

**WASTE STREAM****7A22****Operational ILW Tritium Hard Waste****SITE** AWE Aldermaston**SITE OWNER** Ministry of Defence**WASTE CUSTODIAN** AWE plc**WASTE TYPE** ILW

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2022.....	27.5 m <sup>3</sup>
Future arisings -	1.4.2022 - 31.3.2024.....	0.1 m <sup>3</sup>
	1.4.2025 - 31.3.2027.....	1.3 m <sup>3</sup>
	1.4.2028 - 31.3.2030.....	0.6 m <sup>3</sup>
	1.4.2031 - 31.3.2033.....	5.0 m <sup>3</sup>
	1.4.2034 - 31.3.2036.....	0 m <sup>3</sup>
	1.4.2037 - 31.3.2039.....	0 m <sup>3</sup>
	1.4.2040 - 31.3.2042.....	0.3 m <sup>3</sup>
	1.4.2043 - 31.3.2045.....	0.3 m <sup>3</sup>
	1.4.2046 - 31.3.2058.....	0 m <sup>3</sup>
	1.4.2059 - 31.3.2060.....	5.0 m <sup>3</sup>
	1.4.2061 - 31.3.2080.....	0 m <sup>3</sup>
Total future arisings:		12.5 m <sup>3</sup>
Total waste volume:		39.9 m <sup>3</sup>

Comment on volumes: No major stock change since 2016. Future arisings have been derived from waste operational predictions. Stock volume are recorded in a recently issued database, and are therefore considered to be accurate. The total volume of arisings will depend on the longevity of the AWE site, with estimates based on a site closure date of 2080.

Uncertainty factors on volumes: Stock (upper): x 1.0 Arisings (upper) x 5.0  
 Stock (lower): x 1.0 Arisings (lower) x 0.5

**WASTE SOURCE** Operations involving tritium.**PHYSICAL CHARACTERISTICS**

General description: Mainly metallic content.

Physical components (%wt): Metal (49.57%), cellulose (4.69%), halogenated plastics (17.61%), non-halogenated plastics (22.45%), ceramics (2.89%), and vermiculite (2.79%). The composition has been reviewed and is very similar to the 2019 composition, so has remained the same.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): 0.46

Comment on density: Stock reviewed and very similar to the figure quoted in 2019. The total stream mass has been divided by the total stream volume.

**CHEMICAL COMPOSITION**

General description and components (%wt): Metal (49.57%), cellulose (4.69%), halogenated plastics (17.61%), non-halogenated plastics (22.45%), ceramics (2.89%), and vermiculite (2.79%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Present in the waste stream through diffusion and uranium/titanium tritride (HTO, HT and organically/chemically bound)  
 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 in Waste Stream as oxide form  
 Np: Not present in Waste Stream  
 Pu: Not present in Waste Stream

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Metals and alloys (%wt):                      Discreet metallic items

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	23.5		
Other ferrous metals.....			
Iron.....			
Aluminium.....	25.8		
Beryllium.....			
Cobalt.....			
Copper.....	0.31		
Lead.....			
Magnox/Magnesium.....			
Nickel.....			
Titanium.....			
Uranium.....	NE	Present as a contaminant only	
Zinc.....			
Zircaloy/Zirconium.....			
Other metals.....			

Organics (%wt):    -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	4.7		
Paper, cotton.....	4.7		
Wood.....	0		
Halogenated plastics .....	17.6	PVC	
Total non-halogenated plastics.....	22.5		
Condensation polymers.....	22.5		
Others.....	0		
Organic ion exchange materials....	0		
Total rubber.....	0		
Halogenated rubber .....	0		
Non-halogenated rubber.....	0		
Hydrocarbons.....	0		
Oil or grease .....	0		
Fuel.....	0		
Asphalt/Tarmac (cont.coal tar)...	0		
Asphalt/Tarmac (no coal tar)....	0		
Bitumen.....	0		
Others.....	0		
Other organics.....	0		

Other materials (%wt):    -

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	0		
Brick/Stone/Rubble.....	2.8	Vermiculite (described as rubble)	
Cementitious material.....	0		
Sand.....	0		
Glass/Ceramics.....	2.9		
Graphite.....	0		
Desiccants/Catalysts.....	0		
Asbestos.....	0		
Non/low friable.....	0		
Moderately friable.....	0		
Highly friable.....	0		
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): -

	(%wt)	Type(s) and comment
Fluoride.....	0	
Chloride.....	0	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	0	
Nitrate.....	0	
Nitrite.....	0	
Phosphate.....	0	
Sulphate.....	0	
Sulphide.....	0	

Materials of interest for waste acceptance criteria: -

	(%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.....	P	
Putrescible wastes.....	0	
Non-putrescible wastes.....	P	

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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	
Arsenic.....	0	
Barium.....	0	
Boron.....	0	
Boron (in Boral).....	0	
Boron (non-Boral).....	0	
Cadmium.....	0	
Caesium.....	0	
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	

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Complexing agents (%wt): No

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

Potential for the waste to contain discrete items: No.

**PACKAGING AND CONDITIONING**

Conditioning method: -  
 Plant Name: -  
 Location: -  
 Plant startup date: -  
 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
	500 l drum	100.0	~1	~0.5	40

Likely container type comment: The loading is an estimate based on experience with similar waste at Sellafield.

Range in container waste volume: Supercompaction of the waste drums will allow 5 pucks to be added into a 500 litre drum.

Other information on containers: Not specified

Likely conditioning matrix: Not Specified

Other information: -

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

Conditioned density comment: The conditioned density is an estimate which is subject to change

Other information on conditioning: There are no detailed conditioning plans

Opportunities for alternative disposal routing: -

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

**RADIOACTIVITY**

Source:	Tritium contamination diffused into items and as surface contamination or dust.
Uncertainty:	Revised specific activity for stock wastes has been taken from the on-site waste database and is considered accurate. Predicted waste activities are more difficult and have been based on knowledge of arisings coupled with stock data. Tritium storage bed (TSB) devices include 100 grams depleted uranium per container. One TSB is in stock and 24 will be disposed in with the future arisings.
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'.
Measurement of radioactivities:	Individual ILW items are assayed using calorimetry, mass balance or head-space analysis of a drum. Sampling followed by destructive assay is used to a lesser degree.
Other information:	-

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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	4.18E+00	BB 2	7.27E+00	CC 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				
Mn 54					Pb 205				
Fe 55					Pb 210	1.13E-15	BB 2	1.37E-12	CC 2
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210	1.08E-15	BB 2	1.33E-12	CC 2
Zn 65					Ra 223	2.27E-14	BB 2	1.66E-11	CC 2
Se 79					Ra 225				
Kr 81					Ra 226	4.54E-15	BB 2	3.89E-12	CC 2
Kr 85					Ra 228	9.43E-21	BB 2	5.80E-18	CC 2
Rb 87					Ac 227	2.23E-14	BB 2	1.66E-11	CC 2
Sr 90					Th 227	2.24E-14	BB 2	1.64E-11	CC 2
Zr 93					Th 228	8.39E-21	BB 2	5.40E-18	CC 2
Nb 91					Th 229				
Nb 92					Th 230	7.02E-13	BB 2	3.76E-07	CC 2
Nb 93m					Th 232	1.31E-20	BB 2	7.01E-18	CC 2
Nb 94					Th 234	4.57E-09	BB 2	1.53E-06	CC 2
Mo 93					Pa 231	6.35E-14	BB 2	3.42E-11	CC 2
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234	2.54E-09	BB 2	8.53E-07	CC 2
Ag 108m					U 235	1E-10	BB 2	3.36E-08	CC 2
Ag 110m					U 236	8.82E-12	BB 2	2.96E-09	CC 2
Cd 109					U 238	4.57E-09	BB 2	1.53E-06	CC 2
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129					Am 243				
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>7.22E-09</b>	<b>BB 2</b>	<b>2.80E-06</b>	<b>CC 2</b>
Eu 155					<b>Total b/g</b>	<b>4.18E+00</b>	<b>BB 2</b>	<b>7.27E+00</b>	<b>CC 2</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