

WASTE STREAM	7A113	Decommissioning LLW - Tritiated
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SITE AWE Aldermaston

SITE OWNER Ministry of Defence

WASTE CUSTODIAN AWE plc

WASTE TYPE LLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0.2m ³
Future arisings -	1.4.2022 - 31.3.2024.....	0m ³
	1.4.2025 - 31.3.2027.....	0m ³
	1.4.2028 - 31.3.2030.....	2053.0m ³
	1.4.2031 - 31.3.2041.....	0m ³
	1.4.2042 - 31.3.2045.....	112.0m ³
Total future arisings:		2165.0m ³
Total waste volume:		2165.2m ³

Comment on volumes: The estimated volume of arisings in the waste stream has increased dramatically owing to the re-characterising of contamination levels in a building, due to be demolished between 2028-2030. The stock volume is accurate. The total volume of arisings will depend on the longevity of the AWE site, with a closure date currently set for 2080.

Uncertainty factors on volumes: Stock (upper): x 1.0 Arisings (upper) x 4.0
Stock (lower): x 1.0 Arisings (lower) x 0.3

WASTE SOURCE Waste arisings from tritium decommissioning operations.

PHYSICAL CHARACTERISTICS

General description: The waste stream contains metal, wood and a small amount of organic material.

Physical components (%wt): Rubble (93.20%), metal (5.18%), wood (0.93%), and plastics (0.69%). The composition is based on the 2016 in-stock contents, which may be fraught with uncertainty, but it is currently not possible to accurately re-evaluate the contents until decommissioning commences in 2028.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.5

Comment on density: The density has been reviewed and revised during the 2022 UKRWI and is based upon a predicted future arising figure.

CHEMICAL COMPOSITION

General description and components (%wt): The waste is made up of tritium adsorbed onto hard waste and is composed of rubble (93.20%), metal (5.18%), wood (0.93%), and plastics (0.69%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Present in the waste stream as HTO diffused into metal and wood, and organically bound particulate.

- C-14: Not present in the waste stream
- Cl-36: Not present in the waste stream
- Se-79: Not present in the waste stream
- Tc-99: Not present in the waste stream
- I-129: Not present in the waste stream
- Ra: Not present in the waste stream
- Th: Not present in the waste stream
- U: Not present in the waste stream
- Np: Not present in the waste stream
- Pu: Not present in the waste stream

Metals and alloys (%wt): The greatest proportion of metal is attributable to an empty metal container within a package, the remaining metal comes from small bulk metal items (~0.04m³).

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	~5.2		
Iron.....	0		
Aluminium.....	0		
Beryllium.....	0		
Cobalt.....	0		
Copper.....	0		
Lead.....	0		
Magnox/Magnesium.....	0		
Nickel.....	0		
Titanium.....	0		
Uranium.....	0		
Zinc.....	0		
Zircaloy/Zirconium.....	0		
Other metals.....	0		
Organics (%wt):			
Wood (17%)			
	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~0.93		
Paper, cotton.....	0		
Wood.....	~0.93		
Halogenated plastics	~0.49	PVC	
Total non-halogenated plastics.....	~0.20		
Condensation polymers.....	~0.20		
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.....	93.2		
Cementitious material.....	0		
Sand.....	0		
Glass/Ceramics.....	0		
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): There may be traces of inorganic anions in the waste stream

	(%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: There may be trace amounts of asbestos in this waste stream (suspected)

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

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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: There may be trace amounts of asbestos in this waste stream (suspected)

	(%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.....	0	
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	
Total complexing agents.....	0	

Potential for the waste to contain discrete items: No.

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)	Off-site	~46.6
Incineration	Off-site	~1.6
Solidification		
Decontamination		
Metal treatment	Off-site	~5.2
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None	Off-site	~46.6

Comment on planned treatments:

The treatment breakdown is based on predicted waste arisings and the usage of current disposal routes. Owing to the unknown levels of contamination within building fabrics, a 50%-50% split has been assumed for disposals to LA-LLW Permitted Landfill and burial at LLWR. This breakdown is likely to change when waste exists within the waste stream in 2028 (decommissioning commences).

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	~46.6	~0.50
Expected to be consigned to a Landfill Facility	~46.6	~0.50
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility	~1.6	<0.50
Expected to be consigned to a Metal Treatment Facility	~5.2	~0.50
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known		

Classification codes for waste expected to be consigned to a landfill facility: 150203, 170405, 170203, 170107

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

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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:

Container	Stream volume %	Waste loading m ³	Number of packages
1/3 Height IP-1 ISO			
2/3 Height IP-2 ISO			
1/2 Height WAMAC IP-2 ISO			
1/2 Height IP-2 Disposal/Re-usable ISO	46.6	17	60
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: -

Waste Planned for Disposal at the LLW Repository:

Container voidage: -

Waste Characterisation Form (WCH): The waste meets the LLWR's Waste Acceptance Criteria (WAC).
The waste does not have a current WCH.

Resource not available to produce a WCH for a 205 litre drum of waste.

Waste consigned for disposal to LLWR in year of generation: No. Waste will be held until it is justifiable to produce a WCH for this waste stream (or it decays to OOS for tritium).

Non-Containerised Waste for In-Vault Grouting: (Not applicable to this waste stream)

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

RADIOACTIVITY

Source: Tritium contaminated materials.

Uncertainty: The activity of the stock is accurate and taken from the Database. Future arising activity is estimated based on the in-stock data.

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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 and beta/gamma emitting radionuclides (just tritium in this instance).

Measurement of radioactivities:

Low level tritium analysis is usually done by head-space analysis of wastes within drums. Bulky items are likely to be assayed using sampling and analysis, pyrolysis then subsequent liquid scintillation counting.

Other information:

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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	~1.23E-03	BB 2	~9.31E-04	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				
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m					U 235				
Ag 110m					U 236				
Cd 109					U 238				
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					Total a	0		0	
Eu 155					Total b/g	~1.23E-03	BB 2	~9.31E-04	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.

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