



Science & Technology Facilities Council

Rutherford Appleton Laboratory

PR150035

Appendices to the Specification and Activity
Derivation of Combustible Waste Potentially for
Shipment INC-2015-002

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APPENDIX A – RATIO OF SOFT BETA EMITTERS USED FOR CHARACTERISATION

	OOS limit (Bq/g)	ML	MG	COP	CON	Soft Combustible	MOD	#OM Oils&MEK
Co-60	0.1	0.5	0.5	0.5	0.1	0.5	0.2	0.1
Fe-55	100	0.1	0.1	0.1		0.1		
Na-22	0.1	0.2	0.05		0.1	0.2	0.69	0.2
Be-7	1	0.1	0.05			0.1	0.1	0.7
H-3	100	0.1	0.2	0.2	0.5	0.1	0.01	
Ni-63	100		0.1	0.2				
Eu-152	0.1				0.3			

APPENDIX B -PHYSICAL PROPERTIES OF THE COMBUSTIBLE WASTE

ID	Contents	Weight (Kg)	Volume (m ³)	Dimentions (cm)			Dose rate (μSv/hr)
				Height	Width / Diameter	Length	
14/0239	MEK	24	0.04	61	40		2
14/0240	MEK	25.5	0.04	61	40		45
14/0241	MEK	25.5	0.04	61	40		0.4
14/0242	MEK	25	0.04	61	40		20
14/0741	MEK	31	0.12	80	50		10
14/0742	MEK	30.5	0.12	80	50		5
14/0743	MEK	27	0.12	80	50		15
14/0744	MEK	31	0.12	80	50		60
14/0665	Soft waste	32.5	0.2	85	57		0.2
isis-dsu-0001	Soft waste	79.3	0.2	85	57		8
isis-dsu-0002	Soft waste	64.5	0.2	85	57		2
isis-dsu-0003	Soft waste	54.5	0.2	85	57		2
isis-dsu-0004	Soft waste	67	0.2	85	57		3
isis-dsu-0005	Soft waste	76.5	0.2	85	57		12
isis-dsu-0006	Soft waste	81	0.2	85	57		12
isis-dsu-0007	Soft waste	68.5	0.2	85	57		0.5
isis-dsu-0008	Soft waste	55	0.2	85	57		6
isis-dsu-0009	Soft waste	88.5	0.2	85	57		20
isis-dsu-0010	Soft waste	91	0.2	85	57		8
14/0183	Soft waste	58	0.2	85	57		40
WD/0014	Soft waste	57	0.5	85	57		2
WD/0020	Soft waste	60	0.5	85	57		6
15/0281	Fluorescent lights	22.5	0.171	30	30	190	0.6
15/0282	Fluorescent lights	25.5	0.171	30	30	190	0.6
14/0019	Filter	81.5	0.11	61	61	30	0.1
14/0020	Filter	85	0.11	61	61	30	0.1
14/0021	Filter	85	0.11	61	61	30	0.1
14/0022	Filter	81.5	0.11	61	61	30	0.2
14/0024	Filter	8.5	0.10443	15	118	59	0.1
14-0025	Filter	8.5	0.10	15	118	59	0.2
14-0026	Filter	9	0.10	15	118	59	0.1
14-0027	Filter	9	0.10	15	118	59	0.1
14-0028	Filter	8.5	0.10	15	118	59	0.1
14-0029	Filter	8.5	0.10	15	118	59	0.1
14-0030	Filter	8.5	0.10	15	118	59	0.1
14-0031	Filter	8.5	0.10	15	118	59	0.1
14-0032	Filter	9	0.10	15	118	59	0.1
14-0033	Filter	8.5	0.10	15	118	59	0.2
14-0034	Filter	9	0.10	15	118	59	0.15
14-0035	Filter	8.5	0.10	15	118	59	0.1
14-0036	Filter	8.5	0.10	15	118	59	0.1
14-0037	Filter	9	0.10	15	118	59	0.2
14-0038	Filter	9	0.10	15	118	59	0.15
14-0039	Filter	9	0.10	15	118	59	0.1
14-0013	Filter	16.5	0.11	30	61	61	0.1
14-0014	Filter	20	0.11	30	61	61	0.1
14-0015	Filter	17.5	0.11	30	61	61	0.1
14-0016	Filter	20	0.11	30	61	61	0.1
14-0017	Filter	18	0.11	30	61	61	0.1
14-0018	Filter	17	0.11	30	61	61	0.1
14-0001	Ion-Exchange Column	27	24.00	61	61		1
14-0002	Ion-Exchange Column	80	80.00	104	104		1
B06873	Ion-Exchange Column	80	80.00	104	104		1
B07085	Ion-Exchange Column	81	80.00	104	104		3
B07487	Ion-Exchange Column	80.5	80.00	104	104		3
13-0292	Ion-Exchange Column	82.5	75.00	105	105		1.5
B07477	Ion-Exchange Column	38.5	55.00	61	61		1.5
13-0293	Ion-Exchange Column	82	72.00	105	105		1
B07254	Ion-Exchange Column	27	25.00	61	61		2.5
B07255	Ion-Exchange Column	27	25.00	61	61		3
Y01671	Ion-Exchange Column	27.5	25.00	61	61		24
B07251	Ion-Exchange Column	25.5	25.00	61	61		8
Y02385	Ion-Exchange Column	26	25.00	61	61		15
Y02386	Ion-Exchange Column	34.5	25.00	83	83		10

APPENDIX C -STANDARD NUCLIDES IDENTIFIED IN COMBUSTIBLE WASTE

ID	H-3 (Total Bq)	C-14 (total Bq)	Mn-54 (total Bq)	Co-60 (total Bq)	Be-7 (total Bq)	Na-22 (total Bq)	Sc-46 (total Bq)	Co-57 (total Bq)	Co-58 (total Bq)	Zn-65 (total Bq)	Ag-110m (total Bq)	Ag-108m (total Bq)	Fe-55 (total Bq)
14/0239	408000	1220	91	70									
14/0240	13200000	7400	2043	1583									
14/0241	1700000	1220	18	14									
14/0242	2580000	1020	908	704									
14/0741	2540000	1720	8542	597	540167	135	645	2073	427	2647	576		
14/0742	1100000	1000	4271	299	270083	67	323	1037	213	1323	288		
14/0743	2925000	750	12813	896	810250	202	968	3110	640	3970	865		
14/0744	5420000	2400	51250	3583	3241000	807	3870	12440	2559	15880	3458		
14/0665	1054			5270								5970	1054
isis-dsu-0001	1142		6064	5712	27436	2983							1142
isis-dsu-0002	44850				44850						3652		
isis-dsu-0003	690		5770	3450		7448		1440		6018	4366		690
isis-dsu-0004	748		2505	3741	15610						45820		748
isis-dsu-0005	3079		3089	15395	493500	1650		2193			13521		3079
isis-dsu-0006	2256		14450	11280	21670	78280				50147			2256
isis-dsu-0007	709		8728	3547		6949				2274		10451	709
isis-dsu-0008	1505		9761	7523	653600	3934		2649		4187	115390		1505
isis-dsu-0009	9096		39005	45480	129190	8277		6705		6021	286100		9096
isis-dsu-0010	803		2968	4014	3554000	3738					6337		803
14/0183	592			2960		127000			4460				592
WD/0014	6700		43200	33500		90900		13200	5820	119000			6700
WD/0020	22200		7160	111000	340000	3540				49300	19700		22200
15/0281	0					1224							
15/0282	0					941							0
14/0019			2550	7410		1910				4860			1482
14/0020			1240	2220		2200				3230			444
14/0021			1160	1900		834				2720			380
14/0022			1820	3950		1690				4180			790
14/0024			943	1080		1410				1700			216
14-0025			736	892		1110				1270			178
14-0026			533	1010		952				1930			202
14-0027			798	1020		1040				1090			204
14-0028			811	737		967				1500			147
14-0029			736	675		1170				1920			135
14-0030			715	937		1110				1640			187
14-0031			736	892		889				1700			178
14-0032			760	880		893				1440			176
14-0033			829	971		1070				1430			194
14-0034			779	984		1260				1990			197
14-0035			880	909		1040				1180			182
14-0036			880	766		1170				1640			153
14-0037			834	1060		1200				1580			212
14-0038			816	976		1010				1360			195
14-0039			798	848		850				1770			170
14-0013			679	601		922				1570			120
14-0014			868	685		584				1510			137
14-0015			745	889		1030				1580			178
14-0016			1010	1050		824				1510			210
14-0017			945	842		1120				1130			168
14-0018			941	671		664				1750			134
14-0001	1200												
14-0002	6080000		15700	61900		1700		32200			4050		
B06873	5720000		9440	45600				14200					
B07085	680000		14900	134000		3140		21700					
B07487	1880000		17500	254000		2140		18600					
13-0292	5400000			43300		1700							
B07477	1333475000					2000							
13-0293	360000		3190	61400									
B07254	2026375000			67400		20100							
B07255	1168000000			67400		5660							
Y01671	4007000000			548000		190000							
B07251	1687375000			70000		14400							
Y02385	2728750000			113000		29700							
Y02386	2982500000			331000		77800							

APPENDIX D - ADDITIONAL NUCLIDES DETECTED

ID	Sb-124 (total Bq)	Ti-44 (total Bq)	Ta-182 (total Bq)	Re-183 (total Bq)	Y-88 (total Bq)	Lu-172 (total Bq)	Lu-173 (total Bq)	Hf-175 (total Bq)	Eu-152 (total Bq)	Sc46 (total Bq)	Sc-44 (total Bq)	Ti-44 (total Bq)	Tl-208 (total Bq)	Pb-212 (total Bq)	Cs-134 (total Bq)
14/0239															
14/0240															
14/0241															
14/0242															
14/0741	3983														
14/0742	1992														
14/0743	5975														
14/0744	23898														
14/0665															
isis-dsu-0001	106890														
isis-dsu-0002	1198														
isis-dsu-0003	13207														
isis-dsu-0004	1197														
isis-dsu-0005		4986	102290	7055											
isis-dsu-0006	240290														
isis-dsu-0007	1431														
isis-dsu-0008															
isis-dsu-0009					3094										
isis-dsu-0010															
14/0183						15400	32400								
WD/0014															
WD/0020	24600		35600			8510	13900	9170	14700	3410					7340
15/0281															
15/0282															
14/0019															
14/0020															
14/0021															
14/0022															
14/0024															
14-0025															
14-0026															
14-0027															
14-0028															
14-0029															
14-0030															
14-0031															
14-0032															
14-0033															
14-0034															
14-0035															
14-0036															
14-0037															
14-0038															
14-0039															
14-0013															
14-0014															
14-0015															
14-0016															
14-0017															
14-0018															
14-0001															
14-0002															
B06873															
B07085															
B07487															
13-0292															
B07477															
13-0293															
B07254											14900	17200	12700	11000	
B07255											31200	31300	3960		
Y01671											51200	47200			
B07251											41200	37800			
Y02385											39300	31500			
Y02386											48300	36700			

APPENDIX E - TOTAL ACTIVITY, SPECIFIC ACTIVITY AND ADDITIONAL COMMENTS

ID	Total Beta	Bq/g	A2	comments
14/0239	409381.1556	17.05755	2.04691E-06	
14/0240	13211026	518.0795	6.60551E-05	
14/0241	1701252.231	66.71577	8.50626E-06	
14/0242	2582631.556	103.3053	1.29132E-05	
14/0741	3101510.833	100.0487	1.55076E-05	
14/0742	1380895.417	45.27526	6.90448E-06	
14/0743	3765436.25	139.4606	1.88272E-05	
14/0744	8781145	283.2627	4.39057E-05	
14/0665	13348	0.410708	6.674E-08	
isis-dsu-0001	151368.53	1.908809	7.56843E-07	
isis-dsu-0002	94550.3	1.465896	4.72752E-07	
isis-dsu-0003	43078.4	0.790429	2.15392E-07	
isis-dsu-0004	70369.84	1.050296	3.51849E-07	
isis-dsu-0005	649836.96	8.494601	3.24918E-06	
isis-dsu-0006	420629	5.192951	2.10315E-06	
isis-dsu-0007	34798.36	0.508005	1.73992E-07	
isis-dsu-0008	800054	14.54643	4.00027E-06	
isis-dsu-0009	542064	6.125021	2.71032E-06	
isis-dsu-0010	3572663	39.26003	1.78633E-05	
14/0183	183404	3.162138	9.1702E-07	
WD/0014	319020	5.596842	1.5951E-06	
WD/0020	692330	11.53883	3.46165E-06	
15/0281	1224	0.0544	6.12E-09	
15/0282	941	0.036902	4.705E-09	
14/0019	18212	0.22346	9.106E-08	Au-194 removed, believed to be K-40 misidentified
14/0020	9334	0.109812	4.667E-08	Au-194 removed, believed to be K-40 misidentified
14/0021	6994	0.082282	3.497E-08	Au-194 removed, believed to be K-40 misidentified
14/0022	12430	0.152515	6.215E-08	Au-194 removed, believed to be K-40 misidentified
14/0024	5349	0.629294	2.6745E-08	
14-0025	4186	0.492518	2.0932E-08	
14-0026	4627	0.514111	2.3135E-08	
14-0027	4152	0.461333	2.076E-08	
14-0028	4162	0.489694	2.0812E-08	
14-0029	4636	0.545412	2.318E-08	
14-0030	4589	0.539929	2.2947E-08	
14-0031	4395	0.517106	2.1977E-08	
14-0032	4149	0.461	2.0745E-08	
14-0033	4494	0.528729	2.2471E-08	
14-0034	5210	0.578867	2.6049E-08	
14-0035	4191	0.493035	2.0954E-08	
14-0036	4609	0.542259	2.3046E-08	
14-0037	4886	0.542889	2.443E-08	
14-0038	4357	0.484133	2.1786E-08	
14-0039	4436	0.492844	2.2178E-08	
14-0013	3892	0.235891	1.9461E-08	
14-0014	3784	0.1892	1.892E-08	
14-0015	4422	0.252674	2.2109E-08	
14-0016	4604	0.2302	2.302E-08	
14-0017	4205	0.233633	2.1027E-08	
14-0018	4160	0.244718	2.0801E-08	
14-0001	1200	0.044444	0.000000006	
14-0002	6195550	77.44438	3.09778E-05	
B06873	5789240	72.3655	2.89462E-05	
B07085	853740	10.54	4.2687E-06	
B07487	2172240	26.98435	1.08612E-05	
13-0292	5445000	66	0.000027225	
B07477	1333477000	34635.77	0.006667385	
13-0293	424590	5.177927	2.12295E-06	
B07254	2026518300	75056.23	0.010132592	
B07255	1168139520	43264.43	0.005840698	
Y01671	4007836400	145739.5	0.020039182	
B07251	1687538400	66177.98	0.008437692	
Y02385	2728963500	104960.1	0.013644818	
Y02386	2982993800	86463.59	0.014914969	

APPENDIX F – PHOTOGRAPHS OF SAMPLE WASTE CONTAINERS

Black drums:



Coffins for fluorescent tubes:



IXC1:



Warboys:

