| NRC FORM 618 (8-2000) 10 CFR 71 | | | U.S. NUCLEAR REGULATORY COMMISSION | | |
|---|---|---|---|---|---|
| **CERTIFICATE OF COMPLIANCE FOR RADIOACTIVE MATERIAL PACKAGES** | | | | | |
| 1. a. CERTIFICATE NUMBER | b. REVISION NUMBER | c. DOCKET NUMBER | d. PACKAGE IDENTIFICATION NUMBER | PAGE | PAGES |
| 9337 | 8 | 71-9337 | USA/9337/B(U)-96 | 1 OF | 8 |

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

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

a. ISSUED TO *(Name and Address)*

Croft Associates Limited
Building F4, Culham Science Centre
Culham, Abingdon
Oxfordshire, OX14 3BD, United Kingdom

b. TITLE AND IDENTIFICATION OF REPORT OR APPLICATION

"Safety Analysis Report for Packaging Safkeg–LS Design No. 3979A Package Docket No. 07109337," dated July 17, 2026.

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

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

the lead shielding is either cast or a pre-machined component fitted. 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 (or a pre-machined component fitted). 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. K | “Cover Sheet for Safkeg LS Design No. 3979A” (Licensing Drawing) |
| 0C-6041, Rev. E | “SAFKEG LS Design No. 3979A” (Licensing Drawing) |
| 0C-6042, Rev. H | “Keg Design No. 3979” (licensing Drawing) |
| 0C-6043, Rev. C | “Cork Set for Safkeg LS” (Licensing Drawing) |
| 1C-6044, Rev. H | “Containment Vessel Design No. 3980 (Assy A)” (Licensing Drawing) |
| 1C-9012, Rev. B | “Containment Vessel Design No. 3980 (Assy B)” (Licensing Drawing) |
| 1C-6045, Rev. F | “Containment Vessel Lid (Assy A)” (Licensing Drawing) |
| 1C-6046, Rev. F | “Containment Vessel Body (Assy A)” (Licensing Drawing) |
| 1C-9013, Rev. A | “Containment Vessel Lid (Assy B)” (Licensing Drawing) |
| 1C-9014, Rev. A | “Containment Vessel Body (Assy B)” (Licensing Drawing) |

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

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

2C-6171, Rev. D "LS-12x65-Tu Insert Design No. 3984" (Licensing Drawing)
2C-6172, Rev. D "LS-31x73-Tu Insert Design No. 3983" (Licensing Drawing)
2C-6175, Rev. F "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 x $A_2$ 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.

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.

The content limits in Table 2 include bounding quantities of each listed radionuclide's daughter products. Note that some daughter radionuclides also appear as separate entries in Table 2 because they may be transported independently from their parent radionuclides.

TABLE 2

| Radionuclide | Maximum TBq | Radionuclide | Maximum TBq | Radionuclide | Maximum TBq |
|---|---|---|---|---|---|
| Ac-225 | 3.94E-01 | I-131 | 2.40E+00 | Sc-46 | 1.64E-02 |
| Ac-227 | 1.25E+00 | In-111 | 1.42E+02 | Sc-47 | 2.30E+02 |
| Ac-228 | 3.69E-02 | Ir-192 | 1.42E+00 | Sc-48 | 7.10E-03 |
| Am-241 | 1.13E+01 | Ir-194 | 6.92E-01 | Se-75 | 1.55E+02 |
| As-77 | 1.78E+02 | La-140 | 7.47E-03 | Si-32 | 4.94E+01 |
| Au-198 | 7.43E+00 | Lu-176m | 1.27E+02 | Sm-153 | 1.87E+02 |
| Ba-131 | 9.06E-01 | Lu-177 | 3.41E+02 | Sr-89 | 4.53E+01 |
| Bi-210 | 1.60E+02 | Lu-177m | 4.58E+01 | Sr-90 | 3.99E+00 |
| Bi-213 | 4.00E+00 | Mn-54 | 6.18E-02 | Tb-161 | 2.61E+02 |
| C-14 | 3.20E+01 | Mo-99 | 8.79E-01 | Tc-99m | 4.37E+02 |
| Cm-244 | 4.41E+00 | Mo-101 | 1.58E-02 | Tc-101 | 3.69E+00 |
| Co-60 | 7.58E-03 | Na-24 | 2.90E-03 | Te-127 | 2.72E+02 |
| Cr-51 | 1.70E+03 | Ni-63 | 4.20E+02 | Te-129 | 2.39E+00 |
| Cs-131 | 2.12E+03 | Np-237 | 5.20E-03 | Te-129m | 2.09E+00 |
| Cs-134 | 6.26E-02 | P-32 | 2.54E+01 | Te-131 | 1.71E-01 |
| Cs-137 | 3.41E-01 | P-33 | 8.17E+02 | Te-131m | 2.83E-02 |
| Cu-64 | 1.77E+00 | Pb-203 | 3.51E+01 | Th-227 | 2.70E+00 |
| Cu-67 | 2.35E+02 | Pb-210 | 1.10E+01 | Th-228 | 1.10E-02 |
| Er-169 | 6.03E+02 | Pb-212 | 2.16E-02 | Tl-201 | 4.51E+02 |
| Eu-152 | 2.53E-02 | Pd-103 | 1.04E+03 | Tl-202 | 1.58E+01 |
| Eu-154 | 2.26E-02 | Pd-109 | 1.39E+02 | Tl-204 | 2.62E+02 |
| Eu-155 | 4.96E+02 | Ra-223 | 1.26E+00 | Tm-168 | 5.94E-02 |
| Eu-156 | 1.42E-02 | Ra-224 | 1.52E-02 | Tm-170 | 1.88E+02 |
| Fe-55 | 1.07E+04 | Ra-225 | 8.64E-01 | W-187 | 4.57E-01 |
| Fe-59 | 1.82E-02 | Ra-226 | 1.30E-02 | W-188 | 1.27E+00 |
| Ga-72 | 6.48E-03 | Ra-227 | 5.58E+00 | Y-90 | 5.57E+00 |
| Gd-152 | 1.60E-10 | Re-186 | 1.75E+02 | Yb-169 | 1.31E+02 |
| Gd-153 | 4.18E+02 | Re-188 | 1.15E+00 | Yb-175 | 3.67E+02 |
| Hf-177m | 2.23E+01 | Rh-105 | 2.71E+02 | Yb-177 | 1.45E-01 |
| Hg-203 | 1.85E+02 | Rn-220 | 9.93E+00 | Zn-65 | 4.52E-02 |
| Ho-166 | 7.47E-01 | Rn-222 | 1.39E-02 | Zr-95 | 1.08E-01 |
| I-125 | 1.01E+03 | Sb-122 | 5.50E-01 | | |
| I-129 | 1.30E-03 | Sb-124 | 1.10E-02 | | |

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 |

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. 6 of this certificate may be used until June 30, 2027.

10. Expiration date: April 30, 2031.

**CERTIFICATE OF COMPLIANCE**
**FOR RADIOACTIVE MATERIAL PACKAGES**

| 1. a. CERTIFICATE NUMBER | b. REVISION NUMBER | c. DOCKET NUMBER | d. PACKAGE IDENTIFICATION NUMBER | PAGE | PAGES |
|---|---|---|---|---|---|
| 9337 | 8 | 71-9337 | USA/9337/B(U)-96 | 8 OF | 8 |

REFERENCES

"Safety Analysis Report for Packaging Safkeg–LS Design No. 3979A Package Docket No. 07109337," dated July 17, 2026, ML26202A003.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

YOIRA DIAZ-SANABRIA

Digitally signed by YOIRA DIAZ-SANABRIA
Date: 2026.08.13 13:02:06 -04'00'

Yoira Diaz-Sanabria, Chief
Storage, Transportation, and Microreactors
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Date: August 13, 2026