

WASTE STREAM**7A28****Operational LLW - Miscellaneous Radionuclides****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 m ³
Future arisings -	1.4.2022 - 31.3.2024.....	4.0 m ³
	1.4.2025 - 31.3.2027.....	4.0 m ³
	1.4.2028 - 31.3.2030.....	2.0 m ³
	1.4.2031 - 31.3.2032.....	6.0 m ³
	1.4.2033 - 31.3.2080.....	0 m ³
Total future arisings:		16.0 m ³
Total waste volume:		16.0 m ³

Comment on volumes: The stock has remained at zero for the last few UKRWI exercises. The future waste arisings have been reduced since the last UKRWI in 2019, as stated in the current AWE Decommissioning Liabilities Plan. The total volume of arisings in this category is small and likely to arise in drums and small wrapped packages. This waste stream is likely to be disposed alongside wastes in other waste streams (i.e. 7A27) and therefore, may be recategorised prior to disposal off-site.

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 3.0
 Stock (lower): x Arisings (lower) x 0.3

WASTE SOURCE Waste arising from operations where the fingerprint predominantly contains beta/gamma emitting radionuclides.**PHYSICAL CHARACTERISTICS**

General description: This waste stream contains plastic, rubber, cellulose, metal and other materials (in small quantities).

Physical components (%wt): Metals (59.61%), cellulosic material (9.16%), plastics (23.05%), rubber (2.84%) and other (5.34%)

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.56

Comment on density: Last reviewed on stock in 2013, but no stock. Based the density and composition on waste stream 7A27.

CHEMICAL COMPOSITION

General description and components (%wt): Metals (59.61%), cellulosic material (9.16%), plastics (23.05%), rubber (2.84%) and other (5.34%)

Chemical state: Neutral

Chemical form of radionuclides: H-3: May be present in the waste stream in very small specific activities in HTO, HT and organically bound forms

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: Present in Waste Stream as oxide, chloride or nitrate form

Np: Not present in the waste stream

Pu: Present in Waste Stream as oxide, chloride or nitrate form

Metals and alloys (%wt): -

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	7.6		
Other ferrous metals.....	34.4		
Iron.....	0		
Aluminium.....	2.8		
Beryllium.....	<0.05		
Cobalt.....	0		
Copper.....	0.86		
Lead.....	0.19		
Magnox/Magnesium.....	0		
Nickel.....	0		
Titanium.....	0		
Uranium.....	0		
Zinc.....	0		
Zircaloy/Zirconium.....	0		
Other metals.....	13.7		
Organics (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	9.2		
Paper, cotton.....	5.4	Includes hoover bags and detritus	
Wood.....	3.7		
Halogenated plastics	17.0		
Total non-halogenated plastics.....	6.1		
Condensation polymers.....	6.1		
Others.....	0		
Organic ion exchange materials....	0		
Total rubber.....	2.8		
Halogenated rubber	2.8		
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.....	4.6		
Cementitious material.....	0		
Sand.....	0.05		
Glass/Ceramics.....	0.40		
Graphite.....	0.21		
Desiccants/Catalysts.....	0		
Asbestos.....	<0.10		
Non/low friable.....	<0.10		
Moderately friable.....	<0.10		
Highly friable.....	<0.10		
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): -

	(%wt)	Type(s) and comment
Fluoride.....	0	
Chloride.....	<0.70	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	<0.50	
Nitrate.....	<0.50	
Nitrite.....	0	
Phosphate.....	<0.50	
Sulphate.....	<0.70	
Sulphide.....	0	

Materials of interest for waste acceptance criteria: Asbestos, lead and beryllium are present in this waste stream.

	(%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	Wood, papper and cotton

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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: Asbestos, lead and beryllium are present in this waste stream.

	(%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	PVC
Arsenic.....	NE	
Barium.....	0	
Boron.....	NE	
Boron (in Boral).....	NE	
Boron (non-Boral).....		
Cadmium.....	NE	
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	Complexing agents are not present in the waste stream
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	~3.0
Incineration	Off-site	~2.0
Solidification		
Decontamination		
Metal treatment	Off-site	~55.0
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		~40.0

Comment on planned treatments: -

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	~3.0	~0.56
Expected to be consigned to a Landfill Facility	~40.0	~0.56
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility	~2.0	<0.56
Expected to be consigned to a Metal Treatment Facility	~55.0	~0.56
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: 170601, 150202, 150203, 200140, 200301

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

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			

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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 2m box (no shielding) 4m box (no shielding) Other	~3.0	17	< 1

Other information: Wastes destined for LLWR are likely to go via supercompaction.

Waste Planned for Disposal at the LLW Repository:

Container voidage: Voidage will be minimal as wastes will be supercompacted prior to being sent to LLWR for burial.

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

May be consigned in with the 7A27 waste stream.

Waste consigned for disposal to LLWR in year of generation: -

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: Miscellaneous operations that generate and involve handling a multitude of radionuclides.

Uncertainty: The activity of the waste arisings has been estimated from the facility declared fingerprints and expected activities.

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, these wastes are measured using gamma-ray spectroscopy with the use of a robust fingerprint.

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

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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			6.02E-07	DD 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			1.69E-07	DD 2	Pb 210				
Co 60			1.96E-06	DD 2	Bi 208				
Ni 59					Bi 210m				
Ni 63			1.08E-06	DD 2	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		8.41E-10	DD 2	
Ru 106					U 233				
Pd 107					U 234			NE	
Ag 108m					U 235			NE	
Ag 110m					U 236			NE	
Cd 109					U 238			NE	
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239		1.20E-06	DD 2	
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242		1.02E-09	DD 2	
Te 125m					Am 241		5.26E-08	DD 2	
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137			1.06E-06	DD 2	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	1.25E-06	DD 2	
Eu 155					Total b/g	0	4.87E-06	DD 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