30E-03	Re-186	7.21E+01		



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5.(b)(2) (continued)

(iii) For the contents described in 5(b)(1)(iii):

Total mass of contents and insert not to exceed 2.5 kg. Maximum mass of radioactive material, is 800 g.

TABLE 3

Radionuclide	Maximum TBq	Radionuclide	Maximum TBq	Radionuclide	Maximum TBq
Ac-225	2.08E-02	I-129	5.20E-03	Ra-226	6.81E-04
Ac-227	5.40E-02	I-131	5.03E-02	Re-186	6.93E+00
Ac-228	1.41E-03	In-111	1.42E+02	Re-188	6.02E-02
Am-241	1.13E+01	Ir-192	2.10E-02	Rh-105	1.48E+01
As-77	2.85E+00	Ir-194	3.35E-02	Se-75	1.28E+00
Au-198	7.61E-02	Lu-177	3.43E+02	Sm-153	3.15E+01
Ba-131	2.31E-02	Mo-99	1.70E-02	Sr-89	1.06E+01
Bi-210	2.74E-02	Na-24	1.79E-04	Sr-90	8.94E-01
C-14	1.28E+02	Np-237	2.08E-02	Tb-161	1.69E+01
Co-60	3.68E-04	P-32	2.20E-02	Th-227	1.16E-01
Cs-131	2.24E+03	P-33	8.15E+02	Th-228	5.96E-04
Cs-134	1.62E-03	Pb-203	5.70E-01	Tl-201	4.84E+02
Cs-137	5.85E-03	Pb-210	2.39E+02	W-187	8.88E-03
Cu-67	7.67E+01	Pd-109	1.50E+01	W-188	6.31E-02
Hg-203	6.03E+01	Po-210	1.18E+01	Y-90	6.02E-03
Ho-166	4.46E-02	Ra-223	5.46E-02	Yb-169	5.06E+01
I-125	1.06E+03	Ra-224	7.83E-04	Yb-175	2.56E+00

(iv) For the contents described in 5(b)(1)(iv):

Total mass of contents and insert not to exceed 5.3 kg. Maximum mass of contents; i.e., radioactive material, is 429 g. Maximum volume of contents, including the material of the gas container, is 10cc.

TABLE 4

Radionuclide	Maximum TBq	Radionuclide	Maximum TBq
Kr-79	2.00E-01	Xe-133	3.45E+02

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5.(b)(2) (continued)

(v) For the contents described in 5(b)(1)(v):

Total mass of contents and insert not to exceed 2.5 kg. Maximum mass of radioactive material, is 800 g.

TABLE 5

Radionuclide	Maximum TBq	Radionuclide	Maximum TBq	Radionuclide	Maximum TBq
Pu-238	1.14E+01	Pu-240	6.72E+00	U-235	Note 1
Pu-239	Note 1	Pu-241	Note 1		

Note1: Fissile material must meet the mass limits and conditions of 10 CFR 71.15, "Exemption from classification as fissile material," or of the general license in 10 CFR 71.22 or 71.23. For shipment under the general license for fissile material, 10 CFR 71.22, and plutonium-beryllium special form material, 10 CFR 71.23, package contents are limited to no more than a Type A quantity of radioactive material.

5.(c) Criticality Safety Index

For the contents described in 5(b)(1)(v), as limited in 5(b)(2)(v), the criticality safety index must be calculated in accordance with the provisions of 10 CFR 71.22 or 71.23, as appropriate, and rounded up to the first decimal place. Criticality safety index is not required for material meeting the mass limits and conditions of 10 CFR 71.15.

6. In addition to the requirements of Subpart G of 10 CFR Part 71:

- (a) The package shall be prepared for shipment and operated in accordance with the Package Operations in Section 7.0 of the application.
- (b) The package must meet the Acceptance Tests and Maintenance Program in Section 8.0 of the application, as supplemented.

7. Air transport of plutonium is not authorized.

8. The package authorized by this certificate is hereby approved for use under the general license provisions of 10 CFR 71.17.

9. Revision No. 5 of this certificate may be used until April 30, 2026.

10. Expiration date: April 30, 2031.

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REFERENCES

Croft Associates Limited application dated July 30, 2009.

Supplements dated: October 15, 2009; March 31, and September 30, 2010; April 19, and September 5, 2012; April 20, July 17, and December 17, 2015; January 21, and March 10, 2016; February 21, November 9, and November 22, 2021; and February 3, 2026.

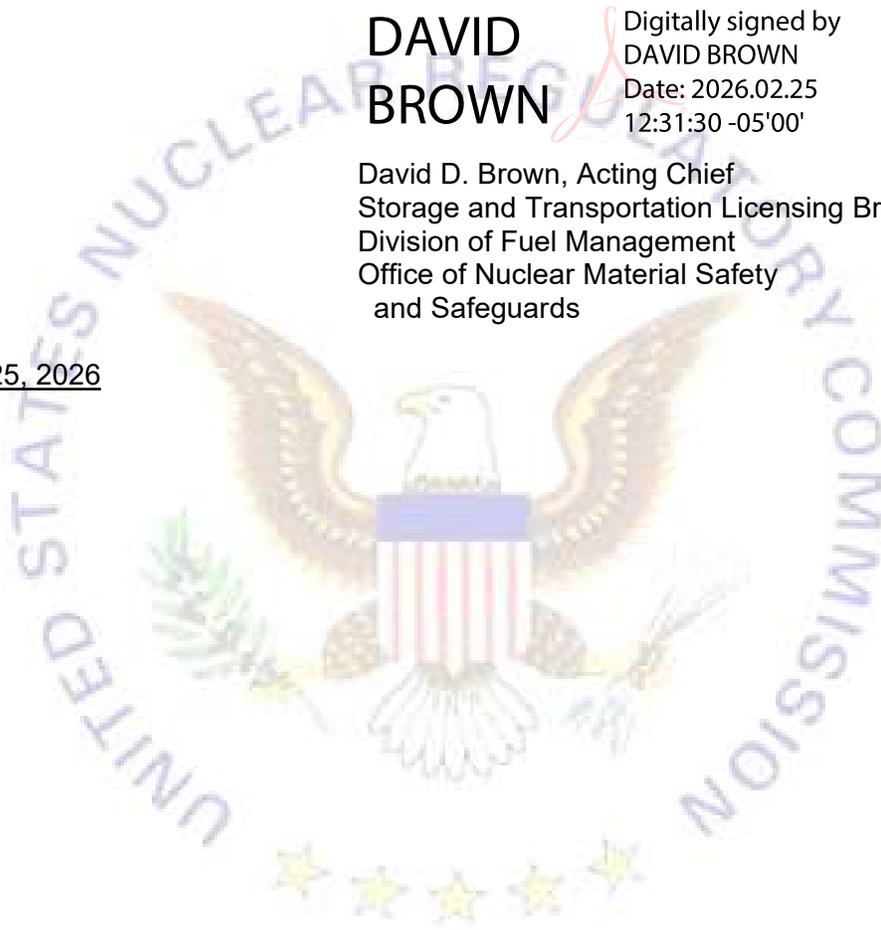
FOR THE U.S. NUCLEAR REGULATORY COMMISSION

**DAVID
BROWN**

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DAVID BROWN
Date: 2026.02.25
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David D. Brown, Acting Chief
Storage and Transportation Licensing Branch
Division of Fuel Management
Office of Nuclear Material Safety
and Safeguards

Date: February 25, 2026





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

SAFETY EVALUATION REPORT

Docket No. 71-9337
Safkeg-LS Model No. 3979A Package
Certificate of Compliance No. 9337
Revision No. 6

SUMMARY

By application dated December 12, 2025 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML25350A015), Croft Associates Limited (Croft) requested renewal, without changes, of Certificate of Compliance (CoC) No. 9337 for the Safkeg-LS Model No. 3979A package. Subsequently, by letter dated February 3, 2026 (ML26034B901), Croft submitted an application for amendment to CoC No. 9337 to include an allowance for activation impurities for all solid content types listed in the CoC. The February 3, 2026, letter requested the CoC amendment to be included in the CoC renewal by the end of February 2026, or if not possible, at the earliest possible date after the renewal.

The certificate has been renewed for a five-year term and amended to include an allowance for activation impurities.

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the application using the guidance in NUREG-2216, "Standard Review Plan for Transportation Packages for Spent Fuel and Radioactive Material" (ML20234A651). Based on the statements and representations in the application, as supplemented, and the conditions listed in the CoC, the staff concludes that the package meets the requirements in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71.

EVALUATION

The proposed amendment would allow small quantities of additional radionuclides not previously considered in the original analysis. These additional radionuclides are activation products generated in a reactor as a result of impurities or contaminants in the ampules or the contained product.

Croft submitted bounding inventories of these additional radionuclides (i.e., bounding list of contaminants / impurities) from two current users of the package, summarized in tables 1 and 2 of the February 3, 2026, amendment request. Many of these additional radionuclides have short half-lives; however, delaying shipment until they decay below exempt activity limits would reduce the available medical product. To address this, Croft requested:

- Inclusion of an allowance for a defined A_2 quantity (i.e., up to $0.25 \times A_2$) of radionuclides not listed within the CoC that arise due to impurities of the contents.
- A requirement that any radionuclides not listed in the CoC continue to meet the other contents requirements, package heat and dose limits, and specified mass limits in the CoC.

The NRC staff reviewed the radionuclides listed in tables 1 and 2 of the February 3, 2026, amendment request. Collectively, these tables identify a total of 36 radionuclides (34 unique radionuclides between the 2 tables). The combined activity of all 36 radionuclides identified by both users is less than 0.18 terabecquerel (TBq) (4.87 curie (Ci)), which represents only a small fraction of the hypothetical 37 TBq (1000 Ci) Ir-192 point source used to evaluate the package shielding.¹

Croft also estimated, and the NRC staff confirmed that the total additional activity in the package from the bounding list of contaminants / impurities from either user would be about $0.22 \times A_2$.

Source Term

The hypothetical source term for CoC No. 9337 is 37 TBq (1,000 Ci) of Ir-192 (ML110250364). Dose rates for this source term were confirmed to meet 10 CFR Part 71 limits as evaluated by Croft and confirmed by NRC staff. Adding 0.18 TBq does not significantly increase dose rates, which remain compliant with regulatory requirements.

Activation products or contamination from impurities contribute to only a minimal increase in radiation. The Safkeg-LS shielding features continue to provide adequate protection. Therefore, NRC staff supports adding an allowance for these impurities in the CoC.

Thermal and Containment

Additionally, using heat generation values for all 34 unique radionuclides, Croft estimated the maximum additional decay heat from a bounding list of contaminants / impurities from either user would be less than 1.1×10^{-2} watts, which is a small fraction of the 10 watt decay heat authorized for this package. The containment boundary acceptance criteria is leaktight (1×10^{-7} ref-cm³/s) per the American National Standards Institute (ANSI) N14.5², as described in sections 4.2.2 and 4.3.2 of the safety analysis report³; therefore, because there are no containment leakage rate calculations based on the content radionuclides, an additional $0.22 \times A_2$ does not impact the containment results. The $0.22 \times A_2$ quantity is also bound by the applicant requested $0.25 \times A_2$ quantity of impurities that are not listed in the CoC. The applicant also confirmed that the impurities are solid or are absorbed into the solid contents or aluminum capsule; therefore, there is no gas generation from the impurities to increase the internal pressure.

On the basis that activation products resulting from impurities or contaminants appear to pose very small additional sources of radiation and decay heat, the NRC staff agrees that an allowance for these impurities may be provided in the CoC.

CONDITIONS

The CoC includes the following conditions of approval:

¹ Letter to R. Vaughn, Croft, from R. Johnson, NRC dated January 24, 2011, Re: Original Issue of Certificate of Compliance No. 9337, ADAMS Package Accession No. ML110250350.

² ANSI N14.5, American National Standard for Radioactive Materials – Leakage Tests on Packages for Shipment, American National Standards Institute, 2022.

³ CTR 2008/10, Revision 4, Safety Analysis Report for Packaging Safkeg-LS Design No. 3979A, dated September 2012, ADAMS Accession No. ML12250A456.

Condition No. 5.(b)(2) "Maximum quantity of material per package" was revised to include an allowance of 0.25 x A₂ quantity for activation products not listed in the CoC, provided all other requirements in the certificate are met.

Condition No. 9 was revised to authorize use of the previous revision of the certificate, Revision No. 5, until April 30, 2026.

Condition No. 10 was updated to reflect the new expiration date of April 30, 2031.

The References were updated to include the February 3, 2026, application for the amendment.

CONCLUSION

The certificate has been renewed for a five-year term, which expires on April 30, 2031. Based on the statements contained in the applications, and the conditions listed above, 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. 9337, Revision No. 6.