

<b>WASTE STREAM</b>	<b>7A13</b>	<b>Sea Disposal Packs (Concrete Lined Drums)</b>
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**SITE** AWE Aldermaston

**SITE OWNER** Ministry of Defence

**WASTE CUSTODIAN** AWE plc

**WASTE TYPE** ILW; PFSD

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2022.....	476.5 m <sup>3</sup>
Future arisings -	1.4.2022 - 31.3.2080.....	0 m <sup>3</sup>
Total future arisings:		0 m <sup>3</sup>
Total waste volume:		476.5 m <sup>3</sup>

Comment on volumes: There will no increase in waste activity. Concrete lined drums are no longer being created. Total number of packs is 743. The drums have not been subjected to modern standard assay, so the activity remains uncertain.

Uncertainty factors on volumes: Stock (upper): x 1.0 Arisings (upper) x  
Stock (lower): x 1.0 Arisings (lower) x

**WASTE SOURCE** The waste stream represents part of the 1983 sea disposal consignment. Wastes were generated from AWE operations of that period, e.g. glovebox and reactor wastes.

**PHYSICAL CHARACTERISTICS**

General description: The drums are likely to suffer some corrosion in storage so will need to be handled with care/appropriately when transferred/moved. The actual waste component of these packages is in the mild steel drum that is surrounded by an over sheaf of concrete. Encapsulated waste in a concrete lined drum.

Physical components (%wt): Cement (overpack) (90%); miscellaneous ILW (10%). The composition has been reviewed in 2022 and remains identical to the data submitted in 2019.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): 1.47

Comment on density: The density of the drummed waste varies from 1.282 t/m<sup>3</sup>, to 2.74 t/m<sup>3</sup>, but the weighted average density of the waste is 1.473 t/m<sup>3</sup>.

**CHEMICAL COMPOSITION**

General description and components (%wt): Miscellaneous ILW, including metal (4.42%), organic (4.73%), ceramic (0.55%), vermiculite (0.30%) and cement (90.00%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: HT and HTO diffused present in waste stream. Small amount of organically bound tritium may be present in solid form  
C-14: Not present in waste stream  
Cl-36: Not present in waste stream  
Se-79: Not present in waste stream  
Tc-99: Not present in waste stream  
I-129: Not present in waste stream  
Ra: Only daughter products present from uranium in this waste stream. Oxide form  
Th: Only daughter products present from uranium in this waste stream. Oxide form  
U: Present as metal or metal oxide  
Np: Np-237 present in waste stream as oxide form from daughter product of Am-241 alpha decay.  
Pu: Present as metal or metal oxide

Metals and alloys (%wt): Steel is present as drum reinforcement and lead is utilised in the package design.

<b>WASTE STREAM</b>	<b>7A13</b>	<b>Sea Disposal Packs (Concrete Lined Drums)</b>
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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	NE		
Other ferrous metals.....	NE		
Iron.....	NE		
Aluminium.....	0.72	Contained within filters	
Beryllium.....	TR		
Cobalt.....	0		
Copper.....	0		
Lead.....	NE		
Magnox/Magnesium.....	0		
Nickel.....	0		
Titanium.....	0		
Uranium.....	NE	Present as a contaminant only	
Zinc.....	0		
Zircaloy/Zirconium.....	0		
Other metals.....	3.7	Mixed metals (3.7%)	
Organics (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	1.2		
Paper, cotton.....	1.1	Contained within filters	
Wood.....	0.05		
Halogenated plastics .....	1.9	PVC	
Total non-halogenated plastics.....	0.05		
Condensation polymers.....	0.05		
Others.....	0		
Organic ion exchange materials....	TR		
Total rubber.....	1.6		
Halogenated rubber .....	1.6		
Non-halogenated rubber.....	0		
Hydrocarbons.....	0		
Oil or grease .....	0		
Fuel.....	0		
Asphalt/Tarmac (cont.coal tar)...	NE		
Asphalt/Tarmac (no coal tar)....	NE		
Bitumen.....	0		
Others.....	0		
Other organics.....	0		

Other materials (%wt):      The drum assembly consists of a concrete liner and cap with a inner container. The void between the inner and outer drums are typically filled with sand, aggregate or pieces of concrete tile.

**WASTE STREAM**

**7A13**

**Sea Disposal Packs (Concrete Lined Drums)**

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	NE		
Brick/Stone/Rubble.....	0.30	Vermiculite (debris in filters)	
Cementitious material.....	90.0		
Sand.....	0		
Glass/Ceramics.....	0.55		
Graphite.....	0		
Desiccants/Catalysts.....	0		
Asbestos.....	TR		
Non/low friable.....	TR		
Moderately friable.....	TR		
Highly friable.....	TR		
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): -

	(%wt)	Type(s) and comment
Fluoride.....	NE	
Chloride.....	NE	
Iodide.....	NE	
Cyanide.....	NE	
Carbonate.....	NE	
Nitrate.....	NE	
Nitrite.....	NE	
Phosphate.....	NE	
Sulphate.....	NE	
Sulphide.....	NE	

Materials of interest for waste acceptance criteria: Small amounts lead and beryllium are present in this waste stream.

	(%wt)	Type(s) and comment
Combustible metals.....	0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	0	
Putrescible wastes.....	0	
Non-putrescible wastes.....	0	

<b>WASTE STREAM</b>	<b>7A13</b>	<b>Sea Disposal Packs (Concrete Lined Drums)</b>
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Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	0
Higher activity particles.....	0
Soluble solids as bulk chemical compounds.....	0

Hazardous substances /  
non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....	0	
Benzene.....	0	
Chlorinated solvents.....	0	
Formaldehyde.....	0	
Organometallics.....	0	
Phenol.....	0	
Styrene.....	0	
Tri-butyl phosphate.....	0	
Other organophosphates.....	0	
Vinyl chloride.....	P	PVC present in halogenated plastics.
Arsenic.....	0	
Barium.....	0	
Boron.....	0	
Boron (in Boral).....	0	
Boron (non-Boral).....	0	
Cadmium.....	0	
Caesium.....	0	< 1ppm caesium
Selenium.....	0	
Chromium.....	0	
Molybdenum.....	0	
Thallium.....	0	
Tin.....	0	
Vanadium.....	0	
Mercury compounds.....	0	
Others.....	0	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	0	
EEE Type 2.....	0	
EEE Type 3.....	0	
EEE Type 4.....	0	
EEE Type 5.....	0	

**WASTE STREAM****7A13****Sea Disposal Packs (Concrete Lined Drums)**

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....	0	
DPTA.....	0	
NTA.....	0	
Polycarboxylic acids.....	0	
Other organic complexants.....	0	The waste contains no organic complexing agents.
Total complexing agents.....	0	

Potential for the waste to contain discrete items: Yes.

**PACKAGING AND CONDITIONING**

Conditioning method: It is intended that the concrete lined drums will be transferred to Sellafield for interim storage pending the final disposal solution (e.g. Thermal Treatment through Geomelt and packaged into a 3m<sup>3</sup> box).

Plant Name: -

Location: Sellafield, Cumbria.

Plant startup date: Unknown

Total capacity (m<sup>3</sup>/y incoming waste): -

Target start date for packaging this stream: -

Throughput for this stream (m<sup>3</sup>/y incoming waste): -

Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages
	3m <sup>3</sup> box (round corners)	100.0	NE	~2.47	NE

Likely container type comment: -

Range in container waste volume: -

Other information on containers: Duplex Grade 2205 stainless steel

Likely conditioning matrix: Not Specified

Other information: -

Conditioned density (t/m<sup>3</sup>): ~2.0

Conditioned density comment: -

Other information on conditioning: These waste packages are being stored pending final disposal. Note that volumes will change, and waste will be re-assayed and recharacterised.

Opportunities for alternative disposal routing: Not yet determined

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

Source:	The activity arises from plutonium, uranium, tritium and through the activation of materials in neutron fluxes/fields.
Uncertainty:	Activity values have been derived from legacy records that were assigned at the time of packaging, pre-1983 and decay corrected to 2022.
Definition of total alpha and total beta/gamma:	Where totals are shown in the table of radionuclide activities, they are the sums of the listed alpha or beta/gamma emitting radionuclides.
Measurement of radioactivities:	Activity determination was conducted by a variety of analytical techniques such as low resolution gamma spectroscopy monitoring, passive neutron coincidence counting (PNCC) and liquid scintillation counting. Decay nuclides with a half-life of less than 3 months have been omitted.
Other information:	-

## WASTE STREAM

7A13

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	2.34E-03	BB 2			Gd 153				
Be 10					Ho 163				
C 14					Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36					Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204	5.21E-07	BB 2		
Mn 54					Pb 205				
Fe 55	2.16E-09	BB 2			Pb 210	4.98E-10	BB 2		
Co 60	6.1E-07	BB 2			Bi 208				
Ni 59					Bi 210m	2.56E-10	BB 2		
Ni 63					Po 210	2.14E-12	BB 2		
Zn 65					Ra 223	1.25E-38	BB 2		
Se 79					Ra 225	2.29E-39	BB 2		
Kr 81					Ra 226	2.47E-09	BB 2		
Kr 85					Ra 228	7.29E-15	BB 2		
Rb 87					Ac 227	1.16E-08	BB 2		
Sr 90					Th 227	5.06E-28	BB 2		
Zr 93					Th 228	3.02E-15	BB 2		
Nb 91					Th 229	7.6E-16	BB 2		
Nb 92					Th 230	4.41E-07	BB 2		
Nb 93m					Th 232	1.51E-14	BB 2		
Nb 94					Th 234	8.17E-19	BB 2		
Mo 93					Pa 231	3.97E-08	BB 2		
Tc 97					Pa 233	1.16E-20	BB 2		
Tc 99					U 232				
Ru 106					U 233	9.79E-13	BB 2		
Pd 107					U 234	1.84E-03	BB 2		
Ag 108m					U 235	7.21E-05	BB 2		
Ag 110m					U 236	1.17E-05	BB 2		
Cd 109					U 238	4.44E-05	BB 2		
Cd 113m					Np 237	1.89E-08	BB 2		
Sn 119m					Pu 236				
Sn 121m					Pu 238	1.74E-04	BB 2		
Sn 123					Pu 239	5.49E-03	BC 2		
Sn 126					Pu 240	1.36E-03	BC 2		
Sb 125					Pu 241	1.2E-02	BC 2		
Sb 126					Pu 242	1.94E-07	BC 2		
Te 125m					Am 241	2.64E-03	BC 2		
Te 127m					Am 242m		5		
I 129					Am 243		5		
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137					Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152					Other b/g				
Eu 154					<b>Total a</b>	<b>1.16E-02</b>	<b>BC 2</b>	<b>0</b>	
Eu 155					<b>Total b/g</b>	<b>1.43E-02</b>	<b>BC 2</b>	<b>0</b>	

**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.

**Code**

- 1 Measured activity
- 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