




**Package Contents Specification
for Safkeg-HS
Package Design No 3977A**

Title	Package Contents Specification for Safkeg-HS - Package Design No 3977A	Number	PCS 038
		Issue	H
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1 Specification of contents

1.1 General nature of contents

The Safkeg-HS 3977A package is designed as a Type B(U) general purpose package for radioactive material.

The package is designed for radioactive material that emits neutron, alpha, beta or gamma radiation.

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	HS-12x95-Tu Design No 3982	See Table 1-3-1	See Table 3
CT-2	Solid	HS-31x114-Tu Design No 3985	See Table 1-3-2	See Table 4
CT- 3	Liquid	HS-55x128-SS Design No 3987 with Titanium liner	See Table 1-3- 3	See Table 5
CT- 4	Liquid	HS-50x85-SS Design No 4081 with tungsten liner	See Table 1-3- 4	See Table 6

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

1.2 Shielding inserts

The shielding inserts specified in Section 1 of the SAR for Safkeg-HS 3977A [1] and listed in Table 1 above are required for all contents.

Under NCT and HAC, the shielding inserts, together with the user defined product containers, provide confinement of the solid or liquid radioactive material.

1.3 Radionuclides included

See Tables 3 to 10.

1.4 Quantity

The maximum mass (and volume for gases) of each radionuclide carried in Type B quantities is detailed in Table 2 and Tables 3 to [6](#) for specific contents types CT-1 to CT-[4](#).

1.5 Activity limit

The package activity limits for individual nuclides, according to the insert used, are given in Tables 3 to [6](#). 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-HS 3977A in Section 1.2.2 in the tables for contents types CT-1 to CT-[4](#).

2 Calculation of allowable contents

The package activity limit in Tables 3 to [6](#) is the least of the limits determined [based on](#) heat output, mass limit [and](#) shielding limit.

2.1 Heat limits

The heat limit for solid contents is 30 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 2).

Table 2 Maximum mass of the radionuclides

Shielding Insert	Mass of a steel cylinder that would fill the cavity of the insert (g)	Maximum mass of the radionuclides (g)
HS-12x95-Tu Design No 3982	90	45
HS-31x114-Tu Design No 3985	690	345
HS-55x128-SS Design No 3987 with titanium liner	1,810	905
HS-50x85-SS Design No 4081 with Tungsten liner	1,615	808

2.3 Shielding limit

The package design is such that the surface dose rate, as opposed to the TI, is the limiting factor under HAC. The shielding limits in Tables 3 to 10 for each radionuclide and each insert for solid contents, are based on an assessment in Report CTR 2011/01 [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 AMEC/SF6652/001 [3]. This shielding limit has been further adjusted to take into account some shielding calculation uncertainties as discussed in Croft report CTR 2013/09 [7].

For the liquid contents the surface dose rate has been determined in AMEC reports AMEC/CRM37327/TN_001 [8] for I-131 and AMEC/CRM42622/TN_001 for Mo-99.

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].

2.5 Criticality Limits

The quantities of fissile material are restricted to the limits defined in 10 CFR 71.15 and those listed in this document whichever is the limiting quantity for the contents.

3 References

- [1] CTR 2008/11, SARP for Safkeg-HS 3977A, Docket No. 71-9337
- [2] Croft, CTR 2011/01, Issue D, SAFKEG LS 3977A, Package Activity Limits Based on Shielding
- [3] AMEC/SF6652/001, Issue 2, Monte Carlo Modelling of Safkeg HS 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 2012/05, Issue A, SAFKEG-HS 3977A - Gas contents limit for leaktight condition
- [7] CTR 2013/09, Issue C, Uncertainties Associated with the Proposed Shielding Calculation Method for the SAFKEG-HS 3977A Package
- [8] AMEC/CRM37327/TN-001, Issue 1, HS Container Shielding Assessment with I-131
- [9] AMEC/CRM42622/TN-001, Issue 1, HS Container Shielding Assessment with Mo-99

Table 3 Activity Limits for Contents Type 1 - CT-1 - Solid in heavy tungsten insert – Design No 3982

1	2	3	4	5	6	7	8	9	10	Contents heat limit			Contents mass limit		Shielding limit	Package limit													
										Nuclide	Max Activity		A2	# A2s	Spec Ac	Mass	Heat gen	Heat output	Package Type	Heat output	Activity		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	2.51E+00	6.78E+01	6.00E-03	417.95	2.10E+03	1.19E-03	3.46E-02	2.34E+00	B	30.00	8.68E+02	3.2105E+13	45	9.45E+16	2.51E+12	2.51E+12			S										
Ac-227	7.24E-01	1.96E+01	9.00E-05	8049.19	2.70E+00	2.68E-01	4.72E-04	9.24E-03	B	30.00	6.35E+04	2.3513E+15	45	1.22E+14	7.24E+11	7.24E+11			S										
Ac-228	4.28E-01	1.16E+01	5.00E-01	0.86	8.40E+04	5.09E-06	8.04E-03	9.30E-02	A	30.00	3.73E+03	1.3807E+14	45	3.78E+18	4.28E+11	4.28E+11			S										
Am-241	3.58E+00	9.68E+01	1.00E-03	3581.11	1.30E-01	2.75E+01	3.28E-02	3.18E+00	B	30.00	9.14E+02	3.3828E+13	45	5.85E+12	3.58E+12	3.58E+12			S										
As-77	7.90E+02	2.13E+04	7.00E-01	1128.38	3.90E+04	2.03E-02	1.41E-03	3.00E+01	B	30.00	2.13E+04	7.8987E+14	45	1.76E+18	9.43E+19	7.90E+14	H												
Au-198	2.56E+02	6.92E+03	6.00E-01	426.50	9.00E+03	2.84E-02	4.34E-03	3.00E+01	B	30.00	6.92E+03	2.5590E+14	45	4.05E+17	6.99E+14	2.56E+14	H												
Ba-131	1.88E+02	5.08E+03	2.00E+00	94.05	3.10E+03	6.07E-02	3.06E-03	1.55E+01	B	30.00	9.82E+03	3.6334E+14	45	1.40E+17	1.88E+14	1.88E+14			S										
C-14	7.20E+00	1.95E+02	3.00E+00	2.40	1.60E-01	4.50E+01	2.93E-04	5.71E-02	B	30.00	1.02E+05	3.7850E+15	45	7.20E+12	6.92E+27	7.20E+12		M											
Co-60	2.38E-01	6.44E+00	4.00E-01	0.60	4.20E+01	5.68E-03	1.54E-02	9.94E-02	A	30.00	1.95E+03	7.1970E+13	45	1.89E+15	2.38E+11	2.38E+11			S										
Cs-131	6.71E+03	1.81E+05	3.00E+01	223.73	3.80E+03	1.77E+00	1.65E-04	3.00E+01	B	30.00	1.81E+05	6.7118E+15	45	1.71E+17	8.39E+35	6.71E+15	H												
Cs-134	7.05E+00	1.90E+02	7.00E-01	10.07	4.80E+01	1.47E-01	1.02E-02	1.94E+00	B	30.00	2.95E+03	1.0905E+14	45	2.16E+15	7.05E+12	7.05E+12			S										
Cs-137	1.44E+02	3.89E+03	6.00E-01	240.00	3.20E+00	4.50E+01	1.01E-03	3.94E+00	B	30.00	2.96E+04	1.0966E+15	45	1.44E+14	1.58E+15	1.44E+14		M											
Cu-67	6.91E+02	1.87E+04	7.00E-01	986.75	2.80E+04	2.47E-02	1.61E-03	3.00E+01	B	30.00	1.87E+04	6.9073E+14	45	1.26E+18	6.50E+25	6.91E+14	H												
Hg-203	3.57E+01	9.66E+02	1.00E+00	35.75	5.10E+02	7.01E-02	1.99E-03	1.92E+00	B	30.00	1.51E+04	5.5787E+14	45	2.30E+16	3.57E+13	3.57E+13			S										
Ho-166	2.04E+00	5.52E+01	4.00E-01	5.10	2.60E+04	7.85E-05	4.29E-03	2.37E-01	B	30.00	6.99E+03	2.5852E+14	45	1.17E+18	2.04E+12	2.04E+12			S										
I-125	3.19E+03	8.61E+04	3.00E+00	1062.52	6.40E+02	4.98E+00	3.48E-04	3.00E+01	B	30.00	8.61E+04	3.1875E+15	45	2.88E+16	4.49E+35	3.19E+15	H												
I-129	2.93E-04	7.91E-03	< 1	< 1	6.50E-06	4.50E+01	4.68E-04	3.70E-06	B	30.00	6.41E+04	2.3720E+15	45	2.93E+08	3.31E+26	2.93E+08		M											
I-131	3.28E+02	8.85E+03	7.00E-01	468.01	4.60E+03	7.12E-02	3.39E-03	3.00E+01	B	30.00	8.85E+03	3.2761E+14	45	2.07E+17	4.11E+15	3.28E+14	H												
In-111	4.27E+02	1.15E+04	3.00E+00	142.34	1.50E+04	2.85E-02	2.60E-03	3.00E+01	B	30.00	1.15E+04	4.2702E+14	45	6.75E+17	1.45E+28	4.27E+14	H												
Ir-192	1.81E+02	4.90E+03	6.00E-01	302.02	3.40E+02	5.33E-01	6.13E-03	3.00E+01	B	30.00	4.90E+03	1.8121E+14	45	1.53E+16	2.71E+15	1.81E+14	H												
Ir-194	3.87E+01	1.04E+03	3.00E-01	128.87	3.10E+04	1.25E-03	5.35E-03	5.59E+00	B	30.00	5.61E+03	2.0766E+14	45	1.40E+18	3.87E+13	3.87E+13			S										
Lu-177	1.03E+03	2.78E+04	7.00E-01	1470.30	4.10E+03	2.51E-01	1.08E-03	3.00E+01	B	30.00	2.78E+04	1.0292E+15	45	1.85E+17	1.56E+24	1.03E+15	H												
Mo-99	5.27E+01	1.42E+03	6.00E-01	87.87	1.80E+04	2.93E-03	3.27E-03	4.66E+00	B	30.00	9.18E+03	3.3972E+14	45	8.10E+17	5.27E+13	5.27E+13			S										
Na-24	2.63E-02	7.12E-01	2.00E-01	0.13	3.20E+05	8.23E-08	2.77E-02	1.97E-02	A	30.00	1.08E+03	4.0053E+13	45	1.44E+19	2.63E+10	2.63E+10			S										
Np-237	1.17E-03	3.16E-02	2.00E-03	0.59	2.60E-05	4.50E+01	2.88E-02	9.10E-04	A	30.00	1.04E+03	3.8570E+13	45	1.17E+09	3.58E+12	1.17E+09		M											
P-32	5.58E+00	1.51E+02	5.00E-01	11.15	1.10E+04	5.07E-04	4.12E-03	6.21E-01	B	30.00	7.28E+03	2.6946E+14	45	4.95E+17	5.58E+12	5.58E+12			S										
P-33	2.44E+03	6.61E+04	1.00E+00	2444.45	5.80E+03	4.21E-01	4.54E-04	3.00E+01	B	30.00	6.61E+04	2.4444E+15	45	2.61E+17	5.10E+37	2.44E+15	H												
Pb-203	5.20E+02	1.40E+04	3.00E+00	173.28	1.10E+04	4.73E-02	2.14E-03	3.00E+01	B	30.00	1.40E+04	5.1983E+14	45	4.95E+17	1.18E+17	5.20E+14	H												
Pb-210	8.04E+00	2.17E+02	5.00E-02	160.79	2.80E+00	2.87E+00	2.31E-04	5.01E-02	B	30.00	1.30E+05	4.8135E+15	45	1.26E+14	8.04E+12	8.04E+12			S										
Pd-109	2.96E+02	7.99E+03	5.00E-01	591.05	7.90E+04	3.74E-03	2.14E-03	1.71E+01	B	30.00	1.40E+04	5.1809E+14	45	3.56E+18	2.96E+14	2.96E+14			S										
Ra-223	1.02E+01	2.75E+02	7.00E-03	1451.55	1.90E+03	5.35E-03	3.50E-02	9.60E+00	B	30.00	8.58E+02	3.1739E+13	45	8.55E+16	1.02E+13	1.02E+13			S										
Ra-224	8.86E-02	2.40E+00	2.00E-02	4.43	5.90E+03	1.50E-05	3.37E-02	8.08E-02	B	30.00	8.90E+02	3.2924E+13	45	2.66E+17	8.86E+10	8.86E+10			S										
Ra-226	1.02E-01	2.75E+00	3.00E-03	33.89	3.70E-02	2.75E+00	2.84E-02	7.80E-02	B	30.00	1.06E+03	3.9093E+13	45	1.67E+12	1.02E+11	1.02E+11			S										
Re-186	1.56E+02	4.23E+03	6.00E-01	260.64	6.90E+03	2.27E-02	2.14E-03	9.04E+00	B	30.00	1.40E+04	5.1910E+14	45	3.11E+17	1.56E+14	1.56E+14			S										
Re-188	1.22E+00	3.31E+01	4.00E-01	3.06	3.60E+04	3.40E-05	4.97E-03	1.64E-01	B	30.00	6.04E+03	2.2355E+14	45	1.62E+18	1.22E+12	1.22E+12			S										
Rh-105	8.12E+02	2.19E+04	8.00E-01	1014.40	3.10E+04	2.62E-02	1.37E-03	3.00E+01	B	30.00	2.19E+04	8.1152E+14	45	1.40E+18	1.05E+31	8.12E+14	H												
Se-75	4.61E+02	1.25E+04	3.00E+00	153.81	5.40E+02	8.55E-01	2.41E-03	3.00E+01	B	30.00	1.25E+04	4.6144E+14	45	2.43E+16	8.89E+18	4.61E+14	H												
Sm-153	6.12E-01	1.65E+01	6.00E-01	1.02	1.60E+04	3.82E-05	1.94E-03	3.21E-02	B	30.00	1.54E+04	5.7134E+14	45	7.20E+17	6.12E+11	6.12E+11			S										
Sr-89	1.22E+01	3.30E+02	6.00E-01	20.34	1.10E+03	1.11E-02	3.46E-03	1.14E+00	B	30.00	8.68E+03	3.2113E+14	45	4.95E+16	1.22E+13	1.22E+13			S										
Sr-90	1.73E+00	4.67E+01	3.00E-01	5.76	5.10E+00	3.39E-01	3.46E-03	1.61E-01	B	30.00	8.68E+03	3.2113E+14	45	2.30E+14	1.73E+12	1.73E+12			S										
Tb-161	1.61E+01	4.36E+02	2.00E-02	806.28	4.35E+03	3.71E-03	1.16E-03	5.06E-01	B	30.00	2.59E+04	9.5690E+14	45	1.96E+17	1.61E+13	1.61E+13			S										
Th-227	1.01E+01	2.73E+02	5.00E-03	2020.21	1.10E+03	9.18E-03	3.59E-02	9.79E+00	B	30.00	8.36E+02	3.0947E+13	45	4.95E+16	1.01E+13	1.01E+13			S										
Th-228	6.79E-02	1.84E+00	1.00E-03	67.95	3.00E+01	2.26E-03	3.21E-02	5.90E-02	B	30.00	9.33E+02	3.4537E+13	45	1.35E+15	6.79E+10	6.79E+10			S										
Tl-201	1.45E+03	3.92E+04	4.00E+00	362.71	7.90E+03	1.84E-01	7.65E-04	3.00E+01	B	30.00	3.92E+04	1.4508E+15	45	3.56E+17	1.59E+22	1.45E+15	H												
W-187	2.24E+01	6.06E+02	6.00E-01	37.36	2.60E+04	8.62E-04	4.54E-03	2.75E+00	B	30.00	6.61E+03	2.4460E+14	45	1.17E+18	2.24E+13	2.24E+13			S										
W-188	1.23E+00	3.31E+01	3.00E-01	4.08	3.70E+02	3.31E-03	5.98E-04	1.98E-02	B	30.00	5.02E+04	1.8558E+15	45	1.67E+16	1.23E+12	1.23E+12			S										
Y-90	1.73E+00	4.67E+01	3.00E-01	5.76	2.00E+04	8.63E-05	5.54E-03	2.59E-01	B	30.00	5.41E+03	2.0032E+14	45	9.00E+17	1.73E+12	1.73E+12			S										

										Contents heat limit			Contents mass limit		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	Package Type	Heat output	Activity		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	
Yb-169	4.42E+02	1.19E+04	1.00E+00	442.11	8.90E+02	4.97E-01	2.51E-03	3.00E+01	B	30.00	1.19E+04	4.4211E+14	45	4.01E+16	1.88E+19	4.42E+14	H			
Yb-175	1.11E+03	2.99E+04	9.00E-01	1228.91	6.60E+03	1.68E-01	1.00E-03	3.00E+01	B	30.00	2.99E+04	1.1060E+15	45	2.97E+17	6.04E+23	1.11E+15	H			
Max	6.71E+03	1.81E+05		8.05E+03		4.50E+01		3.00E+01												

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 from CTR2011/01
- 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 4 Activity Limits for Contents Type 2 - CT-2 - Solid in light tungsten insert – Design No 3985

1	2	3	4	5	6	7	8	9	10	Contents heat limit			Contents mass limit		Shielding limit	Package limit				
										11	12		13	14	15	16	17	18		
											Heat output	Act						Mass	Act	Act
Nuclide	Max Activity		A2	# A2s	Spec Ac	Mass	Heat gen	Heat output	Package Type	W	Ci	Bq	g	Bq	Bq	Bq	H	M	S	
	TBq	Ci	TBq		TBq/g	g	W/Ci	W	A or B	W										
Ac-225	1.09E+00	2.96E+01	6.00E-03	182.45	2.10E+03	5.21E-04	3.46E-02	1.02E+00	B	30.00	8.68E+02	3.2105E+13	345	7.25E+17	1.09E+12	1.09E+12			S	
Ac-227	3.26E-01	8.81E+00	9.00E-05	3622.61	2.70E+00	1.21E-01	4.72E-04	4.16E-03	B	30.00	6.35E+04	2.3513E+15	345	9.32E+14	3.26E+11	3.26E+11			S	
Ac-228	1.86E-01	5.03E+00	5.00E-01	0.37	8.40E+04	2.21E-06	8.04E-03	4.04E-02	A	30.00	3.73E+03	1.3807E+14	345	2.90E+19	1.86E+11	1.86E+11			S	
Am-241	1.58E+00	4.28E+01	1.00E-03	1584.58	1.30E-01	1.22E+01	3.28E-02	1.41E+00	B	30.00	9.14E+02	3.3828E+13	345	4.49E+13	1.58E+12	1.58E+12			S	
As-77	7.90E+02	2.13E+04	7.00E-01	1128.38	3.90E+04	2.03E-02	1.41E-03	3.00E+01	B	30.00	2.13E+04	7.8987E+14	345	1.35E+19	1.14E+19	7.90E+14	H			
Au-198	2.43E+02	6.57E+03	6.00E-01	405.30	9.00E+03	2.70E-02	4.34E-03	2.85E+01	B	30.00	6.92E+03	2.5590E+14	345	3.11E+18	2.43E+14	2.43E+14			S	
Ba-131	6.12E+01	1.65E+03	2.00E+00	30.60	3.10E+03	1.97E-02	3.06E-03	5.05E+00	B	30.00	9.82E+03	3.6334E+14	345	1.07E+18	6.12E+13	6.12E+13			S	
C-14	5.52E+01	1.49E+03	3.00E+00	18.40	1.60E-01	3.45E+02	2.93E-04	4.38E-01	B	30.00	1.02E+05	3.7850E+15	345	5.52E+13	6.13E+27	5.52E+13		M		
Co-60	9.37E-02	2.53E+00	4.00E-01	0.23	4.20E+01	2.23E-03	1.54E-02	3.91E-02	A	30.00	1.95E+03	7.1970E+13	345	1.45E+16	9.37E+10	9.37E+10			S	
Cs-131	6.71E+03	1.81E+05	3.00E+01	223.73	3.80E+03	1.77E+00	1.65E-04	3.00E+01	B	30.00	1.81E+05	6.7118E+15	345	1.31E+18	7.43E+35	6.71E+15	H			
Cs-134	2.63E+00	7.11E+01	7.00E-01	3.76	4.80E+01	5.48E-02	1.02E-02	7.24E-01	B	30.00	2.95E+03	1.0905E+14	345	1.66E+16	2.63E+12	2.63E+12			S	
Cs-137	3.16E+02	8.55E+03	6.00E-01	527.06	3.20E+00	9.88E+01	1.01E-03	8.65E+00	B	30.00	2.96E+04	1.0966E+15	345	1.10E+15	3.16E+14	3.16E+14			S	
Cu-67	6.91E+02	1.87E+04	7.00E-01	986.75	2.80E+04	2.47E-02	1.61E-03	3.00E+01	B	30.00	1.87E+04	6.9073E+14	345	9.66E+18	2.84E+24	6.91E+14	H			
Hg-203	5.58E+02	1.51E+04	1.00E+00	557.87	5.10E+02	1.09E+00	1.99E-03	3.00E+01	B	30.00	1.51E+04	5.5787E+14	345	1.76E+17	5.32E+34	5.58E+14	H			
Ho-166	9.20E-01	2.49E+01	4.00E-01	2.30	2.60E+04	3.54E-05	4.29E-03	1.07E-01	B	30.00	6.99E+03	2.5852E+14	345	8.97E+18	9.20E+11	9.20E+11			S	
I-125	3.19E+03	8.61E+04	3.00E+00	1062.52	6.40E+02	4.98E+00	3.48E-04	3.00E+01	B	30.00	8.61E+04	3.1875E+15	345	2.21E+17	3.98E+35	3.19E+15	H			
I-129	2.24E-03	6.06E-02	< 1	< 1	6.50E-06	3.45E+02	4.68E-04	2.84E-05	B	30.00	6.41E+04	2.3720E+15	345	2.24E+09	2.93E+26	2.24E+09		M		
I-131	3.28E+02	8.85E+03	7.00E-01	468.01	4.60E+03	7.12E-02	3.39E-03	3.00E+01	B	30.00	8.85E+03	3.2761E+14	345	1.59E+18	9.94E+14	3.28E+14	H			
In-111	4.27E+02	1.15E+04	3.00E+00	142.34	1.50E+04	2.85E-02	2.60E-03	3.00E+01	B	30.00	1.15E+04	4.2702E+14	345	5.18E+18	1.29E+28	4.27E+14	H			
Ir-192	1.81E+02	4.90E+03	6.00E-01	302.02	3.40E+02	5.33E-01	6.13E-03	3.00E+01	B	30.00	4.90E+03	1.8121E+14	345	1.17E+17	7.19E+14	1.81E+14	H			
Ir-194	1.47E+01	3.96E+02	3.00E-01	48.84	3.10E+04	4.73E-04	5.35E-03	2.12E+00	B	30.00	5.61E+03	2.0766E+14	345	1.07E+19	1.47E+13	1.47E+13			S	
Lu-177	1.03E+03	2.78E+04	7.00E-01	1470.30	4.10E+03	2.51E-01	1.08E-03	3.00E+01	B	30.00	2.78E+04	1.0292E+15	345	1.41E+18	1.38E+24	1.03E+15	H			
Mo-99	1.91E+01	5.17E+02	6.00E-01	31.85	1.80E+04	1.06E-03	3.27E-03	1.69E+00	B	30.00	9.18E+03	3.3972E+14	345	6.21E+18	1.91E+13	1.91E+13			S	
Na-24	1.28E-02	3.45E-01	2.00E-01	0.06	3.20E+05	3.99E-08	2.77E-02	9.55E-03	A	30.00	1.08E+03	4.0053E+13	345	1.10E+20	1.28E+10	1.28E+10			S	
Np-237	8.97E-03	2.42E-01	2.00E-03	4.49	2.60E-05	3.45E+02	2.88E-02	6.98E-03	B	30.00	1.04E+03	3.8570E+13	345	8.97E+09	1.58E+12	8.97E+09		M		
P-32	2.49E+00	6.73E+01	5.00E-01	4.98	1.10E+04	2.26E-04	4.12E-03	2.77E-01	B	30.00	7.28E+03	2.6946E+14	345	3.80E+18	2.49E+12	2.49E+12			S	
P-33	2.44E+03	6.61E+04	1.00E+00	2444.45	5.80E+03	4.21E-01	4.54E-04	3.00E+01	B	30.00	6.61E+04	2.4444E+15	345	2.00E+18	3.61E+37	2.44E+15	H			
Pb-203	5.20E+02	1.40E+04	3.00E+00	173.28	1.10E+04	4.73E-02	2.14E-03	3.00E+01	B	30.00	1.40E+04	5.1983E+14	345	3.80E+18	2.45E+16	5.20E+14	H			
Pb-210	3.31E+00	8.96E+01	5.00E-02	66.28	2.80E+00	1.18E+00	2.31E-04	2.07E-02	B	30.00	1.30E+05	4.8135E+15	345	9.66E+14	3.31E+12	3.31E+12			S	
Pd-109	9.61E+01	2.60E+03	5.00E-01	192.26	7.90E+04	1.22E-03	2.14E-03	5.57E+00	B	30.00	1.40E+04	5.1809E+14	345	2.73E+19	9.61E+13	9.61E+13			S	
Ra-223	4.14E+00	1.12E+02	7.00E-03	591.20	1.90E+03	2.18E-03	3.50E-02	3.91E+00	B	30.00	8.58E+02	3.1739E+13	345	6.56E+17	4.14E+12	4.14E+12			S	
Ra-224	4.37E-02	1.18E+00	2.00E-02	2.18	5.90E+03	7.40E-06	3.37E-02	3.98E-02	B	30.00	8.90E+02	3.2924E+13	345	2.04E+18	4.37E+10	4.37E+10			S	
Ra-226	4.80E-02	1.30E+00	3.00E-03	16.00	3.70E-02	1.30E+00	2.84E-02	3.68E-02	B	30.00	1.06E+03	3.9093E+13	345	1.28E+13	4.80E+10	4.80E+10			S	
Re-186	5.31E+01	1.43E+03	6.00E-01	88.45	6.90E+03	7.69E-03	2.14E-03	3.07E+00	B	30.00	1.40E+04	5.1910E+14	345	2.38E+18	5.31E+13	5.31E+13			S	
Re-188	5.67E-01	1.53E+01	4.00E-01	1.42	3.60E+04	1.57E-05	4.97E-03	7.60E-02	B	30.00	6.04E+03	2.2355E+14	345	1.24E+19	5.67E+11	5.67E+11			S	
Rh-105	8.12E+02	2.19E+04	8.00E-01	1014.40	3.10E+04	2.62E-02	1.37E-03	3.00E+01	B	30.00	2.19E+04	8.1152E+14	345	1.07E+19	1.17E+29	8.12E+14	H			
Se-75	4.61E+02	1.25E+04	3.00E+00	153.81	5.40E+02	8.55E-01	2.41E-03	3.00E+01	B	30.00	1.25E+04	4.6144E+14	345	1.86E+17	7.87E+18	4.61E+14	H			
Sm-153	5.71E+02	1.54E+04	6.00E-01	952.23	1.60E+04	3.57E-02	1.94E-03	3.00E+01	B	30.00	1.54E+04	5.7134E+14	345	5.52E+18	1.91E+15	5.71E+14	H			
Sr-89	5.17E+00	1.40E+02	6.00E-01	8.62	1.10E+03	4.70E-03	3.46E-03	4.83E-01	B	30.00	8.68E+03	3.2113E+14	345	3.80E+17	5.17E+12	5.17E+12			S	
Sr-90	8.30E-01	2.24E+01	3.00E-01	2.77	5.10E+00	1.63E-01	3.46E-03	7.75E-02	B	30.00	8.68E+03	3.2113E+14	345	1.76E+15	8.30E+11	8.30E+11			S	
Tb-161	7.39E+00	2.00E+02	2.00E-02	369.26	4.35E+03	1.70E-03	1.16E-03	2.32E-01	B	30.00	2.59E+04	9.5690E+14	345	1.50E+18	7.39E+12	7.39E+12			S	
Th-227	4.17E+00	1.13E+02	5.00E-03	834.00	1.10E+03	3.79E-03	3.59E-02	4.04E+00	B	30.00	8.36E+02	3.0947E+13	345	3.80E+17	4.17E+12	4.17E+12			S	
Th-228	3.35E-02	9.07E-01	1.00E-03	33.54	3.00E+01	1.12E-03	3.21E-02	2.91E-02	B	30.00	9.33E+02	3.4537E+13	345	1.04E+16	3.35E+10	3.35E+10			S	
Tl-201	1.45E+03	3.92E+04	4.00E+00	362.71	7.90E+03	1.84E-01	7.65E-04	3.00E+01	B	30.00	3.92E+04	1.4508E+15	345	2.73E+18	1.41E+22	1.45E+15	H			
W-187	8.56E+00	2.31E+02	6.00E-01	14.26	2.60E+04	3.29E-04	4.54E-03	1.05E+00	B	30.00	6.61E+03	2.4460E+14	345	8.97E+18	8.56E+12	8.56E+12			S	
W-188	5.68E-01	1.53E+01	3.00E-01	1.89	3.70E+02	1.53E-03	5.98E-04	9.18E-03	B	30.00	5.02E+04	1.8558E+15	345	1.28E+17	5.68E+11	5.68E+11			S	
Y-90	8.30E-01	2.24E+01	3.00E-01	2.77	2.00E+04	4.15E-05	5.54E-03	1.24E-01	B	30.00	5.41E+03	2.0032E+14	345	6.90E+18	8.30E+11	8.30E+11			S	
Yb-169	4.42E+02	1.19E+04	1.00E+00	442.11	8.90E+02	4.97E-01	2.51E-03	3.00E+01	B	30.00	1.19E+04	4.4211E+14	345	3.07E+17	1.66E+19	4.42E+14	H			
Yb-175	1.11E+03	2.99E+04	9.00E-01	1228.91	6.60E+03	1.68E-01	1.00E-03	3.00E+01	B	30.00	2.99E+04	1.1060E+15	345	2.28E+18	6.09E+22	1.11E+15	H			

										Contents heat limit			Contents mass limit		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	Package Type	Heat output	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	
Max	6.71E+03	1.81E+05		3.62E+03		3.45E+02		3.00E+01												

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 from CTR2011/01
- 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 5 Activity Limits for Contents Type 3 - CT-3 - Liquid in steel insert – Design No 3987

1	2	3	4	5	6	7	8	9	10	Contents heat limit			Contents mass limit		Shielding limit	Package limit			
										11	12	13	14	15	16	17	18	19	20
Nuclide	Max	Activity	A2	# A2s	Spec Ac	Mass	Heat gen	Heat output	PackageType	Heat output	Act	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
I-131	7.40E+00	2.00E+02	7.00E-01	10.57	4.60E+03	1.61E-03	3.41E-03	6.82E-01	B	5.00	1.47E+03	5.4252E+13	905	4.16E+18	7.40E+12	7.40E+12			S

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 from CTR2011/01
- 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 6 Activity Limits for Contents Type 4 - CT-4 - Liquid Mo-99 in a steel insert – Design No 4081

1	2	3	4	5	6	7	8	9	10	Contents heat limit			Contents mass limit		Shielding limit	Package limit			
										11	12	13	14	15	16	17	18	19	20
Nuclide	Max	Activity	A2	# A2s	Spec Ac	Mass	Heat gen	Heat output	Package Type	Heat output	Act	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
Mo-99	3.70E+01	1.00E+03	3.00E-01	123.33	3.10E+04	1.19E-03	3.43E-03	3.43E+00	B	5.00	1.46E+03	5.3901E+13	905	2.81E+19	3.70E+13	3.70E+13			S

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 from CTR2011/01
- 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