

WASTE STREAM**7A26****Operational LLW - Enriched Uranium****SITE** AWE Aldermaston**SITE OWNER** Ministry of Defence**WASTE CUSTODIAN** AWE plc**WASTE TYPE** LLW**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	49.9 m ³
Future arisings -	1.4.2019 - 31.3.2022.....	35.4 m ³
	1.4.2022 - 31.3.2025.....	30.4 m ³
	1.4.2025 - 31.3.2028.....	52.2 m ³
	1.4.2028 - 31.3.2031.....	17.0 m ³
	1.4.2031 - 31.3.2070.....	146.7 m ³
	1.4.2070 - 31.3.2080.....	0 m ³
Total future arisings:		281.6 m ³
Total waste volume:		331.5 m ³

Comment on volumes: The stock volume has increased since the last inventory due to one particular facility processing waste. The waste arising rate is based on facility estimates in the AWE waste arisings plan. Stock volumes 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, estimates have been made based on a site closure date of 2080.

Uncertainty factors on volumes: Stock (upper): x 1.0 Arisings (upper) x 3.0
 Stock (lower): x 1.0 Arisings (lower) x 0.5

WASTE SOURCE Waste arising from enriched uranium operations.**PHYSICAL CHARACTERISTICS**

General description: The waste contains metal, plastics, rubber, glass, fibre glass, asbestos and vermiculite.

Physical components (%wt): Metal (46.72%), Non-halogenated Plastics (32.69%), Halogenated Plastics (1.39%), Rubber (3.26%), Glass (10.87%), Fibre Glass (1.56%), Asbestos (3.44%) and Vermiculite (0.07%). The composition is based on the latest disposals (2013-2016) and stock data, and is subject to change.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.39

Comment on density: Density calculated for the 2019 UK RWI from the in-stock data.

CHEMICAL COMPOSITION

General description and components (%wt): Metal (46.72%), Non-halogenated Plastics (32.69%), Halogenated Plastics (1.39%), Rubber (3.26%), Glass (10.87%), Fibre Glass (1.56%), Asbestos (3.44%) and Vermiculite (0.07%). The composition is based on the latest disposals and stock data, and is subject to change.

Chemical state: Neutral

Chemical form of radionuclides: U: Oxide form.

Metals and alloys (%wt): Steel in the form of box fittings, tools and fixtures. Lead in the form of shielding panels. As this is an operational waste stream, metal is likely to arise as mixed metal (ferrous and non-ferrous segregated) in drums.

Stainless steel.....	2.9
Other ferrous metals.....	33.3
Iron.....	
Aluminium.....	2.1
Beryllium.....	TR
Cobalt.....	
Copper.....	3.5

WASTE STREAM

7A26

Operational LLW - Enriched Uranium

	Lead.....	3.3	
	Magnox/Magnesium.....		
	Nickel.....		
	Titanium.....		
	Uranium.....	NE	Present as a contaminant only.
	Zinc.....		
	Zircaloy/Zirconium.....		
	Other metals.....	1.6	Filters.
Organics (%wt):	-		
	Total cellulose.....		
	Paper, cotton.....		
	Wood.....		
	Halogenated plastics	1.4	PVC.
	Total non-halogenated plastics.....	32.7	
	Condensation polymers.....	28.0	
	Others.....	4.7	Perspex.
	Organic ion exchange materials....		
	Total rubber.....	3.3	
	Halogenated rubber		
	Non-halogenated rubber.....	3.3	
	Hydrocarbons.....		
	Oil or grease		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar)....		
	Bitumen.....		
	Others.....		
	Other organics.....		
Other materials (%wt):	-		
	Inorganic ion exchange materials.		
	Inorganic sludges and flocs.....		
	Soil.....		
	Brick/Stone/Rubble.....	0.07	
	Cementitious material.....		
	Sand.....		
	Glass/Ceramics.....	12.4	
	Graphite.....		
	Desiccants/Catalysts.....		
	Asbestos.....	3.4	
	Non/low friable.....	3.4	
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....		

WASTE STREAM**7A26****Operational LLW - Enriched Uranium**

	Free non-aqueous liquids.....		
	Powder/Ash.....		
Inorganic anions (%wt):	Calcium silicate (0.49%wt).		
	Fluoride.....		
	Chloride.....		
	Iodide.....		
	Cyanide.....		
	Carbonate.....		
	Nitrate.....	0.06	
	Nitrite.....	0.06	
	Phosphate.....	0.02	
	Sulphate.....		
	Sulphide.....		
Materials of interest for waste acceptance criteria:	-		
	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	
	Corrosive materials.....	0.01	
	Pyrophoric materials.....	0	
	Generating toxic gases.....	0.01	
	Reacting with water.....	0	
	Active particles.....	0	
	Soluble solids as bulk chemical compounds.....	0	
Hazardous substances / non hazardous pollutants:	This waste contains lead and asbestos. Oils do exist but will be encapsulated in a solid matrix.		
	Acrylamide.....	0	
	Benzene.....	NE	
	Chlorinated solvents.....	0	
	Formaldehyde.....	0	
	Organometallics.....	0	
	Phenol.....	NE	
	Styrene.....	0	
	Tri-butyl phosphate.....	NE	
	Other organophosphates.....	0	
	Vinyl chloride.....	P	PVC.

WASTE STREAM**7A26****Operational LLW - Enriched Uranium**

Arsenic..... NE
 Barium..... NE
 Boron..... NE
 Cadmium..... NE
 Caesium..... 0
 Selenium..... NE
 Chromium..... NE
 Molybdenum..... NE
 Thallium..... NE
 Tin..... NE
 Vanadium..... NE
 Mercury compounds..... 0
 Others..... NE
 Electronic Electrical Equipment (EEE)
 EEE Type 1.....
 EEE Type 2.....
 EEE Type 3.....
 EEE Type 4.....
 EEE Type 5.....

Complexing agents (%wt):

No
 EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants.....
 Total complexing agents.....

The waste contains no organic complexing agents.

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	~5.0
Incineration	Off-site	~1.0
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None	Off-site	~94.0

Comment on planned treatments:

Treatment % are estimated based on disposals made over the past 3 years and are likely to fluctuate. Currently very little treatable metal is being generated in this stream.

WASTE STREAM**7A26****Operational LLW - Enriched Uranium****Disposal Routes:**

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	~5.0
Expected to be consigned to a Landfill Facility	~94.0
Expected to be consigned to an On-Site Disposal Facility	
Expected to be consigned to an Incineration Facility	~1.0
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	

Upcoming (2019/20-2021/22) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2019/20	2020/21	2021/22
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			

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	5.0	17	< 1
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: -

Waste Planned for Disposal at the LLW Repository:

Container voidage: Voidage will be minimal as wastes will be supercompacted prior to LLWR disposal (assuming fissile quantities within each package are acceptable to the supercompaction service provider).

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: Yes.

Potential for the waste to contain discrete items: No, wastes entering the LLWR will have been supercompacted.

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:	U-234, U-235, U-236, U-238 contaminated material.
Uncertainty:	The gross alpha and gross beta / gamma activities for the in-stock wastes are accurate, radionuclide breakdown has been estimated. Predicted waste activities are based on disposals made in the last 3 years.
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:	Typically, this waste is measured using LRGS or HRGS.
Other information:	-

WASTE STREAM

7A26

Operational LLW - Enriched Uranium

Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3					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	2.42E-07	BB 2	1.29E-07	CC 2
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234	9.03E-06	BB 2	9.14E-06	CC 2
Ag 108m					U 235	2.90E-07	BB 2	2.93E-07	CC 2
Ag 110m					U 236	3.70E-08	BB 2	3.75E-08	CC 2
Cd 109					U 238	2.42E-07	BB 2	1.29E-07	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					Total a	9.59E-06	BB 2	9.59E-06	CC 2
Eu 155					Total b/g	2.42E-07	BB 2	1.29E-07	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