

<b>WASTE STREAM</b>	<b>7A34</b>	<b>Low Activity Liquids (excluding Hg)</b>
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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.....	6.4 m <sup>3</sup>
Future arisings -	1.4.2022 - 31.3.2024.....	2.0 m <sup>3</sup>
	1.4.2025 - 31.3.2027.....	11.0 m <sup>3</sup>
	1.4.2028 - 31.3.2031.....	0 m <sup>3</sup>
	1.4.2032 - 31.3.2033.....	3.0 m <sup>3</sup>
	1.4.2034 - 31.3.2038.....	0 m <sup>3</sup>
	1.4.2039 - 31.3.2040.....	3.0 m <sup>3</sup>
	1.4.2041 - 31.3.2045.....	0 m <sup>3</sup>
	1.4.2046 - 31.3.2047.....	3.0 m <sup>3</sup>
	1.4.2048 - 31.3.2054.....	0 m <sup>3</sup>
	1.4.2055 - 31.3.2056.....	3.0 m <sup>3</sup>
	1.4.2057 - 31.3.2080.....	0 m <sup>3</sup>
	Total future arisings:	
Total waste volume:		31.4 m <sup>3</sup>

Comment on volumes: The wastes in 7A34 can be readily disposed. Higher activity wastes with no disposal route have been captured under appropriate ILW waste streams. There is uncertainty in stock volumes and arising rate, because 'in-facility' liquids are not recorded in the same manner as centrally stored solid wastes. Arising data has been taken from the Site Liabilities Plan. Note that the failure rate of plant and equipment (i.e. lathe failure) has a significant impact on the generation of future arisings, which is problematic to predict.

Uncertainty factors on volumes: Stock (upper): x 1.5 Arisings (upper) x 5.0  
 Stock (lower): x 0.5 Arisings (lower) x 0.2

**WASTE SOURCE** Contaminated liquids originate from four main sources: cutting oil from machining operations, lubrication oils, spent oil from vacuum pumps and sludge from liquid effluent treatment. Machining operations provide the most heavily contaminated wastes from the presence of swarf, whilst the other processes contain fine particulate. Other liquids include coolants, chemicals and chiller solutions.

**PHYSICAL CHARACTERISTICS**

General description: Liquids contaminated with pieces of swarf, fine particles and sludge / liquids with the potential to contain contamination. Some wastes were treated to reduce volume/remove contaminated constituents prior to storage as waste (e.g. ultrafiltration to remove water phase).

Physical components (%wt): Principally hydrocarbon oil, oil/water mixtures (cutting oils) or sludges. Acid wastes are also produced.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): 0.87

Comment on density: The density has been reviewed and revised during the compilation of 2022 UKRWI. Both disposal and in-stock data have been used to determine the density which has increased from 0.5 t/m<sup>3</sup> to 0.87 t/m<sup>3</sup>

**CHEMICAL COMPOSITION**

General description and components (%wt): Hydrocarbon oils, sludge, water and chemicals

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Chemical state: Neutral

Chemical form of radionuclides: H-3: May be present in future arisings in HTO, HT and organically bound form  
 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: Only daughter products present from uranium in this waste stream. Oxide form  
 Th: Only daughter products present from uranium in this waste stream. Oxide form  
 U: Present in the waste stream in oxide form  
 Np: Np-237 present in waste stream as oxide form from daughter product of Am-241 alpha decay  
 Pu: Present in the waste stream in oxide form

Metals and alloys (%wt): -

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	0		
Iron.....	0		
Aluminium.....	0		
Beryllium.....	0		
Cobalt.....	0		
Copper.....	0		
Lead.....	0		
Magnox/Magnesium.....	0		
Nickel.....	0		
Titanium.....	0		
Uranium.....	NE	Likely to be <0.1% weight	
Zinc.....	0		
Zircaloy/Zirconium.....	0		
Other metals.....	0		

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0		
Paper, cotton.....	0		
Wood.....	0		
Halogenated plastics .....	0		
Total non-halogenated plastics.....	0		
Condensation polymers.....	0		
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		

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Asphalt/Tarmac (cont.coal tar)...	0	
Asphalt/Tarmac (no coal tar).....	0	
Bitumen.....	0	
Others.....	0	
Other organics.....	P	Covered below under non-aqueous liquids

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	~25.0		
Soil.....	0		
Brick/Stone/Rubble.....	0		
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.....	~10.0	Includes acids, aqueous liquids, sludges	
Free non-aqueous liquids.....	~65.0	Oils, coolants and cutting oils	
Powder/Ash.....	0		

Inorganic anions (%wt): -

	(%wt)	Type(s) and comment
Fluoride.....	NE	
Chloride.....	NE	
Iodide.....	NE	
Cyanide.....	NE	
Carbonate.....	NE	
Nitrate.....	NE	
Nitrite.....	NE	
Phosphate.....	NE	
Sulphate.....	NE	
Sulphide.....	NE	

Materials of interest for waste acceptance criteria: These wastes are not suitable for LLWR disposal as they are in liquid form.

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	(%wt)	Type(s) and comment
Combustible metals.....	NE	
Low flash point liquids.....	NE	
Explosive materials.....	NE	
Phosphorus.....	NE	
Hydrides.....	NE	
Biological etc. materials.....	P	
Biodegradable materials.....	P	
Putrescible wastes.....	0	
Non-putrescible wastes.....	P	Biodegradeable oil and coolants
Corrosive materials.....	P	Acids
Pyrophoric materials.....	NE	
Generating toxic gases.....	NE	Potentially acids
Reacting with water.....	P	Concentrated acids
Higher activity particles.....	0	
Soluble solids as bulk chemical compounds.....	0	

Hazardous substances /  
non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....	0	
Benzene.....	NE	
Chlorinated solvents.....	0	
Formaldehyde.....	0	
Organometallics.....	0	
Phenol.....	NE	
Styrene.....	0	
Tri-butyl phosphate.....	NE	
Other organophosphates.....	0	
Vinyl chloride.....	0	
Arsenic.....	NE	
Barium.....	0	
Boron.....	NE	
Boron (in Boral).....	NE	
Boron (non-Boral).....	0	
Cadmium.....	NE	
Caesium.....	NE	
Selenium.....	NE	
Chromium.....	NE	
Molybdenum.....	NE	
Thallium.....	0	
Tin.....		

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Vanadium.....	NE
Mercury compounds.....	0
Others.....	NE
Electronic Electrical Equipment (EEE)	
EEE Type 1.....	0
EEE Type 2.....	0
EEE Type 3.....	0
EEE Type 4.....	0
EEE Type 5.....	0

Complexing agents (%wt): Not yet determined

	(%wt)	Type(s) and comment
EDTA.....	NE	
DPTA.....	NE	
NTA.....	NE	
Polycarboxylic acids.....	NE	
Other organic complexants.....	NE	
Total complexing agents.....	NE	

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) Incineration Solidification Decontamination Metal treatment Size reduction Decay storage Recycling / reuse Other / various None	Off-site	~97.0
	Off-site	~3.0

Comment on planned treatments:

Free liquids cannot be disposed via burial at the LLWR. Most liquids will be incinerated, but some will be treated by NNL in order to re-use the uranium in the civil nuclear programme.

**Disposal Routes:**

Disposal Route	Stream volume %	Disposal density t/m3
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	~97.0	~0.87
	~3.0	~0.87

Classification codes for waste expected to be consigned to a landfill facility: -

**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:** No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

**Waste Packaging for Disposal:** (Not applicable to this waste stream)

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 2m box (no shielding) 4m box (no shielding) Other			

Other information: Not intended for disposal/burial at the LLWR as outside of the provisions of the LLWR WAC.

**Waste Planned for Disposal at the LLW Repository:** (Not applicable to this waste stream)

Container voidage: -

Waste Characterisation Form (WCH): The waste does not meet the LLWR's Waste Acceptance Criteria (WAC).

The waste stream is not acceptable to the LLWR as in liquid form.

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: This waste stream contains tritium, plutonium and uranium, and has the potential to contain other minor species.

Uncertainty: The stock waste activity is accurate and taken from the AWE Solid Radioactive Waste

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	<p>Management Records System (SRWMRS) Database. Future arisings have been predicted using the figures in the AWE Site Liabilities Plan for operational waste processes. Fingerprint information was sought from existing stock and disposal data.</p>
Definition of total alpha and total beta/gamma:	<p>Where totals are shown on the table of radionuclides, they are the sums of the listed alpha and beta/gamma emitting radionuclides.</p>
Measurement of radioactivities:	<p>The majority of oils were assayed using a form of high resolution gamma-ray spectroscopy in conjunction with an associated modelling software package. Some oils were sampled and taken for either destructive or non-destructive assay to determine the radionuclides and their isotopic abundances.</p>
Other information:	<p>Decay nuclides with a half-life less than 3 months have been omitted.</p>

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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					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	1.10E-14	BB 2	5.87E-16	CC 2
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210	8.48E-15	BB 2	4.53E-16	CC 2
Zn 65					Ra 223	1.13E-12	BB 2	5.25E-14	CC 2
Se 79					Ra 225			3.36E-23	CC 2
Kr 81					Ra 226	1.88E-13	BB 2	1.00E-14	CC 2
Kr 85					Ra 228	7.73E-19	BB 2	4.69E-20	CC 2
Rb 87					Ac 227	1.18E-12	BB 2	5.46E-14	CC 2
Sr 90					Th 227	1.13E-12	BB 2	5.25E-14	CC 2
Zr 93					Th 228	3.65E-19	BB 2	2.22E-20	CC 2
Nb 91					Th 229				
Nb 92					Th 230	1.45E-10	BB 2	7.22E-12	CC 2
Nb 93m					Th 232	2.87E-18	BB 2	1.63E-19	CC 2
Nb 94					Th 234	4.7E-06	BB 2	7.05E-08	CC 2
Mo 93					Pa 231	1.31E-11	BB 2	6.08E-13	CC 2
Tc 97					Pa 233			1.57E-14	CC 2
Tc 99					U 232				
Ru 106					U 233			1.92E-19	CC 2
Pd 107					U 234	2.62E-06	BB 2	1.4E-07	CC 2
Ag 108m					U 235	1.03E-07	BB 2	4.77E-09	CC 2
Ag 110m					U 236	9.07E-09	BB 2	5.51E-10	CC 2
Cd 109					U 238	4.7E-06	BB 2	7.05E-08	CC 2
Cd 113m					Np 237			1.51E-14	CC 2
Sn 119m					Pu 236				
Sn 121m					Pu 238			2.09E-10	CC 2
Sn 123					Pu 239			4.80E-09	CC 2
Sn 126					Pu 240			1.12E-09	CC 2
Sb 125					Pu 241			2.20E-07	CC 2
Sb 126					Pu 242			4.86E-14	CC 2
Te 125m					Am 241			9.38E-09	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>7.43E-06</b>	<b>BB 2</b>	<b>2.31E-07</b>	<b>CC 2</b>
Eu 155					<b>Total b/g</b>	<b>4.7E-06</b>	<b>BB 2</b>	<b>2.9E-07</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