

<b>WASTE STREAM</b>	<b>7A114</b>	<b>Decommissioning LLW - Enriched Uranium</b>
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**SITE** AWE Aldermaston

**SITE OWNER** Ministry of Defence

**WASTE CUSTODIAN** AWE plc

**WASTE TYPE** LLW

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	0 m <sup>3</sup>
Future arisings -	1.4.2019 - 31.3.2026.....	0 m <sup>3</sup>
	1.4.2026 - 31.3.2038.....	2061.0 m <sup>3</sup>
	1.4.2038 - 31.3.2042.....	720.0 m <sup>3</sup>
	1.4.2042 - 31.3.2071.....	0 m <sup>3</sup>
	1.4.2071 - 31.3.2073.....	75.0 m <sup>3</sup>
	1.4.2073 - 31.3.2080.....	0 m <sup>3</sup>
Total future arisings:		2856.0 m <sup>3</sup>
Total waste volume:		2856.0 m <sup>3</sup>

**Comment on volumes:** Future arisings are estimated based on the decommissioning plans for facilities on site, which have been recently reviewed. 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 Arisings (upper) x 5.0  
 Stock (lower): x Arisings (lower) x 0.5

**WASTE SOURCE** Waste arising from enriched uranium decommissioning operations.

**PHYSICAL CHARACTERISTICS**

**General description:** The waste contains metal, rubble and plastics.  
**Physical components (%wt):** The physical components of this stream were revised based on 2012 decommissioning disposals, but not reviewed for the 2019 RWI, as no data available. Metal (53%), rubble (14%), plastics, rubber, cellulosic (30%), other (3%).  
**Sealed sources:** The waste does not contain sealed sources.  
**Bulk density (t/m<sup>3</sup>):** 0.53  
**Comment on density:** Based on waste stream 7A112.

**CHEMICAL COMPOSITION**

**General description and components (%wt):** Metal (53%), rubble (14%), organic (30%), other (3%).  
**Chemical state:** Neutral  
**Chemical form of radionuclides:** U: Oxide form.  
**Metals and alloys (%wt):** The majority of decommissioning metal is sheets and pipes typically 4mm in thickness. The copper % also includes cables.

Stainless steel.....	3.1
Other ferrous metals.....	43.4
Iron.....	
Aluminium.....	1.0
Beryllium.....	
Cobalt.....	
Copper.....	5.0
Lead.....	0.53
Magnox/Magnesium.....	

**WASTE STREAM****7A114 Decommissioning LLW - Enriched Uranium**

	Nickel.....		
	Titanium.....		
	Uranium.....		
	Zinc.....		
	Zircaloy/Zirconium.....		
	Other metals.....		
Organics (%wt):	Filters included as cellulosic PVC.		
	Total celluloseics.....	14.0	
	Paper, cotton.....	10.0	
	Wood.....	4.0	
	Halogenated plastics .....	9.0	PVC.
	Total non-halogenated plastics.....	5.0	
	Condensation polymers.....	5.0	
	Others.....		
	Organic ion exchange materials....		
	Total rubber.....	2.0	
	Halogenated rubber .....		
	Non-halogenated rubber.....	2.0	
	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.....	1.0	
	Brick/Stone/Rubble.....	13.0	
	Cementitious material.....		
	Sand.....		
	Glass/Ceramics.....	1.0	
	Graphite.....		
	Desiccants/Catalysts.....		
	Asbestos.....	2.0	
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....		
	Free non-aqueous liquids.....		
	Powder/Ash.....		

**WASTE STREAM****7A114****Decommissioning LLW - Enriched Uranium**

Inorganic anions (%wt):

None.  
 Fluoride.....  
 Chloride.....  
 Iodide.....  
 Cyanide.....  
 Carbonate.....  
 Nitrate.....  
 Nitrite.....  
 Phosphate.....  
 Sulphate.....  
 Sulphide.....

Materials of interest for waste acceptance criteria:

lead

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  
 Pyrophoric materials..... 0  
 Generating toxic gases..... 0  
 Reacting with water..... 0  
 Active particles..... 0  
 Soluble solids as bulk chemical compounds..... 0

Wood, paper and cotton.

Hazardous substances / non hazardous pollutants:

This waste contains lead and asbestos.

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  
 Arsenic..... NE  
 Barium..... 0

PVC present.

**WASTE STREAM**

**7A114 Decommissioning LLW - Enriched Uranium**

Boron..... NE  
 Cadmium..... NE  
 Caesium..... 0  
 Selenium..... NE  
 Chromium..... NE  
 Molybdenum..... NE  
 Thallium..... 0  
 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.....

Complexing agents are unlikely to be present because this waste has not been produced yet.

**TREATMENT, PACKAGING AND DISPOSAL**

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	Off-site	~20.0
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		~80.0

Comment on planned treatments:

Waste treatments have been estimated from waste stream 7A112 and 7A26. This waste stream will have quite a high fissile mass and wastes that cannot go to landfill, will not meet the current acceptance criteria for supercompaction, so will go directly to the LLWR.

**WASTE STREAM****7A114****Decommissioning LLW - Enriched Uranium**

Disposal Routes:	Disposal Route	Stream volume %
		Expected to be consigned to the LLW Repository
	Expected to be consigned to a Landfill Facility	~60.0
	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	~20.0
	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 <sup>3</sup>	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	20.0	7	82
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: Assumes wastes have not been supercompacted.

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

Container voidage: Decommissioning wastes can be loaded straight into a HHISO, so voidage shall be avoided where possible.

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

No requirement for a WCH until 2026.

Waste consigned for disposal to LLWR in year of generation: Yes.

Potential for the waste to contain discrete items: No - this waste stream hasn't arisen yet, so the LLWR WAC will be met at the time of production.

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

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

**WASTE STREAM****7A114****Decommissioning LLW - Enriched Uranium**

Other information:

-

**RADIOACTIVITY**

Source:

U-234, U-235, U-236, U-238 contaminated material.

Uncertainty:

It is difficult to project the specific activity of this waste as it has not been produced before, activities have been decayed from 2016 inventory.

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:

The fingerprints for these wastes are determined by the materials that have contaminated them, these are used with low resolution or high resolution gamma spectrometry to assay the wastes.

Other information:

Decay nuclides with a half life of less than 3 months have been omitted.

**WASTE STREAM**

**7A114**

**Decommissioning LLW - Enriched Uranium**

Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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				5
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				5
Zn 65					Ra 223				5
Se 79					Ra 225				5
Kr 81					Ra 226				5
Kr 85					Ra 228				5
Rb 87					Ac 227				5
Sr 90					Th 227				5
Zr 93					Th 228				5
Nb 91					Th 229				5
Nb 92					Th 230				5
Nb 93m					Th 232				5
Nb 94					Th 234				5
Mo 93					Pa 231				5
Tc 97					Pa 233				5
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234		1.77E-05	CC	2
Ag 108m					U 235		5.69E-07	CC	2
Ag 110m					U 236		7.32E-08	CC	2
Cd 109					U 238		6.46E-08	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>0</b>	<b>1.84E-05</b>	<b>CC</b>	<b>2</b>
Eu 155					<b>Total b/g</b>	<b>0</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