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0 SARP STATUS AND CONTENTS

This Safety Analysis Report for Packaging (SARP) has been prepared by Croft Associates Ltd for the new approval of the SAFKEG-LS Design No. 3979A transport package as a Type B(U) design.

This section (Section 0) defines the document status and lists the contents of the SARP (SARP sections and appended documents included in the SARP).

This SARP is a controlled document under the Croft Associates Ltd Quality Assurance Program approved by the NRC under Approval Number 71-0939.



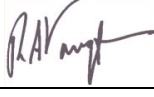
Revisions are on a page control basis, with revisions indicated by a vertical change bar in the right hand margin.

Reference documents, which are listed in the Appendices to each section, are those available in the general literature and are not provided in the SARP.

Supporting documents are those developed specifically for the SARP and are provided in the section that is most closely associated with the document. These supporting documents are listed in this section, together with their revision status.

Document control for the supporting documents, which have been produced by different organizations at different times with different styles, is established by reference designations and issue status and/or date: there is no significance in the various policies of adding the names of author, checker or approver or whether they are manually or electronically signed.

0.1 SARP REVISION STATUS

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Croft Associates Ltd F4 Culham Science Centre Abingdon Oxon OX14 3DB UK Tel 44 (0)1865 407740

0.2 PAGE AND SUPPORTING DOCUMENT REVISION STATUS

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0C-6049	Issue A	Safkeg-LS Construction
1C-6097	Issue A	Containment Vessel LS Lid Construction
1C-6099	Issue A	Containment Vessel LS Body Construction
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1C-6040	Issue G	Cover sheet for Safkeg-LS design no. 3979A (licensing drawing)
0C-6041	Issue C	Safkeg-LS design no. 3979A (licensing drawing)
0C-6042	Issue E	Keg design no. 3979 (licensing drawing)
0C-6043	Issue C	Cork set for Safkeg-LS (licensing drawing)
1C-6044	Issue F	Containment vessel design no. 3980 (licensing drawing)
1C-6045	Issue E	Containment vessel lid (licensing drawing)
1C-6046	Issue E	Containment vessel body (licensing drawing)

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2C-6171	Issue C	LS-12x65-Tu insert design no. 3984 (licensing drawing)
2C-6172	Issue C	LS-31x73-Tu insert design no. 3983 (licensing drawing)
2C-6175	Issue D	LS-50x103-SS insert design no. 3986 (licensing drawing)
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CTR 2009/21	Issue D	Prototype Safkeg-LS 3979A/0002 NCT and HAC Regulatory Test Report

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SERCO/TAS/002762/01	Issue 1	Compression Testing of Cork
Vectra, 925-3272/R1	Rev 6	Stress Analysis of Safkeg LS 3979A Containment Vessel
CS 2009/08	Issue A	SAFKEG LS 3979A – Maximum Pressure in CV
CS 2010/11	Issue B	Calculation of the Density of the 3977A Package
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CS 2010/16	Issue A	SAFKEG LS 3979A – Maximum Temperature of CV Inserts
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CS 2009/07	Issue B	SAFKEG-LS 3979A - Gas contents limit for leaktight condition
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SERCO/TAS/003191/001	Issue 1	Monte Carlo Modelling of Safkeg LS Container
Section 6 - CRITICALITY EVALUATION		
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None	-	

Table 1-4-3 CT-3 – Solid in steel insert (LS-50x103-SS) – Activity Limits

Contents Type 3 - CT-3 - Solid in steel insert

1	2	3	4	5	6	7	8	9	10
Nuclide	Max TBq	Activity Ci	A2 TBq	# A2s	Spec Ac TBq/g	Mass g	Heat gen W/Ci	Heat output W	PackageType A or B
Ac-225	2.08E-02	5.61E-01	6.00E-03	3.46	2.10E+03	9.89E-06	3.46E-02	1.94E-02	B
Ac-227	5.40E-02	1.46E+00	9.00E-05	599.72	2.70E+00	2.00E-02	4.72E-04	6.89E-04	B
Ac-228	1.41E-03	3.81E-02	5.00E-01	0.00	8.40E+04	1.68E-08	8.04E-03	3.06E-04	A
Am-241	1.13E+01	3.05E+02	1.00E-03	11276.02	1.30E-01	8.67E+01	3.28E-02	1.00E+01	B
As-77	2.85E+00	7.71E+01	7.00E-01	4.08	3.90E+04	7.32E-05	1.41E-03	1.08E-01	B
Au-198	7.61E-02	2.06E+00	6.00E-01	0.13	9.00E+03	8.46E-06	4.34E-03	8.92E-03	A
Ba-131	2.31E-02	6.24E-01	2.00E+00	0.01	3.10E+03	7.45E-06	3.06E-03	1.91E-03	A
Bi-210	2.74E-02	7.41E-01	6.00E-01	0.05	4.60E+03	5.96E-06	2.31E-03	1.71E-03	A
C-14	1.28E+02	3.46E+03	3.00E+00	42.67	1.60E-01	8.00E+02	2.93E-04	1.01E+00	B
Co-60	3.68E-04	9.95E-03	4.00E-01	0.00	4.20E+01	8.77E-06	1.54E-02	1.53E-04	A
Cs-131	2.24E+03	6.05E+04	3.00E+01	74.58	3.80E+03	5.89E-01	1.65E-04	1.00E+01	B
Cs-134	1.62E-03	4.37E-02	7.00E-01	0.00	4.80E+01	3.37E-05	1.02E-02	4.44E-04	A
Cs-137	5.85E-03	1.58E-01	6.00E-01	0.01	3.20E+00	1.83E-03	1.01E-03	1.60E-04	A
Cu-67	7.67E+01	2.07E+03	7.00E-01	109.51	2.80E+04	2.74E-03	1.61E-03	3.33E+00	B
Hg-203	6.03E+01	1.63E+03	1.00E+00	60.26	5.10E+02	1.18E-01	1.99E-03	3.24E+00	B
Ho-166	4.46E-02	1.21E+00	4.00E-01	0.11	2.60E+04	1.72E-06	4.29E-03	5.18E-03	A
I-125	1.06E+03	2.87E+04	3.00E+00	354.17	6.40E+02	1.66E+00	3.48E-04	1.00E+01	B
I-129	5.20E-03	1.41E-01	unlimited	unlimited	6.50E-06	8.00E+02	4.68E-04	6.58E-05	B
I-131	5.03E-02	1.36E+00	7.00E-01	0.07	4.60E+03	1.09E-05	3.39E-03	4.61E-03	A
In-111	1.42E+02	3.85E+03	3.00E+00	47.45	1.50E+04	9.49E-03	2.60E-03	1.00E+01	B
Ir-192	2.10E-02	5.68E-01	6.00E-01	0.04	3.40E+02	6.18E-05	6.13E-03	3.48E-03	A
Ir-194	3.35E-02	9.05E-01	3.00E-01	0.11	3.10E+04	1.08E-06	5.35E-03	4.84E-03	A
Lu-177	3.43E+02	9.27E+03	7.00E-01	490.10	4.10E+03	8.37E-02	1.08E-03	1.00E+01	B
Mo-99	1.70E-02	4.60E-01	6.00E-01	0.03	1.80E+04	9.46E-07	3.27E-03	1.50E-03	A
Na-24	1.79E-04	4.84E-03	2.00E-01	0.00	3.20E+05	5.59E-10	2.77E-02	1.34E-04	A
Np-237	2.08E-02	5.62E-01	2.00E-03	10.40	2.60E-05	8.00E+02	2.88E-02	1.62E-02	B
P-32	2.20E-02	5.95E-01	5.00E-01	0.04	1.10E+04	2.00E-06	4.12E-03	2.45E-03	A
P-33	8.15E+02	2.20E+04	1.00E+00	814.82	5.80E+03	1.40E-01	4.54E-04	1.00E+01	B
Pb-203	5.70E-01	1.54E+01	3.00E+00	0.19	1.10E+04	5.18E-05	2.14E-03	3.29E-02	A
Pb-210	2.39E+02	6.46E+03	5.00E-02	4781.91	2.80E+00	8.54E+01	2.31E-04	1.49E+00	B
Pd-109	1.50E+01	4.06E+02	5.00E-01	30.03	7.90E+04	1.90E-04	2.14E-03	8.69E-01	B
Po-210	1.18E+01	3.18E+02	2.00E-02	589.17	1.67E+02	7.08E-02	3.14E-02	1.00E+01	B
Ra-223	5.46E-02	1.47E+00	7.00E-03	7.80	1.90E+03	2.87E-05	3.50E-02	5.16E-02	B
Ra-224	7.83E-04	2.12E-02	2.00E-02	0.04	5.90E+03	1.33E-07	3.37E-02	7.13E-04	A
Ra-226	6.81E-04	1.84E-02	3.00E-03	0.23	3.70E-02	1.84E-02	2.84E-02	5.23E-04	A
Re-186	6.93E+00	1.87E+02	6.00E-01	11.55	6.90E+03	1.00E-03	2.14E-03	4.00E-01	B
Re-188	6.02E-02	1.63E+00	4.00E-01	0.15	3.60E+04	1.67E-06	4.97E-03	8.08E-03	A
Rh-105	1.48E+01	4.00E+02	8.00E-01	18.52	3.10E+04	4.78E-04	1.37E-03	5.48E-01	B
Se-75	1.28E+00	3.47E+01	3.00E+00	0.43	5.40E+02	2.38E-03	2.41E-03	8.34E-02	A
Sm-153	3.15E+01	8.52E+02	6.00E-01	52.55	1.60E+04	1.97E-03	1.94E-03	1.66E+00	B
Sr-89	1.06E+01	2.86E+02	6.00E-01	17.64	1.10E+03	9.62E-03	3.46E-03	9.89E-01	B
Sr-90	8.94E-01	2.42E+01	3.00E-01	2.98	5.10E+00	1.75E-01	3.46E-03	8.35E-02	B
Tb-161	1.69E+01	4.58E+02	2.00E-02	846.49	4.35E+03	3.89E-03	1.16E-03	5.31E-01	B
Th-227	1.16E-01	3.12E+00	5.00E-03	23.10	1.10E+03	1.05E-04	3.59E-02	1.12E-01	B
Th-228	5.96E-04	1.61E-02	1.00E-03	0.60	3.00E+01	1.99E-05	3.21E-02	5.18E-04	A
Tl-201	4.84E+02	1.31E+04	4.00E+00	120.90	7.90E+03	6.12E-02	7.65E-04	1.00E+01	B
W-187	8.88E-03	2.40E-01	3.00E-01	0.03	2.60E+04	3.41E-07	4.54E-03	1.09E-03	A
W-188	6.31E-02	1.71E+00	6.00E-01	0.11	3.70E+02	1.71E-04	5.98E-04	1.02E-03	A
Y-90	6.02E-03	1.63E-01	3.00E-01	0.02	2.00E+04	3.01E-07	5.54E-03	9.02E-04	A
Yb-169	5.06E+01	1.37E+03	1.00E+00	50.62	8.90E+02	5.69E-02	2.51E-03	3.43E+00	B
Yb-175	2.56E+00	6.92E+01	9.00E-01	2.84	6.60E+03	3.88E-04	1.00E-03	6.94E-02	B
Max	2.24E+03	6.05E+04		1.13E+04		8.00E+02		1.00E+01	

Notes

Table 5-5 Summary Table of External Radiation Levels - MicroShield calculations

Ref #	Nuclide	Insert	Activity for Surface Dose of 2 mSv/h		
			LS-12x65-Tu – Design # 3984	LS-31x73-Tu – Design # 3983	LS-50x103-SS – Design # 3986
1	Ac-225		1.22E+11	8.35E+10	2.08E+10
2	Ac-227		8.38E+11	4.70E+11	5.40E+10
3	Ac-228		1.07E+10	6.90E+09	1.41E+09
4	Am-241		7.07E+19	1.88E+19	1.18E+17
5	As-77		1.95E+14	7.84E+13	2.85E+12
6	Au-198		2.33E+12	1.32E+12	7.61E+10
7	Ba-131		4.52E+11	2.56E+11	2.31E+10
7a	Bi-210				2.74E+10
8	C-14		4.55E+36	4.26E+36	1.47E+29
9	Co-60		2.28E+09	1.53E+09	3.68E+08
10	Cs-131		4.85E+35	4.54E+35	3.59E+35
11	Cs-134		2.24E+10	1.29E+10	1.62E+09
12	Cs-137		1.42E+11	7.09E+10	5.85E+09
13	Cu-67		4.53E+16	1.21E+16	7.67E+13
14	Hg-203		1.06E+19	8.26E+17	6.03E+13
15	Ho-166		2.42E+11	1.66E+11	4.46E+10
17	I-125		2.61E+35	2.44E+35	1.93E+35
18	I-129		4.57E+35	4.28E+35	3.38E+35
19	I-131		1.34E+12	6.71E+11	5.03E+10
20	In-111		1.38E+22	4.81E+20	1.70E+15
21	Ir-192		9.60E+11	4.30E+11	2.10E+10
22	Ir-194		2.58E+11	1.66E+11	3.35E+10
23	Kr-79		3.34E+11	2.00E+11	2.49E+10
24	Lu-177		1.21E+19	1.73E+18	1.29E+15
26	Mo-99		2.80E+11	1.52E+11	1.70E+10
28	Na-24		7.80E+08	5.66E+08	1.79E+08
29	Np-237		6.93E+18	6.49E+18	5.02E+18
30	P-32		1.90E+10	1.35E+10	2.20E+10
31	P-33		2.37E+23	9.18E+21	1.37E+17
32	Pb-203		1.45E+13	7.34E+12	5.70E+11
33	Pb-210		3.31E+15	1.87E+15	2.39E+14
34	Pd-109		1.17E+15	4.58E+14	1.50E+13
34a	Po-210				1.97E+14
35	Pu-238		2.99E+14	2.99E+14	2.99E+14
36	Pu-239		6.47E+21	4.64E+21	8.26E+20
37	Pu-240		1.15E+13	1.15E+13	1.15E+13
38	Pu-241		2.77E+21	7.33E+20	4.32E+18
39	Ra-223		8.46E+11	4.74E+11	5.46E+10
40	Ra-224		3.33E+09	2.44E+09	7.83E+08
41	Ra-226		3.62E+09	2.54E+09	6.81E+08
42	Re-186		1.38E+14	7.21E+13	6.93E+12
43	Re-188		5.74E+11	3.55E+11	6.02E+10
44	Rh-105		1.69E+17	2.33E+16	1.48E+13
45	Se-75		6.39E+14	1.70E+14	1.28E+12
47	Sm-153		9.33E+15	2.76E+15	3.15E+13
48	Sr-89		1.11E+14	6.64E+13	1.06E+13
49	Sr-90		1.62E+13	6.89E+12	8.94E+11
50	Tb-161		6.57E+17	2.99E+14	1.69E+13
51	Th-227		1.79E+12	1.01E+12	1.16E+11
52	Th-228		2.53E+09	1.86E+09	5.96E+08
53	Tl-201		1.11E+30	1.04E+30	1.16E+25
55	U-235		5.60E+14	3.14E+14	3.60E+13
56	W-187		1.96E+11	1.01E+11	8.88E+09
57	W-188		6.02E+11	3.72E+11	6.31E+10
58	Xe-133		3.20E+35	2.87E+35	1.61E+25
59	Y-90		8.76E+09	6.41E+09	6.02E+09

Ref#	Insert Nuclide	Activity for Surface Dose of 2 mSv/h		
		LS-12x65-Tu – Design # 3984	LS-31x73-Tu – Design # 3983	LS-50x103-SS – Design # 3986
60	Yb-169	6.46E+17	9.51E+16	5.06E+13
61	Yb-175	1.41E+15	3.65E+14	2.56E+12

8.2.3 Component and Material Tests

The following sections describe the periodic maintenance requirements for package operation. Additional maintenance may be required on packagings that have failed the pre-shipment inspection process. Any additional maintenance requirements shall follow the periodic maintenance and its associated record keeping requirements.

8.2.3.1 Stainless Steel Surfaces

All of the stainless steel surfaces of the keg and containment vessels shall be visually inspected for corrosion. The presence of any surface corrosion on any component shall be cause for further inspection. If the corrosion can be easily wiped off, and no pitting is apparent beneath it, the component is acceptable. If the corrosion cannot be easily wiped off, or if scaling is present, or if pitting is observed, then the surface shall be reworked and the component must undergo a dimensional inspection and dye penetrant and/or radiographic testing to determine the extent of the damage.

In the case of the containment vessel, a hydrostatic test shall be performed. All acceptance criteria for a newly fabricated component (drawing 1C-6044) shall apply to the reworked component. If the corrosion has compromised the structural integrity of the component (e.g. the component no longer meets dimensional criteria for a new part as specified on drawing 1C-6044), then the component shall be rejected. The inspection results and any necessary replacement or repairs, shall be recorded in the package maintenance records.

8.2.3.2 Keg

1. The model/serial numbers of the keg assembly (keg body and keg lid) shall be checked to be matched: where the model/serial numbers of the keg assembly (body and lid) do not match, these assemblies shall be removed from service.
2. The keg name plate shall be checked for legibility of the nameplate information.
3. The keg outer shell shall be visually checked for unacceptable defects. Unacceptable defects are dents greater than 8.9 mm (1 in.) in depth; cracking of welded joints; penetration of the keg skin; or abrasion or scratches greater than half the thickness of the keg skin [shell thickness is 2 mm (0.080 in.)].
4. The keg closure studs shall be checked for tightness of fit in the keg top flange and damage (i.e. stripped or distorted). A die nut (thread class 6g) shall be used to clear any tight threads. The closure studs shall be checked that they are positioned in accordance with drawing 0C-6042. If the stud is loose or the height is incorrect, the stud shall be removed, cleaned, and repositioned using Loctite 270 or any equivalent threadlocker. If any keg closure studs are damaged they shall be replaced according to drawing 0C-6042.