Package Contents Specification
for Safkeg-LS
Package Design No 3979A

Title	Package Contents Specification for Safkeg-LS - Package Design No 3979A	Number Issue File Ref	PCS 036 D PCS036-D-v1-Safkeg-LS-Contents.docx
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1 Specification of contents

1.1 General nature of contents

The Safkeg-LS 3979A package is designed as a general purpose package for radioactive material that requires limited shielding and, with optional shielding inserts, for radioactive material that requires a significant amount of shielding.

The package is designed for radioactive material that emits alpha, beta or gamma radiation. The specified contents do not include materials that emit a significant amount of neutrons.

The contents may be in solid, liquid or gaseous form and carried in various inserts as specified in the Table 1 below.

Table 1 Contents Types

Contents Type Designation	Material Form	Shielding Insert	General Requirements for each Contents Type (1)	Activity Limits for each Contents Type
CT-1	Solid	LS-12x65-Tu Design No 3984	See Table 1-3-1	See Table 3
CT-2	Solid	LS-31x73-Tu Design No 3983	See Table 1-3-2	See Table 4
CT-3	Solid	LS-50x103-SS Design No 3986	See Table 1-3-3	See Table 5
CT-4	Liquid	LS-31x73-Tu Design No 3983	See Table 1-3-4	See Table 6
CT-5	Liquid	LS-50x103-SS Design No 3986	See Table 1-3-5	See Table 7
CT-6	Gas	LS-31x73-Tu Design No 3983	See Table 1-3-6	See Table 8
CT-7	Solid/ Fissile Normal Form	LS-50x103-SS Design No 3986	See Table 1-3-7	See Table 9
CT-8	Solid/ Fissile Special Form	LS-50x103-SS Design No 3986	See Table 1-3-8	See Table 10

1 These are the tables in the SARP [1].

1.2 Shielding inserts

The shielding inserts specified in Section 1 of the SARP for Safkeg-LS 3979A [1] and listed in Table 1 above are required for all contents.

Under NCT, the shielding inserts, together with the user defined product containers, provide confinement of the radioactive material within the shielding.

Under HAC, the shielding inserts, together with the user defined product containers, provide confinement of solid radioactive material within the shielding. However, liquids and gasses are assumed to leak from the user defined product containers and the shielding inserts under HAC.

1.3 Radionuclides included

See Tables 3 to 9.

1.4 Quantity

The maximum mass (and volume for gases) of each radionuclide is detailed in Table 2 and Tables 3 to 9 for specific contents types CT-1 to CT-8.

1.5 Activity limit

The package activity limits for individual nuclides, according to the insert used, are given in Tables 3 to 9. The activity limit is determined in accordance with the methodology in Section 2 below.

1.6 Other limiting factors

Various restrictions and limits of quantity of radionuclides apply according to the insert used and for the form of the radioactive material (solid, liquid or gas). These restrictions and contents limits are detailed in Section 1 of the SARP for Safkeg-LS 3979A in Section 1.2.2 in the tables for contents types CT-1 to CT-8.

2 Calculation of allowable contents

The package activity limit in Tables 3 to 9 is the least of the limits determined on the basis of heat output, mass limit, shielding limit and, for gas contents, the limit based on allowable leakage under NCT or HAC.

2.1 Heat limits

The heat limit for solid and gaseous contents is 10 W and for liquid contents the heat limit is 5 W.

2.2 Mass limit

The upper limit on the mass is different for each insert - as specified in section 1.4 above.

The maximum mass of the radionuclides is set at nominally 50% the mass of a steel cylinder that would fill the cavity of the insert (see Table 1-2).

Table 2 Maximum mass of the radionuclides

Shielding Insert	Mass of a steel cylinder that would fill the cavity of the insert	Maximum mass of the radionuclides
	g	g
LS-12x65-Tu Design No 3984	57	30
LS-31x73-Tu Design No 3983	429	200
LS-50x103-SS Design No 3986	1570	800

2.3 Shielding limit

The package design is such that the surface dose rate, as opposed to the TI, is the limiting factor, except for liquids, under HAC. The shielding limits in Tables 3 to 9 for each radionuclide and each insert, are based on an assessment in Report CTR 2008/22[2] of the maximum activity to give the maximum allowable package surface dose rate (for β, γ and n emitters) of 2mSv/h (200 mrem/h). These calculations are based on the worst case assumption of the radioactive material being a point source at the centre of the base of the insert (neglecting spacing due to use of product containers). This location has been shown to produce the highest package surface dose rate in report SERCO/TAS/003191/001 [3].

For each liquid radionuclide, the HAC shielding limits in Tables 6 and 7 for each applicable insert are based on an assessment in report SERCO/TAS/003191/001 [3] of the maximum activity to give the maximum allowable package dose rate at 1m from the external surface of the package, assuming that the liquid contents leaked into the space between the CV lid and CV body. Liquid contents are limited to the lesser of: a) the activity to give the maximum allowable regulatory dose rate at the package surface under NCT (with the material assumed to be a point source at the centre of the base of the insert) or b) the activity to give the maximum allowable regulatory dose rate at 1m from the external surface of the package, assuming that the liquid contents leaked into the space between the CV lid and CV body.

2.4 Leakage limit

For solid and liquid contents, the contents are completely contained as the O-ring seal of the CV meets the requirement of Leaktight as defined in ANSI N 14.5 [4].

For gaseous radionuclides, it is assumed that they will escape from their product containers under HAC and leak past the seal in the insert within the CV and leak from the CV and the package past the O-ring seal of the CV.

The allowable gas leakage rates in 10CFR Part 71 [5][4] are 1 x 10^{-6} A_2/h under NCT and A_2/week under HAC.

The maximum gas contents are determined as the contents that would leak at the HAC rate of A_2/week from a "Leaktight" seal (as defined in ANSI N14.5 [4] as a leakage rate less than or equal to 1 x 10^{-7} ref·cm^3/s, of air at an upstream pressure of 1 atmosphere (atm) absolute (abs) and a downstream pressure of 0.01 atm abs or less). The calculation of the maximum gas contents is given in report CS 2009/07 [6].

2.5 Criticality Limits

The quantities of fissile material are restricted to the limits in this document and according to the criteria specified in Section 1 of the SARP for Safkeg-LS 3979A [1] in Section 1.2.2 in the tables for Contents Types CT-7 and CT-8 Fissile solid.

3 References

[1] CTR 2008/10, Revision 2, SARP for Safkeg-LS 3979A, Docket No. 71-9337
[2] Croft, CTR 2009/22, Issue A, SAFKEG LS 3979A, Package Activity Limits Based on Shielding
[3] SERCO/TAS/003191/001, Monte Carlo Modelling of Safkeg LS Container
[4] ANSI N14.5, American National Standard for Radioactive Materials - Leakage Test on Packages for Shipment, American National Standards Institute, Inc., 1997
[5] 10CFR PART 71, Packaging And Transportation Of Radioactive Material, U.S. Nuclear Regulatory Commission
[6] CS 2009/07, Issue B, SAFKEG-LS 3979A - Gas contents limit for leaktight condition

Table 3 Activity Limits for Contents Type 1 - CT-1 - Solid in heavy tungsten insert – Design No 3984

Contents Type 1 - CT-1 - Solid in heavy tungsten insert

										Package limits calulations for each nuclide									
										Contents heat limit			Contents mass limit		Package shielding limit	Package limit			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Nuclide	Max	Activity	A2	# A2s	Spec Ac	Mass	Heat gen	Heat output	PackageType	Mass		Act	Mass	Act	Act	Act	Code		
	TBq	Ci	TBq		TBq/g	g	W/Ci	W	A or B	W	Ci	Bq	g	Bq	Bq	Bq	H	M	S
Ac-225	1.22E-01	3.29E+00	6.00E-03	20.29	2.10E+03	5.80E-05	3.46E-02	1.14E-01	B	10.00	2.89E+02	1.0702E+13	30	6.30E+16	1.22E+11	1.22E+11			S
Ac-227	8.38E-01	2.27E+01	9.00E-05	9311.69	2.70E+00	3.10E-01	4.72E-04	1.07E-02	B	10.00	2.12E+04	7.8377E+14	30	8.10E+13	8.38E+11	8.38E+11			S
Ac-228	1.07E-02	2.89E-01	5.00E-01	0.02	8.40E+04	1.27E-07	8.04E-03	2.32E-03	A	10.00	1.24E+03	4.6023E+13	30	2.52E+18	1.07E+10	1.07E+10			S
Am-241	3.90E+00	1.05E+02	1.00E-03	3900.00	1.30E-01	3.00E+01	3.28E-02	3.46E+00	B	10.00	3.05E+02	1.1276E+13	30	3.90E+12	7.07E+19	3.90E+12		M	
As-77	1.95E+02	5.28E+03	7.00E-01	278.86	3.90E+04	5.01E-03	1.41E-03	7.41E+00	B	10.00	7.12E+03	2.6329E+14	30	1.17E+18	1.95E+14	1.95E+14			S
Au-198	2.33E+00	6.29E+01	6.00E-01	3.88	9.00E+03	2.59E-04	4.34E-03	2.73E-01	B	10.00	2.31E+03	8.5301E+13	30	2.70E+17	2.33E+12	2.33E+12			S
Ba-131	4.52E-01	1.22E+01	2.00E+00	0.23	3.10E+03	1.46E-04	3.06E-03	3.73E-02	A	10.00	3.27E+03	1.2111E+14	30	9.30E+16	4.52E+11	4.52E+11			S
C-14	4.80E+00	1.30E+02	3.00E+00	1.60	1.60E-01	3.00E+01	2.93E-04	3.80E-02	B	10.00	3.41E+04	1.2617E+15	30	4.80E+12	4.55E+36	4.80E+12		M	
Co-60	2.28E-03	6.17E-02	4.00E-01	0.01	4.20E+01	5.44E-05	1.54E-02	9.52E-04	A	10.00	6.48E+02	2.3990E+13	30	1.26E+15	2.28E+09	2.28E+09			S
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	10.00	6.05E+04	2.2373E+15	30	1.14E+17	4.85E+35	2.24E+15	H		
Cs-134	2.24E-02	6.06E-01	7.00E-01	0.03	4.80E+01	4.67E-04	1.02E-02	6.17E-03	A	10.00	9.82E+02	3.6349E+13	30	1.44E+15	2.24E+10	2.24E+10			S
Cs-137	1.42E-01	3.83E+00	6.00E-01	0.24	3.20E+00	4.43E-02	1.01E-03	3.88E-03	A	10.00	9.88E+03	3.6554E+14	30	9.60E+13	1.42E+11	1.42E+11			S
Cu-67	2.30E+02	6.22E+03	7.00E-01	328.92	2.80E+04	8.22E-03	1.61E-03	1.00E+01	B	10.00	6.22E+03	2.3024E+14	30	8.40E+17	4.53E+16	2.30E+14	H		
Hg-203	1.86E+02	5.03E+03	1.00E+00	185.96	5.10E+02	3.65E-01	1.99E-03	1.00E+01	B	10.00	5.03E+03	1.8596E+14	30	1.53E+16	1.06E+19	1.86E+14	H		
Ho-166	2.42E-01	6.53E+00	4.00E-01	0.60	2.60E+04	9.30E-06	4.29E-03	2.80E-02	A	10.00	2.33E+03	8.6175E+13	30	7.80E+17	2.42E+11	2.42E+11			S
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	10.00	2.87E+04	1.0625E+15	30	1.92E+16	2.61E+35	1.06E+15	H		
I-129	1.95E-04	5.27E-03	unlimited	unlimited	6.50E-06	3.00E+01	4.68E-04	2.47E-06	B	10.00	2.14E+04	7.9067E+14	30	1.95E+08	4.57E+35	1.95E+08		M	
I-131	1.34E+00	3.62E+01	7.00E-01	1.91	4.60E+03	2.91E-04	3.39E-03	1.23E-01	B	10.00	2.95E+03	1.0920E+14	30	1.38E+17	1.34E+12	1.34E+12			S
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	10.00	3.85E+03	1.4234E+14	30	4.50E+17	1.38E+22	1.42E+14	H		
Ir-192	9.60E-01	2.59E+01	6.00E-01	1.60	3.40E+02	2.82E-03	6.13E-03	1.59E-01	B	10.00	1.63E+03	6.0404E+13	30	1.02E+16	9.60E+11	9.60E+11			S
Ir-194	2.58E-01	6.96E+00	3.00E-01	0.86	3.10E+04	8.31E-06	5.35E-03	3.72E-02	A	10.00	1.87E+03	6.9220E+13	30	9.30E+17	2.58E+11	2.58E+11			S
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	10.00	9.27E+03	3.4307E+14	30	1.23E+17	1.21E+19	3.43E+14	H		
Mo-99	2.80E-01	7.58E+00	6.00E-01	0.47	1.80E+04	1.56E-05	3.27E-03	2.48E-02	A	10.00	3.06E+03	1.1324E+14	30	5.40E+17	2.80E+11	2.80E+11			S
Na-24	7.80E-04	2.11E-02	2.00E-01	0.00	3.20E+05	2.44E-09	2.77E-02	5.85E-04	A	10.00	3.61E+02	1.3351E+13	30	9.60E+18	7.80E+08	7.80E+08			S
Np-237	7.80E-04	2.11E-02	2.00E-03	0.39	2.60E-05	3.00E+01	2.88E-02	6.07E-04	A	10.00	3.47E+02	1.2857E+13	30	7.80E+08	6.93E+18	7.80E+08		M	
P-32	1.90E-02	5.12E-01	5.00E-01	0.04	1.10E+04	1.72E-06	4.12E-03	2.11E-03	A	10.00	2.43E+03	8.9819E+13	30	3.30E+17	1.90E+10	1.90E+10			S
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	10.00	2.20E+04	8.1482E+14	30	1.74E+17	2.37E+23	8.15E+14	H		
Pb-203	1.45E+01	3.91E+02	3.00E+00	4.83	1.10E+04	1.32E-03	2.14E-03	8.35E-01	B	10.00	4.68E+03	1.7328E+14	30	3.30E+17	1.45E+13	1.45E+13			S
Pb-210	8.40E+01	2.27E+03	5.00E-02	1680.00	2.80E+00	3.00E+01	2.31E-04	5.24E-01	B	10.00	4.34E+04	1.6045E+15	30	8.40E+13	3.31E+15	8.40E+13		M	
Pd-109	1.73E+02	4.67E+03	5.00E-01	345.39	7.90E+04	2.19E-03	2.14E-03	1.00E+01	B	10.00	4.67E+03	1.7270E+14	30	2.37E+18	1.17E+15	1.73E+14	H		
Ra-223	8.46E-01	2.29E+01	7.00E-03	120.84	1.90E+03	4.45E-04	3.50E-02	8.00E-01	B	10.00	2.86E+02	1.0580E+13	30	5.70E+16	8.46E+11	8.46E+11			S
Ra-224	3.33E-03	8.99E-02	2.00E-02	0.17	5.90E+03	5.64E-07	3.37E-02	3.03E-03	A	10.00	2.97E+02	1.0975E+13	30	1.77E+17	3.33E+09	3.33E+09			S
Ra-226	3.62E-03	9.79E-02	3.00E-03	1.21	3.70E-02	9.79E-02	2.84E-02	2.78E-03	B	10.00	3.52E+02	1.3031E+13	30	1.11E+12	3.62E+09	3.62E+09			S
Re-186	1.38E+02	3.74E+03	6.00E-01	230.66	6.90E+03	2.01E-02	2.14E-03	8.00E+00	B	10.00	4.68E+03	1.7303E+14	30	2.07E+17	1.38E+14	1.38E+14			S
Re-188	5.74E-01	1.55E+01	4.00E-01	1.43	3.60E+04	1.59E-05	4.97E-03	7.70E-02	B	10.00	2.01E+03	7.4517E+13	30	1.08E+18	5.74E+11	5.74E+11			S
Rh-105	2.71E+02	7.31E+03	8.00E-01	338.13	3.10E+04	8.73E-03	1.37E-03	1.00E+01	B	10.00	7.31E+03	2.7051E+14	30	9.30E+17	1.69E+17	2.71E+14	H		
Se-75	1.54E+02	4.16E+03	3.00E+00	51.27	5.40E+02	2.85E-01	2.41E-03	1.00E+01	B	10.00	4.16E+03	1.5381E+14	30	1.62E+16	6.39E+14	1.54E+14	H		
Sm-153	1.90E+02	5.15E+03	6.00E-01	317.41	1.60E+04	1.19E-02	1.94E-03	1.00E+01	B	10.00	5.15E+03	1.9045E+14	30	4.80E+17	9.33E+15	1.90E+14	H		
Sr-89	1.07E+02	2.89E+03	6.00E-01	178.41	1.10E+03	9.73E-02	3.46E-03	1.00E+01	B	10.00	2.89E+03	1.0704E+14	30	3.30E+16	1.11E+14	1.07E+14	H		
Sr-90	1.62E+01	4.37E+02	3.00E-01	53.92	5.10E+00	3.17E+00	3.46E-03	1.51E+00	B	10.00	2.89E+03	1.0704E+14	30	1.53E+14	1.62E+13	1.62E+13			S
Tb-161	3.19E+02	8.62E+03	2.00E-02	15948.28	4.35E+03	7.33E-02	1.16E-03	1.00E+01	B	10.00	8.62E+03	3.1897E+14	30	1.31E+17	6.57E+17	3.19E+14	H		
Th-227	1.79E+00	4.85E+01	5.00E-03	358.70	1.10E+03	1.63E-03	3.59E-02	1.74E+00	B	10.00	2.79E+02	1.0316E+13	30	3.30E+16	1.79E+12	1.79E+12			S
Th-228	2.53E-03	6.84E-02	1.00E-03	2.53	3.00E+01	8.44E-05	3.21E-02	2.20E-03	B	10.00	3.11E+02	1.1512E+13	30	9.00E+14	2.53E+09	2.53E+09			S
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	10.00	1.31E+04	4.8362E+14	30	2.37E+17	1.11E+30	4.84E+14	H		
W-187	1.96E-01	5.31E+00	3.00E-01	0.65	2.60E+04	7.55E-06	4.54E-03	2.41E-02	A	10.00	2.20E+03	8.1534E+13	30	7.80E+17	1.96E+11	1.96E+11			S
W-188	6.02E-01	1.63E+01	6.00E-01	1.00	3.70E+02	1.63E-03	5.98E-04	9.73E-03	B	10.00	1.67E+04	6.1860E+14	30	1.11E+16	6.02E+11	6.02E+11			S
Y-90	8.76E-03	2.37E-01	3.00E-01	0.03	2.00E+04	4.38E-07	5.54E-03	1.31E-03	A	10.00	1.80E+03	6.6774E+13	30	6.00E+17	8.76E+09	8.76E+09			S
Yb-169	1.47E+02	3.98E+03	1.00E+00	147.37	8.90E+02	1.66E-01	2.51E-03	1.00E+01	B	10.00	3.98E+03	1.4737E+14	30	2.67E+16	6.46E+17	1.47E+14	H		
Yb-175	3.69E+02	9.96E+03	9.00E-01	409.64	6.60E+03	5.59E-02	1.00E-03	1.00E+01	B	10.00	9.96E+03	3.6867E+14	30	1.98E+17	1.41E+15	3.69E+14	H		
Max	2.24E+03	6.05E+04		1.59E+04		3.00E+01		1.00E+01											

Notes

Column	
1	Identifies nuclide
2	Package activity limit for this Contents Type - from Col 17
3	Calculated from Bq amount in Col 2
4	A2 from 10CFR71
5	# of A2's of nuclide at package activity limit
6	Specific activity from 10CFR71
7	Mass of nuclide at package activity limit
8	Heat generation rate of nuclide - from Microshield.
9	Heat output of nuclide at package activity limit
10	Package Type [A or B] based on individual nuclide limit
11	Mass limit of nuclide based on package heat limit
12	Calculated from limit in Col 11
13	Calculated from Bq amount in Col 12
14	Mass limit of nuclide based on capacity of insert
15	Calculated from Bq amount in Col 14

Colour codes

- Radionuclides
- Package limit
- Physics data
- Contents limit based on heat, mass or shielding

16	Package shielding limit
17	Package limit = least of heat, mass and shielding limits in Cols 13, 15 & 16
18	H shown where package limit is Heat limit
19	M shown where package limit is Mass limit
20	S shown where package limit is Shielding limit

Table 4 Activity Limits for Contents Type 2 - CT-2 - Solid in light tungsten insert – Design No 3983

Contents Type 2 - CT-2 - Solid in light tungsten insert

										Package limits calulations for each nuclide									
										Contents heat limit			Contents mass limit		Package shielding limit	Package limit			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Nuclide	Max	Activity	A2	# A2s	Spec Ac	Mass	Heat gen	Heat output	PackageType	Mass		Act	Mass	Act	Act	Act	Code		
	TBq	Ci	TBq		TBq/g	g	W/Ci	W	A or B	W	Ci	Bq	g	Bq	Bq	Bq	H	M	S
Ac-225	8.35E-02	2.26E+00	6.00E-03	13.92	2.10E+03	3.98E-05	3.46E-02	7.80E-02	B	10.00	2.89E+02	1.0702E+13	200	4.20E+17	8.35E+10	8.35E+10			S
Ac-227	4.70E-01	1.27E+01	9.00E-05	5217.15	2.70E+00	1.74E-01	4.72E-04	5.99E-03	B	10.00	2.12E+04	7.8377E+14	200	5.40E+14	4.70E+11	4.70E+11			S
Ac-228	6.90E-03	1.86E-01	5.00E-01	0.01	8.40E+04	8.21E-08	8.04E-03	1.50E-03	A	10.00	1.24E+03	4.6023E+13	200	1.68E+19	6.90E+09	6.90E+09			S
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	10.00	3.05E+02	1.1276E+13	200	2.60E+13	1.88E+19	1.13E+13	H		
As-77	7.84E+01	2.12E+03	7.00E-01	111.95	3.90E+04	2.01E-03	1.41E-03	2.98E+00	B	10.00	7.12E+03	2.6329E+14	200	7.80E+18	7.84E+13	7.84E+13			S
Au-198	1.32E+00	3.56E+01	6.00E-01	2.19	9.00E+03	1.46E-04	4.34E-03	1.54E-01	B	10.00	2.31E+03	8.5301E+13	200	1.80E+18	1.32E+12	1.32E+12			S
Ba-131	2.56E-01	6.93E+00	2.00E+00	0.13	3.10E+03	8.27E-05	3.06E-03	2.12E-02	A	10.00	3.27E+03	1.2111E+14	200	6.20E+17	2.56E+11	2.56E+11			S
C-14	3.20E+01	8.65E+02	3.00E+00	10.67	1.60E-01	2.00E+02	2.93E-04	2.54E-01	B	10.00	3.41E+04	1.2617E+15	200	3.20E+13	4.26E+36	3.20E+13		M	
Co-60	1.53E-03	4.12E-02	4.00E-01	0.00	4.20E+01	3.63E-05	1.54E-02	6.36E-04	A	10.00	6.48E+02	2.3990E+13	200	8.40E+15	1.53E+09	1.53E+09			S
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	10.00	6.05E+04	2.2373E+15	200	7.60E+17	4.54E+35	2.24E+15	H		
Cs-134	1.29E-02	3.49E-01	7.00E-01	0.02	4.80E+01	2.69E-04	1.02E-02	3.55E-03	A	10.00	9.82E+02	3.6349E+13	200	9.60E+15	1.29E+10	1.29E+10			S
Cs-137	7.09E-02	1.92E+00	6.00E-01	0.12	3.20E+00	2.22E-02	1.01E-03	1.94E-03	A	10.00	9.88E+03	3.6554E+14	200	6.40E+14	7.09E+10	7.09E+10			S
Cu-67	2.30E+02	6.22E+03	7.00E-01	328.92	2.80E+04	8.22E-03	1.61E-03	1.00E+01	B	10.00	6.22E+03	2.3024E+14	200	5.60E+18	1.21E+16	2.30E+14	H		
Hg-203	1.86E+02	5.03E+03	1.00E+00	185.96	5.10E+02	3.65E-01	1.99E-03	1.00E+01	B	10.00	5.03E+03	1.8596E+14	200	1.02E+17	8.26E+17	1.86E+14	H		
Ho-166	1.66E-01	4.49E+00	4.00E-01	0.42	2.60E+04	6.40E-06	4.29E-03	1.93E-02	A	10.00	2.33E+03	8.6175E+13	200	5.20E+18	1.66E+11	1.66E+11			S
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	10.00	2.87E+04	1.0625E+15	200	1.28E+17	2.44E+35	1.06E+15	H		
I-129	1.30E-03	3.51E-02	unlimited	unlimited	6.50E-06	2.00E+02	4.68E-04	1.64E-05	B	10.00	2.14E+04	7.9067E+14	200	1.30E+09	4.28E+35	1.30E+09		M	
I-131	6.71E-01	1.81E+01	7.00E-01	0.96	4.60E+03	1.46E-04	3.39E-03	6.14E-02	A	10.00	2.95E+03	1.0920E+14	200	9.20E+17	6.71E+11	6.71E+11			S
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	10.00	3.85E+03	1.4234E+14	200	3.00E+18	4.81E+20	1.42E+14	H		
Ir-192	4.30E-01	1.16E+01	6.00E-01	0.72	3.40E+02	1.27E-03	6.13E-03	7.12E-02	A	10.00	1.63E+03	6.0404E+13	200	6.80E+16	4.30E+11	4.30E+11			S
Ir-194	1.66E-01	4.48E+00	3.00E-01	0.55	3.10E+04	5.35E-06	5.35E-03	2.40E-02	A	10.00	1.87E+03	6.9220E+13	200	6.20E+18	1.66E+11	1.66E+11			S
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	10.00	9.27E+03	3.4307E+14	200	8.20E+17	1.73E+18	3.43E+14	H		
Mo-99	1.52E-01	4.12E+00	6.00E-01	0.25	1.80E+04	8.47E-06	3.27E-03	1.35E-02	A	10.00	3.06E+03	1.1324E+14	200	3.60E+18	1.52E+11	1.52E+11			S
Na-24	5.66E-04	1.53E-02	2.00E-01	0.00	3.20E+05	1.77E-09	2.77E-02	4.24E-04	A	10.00	3.61E+02	1.3351E+13	200	6.40E+19	5.66E+08	5.66E+08			S
Np-237	5.20E-03	1.41E-01	2.00E-03	2.60	2.60E-05	2.00E+02	2.88E-02	4.04E-03	B	10.00	3.47E+02	1.2857E+13	200	5.20E+09	6.49E+18	5.20E+09		M	
P-32	1.35E-02	3.64E-01	5.00E-01	0.03	1.10E+04	1.22E-06	4.12E-03	1.50E-03	A	10.00	2.43E+03	8.9819E+13	200	2.20E+18	1.35E+10	1.35E+10			S
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	10.00	2.20E+04	8.1482E+14	200	1.16E+18	9.18E+21	8.15E+14	H		
Pb-203	7.34E+00	1.98E+02	3.00E+00	2.45	1.10E+04	6.67E-04	2.14E-03	4.24E-01	B	10.00	4.68E+03	1.7328E+14	200	2.20E+18	7.34E+12	7.34E+12			S
Pb-210	5.60E+02	1.51E+04	5.00E-02	11200.00	2.80E+00	2.00E+02	2.31E-04	3.49E+00	B	10.00	4.34E+04	1.6045E+15	200	5.60E+14	1.87E+15	5.60E+14		M	
Pd-109	1.73E+02	4.67E+03	5.00E-01	345.39	7.90E+04	2.19E-03	2.14E-03	1.00E+01	B	10.00	4.67E+03	1.7270E+14	200	1.58E+19	4.58E+14	1.73E+14	H		
Ra-223	4.74E-01	1.28E+01	7.00E-03	67.72	1.90E+03	2.50E-04	3.50E-02	4.48E-01	B	10.00	2.86E+02	1.0580E+13	200	3.80E+17	4.74E+11	4.74E+11			S
Ra-224	2.44E-03	6.60E-02	2.00E-02	0.12	5.90E+03	4.14E-07	3.37E-02	2.23E-03	A	10.00	2.97E+02	1.0975E+13	200	1.18E+18	2.44E+09	2.44E+09			S
Ra-226	2.54E-03	6.85E-02	3.00E-03	0.85	3.70E-02	6.85E-02	2.84E-02	1.95E-03	A	10.00	3.52E+02	1.3031E+13	200	7.40E+12	2.54E+09	2.54E+09			S
Re-186	7.21E+01	1.95E+03	6.00E-01	120.21	6.90E+03	1.05E-02	2.14E-03	4.17E+00	B	10.00	4.68E+03	1.7303E+14	200	1.38E+18	7.21E+13	7.21E+13			S
Re-188	3.55E-01	9.59E+00	4.00E-01	0.89	3.60E+04	9.86E-06	4.97E-03	4.76E-02	A	10.00	2.01E+03	7.4517E+13	200	7.20E+18	3.55E+11	3.55E+11			S
Rh-105	2.71E+02	7.31E+03	8.00E-01	338.13	3.10E+04	8.73E-03	1.37E-03	1.00E+01	B	10.00	7.31E+03	2.7051E+14	200	6.20E+18	2.33E+16	2.71E+14	H		
Se-75	1.54E+02	4.16E+03	3.00E+00	51.27	5.40E+02	2.85E-01	2.41E-03	1.00E+01	B	10.00	4.16E+03	1.5381E+14	200	1.08E+17	1.70E+14	1.54E+14	H		
Sm-153	1.90E+02	5.15E+03	6.00E-01	317.41	1.60E+04	1.19E-02	1.94E-03	1.00E+01	B	10.00	5.15E+03	1.9045E+14	200	3.20E+18	2.76E+15	1.90E+14	H		
Sr-89	6.64E+01	1.79E+03	6.00E-01	110.61	1.10E+03	6.03E-02	3.46E-03	6.20E+00	B	10.00	2.89E+03	1.0704E+14	200	2.20E+17	6.64E+13	6.64E+13			S
Sr-90	6.89E+00	1.86E+02	3.00E-01	22.97	5.10E+00	1.35E+00	3.46E-03	6.44E-01	B	10.00	2.89E+03	1.0704E+14	200	1.02E+15	6.89E+12	6.89E+12			S
Tb-161	2.99E+02	8.08E+03	2.00E-02	14955.54	4.35E+03	6.88E-02	1.16E-03	9.38E+00	B	10.00	8.62E+03	3.1897E+14	200	8.70E+17	2.99E+14	2.99E+14			S
Th-227	1.01E+00	2.72E+01	5.00E-03	201.06	1.10E+03	9.14E-04	3.59E-02	9.75E-01	B	10.00	2.79E+02	1.0316E+13	200	2.20E+17	1.01E+12	1.01E+12			S
Th-228	1.86E-03	5.02E-02	1.00E-03	1.86	3.00E+01	6.20E-05	3.21E-02	1.61E-03	B	10.00	3.11E+02	1.1512E+13	200	6.00E+15	1.86E+09	1.86E+09			S
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	10.00	1.31E+04	4.8362E+14	200	1.58E+18	1.04E+30	4.84E+14	H		
W-187	1.01E-01	2.74E+00	3.00E-01	0.34	2.60E+04	3.90E-06	4.54E-03	1.24E-02	A	10.00	2.20E+03	8.1534E+13	200	5.20E+18	1.01E+11	1.01E+11			S
W-188	3.72E-01	1.01E+01	6.00E-01	0.62	3.70E+02	1.01E-03	5.98E-04	6.02E-03	A	10.00	1.67E+04	6.1860E+14	200	7.40E+16	3.72E+11	3.72E+11			S
Y-90	6.41E-03	1.73E-01	3.00E-01	0.02	2.00E+04	3.20E-07	5.54E-03	9.59E-04	A	10.00	1.80E+03	6.6774E+13	200	4.00E+18	6.41E+09	6.41E+09			S
Yb-169	1.47E+02	3.98E+03	1.00E+00	147.37	8.90E+02	1.66E-01	2.51E-03	1.00E+01	B	10.00	3.98E+03	1.4737E+14	200	1.78E+17	9.51E+16	1.47E+14	H		
Yb-175	3.65E+02	9.87E+03	9.00E-01	405.84	6.60E+03	5.53E-02	1.00E-03	9.91E+00	B	10.00	9.96E+03	3.6867E+14	200	1.32E+18	3.65E+14	3.65E+14			S
Max	2.24E+03	6.05E+04		1.50E+04		2.00E+02		1.00E+01											

Notes

Column	
1	Identifies nuclide
2	Package activity limit for this Contents Type - from Col 17
3	Calculated from Bq amount in Col 2
4	A2 from 10CFR71
5	# of A2's of nuclide at package activity limit
6	Specific activity from 10CFR71
7	Mass of nuclide at package activity limit
8	Heat generation rate of nuclide - from Microshield.
9	Heat output of nuclide at package activity limit
10	Package Type [A or B] based on individual nuclide limit
11	Mass limit of nuclide based on package heat limit
12	Calculated from limit in Col 11
13	Calculated from Bq amount in Col 12
14	Mass limit of nuclide based on capacity of insert
15	Calculated from Bq amount in Col 14
16	Package shielding limit

Colour codes

- Radionuclides
- Package limit
- Physics data
- Contents limit based on heat, mass or shielding

17	Package limit = least of heat, mass and shielding limits in Cols 13, 15 & 16
18	H shown where package limit is Heat limit
19	M shown where package limit is Mass limit
20	S shown where package limit is Shielding limit

Table 5 Activity Limits for Contents Type 3 - CT-3 - Solid in steel insert – Design No 3986

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

										Package limits calculations for each nuclide									
										Contents heat limit			Contents mass limit		Package shielding limit	Package limit			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Nuclide	Max	Activity	A2	# A2s	Spec Ac	Mass	Heat gen	Heat output	PackageType	Mass		Act	Mass	Act	Act	Act	Code		
	TBq	Ci	TBq		TBq/g	g	W/Ci	W	A or B	W	Ci	Bq	g	Bq	Bq	Bq	H	M	S
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	10.00	2.89E+02	1.0702E+13	800	1.68E+18	2.08E+10	2.08E+10			S
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	10.00	2.12E+04	7.8377E+14	800	2.16E+15	5.40E+10	5.40E+10			S
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	10.00	1.24E+03	4.6023E+13	800	6.72E+19	1.41E+09	1.41E+09			S
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	10.00	3.05E+02	1.1276E+13	800	1.04E+14	1.18E+17	1.13E+13	H		
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	10.00	7.12E+03	2.6329E+14	800	3.12E+19	2.85E+12	2.85E+12			S
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	10.00	2.31E+03	8.5301E+13	800	7.20E+18	7.61E+10	7.61E+10			S
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	10.00	3.27E+03	1.2111E+14	800	2.48E+18	2.31E+10	2.31E+10			S
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	10.00	4.33E+03	1.6017E+14	800	3.68E+18	2.74E+10	2.74E+10			S
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	10.00	3.41E+04	1.2617E+15	800	1.28E+14	1.47E+29	1.28E+14		M	
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	10.00	6.48E+02	2.3990E+13	800	3.36E+16	3.68E+08	3.68E+08			S
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	10.00	6.05E+04	2.2373E+15	800	3.04E+18	3.59E+35	2.24E+15	H		
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	10.00	9.82E+02	3.6349E+13	800	3.84E+16	1.62E+09	1.62E+09			S
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	10.00	9.88E+03	3.6554E+14	800	2.56E+15	5.85E+09	5.85E+09			S
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	10.00	6.22E+03	2.3024E+14	800	2.24E+19	7.67E+13	7.67E+13			S
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	10.00	5.03E+03	1.8596E+14	800	4.08E+17	6.03E+13	6.03E+13			S
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	10.00	2.33E+03	8.6175E+13	800	2.08E+19	4.46E+10	4.46E+10			S
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	10.00	2.87E+04	1.0625E+15	800	5.12E+17	1.93E+35	1.06E+15	H		
I-129	5.20E-03	1.41E-01	unlimited	unlimited	6.50E-06	8.00E+02	4.68E-04	6.58E-05	B	10.00	2.14E+04	7.9067E+14	800	5.20E+09	3.38E+35	5.20E+09		M	
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	10.00	2.95E+03	1.0920E+14	800	3.68E+18	5.03E+10	5.03E+10			S
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	10.00	3.85E+03	1.4234E+14	800	1.20E+19	1.70E+15	1.42E+14	H		
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	10.00	1.63E+03	6.0404E+13	800	2.72E+17	2.10E+10	2.10E+10			S
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	10.00	1.87E+03	6.9220E+13	800	2.48E+19	3.35E+10	3.35E+10			S
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	10.00	9.27E+03	3.4307E+14	800	3.28E+18	1.29E+15	3.43E+14	H		
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	10.00	3.06E+03	1.1324E+14	800	1.44E+19	1.70E+10	1.70E+10			S
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	10.00	3.61E+02	1.3351E+13	800	2.56E+20	1.79E+08	1.79E+08			S
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	10.00	3.47E+02	1.2857E+13	800	2.08E+10	5.02E+18	2.08E+10		M	
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	10.00	2.43E+03	8.9819E+13	800	8.80E+18	2.20E+10	2.20E+10			S
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	10.00	2.20E+04	8.1482E+14	800	4.64E+18	1.37E+17	8.15E+14	H		
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	10.00	4.68E+03	1.7328E+14	800	8.80E+18	5.70E+11	5.70E+11			S
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	10.00	4.34E+04	1.6045E+15	800	2.24E+15	2.39E+14	2.39E+14			S
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	10.00	4.67E+03	1.7270E+14	800	6.32E+19	1.50E+13	1.50E+13			S
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	10.00	3.18E+02	1.1783E+13	800	1.33E+17	1.97E+14	1.18E+13	H		
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	10.00	2.86E+02	1.0580E+13	800	1.52E+18	5.46E+10	5.46E+10			S
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	10.00	2.97E+02	1.0975E+13	800	4.72E+18	7.83E+08	7.83E+08			S
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	10.00	3.52E+02	1.3031E+13	800	2.96E+13	6.81E+08	6.81E+08			S
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	10.00	4.68E+03	1.7303E+14	800	5.52E+18	6.93E+12	6.93E+12			S
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	10.00	2.01E+03	7.4517E+13	800	2.88E+19	6.02E+10	6.02E+10			S
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	10.00	7.31E+03	2.7051E+14	800	2.48E+19	1.48E+13	1.48E+13			S
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	10.00	4.16E+03	1.5381E+14	800	4.32E+17	1.28E+12	1.28E+12			S
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	10.00	5.15E+03	1.9045E+14	800	1.28E+19	3.15E+13	3.15E+13			S
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	10.00	2.89E+03	1.0704E+14	800	8.80E+17	1.06E+13	1.06E+13			S
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	10.00	2.89E+03	1.0704E+14	800	4.08E+15	8.94E+11	8.94E+11			S
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	10.00	8.62E+03	3.1897E+14	800	3.48E+18	1.69E+13	1.69E+13			S
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	10.00	2.79E+02	1.0316E+13	800	8.80E+17	1.16E+11	1.16E+11			S
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	10.00	3.11E+02	1.1512E+13	800	2.40E+16	5.96E+08	5.96E+08			S
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	10.00	1.31E+04	4.8362E+14	800	6.32E+18	1.16E+25	4.84E+14	H		
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	10.00	2.20E+03	8.1534E+13	800	2.08E+19	8.88E+09	8.88E+09			S
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	10.00	1.67E+04	6.1860E+14	800	2.96E+17	6.31E+10	6.31E+10			S
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	10.00	1.80E+03	6.6774E+13	800	1.60E+19	6.02E+09	6.02E+09			S
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	10.00	3.98E+03	1.4737E+14	800	7.12E+17	5.06E+13	5.06E+13			S
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	10.00	9.96E+03	3.6867E+14	800	5.28E+18	2.56E+12	2.56E+12			S
Max	2.24E+03	6.05E+04		1.13E+04		8.00E+02		1.00E+01											

Notes

Column

1	Identifies nuclide
2	Package activity limit for this Contents Type - from Col 17
3	Calculated from Bq amount in Col 2
4	A2 from 10CFR71
5	# of A2's of nuclide at package activity limit
6	Specific activity from 10CFR71
7	Mass of nuclide at package activity limit
8	Heat generation rate of nuclide - from Microshield.

Colour codes

- Radionuclides
- Package limit
- Physics data
- Contents limit based on heat, mass or shielding

9	Heat output of nuclide at package activity limit
10	Package Type [A or B] based on individual nuclide limit
11	Mass limit of nuclide based on package heat limit
12	Calculated from limit in Col 11
13	Calculated from Bq amount in Col 12
14	Mass limit of nuclide based on capacity of insert
15	Calculated from Bq amount in Col 14
16	Package shielding limit
17	Package limit = least of heat, mass and shielding limits in Cols 13, 15 & 16
18	H shown where package limit is Heat limit
19	M shown where package limit is Mass limit
20	S shown where package limit is Shielding limit

Table 6 Activity Limits for Contents Type 4 - CT-4 - Liquid in light tungsten insert – Design No 3983

Contents Type 4 - CT-4 - Liquid in light tungsten insert

										Package limits calulations for each nuclide									
										Contents heat limit			Contents mass limit		Package shielding limit	Package limit		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Nuclide	Max	Activity	A2	# A2s	Spec Ac	Mass	Heat gen	Heat output	PackageType	Mass		Act	Mass	Act	Act	Act	Code		
	TBq	Ci	TBq		TBq/g	g	W/Ci	W	A or B	W	Ci	Bq	g	Bq	Bq	Bq	H	M	S
Ho-166-Liquid	2.22E+01	6.00E+02	4.00E-01	55.50	2.60E+04	8.54E-04	4.29E-03	2.58E+00	B	5.00	1.16E+03	4.3087E+13	200	5.20E+18	2.22E+13	2.22E+13			S
Lu-177-Liquid	1.72E+02	4.64E+03	7.00E-01	245.05	4.10E+03	4.18E-02	1.08E-03	5.00E+00	B	5.00	4.64E+03	1.7153E+14	200	8.20E+17	1.99E+15	1.72E+14	H		
Mo-99-Liquid	7.13E+00	1.93E+02	6.00E-01	11.88	1.80E+04	3.96E-04	3.27E-03	6.30E-01	B	5.00	1.53E+03	5.6620E+13	200	3.60E+18	7.13E+12	7.13E+12			S
Se-75-Liquid	6.94E+01	1.88E+03	3.00E+00	23.13	5.40E+02	1.29E-01	2.41E-03	4.51E+00	B	5.00	2.08E+03	7.6907E+13	200	1.08E+17	6.94E+13	6.94E+13			S
Tl-201-Liquid	2.42E+02	6.54E+03	4.00E+00	60.45	7.90E+03	3.06E-02	7.65E-04	5.00E+00	B	5.00	6.54E+03	2.4181E+14	200	1.58E+18	8.39E+15	2.42E+14	H		
Max	2.42E+02	6.54E+03		2.45E+02		1.29E-01		5.00E+00											

Contents Type 4 - CT-4 - Liquid in light tungsten insert

Package limits calulations for each nuclide

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

Notes

Column	
1	Identifies nuclide
2	Package activity limit for this Contents Type - from Col 17
3	Calculated from Bq amount in Col 2
4	A2 from 10CFR71
5	# of A2's of nuclide at package activity limit
6	Specific activity from 10CFR71
7	Mass of nuclide at package activity limit
8	Heat generation rate of nuclide - from Microshield.
9	Heat output of nuclide at package activity limit
10	Package Type [A or B] based on individual nuclide limit
11	Mass limit of nuclide based on package heat limit
12	Calculated from limit in Col 11
13	Calculated from Bq amount in Col 12
14	Mass limit of nuclide based on capacity of insert
15	Calculated from Bq amount in Col 14
16	Package shielding limit
17	Package limit = least of heat, mass and shielding limits in Cols 13, 15 & 16
18	H shown where package limit is Heat limit
19	M shown where package limit is Mass limit
20	S shown where package limit is Shielding limit

Colour codes

	Radionuclides
	Package limit
	Physics data
	Contents limit based on heat, mass or shielding

Table 7 Activity Limits for Contents Type 5 - CT-5 - Liquid in steel insert – Design No 3986

Contents Type 5 - CT-5 - Liquid in steel insert

										Package limits calulations for each nuclide									
										Contents heat limit			Contents mass limit		Package shielding limit	Package limit			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Nuclide	Max	Activity	A2	# A2s	Spec Ac	Mass	Heat gen	Heat output	PackageType	Mass		Act	Mass	Act	Act	Act	Code		
	TBq	Ci	TBq		TBq/g	g	W/Ci	W	A or B	W	Ci	Bq	g	Bq	Bq	Bq	H	M	S
Ho-166-Liquid	2.22E+01	6.00E+02	4.00E-01	55.50	2.60E+04	8.54E-04	4.29E-03	2.58E+00	B	5.00	1.16E+03	4.3087E+13	800	2.08E+19	2.22E+13	2.22E+13			S
Lu-177-Liquid	1.72E+02	4.64E+03	7.00E-01	245.05	4.10E+03	4.18E-02	1.08E-03	5.00E+00	B	5.00	4.64E+03	1.7153E+14	800	3.28E+18	1.99E+15	1.72E+14	H		
Mo-99-Liquid	7.13E+00	1.93E+02	6.00E-01	11.88	1.80E+04	3.96E-04	3.27E-03	6.30E-01	B	5.00	1.53E+03	5.6620E+13	800	1.44E+19	7.13E+12	7.13E+12			S
Se-75-Liquid	6.94E+01	1.88E+03	3.00E+00	23.13	5.40E+02	1.29E-01	2.41E-03	4.51E+00	B	5.00	2.08E+03	7.6907E+13	800	4.32E+17	6.94E+13	6.94E+13			S
Tl-201-Liquid	2.42E+02	6.54E+03	4.00E+00	60.45	7.90E+03	3.06E-02	7.65E-04	5.00E+00	B	5.00	6.54E+03	2.4181E+14	800	6.32E+18	8.39E+15	2.42E+14	H		
Max	2.42E+02	6.54E+03		2.45E+02		1.29E-01		5.00E+00											

Notes

Column	
1	Identifies nuclide
2	Package activity limit for this Contents Type - from Col 17
3	Calculated from Bq amount in Col 2
4	A2 from 10CFR71
5	# of A2's of nuclide at package activity limit
6	Specific activity from 10CFR71
7	Mass of nuclide at package activity limit
8	Heat generation rate of nuclide - from Microshield.
9	Heat output of nuclide at package activity limit
10	Package Type [A or B] based on individual nuclide limit
11	Mass limit of nuclide based on package heat limit
12	Calculated from limit in Col 11
13	Calculated from Bq amount in Col 12
14	Mass limit of nuclide based on capacity of insert
15	Calculated from Bq amount in Col 14
16	Package shielding limit
17	Package limit = least of heat, mass and shielding limits in Cols 13, 15 & 16
18	H shown where package limit is Heat limit
19	M shown where package limit is Mass limit
20	S shown where package limit is Shielding limit

Colour codes

	Radionuclides
	Package limit
	Physics data
	Contents limit based on heat, mass or shielding

Table 8 Activity Limits for Contents Type 6 - CT-6 - Gas in light tungsten insert – Design No 3983

Contents Type 6 - CT-6 - Gas in light tungsten insert

											Package limits calulations for each nuclide											
											Contents heat limit			Contents mass limit		Gas limit	Shielding limit	Package limit				
1	2	3	4	5	6	7	7a	8	9	10	11	12	13	14	15	15a	16	17	18	19	19a	20
Nuclide	Max	Activity	A2	# A2s	Spec Ac	Mass	Volume	Heat gen	Heat output	Package Type	Mass		Act	Mass	Act	Act	Act	Act	Code			
	TBq	Ci	TBq		TBq/g	g	cc	W/Ci	W	A or B	W	Ci	Bq	g	Bq	Bq	Bq	Bq	H	M	L	S
Kr-79	2.00E-01	5.41E+00	2.00E-02	10.01	9.24E+04	2.17E-06	5.87E-04	1.67E-03	9.02E-03	B	10.00	5.99E+03	2.2176E+14	1	9.24E+16	3.07E+14	2.00E+11	2.00E+11				S
Xe-133	3.45E+02	9.33E+03	1.00E+01	34.51	6.90E+03	5.00E-02	8.66E+00	1.07E-03	1.00E+01	B	10.00	9.33E+03	3.4515E+14	1	6.90E+15	6.97E+15	2.87E+35	3.45E+14	H			
Max	3.45E+02	9.33E+03		3.45E+01		5.00E-02			1.00E+01													

Notes

Column	
1	Identifies nuclide
2	Package activity limit for this Contents Type - from Col 17
3	Calculated from Bq amount in Col 2
4	A2 from 10CFR71
5	# of A2's of nuclide at package activity limit
6	Specific activity from 10CFR71
7	Mass of nuclide at package activity limit
7a	Volume of nuclide at package activity limit
8	Heat generation rate of nuclide - from Microshield.
9	Heat output of nuclide at package activity limit
10	Package Type [A or B] based on individual nuclide limit
11	Mass limit of nuclide based on package heat limit
12	Calculated from limit in Col 11
13	Calculated from Bq amount in Col 12
14	Mass limit of nuclide based on capacity of insert
15	Calculated from Bq amount in Col 14
15a	Gas limit from CS 2009/07
16	Package shielding limit
17	Package limit = least of heat, mass and shielding limits in Cols 13, 15 & 16
18	H shown where package limit is Heat limit
19	M shown where package limit is Mass limit
19a	L shown where package limit is Gas Limit
20	S shown where package limit is Shielding limit

Colour codes

	Radionuclides
	Package limit
	Physics data
	Contents limit based on heat, mass or shielding

Table 9 Activity Limits for Contents Type 7 - CT-7 - Fissile solid in Normal Form in steel insert – Design No 3986

Contents Type 7 - CT-7 - Fissile solid in Normal Form in steel insert

										Package limits calulations for each nuclide									
										Contents heat limit			Contents mass limit		Package shielding limit	Package limit			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Nuclide	Max	Activity	A2	# A2s	Spec Ac	Mass	Heat gen	Heat output	PackageType	Mass		Act	Mass	Act	Act	Act	Code		
	TBq	Ci	TBq		TBq/g	g	W/Ci	W	A or B	W	Ci	Bq	g	Bq	Bq	Bq	H	M	S
Pu-238	1.14E+01	3.07E+02	1.00E-03	11354.22	6.30E-01	1.80E+01	3.26E-02	1.00E+01	B	10.00	3.07E+02	1.1354E+13	800	5.04E+14	2.99E+14	1.14E+13	H		
Pu-239	1.84E+00	4.97E+01	1.00E-03	1840.00	2.30E-03	8.00E+02	3.06E-02	1.52E+00	B	10.00	3.27E+02	1.2111E+13	800	1.84E+12	8.26E+20	1.84E+12		M	
Pu-240	6.72E+00	1.82E+02	1.00E-03	6720.00	8.40E-03	8.00E+02	3.06E-02	5.56E+00	B	10.00	3.27E+02	1.2086E+13	800	6.72E+12	1.15E+13	6.72E+12		M	
Pu-241	3.04E+03	8.22E+04	6.00E-02	50666.67	3.80E+00	8.00E+02	3.10E-05	2.55E+00	B	10.00	3.23E+05	1.1934E+16	800	3.04E+15	4.32E+18	3.04E+15		M	
U-235	6.40E-05	1.73E-03	unlimited	unlimited	8.00E-08	8.00E+02	2.71E-02	4.69E-05	B	10.00	3.69E+02	1.3646E+13	800	6.40E+07	3.60E+13	6.40E+07		M	
Max	3.04E+03	8.22E+04		5.07E+04		8.00E+02		1.00E+01											

Notes

Column	
1	Identifies nuclide
2	Package activity limit for this Contents Type - from Col 17
3	Calculated from Bq amount in Col 2
4	A2 from 10CFR71
5	# of A2's of nuclide at package activity limit
6	Specific activity from 10CFR71
7	Mass of nuclide at package activity limit
8	Heat generation rate of nuclide - from Microshield.
9	Heat output of nuclide at package activity limit
10	Package Type [A or B] based on individual nuclide limit
11	Mass limit of nuclide based on package heat limit
12	Calculated from limit in Col 11
13	Calculated from Bq amount in Col 12
14	Mass limit of nuclide based on capacity of insert
15	Calculated from Bq amount in Col 14
16	Package shielding limit
17	Package limit = least of heat, mass and shielding limits in Cols 13, 15 & 16
18	H shown where package limit is Heat limit
19	M shown where package limit is Mass limit
20	S shown where package limit is Shielding limit

Colour codes

- Radionuclides
- Package limit
- Physics data
- Contents limit based on heat, mass or shielding

Table 10 Activity Limits for Contents Type 8 - CT-8 - Fissile solid in Special Form in steel insert – Design No 3986

Contents Type 8 - CT-8 - Fissile solid in Special Form in steel insert

										Package limits calulations for each nuclide									
										Contents heat limit			Contents mass limit		Package shielding limit	Package limit			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Nuclide	Max	Activity	A2	# A2s	Spec Ac	Mass	Heat gen	Heat output	PackageType	Mass		Act	Mass	Act	Act	Act	Code		
	TBq	Ci	TBq		TBq/g	g	W/Ci	W	A or B	W	Ci	Bq	g	Bq	Bq	Bq	H	M	S
Pu-238	1.14E+01	3.07E+02	1.00E-03	11354.22	6.30E-01	1.80E+01	3.26E-02	1.00E+01	B	10.00	3.07E+02	1.1354E+13	800	5.04E+14	2.99E+14	1.14E+13	H		
Pu-239	1.84E+00	4.97E+01	1.00E-03	1840.00	2.30E-03	8.00E+02	3.06E-02	1.52E+00	B	10.00	3.27E+02	1.2111E+13	800	1.84E+12	8.26E+20	1.84E+12		M	
Pu-240	6.72E+00	1.82E+02	1.00E-03	6720.00	8.40E-03	8.00E+02	3.06E-02	5.56E+00	B	10.00	3.27E+02	1.2086E+13	800	6.72E+12	1.15E+13	6.72E+12		M	
Pu-241	3.04E+03	8.22E+04	6.00E-02	50666.67	3.80E+00	8.00E+02	3.10E-05	2.55E+00	B	10.00	3.23E+05	1.1934E+16	800	3.04E+15	4.32E+18	3.04E+15		M	
U-235	6.40E-05	1.73E-03	unlimited	unlimited	8.00E-08	8.00E+02	2.71E-02	4.69E-05	B	10.00	3.69E+02	1.3646E+13	800	6.40E+07	3.60E+13	6.40E+07		M	
Max	3.04E+03	8.22E+04		5.07E+04		8.00E+02		1.00E+01											

Notes

Column	
1	Identifies nuclide
2	Package activity limit for this Contents Type - from Col 17
3	Calculated from Bq amount in Col 2
4	A2 from 10CFR71
5	# of A2's of nuclide at package activity limit
6	Specific activity from 10CFR71
7	Mass of nuclide at package activity limit
8	Heat generation rate of nuclide - from Microshield.
9	Heat output of nuclide at package activity limit
10	Package Type [A or B] based on individual nuclide limit
11	Mass limit of nuclide based on package heat limit
12	Calculated from limit in Col 11
13	Calculated from Bq amount in Col 12
14	Mass limit of nuclide based on capacity of insert
15	Calculated from Bq amount in Col 14
16	Package shielding limit
17	Package limit = least of heat, mass and shielding limits in Cols 13, 15 & 16
18	H shown where package limit is Heat limit
19	M shown where package limit is Mass limit
20	S shown where package limit is Shielding limit

Colour codes

	Radionuclides
	Package limit
	Physics data
	Contents limit based on heat, mass or shielding