

**WASTE STREAM****7A21****Operational ILW Plutonium Contaminated****SITE** AWE Aldermaston**SITE OWNER** Ministry of Defence**WASTE CUSTODIAN** AWE plc**WASTE TYPE** ILW**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	1497.0 m <sup>3</sup>
Future arisings -	1.4.2019 - 31.3.2022.....	21.0 m <sup>3</sup>
	1.4.2022 - 31.3.2025.....	21.0 m <sup>3</sup>
	1.4.2025 - 31.3.2028.....	26.0 m <sup>3</sup>
	1.4.2028 - 31.3.2062.....	938.0 m <sup>3</sup>
	1.4.2062 - 31.3.2080.....	0 m <sup>3</sup>
Total future arisings:		1006.0 m <sup>3</sup>
Total waste volume:		2503.0 m <sup>3</sup>

**Comment on volumes:** The stock volume has increased since the previous Inventory. The increase is due to a quantity of the 7A111 waste stream being recategorized as 'Operational'. Arising rate is estimated based on relevant facility predictions. Owing to the pending re-assay programme schedule of ILW Pu waste at AWE, it is envisaged that approximately 312 m<sup>3</sup> of waste (around 1,520 drums) will be recategorized as LLW and subsequently transferred to waste stream 7A27. 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 2.0 Arisings (upper) x 3.0  
 Stock (lower): x 0.5 Arisings (lower) x 0.2

**WASTE SOURCE** Organic and inorganic solids arising from operations with plutonium and uranium.**PHYSICAL CHARACTERISTICS**

**General description:** The waste consists of solids arising from operations with plutonium and uranium. These include tools, filters, box gloves, discarded and unusable equipment. It also includes some facility re-kit (refurbishment) wastes.

**Physical components (%wt):** Metal (37%), cellulosic (7%), plastics (37%), rubber (1%), non-organics (17%), Be (1%). The composition has not been changed as the arisings have stayed consistent over the past three years.

**Sealed sources:** The waste does not contain sealed sources.

**Bulk density (t/m<sup>3</sup>):** 0.26

**Comment on density:** Estimated from 'in-stock' data, revised 2019

**CHEMICAL COMPOSITION**

**General description and components (%wt):** Metal (37%), cellulosic (7%), plastics (37%), rubber (1%), non-organics (17%), Be (1%).

**Chemical state:** Neutral

**Chemical form of radionuclides:** U: Oxide form.  
Pu: Oxide form.

**Metals and alloys (%wt):** None is present as bulk items, all discreet items placed in drum (ILW).

Stainless steel.....	13.8
Other ferrous metals.....	13.1
Iron.....	NE
Aluminium.....	2.9
Beryllium.....	1.3
Cobalt.....	0
Copper.....	2.8

Cable (0.8%wt - assumed copper cable).

**WASTE STREAM**

**7A21**

**Operational ILW Plutonium Contaminated**

	Lead.....	2.5	
	Magnox/Magnesium.....	0	
	Nickel.....		
	Titanium.....		
	Uranium.....	NE	Present as a contaminant only.
	Zinc.....	0	
	Zircaloy/Zirconium.....	0	
	Other metals.....	1.6	Tin (0.5%wt), filters (1.1%wt).
Organics (%wt):	The cellulose content of the waste is made up of paper/fibreboard and cotton. PVC.		
	Total cellulosics.....	6.7	
	Paper, cotton.....	6.7	Paper/fibreboard and cotton.
	Wood.....		
	Halogenated plastics .....	20.9	PVC.
	Total non-halogenated plastics.....	16.1	
	Condensation polymers.....	16.1	
	Others.....		
	Organic ion exchange materials....	TR	
	Total rubber.....	0.90	
	Halogenated rubber .....	0.90	
	Non-halogenated rubber.....		
	Hydrocarbons.....		
	Oil or grease .....		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar)....		
	Bitumen.....		
	Others.....		
	Other organics.....		
Other materials (%wt):	This waste contains small quantities of grouted ion exchange resin.		
	Inorganic ion exchange materials.	TR	
	Inorganic sludges and flocs.....		
	Soil.....		
	Brick/Stone/Rubble.....	6.3	
	Cementitious material.....		
	Sand.....		
	Glass/Ceramics.....	2.2	
	Graphite.....	8.9	
	Desiccants/Catalysts.....		
	Asbestos.....	TR	
	Non/low friable.....	TR	
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....		

**WASTE STREAM**

**7A21**

**Operational ILW Plutonium Contaminated**

	Free non-aqueous liquids.....	
	Powder/Ash.....	
Inorganic anions (%wt):	-	
	Fluoride.....	
	Chloride.....	P
	Iodide.....	
	Cyanide.....	
	Carbonate.....	
	Nitrate.....	P
	Nitrite.....	
	Phosphate.....	
	Sulphate.....	1.0
	Sulphide.....	<0.01

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

Paper, cotton.

Hazardous substances / non hazardous pollutants:

	-	
	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.

**WASTE STREAM****7A21****Operational ILW Plutonium Contaminated**

Arsenic.....	0
Barium.....	0
Boron.....	0
Cadmium.....	0
Caesium.....	0
Selenium.....	0
Chromium.....	0
Molybdenum.....	0
Thallium.....	0
Tin.....	0.50
Vanadium.....	0
Mercury compounds.....	0
Others.....	0
Electronic Electrical Equipment (EEE)	
EEE Type 1.....	
EEE Type 2.....	
EEE Type 3.....	
EEE Type 4.....	
EEE Type 5.....	

Complexing agents (%wt):

Yes	
EDTA.....	
DPTA.....	
NTA.....	
Polycarboxylic acids.....	TR
Other organic complexants.....	TR
Total complexing agents.....	TR

The waste could contain trace organic complexing agents from decontamination operations.

**PACKAGING AND CONDITIONING**

Conditioning method:	The proposal is to transfer the 205 litre drums to Sellafield for interim storage prior to being supercompacted and loaded into 500 litre drums, finally, grouting with cement. Around 5 supercompacted pucks will fit into a 500 litre drum.
Plant Name:	Unknown.
Location:	Sellafield, Seascale, 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:	-

**WASTE STREAM 7A21 Operational ILW Plutonium Contaminated**

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	~0.47	2503

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

Range in container waste volume: The proposed supercompacted at Sellafield will allow 5 pucks to be packed 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: No

Treatment	Stream volume (%)	Comment
-	-	-

**RADIOACTIVITY**

Source: Tritium, uranium, plutonium and americium.

Uncertainty: The gross alpha and gross beta activity for in stock wastes is accurate, the revised radionuclide breakdown has been estimated using expected fingerprints. Projected activity is an estimate based on past 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: Fingerprints used with non-destructive assay techniques such as high resolution gamma spectrometry and passive neutron coincidence counting.

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

## WASTE STREAM

7A21

## Operational ILW Plutonium Contaminated

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		6		6	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		6		6
Zn 65					Ra 223		6		6
Se 79					Ra 225		6		6
Kr 81					Ra 226		6		6
Kr 85					Ra 228		6		6
Rb 87					Ac 227		6		6
Sr 90					Th 227		6		6
Zr 93					Th 228		6		6
Nb 91					Th 229		6		6
Nb 92					Th 230		6		6
Nb 93m					Th 232		6		6
Nb 94					Th 234		6		6
Mo 93					Pa 231		6		6
Tc 97					Pa 233		6		6
Tc 99					U 232				
Ru 106					U 233		6		6
Pd 107					U 234	2.04E-05	BB 2		6
Ag 108m					U 235	7.95E-07	BB 2		6
Ag 110m					U 236	9.04E-06	BB 2		6
Cd 109					U 238	2.71E-05	BB 2		6
Cd 113m					Np 237		6		6
Sn 119m					Pu 236				
Sn 121m					Pu 238	6.02E-03	BB 2	5.14E-03	CC 2
Sn 123					Pu 239	1.10E-01	BB 2	1.31E-01	CC 2
Sn 126					Pu 240	3.33E-02	BB 2	3.44E-02	CC 2
Sb 125					Pu 241	2.93E-02	BB 2	6.21E-02	CC 2
Sb 126					Pu 242	7.21E-06	BB 2	5.33E-06	CC 2
Te 125m					Am 241	4.91E-02	BB 2	4.44E-02	CC 2
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>1.98E-01</b>	<b>BB 2</b>	<b>2.15E-01</b>	<b>CC 2</b>
Eu 155					<b>Total b/g</b>	<b>2.93E-02</b>	<b>BB 2</b>	<b>6.21E-02</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