

WASTE STREAM	7A41	Cemented Sludges
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SITE AWE Aldermaston

SITE OWNER Ministry of Defence (MOD)

WASTE CUSTODIAN AWE plc

WASTE TYPE LLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025 = 194.4			
Future arisings:	1.4.2025 - 31.3.2080 = 0			
Total future arisings:	0.0			
Total waste volume:	194.4			

Number of waste packages in stock: At 1.4.2025..... - packages

Comment on arising rates: This code contains AWE's cemented sludges. It had been previously agreed that these would be disposed as LLW under 7A27 (agreement with LLWR), but LLWR has not accepted these items since the introduction of discrete items in the LLWR WAC.

Additional information on quantities: Stock volumes are recorded in a database and are considered to be accurate. The total volume of arisings will depend on the BAT route for processing the sludge drums, which is subject to change.

Uncertainty factors on volumes: Stock (upper): x 1.00 Arisings (upper): x -
Stock (lower): x 1.00 Arisings (lower): x -

WASTE SOURCE Effluent treatment using ferric floc precipitation process to remove radioactivity from aqueous waste streams, which have originated from uranium and plutonium operations, and been cemented.

PHYSICAL CHARACTERISTICS

General description: The waste consists of uranium and plutonium bearing sludges resulting from legacy operations. The waste contains no items that require special handling.

Changes since waste generated: Solid component of the sludge has been concentrated by aqueous waste treatment processes. The sludge has been mixed with cement to solidify inside 205 litre lost paddle steel drums.

Bulk density (t/m³): = 1.8

Comment on density: The figure has been reviewed and slightly adjusted for the 2022 UKRWI, and is an average of all in-stock containers.

CHEMICAL COMPOSITION

General description and components (%wt): Contains trace metals, other ferrous metal (12%) and cemented flocculant sludge (88%). This is an accurate description (2022) taken from an analysis report. The last RWI also identified the waste as being made up of uranium and plutonium bearing ferric hydroxide sludges. The waste contains silica as SiO₂ (1.2%), iron as Fe₂O₃ (1.6%), calcium as CaO (2.4%), sodium as Na₂O (0.2%), carbonate as CO₂ (1.9%), chloride as Cl (0.1%), plutonium as oxide (<0.1%), uranium as oxide (<0.1%), heavy metals as oxides (<0.1%), potassium as sulphate (<0.1%), magnesium as hydroxide (<0.1%). As in the 2019, 2022 UK RWI, this data has been assumed to be correct and not reviewed for the 2025 UKRWI.

Chemical state: Alkali

Sheet metal proportion / thickness: No sheet metal.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 0	-	
Other ferrous metals.....	= 12.0	Includes drum and lost paddle (both mild steel)	
Iron.....	= 0	-	
Aluminium.....	= 0	-	
Beryllium.....	TR	-	
Cobalt.....	TR	-	
Copper.....	TR	-	
Lead.....	TR	-	
Magnox/Magnesium.....	TR	-	
Nickel.....	TR	-	
Titanium.....	TR	-	
Uranium.....	TR	-	
Zinc.....	TR	-	
Zircaloy/Zirconium.....	TR	-	
Other metals.....	TR	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....	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	-	
Asphalt/Tarmac (cont.coal tar).....	0	-	
Asphalt/Tarmac (no coal tar).....	0	-	
Bitumen.....	0	-	
Others.....	0	-	
Other organics.....	0	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	TR	-	
Inorganic sludges and flocs.....	= 63.0	-	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	= 25.0	Cement	
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.....	= 0	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....	= 0	-	

COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

	(%wt)	Type(s) and comment
Fluoride.....	TR	-
Chloride.....	= 0.10	350 to 1100 ppm
Iodide.....	= 0	-
Cyanide.....	= 0	-
Carbonate.....	= 1.9	-
Nitrate.....	TR	-
Nitrite.....	= 0	-
Phosphate.....	TR	-
Sulphate.....	< 0.10	-
Sulphide.....	TR	-

Materials of interest for waste acceptance criteria:

	(%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.....	0	-
Putrescible wastes.....	0	-
Non-putrescible wastes.....	0	-
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:

	(%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.....	= 0	-
Arsenic.....	P	0.34ppm
Barium.....	= 0	-
Boron.....	P	0.84ppm
Boron (in Boral).....	P	0.84ppm
Boron (non-Boral).....	= 0	-
Cadmium.....	P	0.51ppm
Caesium.....	TR	-
Selenium.....	P	0.51ppm
Chromium.....	P	4.21ppm
Molybdenum.....	P	0.25ppm
Thallium.....	= 0	-
Tin.....	P	0.93ppm
Vanadium.....	P	0.34ppm
Mercury compounds.....	= 0	-
Others.....	P	TR

Complexing agents (%wt):

	(%wt)	Type(s) and comment
EDTA.....	= 0	-
DPTA.....	= 0	-
NTA.....	= 0	-
Polycarboxylic acids.....	= 0	-
Other organic complexants.....	= 0	The waste stream does not contain any complexing agents.
Total complexing agents.....	= 0	-

Physical components:

	Number	Type(s) and comment
Sources.....		-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....		-
EEE Type 2.....		-
EEE Type 3.....		-
EEE Type 4.....		-
EEE Type 5.....		-

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off-site	Stream volume %
Size reduction		
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None	Off-site	= 100.0

Comments on planned treatments:

AWE is awaiting confirmation from LLWR that this waste cannot be accepted on a variation, as it was acceptable up until June 2014. The average alpha activity is 3800 Bq/g so is LLW, but does not fall under the discrete items' limit.

Conditioning method:

-

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

-

Further information on the conditioning matrix:

-

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
-	-	-	-	-	-

Range in container waste loading:

Other information on packaging and conditioning:

Will only go into a HHISO if the waste is accepted at the LLWR. Some voidage will be filled with small packages from the 7A27 waste stream and there will be no inaccessible voidage.

Conditioned density (t/m³):

-

Conditioned density comment:

-

Management Routes:

Disposal Route	Stream volume %	Raw density t/m³	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)			
Expected to be Non-NSD HAW managed under Scottish Government's policy			
Expected to be disposed to LLW Vaults NRS Dounreay			
Expected to be consigned to the Geological Disposal Facility			
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be Out of Scope			
Expected to be recycled / reused			
Disposal route not known	= 100.0	= 1.9	

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

Opportunities for alternative disposal routing: Not yet determined

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
-	-	-	-	-

RADIOACTIVITY

Source: Plutonium, Uranium and Tritium. With traces of Cs-137, Fe-55 and Co-60.

Uncertainty: The total activities have been derived by decay correction of the twelve fingerprints that were applied to the entirety of the cemented sludges.

Measurement of radioactivities: The activity contained within the sludge is determined by sampling and using destructive assay. Decay nuclides with a half-life of less than 3 months have been omitted.

Chemical form of radionuclides: H-3: HT and HTO diffused present in waste stream. Small amount of organically bound tritium may be present in solid 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

WASTE STREAM		7A41		Cemented Sludges					
Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code		Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3	= 1.64E-08	B B 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	= 1.79E-12	B B 2			Pb 210	= 7.78E-10	B B 2		
Co 60	= 5.77E-10	B B 2			Bi 208				
Ni 59					Bi 210m	= 7.78E-10	B B 2		
Ni 63					Po 210	= 7.12E-10	B B 2		
Zn 65					Ra 223	= 2.36E-08	B B 2		
Se 79					Ra 225	= 9.63E-18	B B 2		
Kr 81					Ra 226	= 4.93E-09	B B 2		
Kr 85					Ra 228	= 3.12E-14	B B 2		
Rb 87					Ac 227	= 2.91E-08	B B 2		
Sr 90					Th 227	= 2.34E-08	B B 2		
Zr 93					Th 228	= 2.43E-14	B B 2		
Nb 91					Th 229	= 9.75E-18	B B 2		
Nb 92					Th 230	= 1.30E-06	B B 2		
Nb 93m					Th 232	= 5.35E-14	B B 2		
Nb 94					Th 234	= 1.85E-03	B B 2		
Mo 93					Pa 231	= 1.02E-07	B B 2		
Tc 97					Pa 233	= 7.26E-10	B B 2		
Tc 99					U 232				
Ru 106					U 233	= 2.12E-14	B B 2		
Pd 107					U 234	= 8.07E-03	B B 2		
Ag 108m					U 235	= 2.75E-04	B B 2		
Ag 110m					U 236	= 6.19E-05	B B 2		
Cd 109					U 238	= 1.85E-03	B B 2		
Cd 113m					Np 237	= 7.33E-10	B B 2		
Sn 119m					Pu 236				
Sn 121m					Pu 238	= 1.06E-06	B B 2		
Sn 123					Pu 239	= 2.35E-05	B B 2		
Sn 126					Pu 240	= 5.50E-06	B B 2		
Sb 125					Pu 241	= 4.22E-03	B B 2		
Sb 126					Pu 242	= 6.44E-11	B B 2		
Te 125m					Am 241	= 2.07E-04	B B 2		
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137	= 1.66E-08	B B 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					Unsp a				
Eu 152					Unsp b/g				
Eu 154					Total a	1.05E-02	*	0	*
Eu 155					Total b/g	6.07E-03	*	0	*

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 the 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
* Total calculated from the 114 declared radionuclides