

WASTE STREAM	2D95.1	Magnox Fuel Storage Pond Sludge
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SITE Sellafield

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Sellafield Ltd

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025			
Future arisings:				
Total future arisings:				
Total waste volume:				

Total future arisings: 0.0
Total waste volume: 1159.6

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

Comment on arising rates: No future arisings are expected. The pond is no longer an operational plant.

Additional information on quantities: The pond sludge volumes are only estimates based on crude sludge depth measurements taken at a number of points across the pond. No routine measurements of the sludge are taken.

Uncertainty factors on volumes: Stock (upper): x 1.30 Arisings (upper): x -
Stock (lower): x 0.70 Arisings (lower): x -

WASTE SOURCE The waste originates as sludge from the corrosion of Magnox cladding.

PHYSICAL CHARACTERISTICS

General description: Magnesium hydroxide sludge, containing quantities of corroded uranium. No items require special handling.

Changes since waste generated: -

Bulk density (t/m³): = 1.5

Comment on density: The density has been estimated as: 1.5 t/m³ wet, 2.5 t/m³ dry solid.

CHEMICAL COMPOSITION

General description and components (%wt): Magnesium hydroxide with quantities of uranium.

Chemical state: Alkali

Sheet metal proportion / thickness: Metal only present as small particles.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 0	-	
Other ferrous metals.....	= 0	-	
Iron.....		-	
Aluminium.....		-	
Beryllium.....		-	
Cobalt.....	= 0	-	
Copper.....		-	
Lead.....	= 0	-	
Magnox/Magnesium.....	P	-	
Nickel.....		-	
Titanium.....		-	
Uranium.....	P	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....		-	

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.....		-	
Oil or grease.....		-	
Fuel.....		-	
Asphalt/Tarmac (cont.coal tar).....		-	
Asphalt/Tarmac (no coal tar).....		-	
Bitumen.....		-	
Others.....		-	
Other organics.....	= 0	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	-	
Inorganic sludges and flocs.....	= 100.0	-	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	TR	-	
Sand.....	TR	-	
Glass/Ceramics.....		-	
Graphite.....	= 0	-	
Desiccants/Catalysts.....		-	
Asbestos.....	= 0	-	
Non/low friable.....		-	
Moderately friable.....		-	
Highly friable.....		-	
Free aqueous liquids.....	NE	-	
Free non-aqueous liquids.....	= 0	-	
Powder/Ash.....		-	

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

Inorganic anions (%wt):

	(%wt)	Type(s) and comment
Fluoride.....	TR	-
Chloride.....	TR	-
Iodide.....	TR	-
Cyanide.....		-
Carbonate.....	TR	-
Nitrate.....	TR	-
Nitrite.....		-
Phosphate.....	TR	-
Sulphate.....	TR	-
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.....		-
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.....	NE	-
Soluble solids as bulk chemical compounds.....	NE	-

Hazardous substances / non hazardous pollutants:

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

Complexing agents (%wt):

No		
	(%wt)	Type(s) and comment
EDTA.....		-
DPTA.....		-
NTA.....		-
Polycarboxylic acids.....		-
Other organic complexants.....		Unlikely to be present.
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	On-site	= 100.0

Comments on planned treatments:

Sludge will be buffer stored in Sludge Packaging Plant 1, before being sent to the Sludge Handling & Export Plant for dewatering and interim containerisation for transport to the Wastes Encapsulation Plant for conditioning and subsequent encapsulation in 500l drums.

Conditioning method:

In-drum encapsulation using an inorganic cement matrix in a 500l drum.

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
	500 l drum	100.0	0.15	0.47	7783	-

Range in container waste loading:

Other information on packaging and conditioning: -

Conditioned density (t/m³): NE
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)	= 100.0		
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			

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: The main source of activity is mixed fission products, uranium and plutonium.

Uncertainty: The accuracy of activity for some sludges is fairly good as they have been sampled. From the best available data an overall average has been derived.

Measurement of radioactivities: -

Chemical form of radionuclides:

- H-3: -
- C-14: -
- Cl-36: -
- Se-79: -
- Tc-99: -
- I-129: -
- Ra: Present in less than trace amounts in fuel.
- Th: -
- U: Present in metallic and reacted forms (oxides and possibly hydride).
- Np: -
- Pu: Present in metallic and mixed oxide forms.

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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					Gd 153				
Be 10					Ho 163				
C 14					Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36	1.04E-04	B B 2			Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Ti 204				
Mn 54					Pb 205				
Fe 55					Pb 210	2.14E-10	B B 2		
Co 60	1.97E-04	A 3			Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210	2.00E-10	B B 2		
Zn 65					Ra 223	3.94E-09	B B 2		
Se 79	1.72E-05	B B 2			Ra 225	5.30E-13	B B 2		
Kr 81					Ra 226	1.04E-09	B B 2		
Kr 85					Ra 228	6.68E-17			
Rb 87					Ac 227	3.97E-09	B B		
Sr 90	9.49E+00	B B 2			Th 227	3.90E-09	B B 2		
Zr 93	8.00E-04	B B 2			Th 228	2.62E-17			
Nb 91					Th 229	5.34E-13	B B 2		
Nb 92					Th 230	2.01E-07	B B 2		
Nb 93m	5.05E-04	B B 2			Th 232	2.48E-16	B B 2		
Nb 94	5.00E-07	B B 2			Th 234	1.00E-03	B B 2		
Mo 93					Pa 231	1.32E-08	B B 2		
Tc 97					Pa 233	1.44E-05	B B 2		
Tc 99	1.30E-02	A 3			U 232				
Ru 106	7.43E-11	A 3			U 233	7.24E-10	B B 2		
Pd 107					U 234	9.23E-04	B B 2		
Ag 108m					U 235	2.60E-05	B B 2		
Ag 110m					U 236	4.19E-07	B B 2		
Cd 109					U 238	1.00E-03	B B 2		
Cd 113m					Np 237	1.44E-05	B B 2		
Sn 119m					Pu 236				
Sn 121m					Pu 238	3.04E-01	B B 2		
Sn 123					Pu 239	4.70E-01	B B 2		
Sn 126	1.30E-04	B B 2			Pu 240	5.89E-01	B B 2		
Sb 125					Pu 241	5.76E+00	B B 2		
Sb 126	1.83E-05	B B 2			Pu 242				
Te 125m					Am 241	1.99E+00	B B 2		
Te 127m					Am 242m				
I 129	1.00E-05	B B 2			Am 243				
Cs 134	7.15E-07	B B 2			Cm 242				
Cs 135	7.00E-05	B B 2			Cm 243				
Cs 137	2.68E+00	B B 2			Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	8.47E-14	A 3			Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Unsp a	1.20E-01	B B 2		
Eu 152	5.33E-03	A 3			Unsp b/g	2.06E-19	B B 2		
Eu 154	2.18E-02	A 3			Total a	3.47E+00	*	0	*
Eu 155	1.84E-03	A 3			Total b/g	1.80E+01	*	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