NRC FORM 699
(05-2012)

U.S. NUCLEAR REGULATORY COMMISSION

CONVERSATION RECORD

DATE: 3/25/2014

TIME: 11 : 10 ☑ AM ☐ PM

NAME OF PERSON(S) CONTACTED OR IN CONTACT WITH YOU: See below

TELEPHONE NO.:

E-MAIL ADDRESS:

ORGANIZATION: Croft Associates and Missouri University Research Reactor (MURR)

SUBJECT: Revised Draft CoC Discussion (Corrected)

TYPE OF CONVERSATION
- ☐ IN-PERSON
- ☐ E-MAIL
- ☑ TELEPHONE
- ☐ INCOMING
- ☑ OUTGOING

SUMMARY

NRC participants: Chris Allen and Michele Sampson
Croft participant: Sarah Bryson
MURR participants: Michael Flagg, Amber Gaddy, C.J. Roberts, John Ernst

A copy of the attached revised draft certificate of compliance was provided to Croft Associates, Ltd. prior to the call commencing at approximately 11:10 A.M. eastern standard time. The NRC notified Croft that, because analyses addressing hydrogen generation for liquid contents had not been provided, the NRC would not be able to approve liquids as authorized contents for the Safkeg-HS package at this time. The NRC acknowledged that a request for additional information should have been issued during the review to give Croft the opportunity to address the situation. MURR expressed strong disappointment that liquids would not be authorized for transport in the Safkeg-HS and asked to know the regulatory basis for denying liquids as authorized contents. MURR also requested suggestions for avoiding extensive technical review time. The NRC committed to providing a summary of the information that was missing from the application as well as the review criteria used by NRC staff for evaluating hydrogen gas generation by March 28. MURR noted their concern that the NRC's review of liquid contents appeared inconsistent with the application of international regulations as reflected in certificates issued by other countries' competent authorities. The NRC acknowledged that while there is general harmonization in the specific regulatory requirements, there are differences in the application of review criteria in different countries. The call concluded at approximately 11:45 A.M. eastern standard time.

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ACTION REQUIRED

NAME OF PERSON DOCUMENTING CONVERSATION	SIGNATURE	DATE
Chris Allen	William C. Allen	April 3, 2014

ACTION TAKEN

TITLE OF PERSON TAKING ACTION	SIGNATURE OF PERSON TAKING ACTION	DATE

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
9338	0	71-9338	USA/9338/B(U)-96	1	OF	6

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 *(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

Croft Associates Limited application dated September 29, 2012, 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.: 3977A

(2) Description

The Model No. 3977A 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 two specific inserts, designated as Shielding Insert Design Nos. 3982 and 3985, authorized for use in the Model No. 3977A. The outer keg provides impact and thermal protection. Containment is provided by the containment vessel. Shielding is provided by the containment vessel and shielding inserts.

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 eight 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 DU shielding is placed. The DU shielding thickness is approximately 46 mm at the base of the CV and 47.6 mm along the side of the CV except at the top where the lid seats. The DU shielding thickness at the top is 22.5 mm thick. After the DU shielding is installed, the base is then welded to the outer wall. The containment vessel lid top and lid shielding casing are stainless steel, with 45.9 mm of DU inside. The containment vessel lid is secured by eight, M-10x1.5x20, alloy steel recessed hexagon socket head cap

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

screws. The containment vessel is sealed by two concentric fluoroelastomer O-rings, and the lid is equipped with a leak test port.

There are two shielding inserts designed for use in the Model No. 3977A packaging. Design No. 3982, HS-12x95-Tu, is a tungsten insert with inner cavity size of 12 mm diameter by 95 mm height. The approximate mass of the insert is 9.2 kg. Design No. 3985, HS-31x114-Tu, is a tungsten insert with inner cavity size of 31 mm diameter by 114 mm in height. The approximate mass of the insert is 7.9 kg.

The radioactive material shall be enclosed in a convenient product container such as a quartz vial or aluminum capsule. Irradiated items may be carried in a 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	585 mm
Containment vessel outer diameter	200 mm
Containment vessel height	302.5 mm
Containment vessel cavity inner diameter	65.8 mm
Containment vessel cavity inner height	157.1 mm
Maximum package mass	163 kg

(3) Drawings

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

1C-5940, Rev. E	Cover Sheet for Safkeg HS Design No. 3977A (Licensing Drawing)
0C-5941, Rev. D	SAFKEG HS Design No. 3977A (Licensing Drawing)
0C-5942, Rev. B	Keg Design No. 3977 (Licensing Drawing)
0C-5943, Rev. B	Cork Set for Safkeg HS (Licensing Drawing)
1C-5944, Rev. C	Containment Vessel Design No. 3978 (Licensing Drawing)
1C-5945, Rev. C	Containment Vessel Lid (Licensing Drawing)
1C-5946, Rev. D	Containment Vessel Body (Licensing Drawing)
2C-6920, Rev. A	Silicone Sponge Rubber Disc (Licensing Drawing)

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

2C-6173, Rev. D	HS-12 x 95-Tu Insert Design No. 3982 (Licensing Drawing)
2C-6174, Rev. D	HS-31 x 114-Tu Insert Design No. 3985 (Licensing Drawing)

5.(b) Contents

(1) Type and form of material

Solid material must have a melting point greater than 250 °C and must not be volatile below 250 °C.

(i). Solids, normal or special form material, as limited in Table 1, within insert Design No. 3982. Only compounds of Cs, Hg, I, Na, and P are allowed. All other contents may be shipped as individual elements or compounds.

(ii). Solids, normal or special form material, as limited in Table 2, within insert Design No. 3985. Only compounds of Cs, Hg, I, Na, and P are allowed. All other contents may be shipped as individual elements or compounds.

(iii). Gases, normal form material, as limited in Table 3, within insert Design No. 3985 as individual elements. The product container shall be a quartz vial sealed by fusing or aluminum capsules.

(2) Maximum quantity of material per package

Decay heat not to exceed 30 watts per package for both solid and gaseous contents. 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 include the progeny of the radionuclides listed in Tables 1 through 4; however, the quantities in the tables are for the listed radionuclides without progeny present (i.e., at the time of loading, only the radionuclides explicitly listed in the table may be present up to the quantities shown in the tables).

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

Total mass of contents and insert not to exceed 9.3 kg. Maximum mass of radioactive material is 45 g.

TABLE 1

Radionuclide	Maximum TBq	Radionuclide	Maximum TBq	Radionuclide	Maximum TBq
Ac-225	2.51E+00	I-131	3.26E+02	Re-186	1.56E+02
Ac-227	7.24E-01	In-111	4.25E+02	Re-188	7.25E-01
Ac-228	4.28E-01	Ir-192	1.81E+02	Rh-105	8.12E+02
Am-241	3.51E-01	Ir-194	2.05E+00	Se-75	4.61E+02
As-77	7.90E+02	Lu-177	1.03E+03	Sm-153	6.12E-01
Au-198	2.56E+02	Mo-99	5.27E+01	Sr-89	1.22E+01
Ba-131	1.88E+02	Na-24	2.63E-02	Sr-90	1.73E+00
C-14	7.20E+00	Np-237	1.17E-03	Tb-161	1.61E+01
Co-60	2.38E-01	P-32	5.58E+00	Th-227	1.01E+01
Cs-131	6.71E+03	P-33	2.44E+03	Th-228	6.79E-02
Cs-134	7.05E+00	Pb-203	5.20E+02	Tl-201	1.45E+03
Cs-137	1.44E+02	Pb-210	8.04E+00	W-187	2.24E+01
Cu-67	6.91E+02	Pd-109	2.96E+02	W-188	6.43E-01
Hg-203	3.57E+01	Ra-223	6.83E+00	Y-90	1.73E+00
Ho-166	2.04E+00	Ra-224	8.86E-02	Yb-169	4.42E+02
I-125	3.19E+03	Ra-226	9.91E-02	Yb-175	1.11E+03
I-129	2.93E-04				

Note: Boron and beryllium shall not be loaded with the contents in Table 1.

5.(b) (2) (continued)

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

Total mass of contents and insert not to exceed 8.6 kg. Maximum mass of radioactive material is 345 g.

TABLE 2

Radionuclide	Maximum TBq	Radionuclide	Maximum TBq	Radionuclide	Maximum TBq
Ac-225	5.47E-01	I-131	3.26E+02	Re-186	2.66E+01
Ac-227	1.63E-01	In-111	4.25E+02	Re-188	2.61E-01
Ac-228	9.30E-02	Ir-192	1.81E+02	Rh-105	8.12E+02
Am-241	7.92E-01	Ir-194	4.83E-01	Se-75	4.61E+02
As-77	7.90E+02	Lu-177	1.03E+03	Sm-153	5.71E+02
Au-198	5.69E+01	Mo-99	9.56E+00	Sr-89	2.59E+00
Ba-131	3.06E+01	Na-24	6.38E-03	Sr-90	4.15E-01
C-14	5.52E+01	Np-237	8.97E-03	Tb-161	3.70E+00
Co-60	4.68E-02	P-32	1.25E+00	Th-227	2.09E+00
Cs-131	6.71E+03	P-33	2.44E+03	Th-228	1.67E-02
Cs-134	1.32E+00	Pb-203	5.20E+02	Tl-201	1.45E+03
Cs-137	1.58E+02	Pb-210	1.66E+00	W-187	4.28E+00
Cu-67	6.91E+02	Pd-109	4.81E+01	W-188	2.19E-01
Hg-203	5.58E+02	Ra-223	2.07E+00	Y-90	4.15E-01
Ho-166	4.60E-01	Ra-224	2.19E-02	Yb-169	4.42E+02
I-125	3.19E+03	Ra-226	2.34E-02	Yb-175	1.11E+03
I-129	2.24E-03				

Note: Boron and beryllium shall not be loaded with the contents in Table 2.

5.(b) (2) (continued)

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

Total mass of contents and insert not to exceed 8.6 kg. Maximum mass of radioactive material is less than one gram. Maximum volume of contents, including the product container material and packing, is less than 10 cc.

TABLE 3

Radionuclide	Maximum TBq	Radionuclide	Maximum TBq
Kr-79	1.15E+01	Xe-133	1.04E+03

NRC FORM 618 (8-2000) 10 CFR 71			U.S. NUCLEAR REGULATORY COMMISSION		
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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, as supplemented.

   (b) The package must meet the Acceptance Tests and Maintenance Program in Section 8.0 of the application, as supplemented.

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

8. Expiration date: March 31, 2019.

REFERENCES

Croft Associates Limited application dated September 29, 2012.

Supplements dated: December 20, 2012; April 23, September 20, November 21, and 28, December 13, 16, and 17, 2013; January 6, 10, 27, and 31, and February 11, 2014.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

DRAFT

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

Date: _____