SITE	HMNB Devonport			
SITE OWNER	Ministry of Defence			
WASTE CUSTODIAN	Babcock International Group			
WASTE TYPE	LLW			
Is the waste subject to Scottish Policy:	No			
WASTE VOLUMES		Reported		
Stocks:	At 1.4.2022	10.2 m³		
Future arisings -	1.4.2022 - 31.3.2030	~110.4 m <sup>3</sup>		
Total future arisings:		110.4 m³		
Total waste volume:		120.6 m³		
Comment on volumes:	Arisings are dependent upon the level of submarine refit and maintenance activity that is carried out. Arisings have been calculated using best available data.			
Uncertainty factors on	Stock (upper): x 1.3		Arisings (upper)	x 2.0
volumes:	Stock (lower): x 0.7		Arisings (lower)	x 0.5
WASTE SOURCE	The waste is produced as a conseque propulsion programme e.g. reactor pl	ence of the g ant mainten	general support of ance and refuelling	Naval nuclear J operations.

## PHYSICAL CHARACTERISTICS

General description:	Solid low level waste for disposal to the NWS, comprising metal items of varying size from contaminated tools to large plant items. Other items include metal pipes, valves, swarf, glass and thermal lagging materials and mild steel waste drums. All items derive from the submarines or from shore based facilities. Large items do occasionally originate from the nuclear submarine reactor plant or from support services. In these instances the item will be classified as non-compactable waste and will be packed into half height ISO containers, or other container, as agreed by NWS Ltd, for disposal as non-compactable waste. Material may have been size reduced to fit within 200l drum. Certain large items of hard waste could be consigned as being non-compactable waste should they satisfy the NWS CFA.
Physical components (%wt):	Metal (94%), soil/rubble (1%), biodegradable-non putrescibles (1%), plastic/rubber (3%), others (1%).
Sealed sources:	The waste does not contain sealed sources.
Bulk density (t/m <sup>3</sup> ):	0.6
Comment on density:	The average density of hard trash within 200 litre drums is 600 kg/m <sup>3</sup> .
CHEMICAL COMPOSITION	I

The waste consists of mainly metallic components primarily stainless steel. There are lesser amounts of mild steel, iron and also aluminium. Drums are mild steel. Other constituents of the stream are calcium silicate lagging, glass. There will be small amounts of polythene within drums along with other soft organics, e.g. paper.
Neutral
H-3: Potential to be present as tritiated water adhered to internal surface of pipes (0.4% of total activity). C-14: Present in waste in various chemical forms, predominately carbonate, (5% of total activity iaw extant WCH).
Large primary circuit components will be classed as non-compactable waste and will be disposed of in half height ISO containers, or other, as agreed with NWS Ltd. Difficult to provide dimensional information. Total percentage of waste <<10% of current arisings.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel	. Р	316L stainless steel	
Other ferrous metals	. ~83.8	Mild Steel Drum	
Iron	i		
Aluminium			
Beryllium			
Cobalt	. Р	In the form of mild/stainless steel for example stellite	
Copper			
Lead	•		
Magnox/Magnesium			
Nickel			
Titanium			
Uranium			
Zinc	. ~0.11	As a metal in solid form.	
Zircaloy/Zirconium			
Other metals	. ~10.1	Stellite is present in certain valve seats. Other metals include Chromium and Molybdenum	
Organics (%wt): There will be small and possibly cotton mass of metal pres	quantities . The perc ent in the v	of organic material in the waste, namely p entage composition is very small when co waste stream.	oolythene, paper mpared to the tota
	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	~1.0	Paper/cotton.	
Paper, cotton	~1.0	Paper/cotton.	
Wood	0		
Halogenated plastics	0		
Total non-halogenated plastics	2.0	e.g. Polythene	
Condensation polymers	0		
Others	2.0	Polythene	
Organic ion exchange materials	0		
Total rubber	1.0		
Halogenated rubber	0		
Non-halogenated rubber	1.0		
Hydrocarbons	0		
Oil or grease			
Fuel			

0

Other materials (%wt):

Asphalt/Tarmac (cont.coal tar)... Asphalt/Tarmac (no coal tar).... Bitumen.... Others... Other organics...

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# WASTE STREAM 7D23 Devonport RA Hard Trash (for Disposal to NWS)

	(%wt)	Type(s) and comment	% of total C14
Inorganic ion exchange materials.	0		activity
Inorganic sludges and flocs	0		
Soil	0		
Brick/Stone/Rubble	~0.50		
Cementitious material	~0.50		
Sand			
Glass/Ceramics	~1.0	Glass	
Graphite	0		
Desiccants/Catalysts			
Asbestos	0		
Non/low friable			
Moderately friable			
Highly friable			
Free aqueous liquids	0		
Free non-aqueous liquids	0		
Powder/Ash	0		

(%wt)

Inorganic anions (%wt):

Silicate from lagging is the only inorganic anion in the waste. However this will reduce in forthcoming years because new re-usable metallic lagging is being installed onto the submarine reactor plant.

Type(s) and comment

Fluoride	0
Chloride	0
lodide	0
Cyanide	0
Carbonate	0
Nitrate	0
Nitrite	0
Phosphate	0
Sulphate	0
Sulphide	0

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Materials of interest for waste acceptance criteria:

	(%wt)	Ту
Combustible metals	0	
Low flash point liquids	0	
Explosive materials	0	
Phosphorus	0	
Hydrides	0	
Biological etc. materials	0	
Biodegradable materials	1.0	
Putrescible wastes	0	

Type(s) and comment

# WASTE STREAM 7D23 Devonport RA Hard Trash (for Disposal to NWS)

Non-putrescible wastes	~1.0
Corrosive materials	0
Pyrophoric materials	0
Generating toxic gases	0
Reacting with water	TR
Higher activity particles	NE
Soluble solids as bulk chemical compounds	0

Hazardous substances / non hazardous pollutants:

There are no heavy metals in the waste. Certain identified items may contain boron-10 (<<0.1%) in nucleonic instrumentation and also titanium (<1%). Prior to consignment offsite, approval from NWS to accept waste will be obtained by D5 route. All documentation to comply with special waste regulations is also generated.

(%wt) Type(s) and comment

Acrylamide	
Benzene	0
Chlorinated solvents	
Formaldehyde	
Organometallics	
Phenol	0
Styrene	
Tri-butyl phosphate	0
Other organophosphates	
Vinyl chloride	0
Arsenic	0
Barium	
Boron	NE
Boron (in Boral)	NE
Boron (non-Boral)	NE
Cadmium	0
Caesium	
Selenium	0
Chromium	~8.8
Molybdenum	~1.4
Thallium	
Tin	0
Vanadium	0
Mercury compounds	
Others	NE
Electronic Electrical Equipment (EEE)	
ЕЕЕ Туре 1	
ЕЕЕ Туре 2	
EEE Type 3	
EEE Type 4	
EEE Type 5	

2022 Inventory

Potential for the waste to

contain discrete items:

Planned on-site / off-site

treatment(s):

7D23

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA		
DPTA		
NTA		
Polycarboxylic acids		
Other organic complexants		There are no organic complexing agents in the waste.
Total complexing agents	NE	

Yes. Some items may be discrete items; however, the activities routinely seen make it unlikely to fall into this category.

### TREATMENT, PACKAGING AND DISPOSAL

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)	Off-Site	~7.5
Incineration	Off-site	~17.5
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recyling / reuse	Off-site	~~32.5
Other / various		
None	Off-site	~42.5

Comment on planned treatments:

**Disposal Routes:** 

Aprroximate stream volumes derived from current holdings.

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	~22.5	~0.60
Expected to be consigned to a Landfill Facility	~27.5	~0.60
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility	~17.5	~0.60
Expected to be consigned to a Metal Treatment Facility		
Expected to be consigned as Out of Scope		
Expected to be recycled / reused	~~32.5	~~0.60
Disposal route not known		

Classification codes for waste expected to be consigned to a landfill facility:

### Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):

-

Disposal Route	Stream volume %				
	2022/23	2023/24	2024/25		
Expected to be consigned to the LLW Repository Expected to be consigned to a Landfill Facility Expected to be consigned to an On-Site Disposal Facility Expected to be consigned to an Incineration Facility Expected to be consigned to a Metal Treatment Facility Expected to be consigned as Out of Scope Expected to be recycled / reused Disposal route not known					

### Opportunities for alternative disposal routing:

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

-

#### Waste Packaging for Disposal:

Stream volume (%):

Container		Stream volume %	Waste loading m <sup>3</sup>	Number of packages < 1	
1/3 Height IP-1 ISC 2/3 Height IP-2 ISC 1/2 Height WAMAC 1/2 Height IP-2 Disp 2m box (no shieldir 4m box (no shieldir Other	) ; IP-2 ISO posal/Re-usable ISO ig) ig)	~22.5	~39.39		
her information:	A typical conditioning factor fo displaced volume of the 200 l Disposal/ Reusable ISO (TCC	or 7D23 drums is 0.3 itre drum. It is assur 1/TC02) will approx	33 relative to the o ned each 1/2 Heig imatively have a 13	riginal ht IP-2 3m3 waste	

loading which equates to approximately 39 m3 of raw waste

### Waste Planned for Disposal at the LLW Repository:

Container voidage:	<10%. Openings into plant items are covered with soluble polythene and vent holes are drilled into large items. When grouting occurs the grout should be able to permeate fully into the item.
Waste Characterisation Form (WCH):	The waste meets the LLWR's Waste Acceptance Criteria (WAC). The waste has a current WCH. Inventory information is consistent with the current WCH.
Waste consigned for disposal to LLWR in year of generation:	No. Not always consigned in the year of generation. Waste is consigned for conditioning on a batch basis. It is therefore possible that waste will be retained until sufficient drums (68) for a 'full' load is available for consignment to Tradebe Inutec Winfrith for supercompaction prior to consignment to NWS.

Non-Containerised Waste for In-Vault Grouting:	(Not applicable to this waste stream)
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Waste stream variation:	-
Bounding cuboidal volume:	
Inaccessible voidage:	-
Other information:	-
RADIOACTIVITY	
Source:	Contamination of plant items through contact with the submarine primary plant. Minor neutron activation of components can also occur. Major nuclides at time of generation are Fe-55 (34%), Co-60 (41%), C-14 (5%), Mn-54 (1.3%), Ni-63 (1.6%) and others.
Uncertainty:	The drum monitor assesses the gamma activity of the waste using a segmented gamma spectroscopy system. The system accuracy is assessed to be $\pm 20\%$ of gamma activity. Activity of other beta/gamma nuclides associated with the waste is assessed using a generic fingerprint relative to the measured Co-60 activity. Accuracy of the total activity measurement and assessment is considered to be within 50%.
Definition of total alpha and total beta/gamma:	Where totals are shown on the table of radionuclide activities they are the sums of the listed alpha or beta/gamma emitting radionuclides plus 'other alpha' or 'other beta/gamma'.

WASTE STREAM	7D23 Devonport RA Hard Trash (for Disposal to NWS)
Measurement of radioactivities:	Co-60 is measured directly by the drum monitor system using segmented gamma spectroscopy. Other gamma emitters will also be detected if present within the waste. The fingerprint has been derived by the use of best available sampling information and accepted international practice to determine correlations and relationships. All other nuclides are determined relative to Co-60 activity. Specific activity figures have been derived from current stock data and represent a reasonably consistent waste origin, therefore future arisings, which are expected to remain consistent, can only be estimated based on the same SA estimated figure i.e. the values are specific activity not total activity (which would vary depending on expected volume).
Other information:	Drummed waste is subjected to gamma spectrometry. Beta nuclides are apportioned to Co- 60 activity in normalised ratios.

# WASTE STREAM 7D23 Devonport RA Hard Trash (for Disposal to NWS)

Mate at Banck and (140202     Goode (140202     Wate at (140202     Banck and prising (140202     Bunck and (140202     Wate at (140202     Banck and prising (14020     Bunck and (14020     Bunck and prising (14020     Bunck and (14020		Mean radioactivity, TBq/m <sup>3</sup>					Mean radioa	ctivity, TBq/m <sup>3</sup>		
H3     -2.20E-09     BB     2     -2.20E-07     BB     2     -2.30E-07     BB     2     -2.30E-07     BC     2     -2.20E-07     BB     2     -2.30E-07     BC     2     -3.30E-12     CC     2     Lin 171     H     173     H     173     H     173     H     173     H     173     H     173 <th>Nuclide</th> <th>Waste at</th> <th>Bands and</th> <th>Future</th> <th>Bands and</th> <th>Nuclide</th> <th>Waste at</th> <th>Bands and</th> <th>Future</th> <th>Bands and</th>	Nuclide	Waste at	Bands and	Future	Bands and	Nuclide	Waste at	Bands and	Future	Bands and
Bas 10     -2.705.00     US 10     -2.705.00     US 10     -2.705.00     US 10     -7.705.00 <td>НЗ</td> <td>1.4.2022</td> <td>BB 2</td> <td>2 78E-09</td> <td></td> <td>Gd 153</td> <td>1.4.2022</td> <td>Code</td> <td>ansings</td> <td>Code</td>	НЗ	1.4.2022	BB 2	2 78E-09		Gd 153	1.4.2022	Code	ansings	Code
C14     -2.95E-07     B8     2     -2.95E-07     CC     2     Ho168m       N322     -1.27E-11     B8     2     -2.95E-07     CC     2     Ho168m       N362     -1.27E-11     B8     2     -6.51E-12     CC     2     Ho168m       A126     -6.51E-12     B8     2     -6.51E-12     CC     2     Hu174       A126     -3.77E-06     B8     2     -1.69E-06     CC     2     PP 205       F656     -1.69E-06     B8     2     -1.69E-06     CC     2     PP 201       N163     -2.69E-68     B8     2     -2.69E-66     CC     2     PP 210       N163     -2.69E-66     B8     2     -2.69E-66     CC     2     PP 210       N163     -2.69E-66     B8     2     -2.69E-66     CC     2     PP 210       N163     -2.27E-68     B8     2     -2.29E-66     CC     2     PP 230       N163     -1.89E-67     B8 <td>Be 10</td> <td>~2.762-03</td> <td></td> <td>~2.70E-03</td> <td>00 2</td> <td>Ho 163</td> <td></td> <td></td> <td></td> <td></td>	Be 10	~2.762-03		~2.70E-03	00 2	Ho 163				
NA22     -1.2TE-11     BB     2     -1.2TE-11     CC     2     Tm 170 m 171 m 172 m	C 14	~2.95E-07	BB 2	~2.95E-07	CC 2	Ho 166m				
Alge     Alge     Alge     Alge     Alge     Alge     Th 171       C136     -6.51E-12     BB     2     -6.51E-12     CC     2     H174       Ar 30     -	Na 22	~1.27E-11	BB 2	~1.27E-11	CC 2	Tm 170				
C136    0.51E-12     BB     2    0.51E-12     CC     2     LU 76 H1 780 H1 780 H1 1780 H1 180 H1 180	AI 26					Tm 171				
Ar-32 Ar-32 Ar-32 Lu 76 H178 H178 H178   K-40 H-12 H178 H178 H178 H178 H178   Mn 53 -3.78E-08 BB 2 -3.78E-08 CC 2 P205 Fe56 -169E-08 BB 2 -169E-06 CC 2 P207   Fe65 -169E-08 BB 2 -169E-06 CC 2 P2010 Fe57 Fe56 -169E-08 BB 2 -169E-08 CC 2 P2010   N163 -4.67E-08 BB 2 -1.21E-08 CC 2 P2010 Fe57	CI 36	~6.51E-12	BB 2	~6.51E-12	CC 2	Lu 174				
Ar.42     Image: Marting the section of the sectin of the section of the sectin of the section of the se	Ar 39					Lu 176				
K 40   Image: Section of the sectin of the section of the section of the section o	Ar 42					Hf 178n				
Ca 41 Mn 53	K 40					Hf 182				
Min 53     -3.78E-08     BB     2     -1.78E-08     CC     2     Pb 210       Fe 55     -1.69E-06     BB     2     -1.69E-06     CC     2     Pb 210       N 54     -2.69E-08     BB     2     -2.69E-08     CC     2     B203       N 56     -4.47E-08     BB     2     -1.72E-08     CC     2     Pb 210       Zn 65     -1.21E-08     BB     2     -1.67E-08     CC     2     Pb 210       S 709     -1.72E-08     BB     2     -1.72E-08     CC     2     Ra 225       Kr 81     -1.72E-08     BB     2     -1.72E-08     CC     2     Na 228     Ac 271       S 700     -3.38E-12     BB     2     -3.38E-12     CC     2     Ph 231       N 94	Ca 41					Pt 193				
m1134   -3,062-00   b3   2   -3,062-00   C 2   P1 2010     F6 56   -1.862-06   B8   2   -1.802-06   C 2   B1 200     N163   -2.2667-08   B8   2   -1.802-06   C 2   B2 200m     N163   -4.677-08   B8   2   -4.677-08   C 2   P2 210     Se 70   -1.121-08   C 2   P2 210   Ra 223   Ra 225   Ra 223     Kr 85   -3.38E-12   B8   2   -1.212-08   C 2   P2 210   Ra 223     Sr 80   -3.38E-12   B8   2   -1.212-08   C 2   Ra 228   Ra 228     Nb 91	Mn 53	2 705 00				11 204 Pb 205				
1-1.082-06   BB 2   1-1.082-06   BB 2   -2.660-08   BB 2   -2.660-08   CC 2   B120m     N163   -2.660-08   BB 2   -2.660-08   CC 2   P2.010   Ra225     Zn.65   -1.21E-08   BB 2   -1.21E-08   CC 2   Ra225   Ra225     Kr.85   -3.38E-12   BB 2   -3.38E-12   CC 2   Th 228   Ra225     Yr.85   -3.38E-12   BB 2   -3.38E-12   CC 2   Th 228   Ra226     Nb 94	IVIN 54	~3.78E-08		~3.78E-08		Pb 203				
0.000   -1.0000   BB 2   -1.00000   CC 2   B-10m     N153   -4.6700   BB 2   -4.6700   CC 2   Po 210     N163   -4.6700   BB 2   -4.6700   CC 2   Po 210     Se 79   -1.210-08   BB 2   -1.210-08   CC 2   Ra 223   Ra 225     Kr 81   -1.3380-12   BB 2   -3.380-12   CC 2   Th 227   Fa 225   Ra 223   Ra 223   Ra 223   Ra 223   Ra 225   Ra 25   Ra 25   Ra 25	Co 60	~1.09E-00	BB 2	~1.09E-00		Bi 208				
N163     -4.67E-08     BB     2     -4.67E-08     CC     2     Pa 210       2n 66     -1.21E-08     BB     2     -1.21E-08     CC     2     Pa 223     Pa 225     Pa 226	Ni 59	~1.09E-00	BB 2	~1.89E-00		Bi 210m				
2.066 Se 79 Kr 81 Kr 85 Kr 81 Kr 85 Kr 85 Kr 85   -1.21E-08   CC   2   Ra 223 Ra 225 Ra 226 Ra 228 Ra 226 Ra 228 Ra 226 Ra 228 Ra 226 Ra 228 Ra 226 Ra 228 Ra 28 Ra 28	Ni 63	~4 67E-08	BB 2	~4 67E-08	CC 2	Po 210				
Se 79 Kr 81 Kr 85 Kr 85 Kr 85 Kr 85 Sr 90   -3.38E-12   BB   2   -3.38E-12   C   2   R2 25 R2 26 R2 26 R2 26 R2 28 Ac 227   H<	Zn 65	~1.21E-08	BB 2	~1.21E-08	CC 2	Ra 223				
Kr86 Kr86 Kr86 Kr86 Sr90   -3.38E-12   BB   2   -3.38E-12   CC   2   R228 A227 Th 227	Se 79					Ra 225				
Kr.85   -3.38E-12   BB   2   -3.38E-12   CC   2   7   7   8   2   -3.38E-12   CC   2   7   7   8   2   -2.38E-12   CC   2   7 </td <td>Kr 81</td> <td></td> <td></td> <td></td> <td></td> <td>Ra 226</td> <td></td> <td></td> <td></td> <td></td>	Kr 81					Ra 226				
Rb 87  3.38E-12   BB 2  3.38E-12   CC 2   Th 227     Zr 93  3.38E-12   BB 2  3.38E-12   CC 2   Th 227     Nb 91	Kr 85					Ra 228				
Sr 90   -3.38E-12   BB 2   -3.38E-12   CC 2   III 22/1     Sr 90   -3.38E-12   CC 2   III 22/1   Th 228     Nb 91	Rb 87					Ac 227				
	Sr 90	~3.38E-12	BB 2	~3.38E-12	CC 2	Th 227				
No 91 No 93 No 93m	Zr 93					Th 229				
N0 93/2   N0 93/2   Th 232   Th 234     N0 93/2   -2.20E-11   BB   2   -2.20E-11   CC   2     Th 234   Pa 231   Pa 233   Pa 233   Pa 233   Pa 233     Pd 107   BB   2   -1.80E-13   BB   2   -1.80E-13   CC   2   U232     Pd 107   -1.74E-11   BB   2   -1.74E-11   CC   2   U235   U236     Ag 100m   -1.74E-11   BB   2   -1.74E-11   CC   2   U236   U238     Ag 100m   -3.58E-07   BB   2   -3.58E-07   CC   2   U236   U238     Sh 126   -3.07E-08   BB   2   -3.07E-08   CC   2   Pu 230   Pu 230     Sh 126   -3.07E-08   BB   2   -3.07E-08   CC   2   Cm 242   Am 241   Am 241   Am 243   Am 244   Am 244   Am 244<	ND 91					Th 230				
No 94 Me 93 C 97   -2.20E-11   BB   2   -2.20E-11   CC   2   Pa 231 Pa 231 Pa 233 U 236 U 236 U 236 U 236 U 236 U 236 U 238 N 237 Pu 236 Pu 238 Pu 238 P	ND 92 Nb 93m					Th 232				
Mo 93 Te 97 No 90  2.20E-11   BB 2  2.20E-11   CC 2   Pa 231 Pa 233   Pa 233 Pa 233     Tc 97 Tc 99  1.80E-13   BB 2  1.80E-13   CC 2   U232 U233   U234     Pa 106  1.74E-11   BB 2  1.74E-11   CC 2   U234   U234     Ag 100m  1.74E-11   BB 2  1.74E-11   CC 2   U236   U236     Ag 110m  3.58E-07   BB 2  3.58E-07   CC 2   U238   U238     Sh 12m	Nb 94					Th 234				
Tc 97 Tc 99   -1.80E-13   BB   2   -1.80E-13   CC   2   U232 U 233 U 234 U 234 U 234 U 234 U 234 U 234 U 234 U 236 U 236 U 236 U 236 U 238 U 236 U 238 U 236 U 238 U 238 U 236 U 238 U 238 D 2	Mo 93	~2.20E-11	BB 2	~2.20E-11	CC 2	Pa 231				
Tc 99   -1.80E-13   BB 2   -1.80E-13   CC 2   U232   U233     Ru 106   -1.74E-11   BB 2   -1.74E-11   CC 2   U235   U236     Ag 108m   -1.74E-11   BB 2   -1.74E-11   CC 2   U235   U236     Ag 109m   -3.58E-07   BB 2   -3.58E-07   CC 2   U236   U238     Cd 113m   -3.58E-07   BB 2   -3.58E-07   CC 2   U238   Np 237     Sh 126   -3.07E-08   BB 2   -3.07E-08   CC 2   Pu 238   Pu 239     Sh 126   -3.07E-08   BB 2   -3.07E-08   CC 2   Pu 241     Sh 126   -9.89E-12   BB 2   -9.89E-12   CC 2   Am 241     Te 127m   -4.35E-10   BE 2   -4.35E-10   CC 2   Cm 243     Cs 136   -1.64E-09   BB 2   -1.64E-09   CC 2   Cm 246     Cs 137   -1.64E-09   BB 2   -1.64E-09   CC 2   Cm 246     Ca 138   -1.64E-09   BB 2   -1.64E-09   CC 2   Cm 246     Ca 138   -1.64E-09   CB 2	Tc 97					Pa 233				
Ru 106   U233   U233   U234     Pd 107  1.74E-11   BB 2  1.74E-11   CC 2   U235     Ag 108  3.58E-07   BB 2  3.58E-07   CC 2   U236   U236     Cd 109  3.58E-07   BB 2  3.58E-07   CC 2   U236   U236     Sh 120	Tc 99	~1.80E-13	BB 2	~1.80E-13	CC 2	U 232				
Pd 107   -1.74E-11   BB 2   -1.74E-11   CC 2   U 235     Ag 100m   -3.58E-07   BB 2   -3.58E-07   CC 2   U 235     Cd 109   -3.58E-07   BB 2   -3.58E-07   CC 2   U 236     Cd 109   -3.58E-07   BB 2   -3.58E-07   CC 2   U 236     Sh 121   Np 237   Pu 236   Pu 236   Pu 236   Pu 236     Sh 123   -3.07E-08   BB 2   -3.07E-08   CC 2   Pu 230   Pu 230     Sh 125   -3.07E-08   BB 2   -3.07E-08   CC 2   Pu 240   Pu 240     Sb 126   -3.07E-08   BB 2   -3.07E-08   CC 2   Ma 241   -4.71E-12   BB 2   -4.71E-12   CC 2     Sh 126   -3.07E-08   BB 2   -1.64E-09   CC 2   Cm 242   Am 243   Cm 243   Cm 244   Cm 244   Cm 244   Cm 245   Cm 244   Cm 246	Ru 106					U 233				
Ag 108m   -1.74E-11   BB 2   -1.74E-11   CC 2   0 236     Ag 110m   -3.58E-07   BB 2   -3.58E-07   CC 2   0 236     Cd 109   -3.58E-07   BB 2   -3.58E-07   CC 2   0 236     Cd 113m	Pd 107					U 234				
Ag 110m  3.58E-07   BB 2  3.58E-07   CC 2   0 238     Cd 109   Np 237   Np 237   Np 236   Np 237   Np 236     Sh 121m   Np 237   Pu 236   Pu 238   Pu 239   Pu 239     Sh 126   Sb 125  3.07E-08   BB 2  3.07E-08   CC 2   Pu 240     Sb 126   Te 125m	Ag 108m	~1.74E-11	BB 2	~1.74E-11	CC 2	U 235 11 236				
Cd 109   Cd 113m   Sn 119m   Sn 119m   Pu 236   Pu 238   Pu 238   Pu 230   Pu 230   Pu 230   Pu 240   Pu 240   Pu 240   Pu 240   Pu 240   Pu 241   Pu 242   Am 242m   Am 244   Cm 243   Cm 243   Cm 244   Cf 250   Cm 246   Cf 250   Cm 246   Cf 250	Ag 110m	~3.58E-07	BB 2	~3.58E-07	CC 2	U 238				
Su 113m   Fu 236   Pu 236   Pu 238   Pu 239   Pu 239   Pu 239   Pu 240	Cd 109					Np 237				
Sn 10.1m   Sn 121m   Pu 238   Pu 239   Pu 239   Pu 240   Pu 240   Pu 241   Pu 242   Am 241   A.71E-12   BB 2   -4.71E-12   CC 2   Am 242m     Te 125m   -   -   -9.89E-12   BB 2   -9.89E-12   CC 2   Am 243   -4.71E-12   BB 2   -4.71E-12   CC 2   Cm 243     Cs 134   -4.35E-10   BB 2   -4.35E-10   CC 2   Cm 243   Cm 243   -4.71E-12   B -   -4.71E-12   CC 2	Sn 119m					Pu 236				
Sn 123   Sn 126   Pu 239   Pu 240   Pu 241	Sn 121m					Pu 238				
Sn 126   Pu 240   Pu 240   Pu 241   Pu 241   Pu 241   Pu 241   Pu 242   Pu 241   Pu 242	Sn 123					Pu 239				
Sb 125   -3.07E-08   BB 2   -3.07E-08   CC 2   Pu 241   Pu 242   -4.71E-12   BB 2   -4.71E-12   CC 2   2     Te 125m   -9.89E-12   BB 2   -9.89E-12   CC 2   Am 241   -4.71E-12   BB 2   -4.71E-12   CC 2   2     I 129   -9.89E-12   BB 2   -9.89E-12   CC 2   Am 243   Cm 242   Cm 243   -4.71E-12   B 2   -4.71E-12   CC 2   2     Cs 134   -4.35E-10   BB 2   -4.35E-10   CC 2   Cm 243   Cm 243   -4.71E-12   CC 4   -4.71E-12 <td< td=""><td>Sn 126</td><td></td><td></td><td></td><td></td><td>Pu 240</td><td></td><td></td><td></td><td></td></td<>	Sn 126					Pu 240				
Sb 126   FU 242   Am 241   -4.71E-12   BB 2   -4.71E-12   CC 2     Te 125m   -9.89E-12   BB 2   -9.89E-12   CC 2   Am 243   -4.71E-12   BB 2   -4.71E-12   CC 2     I 129   -9.89E-12   BB 2   -9.89E-12   CC 2   Am 243   -4.71E-12   B 2   -4.71E-12   C 2   -   -4.71E-12   C 2	Sb 125	~3.07E-08	BB 2	~3.07E-08	CC 2	Pu 241				
Te 125m   Am 247m   Am 242m   Am 242m   Am 242m   Am 242m   Am 243m     I 129   ~9.89E-12   BB 2   ~9.89E-12   C C 2   Cm 242   Cm 243     Cs 134   ~4.35E-10   BB 2   ~4.35E-10   C C 2   Cm 242   Cm 243     Cs 137   ~1.64E-09   BB 2   ~1.64E-09   C C 2   Cm 244   Cm 243     La 137   La 137   La 138   La 137   La 138   Cf 249   Cf 250   Cf 250     Pm 145   Fm 147   Fm 147   Fm 147   Ff 252   Other a   Other a     Sm 151   Fu 152   ~1.32E-09   BB 2   ~1.32E-09   C C 2   Total a   ~1.72E-09   BB 2   ~1.72E-09   C C 2     Eu 152   ~1.32E-09   BB 2   ~5.59E-09   C C 2   Total a   ~4.71E-12   BB 2   ~4.71E-12   C C 2     Eu 155   ~1.08E-10   C C 2   Total a   ~4.71E-12   BB 2   ~4.71E-12   C C 2	Sb 126					Pu 242	1715 12	BB 2	4715.12	
I e 12/m   -9.89E-12   BB 2   -9.89E-12   CC 2   Am 243     Cs 134   -4.35E-10   BB 2   -4.35E-10   CC 2   Cm 242     Cs 135   -1.64E-09   BB 2   -1.64E-09   CC 2   Cm 243     Cs 137   -1.64E-09   BB 2   -1.64E-09   CC 2   Cm 244     Ba 133   -1.64E-09   CC 2   Cm 248   Cm 248     Ce 144   -1.10   -1.04E-09   CC 2   Cm 248   Cf 249     Pm 145   -1.10   -1.10   -1.10   -1.10   -1.10   -1.10     Fm 147   -1.10   -1.10   -1.10   -1.10   -1.10   -1.10   -1.10     Sm 151   -1.10 <td>Te 125m</td> <td></td> <td></td> <td></td> <td></td> <td>Am 242m</td> <td>~4.716-12</td> <td></td> <td>~4.716-12</td> <td>00 2</td>	Te 125m					Am 242m	~4.716-12		~4.716-12	00 2
1129   -9.09E-12   0.00   2   CC 2   Cm 242     Cs 134   -4.35E-10   BB 2   -4.35E-10   CC 2   Cm 242     Cs 135   -1.64E-09   BB 2   -1.64E-09   CC 2   Cm 244     Ba 133   -1.64E-09   BB 2   -1.64E-09   CC 2   Cm 244     La 137   -1.104E-09   BB 2   -1.64E-09   CC 2   Cm 248     Ce 144	Te 127m	0.905 40				Am 243				
Cs 134   AL.35E-10   BB 2   AL.35E-10   CC 2   Cm 243     Cs 135  1.64E-09   BB 2  1.64E-09   CC 2   Cm 244     Ba 133  1.64E-09   BB 2  1.64E-09   CC 2   Cm 244     La 137  1.32E-09   BB 2  1.64E-09   CC 2   Cm 248     Ce 144	1 129 Cs 134	~9.89E-12	BB 2	~9.69E-12		Cm 242				
Cs 137   ~1.64E-09   BB 2   ~1.64E-09   CC 2   Cm 244     Ba 133   La 137   La 138   Cm 244   Cm 245   Cm 246     Ca 144   La 138   Ce 144   La 138   Cf 249   Cf 249     Ce 144   La 138   Cf 250   Cf 250   Cf 251   Cf 251     Pm 145   La 132   Cf 250   Cf 251   Cf 251   Cf 252     Sm 147   La 132E-09   BB 2   ~1.32E-09   CC 2   Other a   Cf 252     Sm 151   La 152   ~1.32E-09   BB 2   ~1.32E-09   CC 2   Cd 14a   -4.71E-12   BB 2   ~1.72E-09   CC 2     Eu 152   ~1.32E-09   BB 2   ~5.59E-09   CC 2   Total a   -4.71E-12   BB 2   ~4.71E-12   CC 2     Eu 155   ~1.08E-10   BB 2   ~1.08E-10   CC 2   Total a   -4.4E-06   BB 2   -4.40E-06   CC 2	Cs 135	~4.33L-10	BB 2	~4.35E-10	00 2	Cm 243				
Ba 133   La 137   La 137   La 138   Cm 245   Cm 246     La 138   La 138   Cm 245   Cm 246   Cm 248     Ce 144   La 138   Cf 249   Cf 249   Cf 250     Pm 145   La 138   Cf 250   Cf 251   Cf 251     Pm 147   La 132E-09   BB 2   ~1.32E-09   CC 2   Other a     Sm 151   La 152   ~1.32E-09   BB 2   ~1.32E-09   CC 2   Cd 14a   -4.71E-12   BB 2   ~1.72E-09   CC 2     Eu 152   ~1.08E-10   BB 2   ~1.08E-10   CC 2   Total a   -4.41E-06   BB 2   -4.40E-06   CC 2	Cs 137	~1.64E-09	BB 2	~1.64E-09	CC 2	Cm 244				
La 137 La 138 Ce 144 Pm 145 Pm 147 Sm 147 Sm 151 Eu 152 -1.32E-09 BB 2 -1.32E-09 BB 2 -1.32E-09 BB 2 -1.32E-09 BB 2 -1.32E-09 BB 2 -1.32E-09 BB 2 -1.32E-09 BB 2 -1.32E-09 CC 2 CC 2 Total a -1.72E-09 CC 2 Total a -4.71E-12 BB 2 -4.71E-12 BB 2 -4.71E-12 CC 2	Ba 133					Cm 245				
La 138 Ce 144 Pm 145 Pm 147 Sm 147 Sm 151 Eu 152 -1.32E-09 BB 2 -1.32E-09 BB 2 -1.32E-09 BB 2 -1.32E-09 BB 2 -1.32E-09 BB 2 -1.32E-09 BB 2 -1.32E-09 CC 2 CC 2 Total a -1.72E-09 BB 2 -1.72E-09 CC 2 Total a -4.71E-12 BB 2 -4.71E-12 BB 2 -4.40E-06 CC 2	La 137					Cm 246				
Ce 144   Pm 145   Cf 249   Cf 250   F   Cf 250   F	La 138					Cm 248				
Pm 145   Pm 145   Cf 250   Cf 250     Pm 147   Cf 251   Cf 251     Sm 147   Cf 252   Other a     Sm 151   Other a   Other b/g     Eu 152   ~1.32E-09   BB 2   ~1.32E-09   CC 2     Eu 154   ~5.59E-09   BB 2   ~5.59E-09   CC 2     Eu 155   ~1.08E-10   BB 2   ~1.08E-10   CC 2	Ce 144					Cf 249				
Pm 147   Sm 147   Cf 252   Cf 252   Other a     Sm 151   Other a   Other b/g   ~1.72E-09   BB 2   ~1.72E-09   CC 2     Eu 152   ~1.32E-09   BB 2   ~1.32E-09   CC 2   Other b/g   ~1.72E-09   BB 2   ~1.72E-09   CC 2     Eu 154   ~5.59E-09   BB 2   ~5.59E-09   CC 2   Total a   ~4.71E-12   BB 2   ~4.40E-06   CC 2     Eu 155   ~1.08E-10   BB 2   ~1.08E-10   CC 2   Total b/g   ~4.4E-06   BB 2   ~4.40E-06   CC 2	Pm 145					Cf 251				
Sim 147   Other a   Other a     Sm 151   -1.32E-09   BB 2   ~1.32E-09   CC 2   Other b/g   ~1.72E-09   BB 2   ~1.72E-09   CC 2     Eu 152   ~1.32E-09   BB 2   ~5.59E-09   CC 2   Total a   ~4.71E-12   BB 2   ~4.71E-12   CC 2     Eu 155   ~1.08E-10   BB 2   ~1.08E-10   CC 2   Total b/g   ~4.4E-06   BB 2   ~4.40E-06   CC 2	Pm 147					Cf 252				
Sin 101   ~1.32E-09   BB 2   ~1.32E-09   CC 2   Other b/g   ~1.72E-09   BB 2   ~1.72E-09   CC 2     Eu 152   ~5.59E-09   BB 2   ~5.59E-09   CC 2   Total a   ~4.71E-12   BB 2   ~4.71E-12   CC 2     Eu 155   ~1.08E-10   BB 2   ~1.08E-10   CC 2   Total b/g   ~4.4E-06   BB 2   ~4.40E-06   CC 2	Sm 147 Sm 151					Other a				
Eu 154   ~5.59E-09   BB 2   ~5.59E-09   CC 2   Total a   ~4.71E-12   BB 2   ~4.71E-12   CC 2     Eu 155   ~1.08E-10   BB 2   ~1.08E-10   CC 2   Total b/g   ~4.4E-06   BB 2   ~4.40E-06   CC 2	511 151 Fu 152	~1.32E-09	BB 2	~1.32E-00	0.0 2	Other b/g	~1.72E-09	BB 2	~1.72E-09	CC 2
Eu 155 ~1.08E-10 BB 2 ~1.08E-10 CC 2 Total b/g ~4.4E-06 BB 2 ~4.40E-06 CC 2	Eu 154	~5.59E-09	BB 2	~5.59E-09	CC 2	Total a	~4.71E-12	BB 2	~4.71E-12	CC 2
	Eu 155	~1.08E-10	BB 2	~1.08E-10	CC 2	Total b/g	~4.4E-06	BB 2	~4.40E-06	CC 2

Bands (Upper and Lower)

A a factor of 1.5

B a factor of 3

C a factor of 10 D a factor of 100

E a factor of 1000

Note: Bands quantify uncertainty in mean radioactivity.

1 Measured activity

Code

2 Derived activity (best estimate)

3 Derived activity (upper limit)

4 Not present

5 Present but not significant

6 Likely to be present but not assessed

7 Present in significant quantities but not determined

8 Not expected to be present in significant quantity