

WASTE STREAM	2D95.2	Settling 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	= 72.4		
Future arisings:				
Total future arisings:		0.0		
Total waste volume:		72.4		

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

Comment on arising rates: The settling pond (Redundant Settling Tank) is no longer an operational facility and is currently being prepared for decommissioning. Sludge inventory will remain static.

Additional information on quantities: Sludge volume estimates are derived from SONAR surveys undertaken in 2012.

Uncertainty factors on volumes: Stock (upper): x 1.04 Arisings (upper): x -
Stock (lower): x 0.88 Arisings (lower): x -

WASTE SOURCE Sludge which has settled from liquid effluents from the Magnox decanning and storage building.

PHYSICAL CHARACTERISTICS

General description: The beta/gamma active sludge has settled from liquid effluents. The particle size for fine sludge is <1700 microns, with the majority in the range 87.2 to 212 microns. Over 40% of the sludge is of particle size less than 87.2 microns. Material at outlet end of the building is significantly finer than the material in the inlet sump. No items require special handling.

Changes since waste generated: -

Bulk density (t/m³): = 1.2

Comment on density: The waste density is 1.2 t/m³ as stored, and 0.7 t/m³ for dry settled sludge.

CHEMICAL COMPOSITION

General description and components (%wt): Magnesium hydroxide sludge. Uranium (3.4%), plutonium (0.02%). Minor constituents are Co, Ru, Sb, Cs, Ce and Eu. Moisture content 40 - 70%.

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.....	= 0.40	-	
Iron.....		-	
Aluminium.....	= 0.60	-	
Beryllium.....		-	
Cobalt.....	= 0	-	
Copper.....		-	
Lead.....	= 0	-	
Magnox/Magnesium.....	<< 1.0	-	
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.....		-	
Wood.....		-	
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.....	= 98.0	-	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	= 0	-	
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.....		Organic complexing agents are 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	On-site	= 100.0
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		

Comments on planned treatments:

Sludge is allowed to drain of mobile water, before being sent to WEP for annular encapsulation.

Conditioning method:

Placed into a mesh basket, in turn placed into a 500 litre drum in the Wastes Encapsulation Plant (WEP) and annually encapsulated using grout.

Conditioning plants:

Plant Name	Location
Wastes Encapsulation Plant (WEP)	Sellafield

Likely conditioning matrix:

-

Further information on the conditioning matrix:

Likely matrix 5:1 GGBS:CEM1

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 (basket for waste)	100.0	0.27	0.50	269	-

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 is from fuel corrosion and the nuclides involved include Cs, Eu, Ru, Sr-90 and other mixed fission products and actinides.

Uncertainty: Best available.

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.

WASTE STREAM		2D95.2		Settling Pond Sludge					
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	8.51E-05	B B 2			Gd 153	3.35E-11	B B 2		
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	3.14E-11	B B 2						
Mn 54	Pb 205								
Fe 55	Pb 210								
Co 60	Bi 208								
Ni 59	Bi 210m								
Ni 63	Po 210								
Zn 65	Ra 223								
Se 79	Ra 225								
Kr 81	Ra 226								
Kr 85	Ra 228								
Rb 87	Ac 227	6.11E-10	B B						
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					1.09E-10	B B 2		
Ru 106	U 233								
Pd 107	U 234								
Ag 108m	U 235								
Ag 110m	U 236								
Cd 109	U 238								
Cd 113m	Np 237								
Sn 119m	Pu 236								
Sn 121m	Pu 238								
Sn 123	Pu 239	7.20E-02	B B 2						
Sn 126	Pu 240								
Sb 125	Pu 241								
Sb 126	Pu 242								
Te 125m	Am 241								
Te 127m	Am 242m								
I 129	Am 243								
Cs 134	Cm 242								
Cs 135	Cm 243								
Cs 137	Cm 244					9.06E-02	B B 2		
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	2.70E-02	B B 2						
Eu 154	Total a								
Eu 155	Total b/g								

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