

WASTE STREAM	2D19	Aluminium-Ferric Floc from Effluent Treatment
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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	= 2961.0		
Future arisings:	1.4.2025 - 31.3.2026	= 0		
	1.4.2026 - 31.3.2027	= -296.0		
	1.4.2027 - 31.3.2028	= -296.0		
	1.4.2028 - 31.3.2029	= -296.0		
	1.4.2029 - 31.3.2030	= -296.0		
	1.4.2030 - 31.3.2031	= -296.0		
	1.4.2031 - 31.3.2032	= -296.0		
	1.4.2032 - 31.3.2033	= -296.0		
	1.4.2033 - 31.3.2034	= -296.0		
	1.4.2034 - 31.3.2035	= -296.0		
	1.4.2035 - 31.3.2036	= -297.0		
Total future arisings:		-2961.0		
Total waste volume:		0.0		

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

Comment on arising rates: Arisings from this legacy stream have ceased.
Negative future arisings indicate the planned retrieval schedule which are based on the EARP Concentrate Strategy and the LAEMG PSWP 2022. Arisings of the conditioned waste are included in the EARP/WPEP (2D27/C) stream before eventual deep disposal.

Additional information on quantities: The volume is given for homogenised sludge and supernate. Uncertainty, standard figure applied to account for measurement uncertainties. +/-5% quoted.

Uncertainty factors on volumes: Stock (upper): x 1.05 Arisings (upper): x 1.05
Stock (lower): x 0.95 Arisings (lower): x 0.95

WASTE SOURCE The waste has arisen from the historical recovery of plutonium and other transuranic elements by precipitation from reprocessing plant effluent.

PHYSICAL CHARACTERISTICS

General description: The waste stream consists of settled sludges and associated supernate. The sludge is precipitated alpha active floc. On top of each tank of sludge is a supernate of ammonium nitrate solution. No items require special handling.

Changes since waste generated: Settling of floc has occurred, so re-suspension is used to retrieve floc in the PS tanks.

Bulk density (t/m³): = 1.1

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): The waste consists of a settled ferric/aluminium hydroxide floc (principally a mixture of Al, Fe, Ca, and Cr hydroxides) beneath an aqueous supernate of ammonium nitrate. The chemical composition as % weight of the whole is as follows: Water (75%), Ammonium nitrate (20%), Fe (1.5%), Others (3.5%). Note: included in others are organics at 0.1%.

Chemical state: Alkali

Sheet metal proportion / thickness: The waste contains no sheet or bulk metal.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(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.....	= 0	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	= 0	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....		-	
Paper, cotton.....		-	
Wood.....		-	
Halogenated plastics.....		-	
Total non-halogenated plastics.....		-	
Condensation polymers.....		-	
Others.....		-	
Organic ion exchange materials.....		-	
Total rubber.....		-	
Halogenated rubber.....		-	
Non-halogenated rubber.....		-	
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.....		-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 70.0	-	
Inorganic sludges and flocs.....		Includes small amounts of organic material (~0.1%).	
Soil.....		-	
Brick/Stone/Rubble.....		-	
Cementitious material.....		-	
Sand.....		-	
Glass/Ceramics.....		-	
Graphite.....		-	
Desiccants/Catalysts.....		-	
Asbestos.....		-	
Non/low friable.....	= 0	-	
Moderately friable.....	= 0	-	
Highly friable.....	= 0	-	
Free aqueous liquids.....	= 30.0	Ammonium nitrate (as supernate).	
Free non-aqueous liquids.....		-	
Powder/Ash.....		-	

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

Inorganic anions (%wt):

	(%wt)	Type(s) and comment
Fluoride.....	TR	-
Chloride.....	~ 0.09	-
Iodide.....	0	-
Cyanide.....	0	-
Carbonate.....		-
Nitrate.....	~ 14.9	-
Nitrite.....	P	-
Phosphate.....	0	-
Sulphate.....	0	-
Sulphide.....	0	-

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.....	= 20.0	-
Reacting with water.....	= 0	-
Higher activity particles.....	P	-
Soluble solids as bulk chemical compounds.....	= 0	-

Hazardous substances / non hazardous pollutants:

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

Complexing agents (%wt):

Yes		
	(%wt)	Type(s) and comment
EDTA.....	= 0	-
DPTA.....	= 0	-
NTA.....	= 0	-
Polycarboxylic acids.....	= 0	-
Other organic complexants.....	~ 0.05	TBP & DBP.
Total complexing agents.....	~ 0.05	-

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	On-site	= 100.0
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments:

Waste is dewatered prior to encapsulation

Conditioning method:

Dewatered followed by Encapsulation

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

Cement (~41% water)

Further information on the conditioning matrix:

Will contain lime.

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	0.90	0.47	0	-

Range in container waste loading: <5%.

Other information on packaging and conditioning:

Packages read as zero as this waste is transferred to 2D27_C when it is conditioned and packaged.

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			

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

Opportunities for alternative disposal routing: No

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

RADIOACTIVITY

Source: The main sources are actinides from fuel reprocessing, where >90% is Am-241. Uranium and plutonium are also present.

Uncertainty: The activity accuracy is good, as it is based on analytical records.

Measurement of radioactivities: From analytical records after sampling of tanks.

Chemical form of radionuclides:

- H-3: -
- C-14: -
- Cl-36: -
- Se-79: -
- Tc-99: Likely to be Tc VII as TcO₄⁻.
- I-129: -
- Ra: -
- Th: -
- U: U is not present in simple metallic or oxide forms. Is present as a hydrated oxide associated with aluminium/ferric floc.
- Np: -
- Pu: Pu is not present in simple metallic or oxide forms. Is present as a hydrated oxide associated with aluminium/ferric floc.

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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					Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Ti 204				
Mn 54	< 4.38E-15	A 3	< 4.38E-15	A 3	Pb 205				
Fe 55					Pb 210				
Co 60	< 1.05E-06	A 3	< 1.05E-06	A 3	Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65	< 1.52E-17	A 3	< 1.52E-17	A 3	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	1.83E-03	A A 2	1.83E-03	A A 2	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	< 1.28E-04	A 3	< 1.28E-04	A 3
Tc 99	2.44E-04	A A 2	2.44E-04	A A 2	U 232				
Ru 106	< 7.32E-13	A 3	< 7.32E-13	A 3	U 233				
Pd 107					U 234	< 3.25E-05	C 3	< 3.25E-05	C 3
Ag 108m					U 235	3.63E-07	C C 2	3.63E-07	C C 2
Ag 110m	< 2.20E-17	A 3	< 2.20E-17	A 3	U 236	< 3.24E-07	C 3	< 3.24E-07	C 3
Cd 109					U 238	7.56E-06	C C 2	7.56E-06	C C 2
Cd 113m					Np 237	< 1.28E-04	A 3	< 1.28E-04	A 3
Sn 119m					Pu 236				
Sn 121m					Pu 238	< 1.92E-03	C 3	< 1.92E-03	C 3
Sn 123					Pu 239	< 9.02E-03	C 3	< 9.02E-03	C 3
Sn 126					Pu 240	< 4.35E-03	C 3	< 4.35E-03	C 3
Sb 125	< 7.66E-08	A 3	< 7.66E-08	A 3	Pu 241	< 2.02E-03	C 3	< 2.02E-03	C 3
Sb 126					Pu 242	< 1.36E-06	C 3	< 1.36E-06	C 3
Te 125m					Am 241	~ 1.86E-01	A A 2	~ 1.86E-01	A A 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	< 3.04E-09	A 3	< 3.04E-09	A 3	Cm 242				
Cs 135					Cm 243				
Cs 137	~ 1.05E-04	A A 2	~ 1.05E-04	A A 2	Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	< 6.63E-15	A 3	< 6.63E-15	A 3	Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Unsp a				
Eu 152	< 3.16E-05	A 3	< 3.16E-05	A 3	Unsp b/g				
Eu 154	< 9.80E-06	A 3	< 9.80E-06	A 3	Total a	2.02E-01	*	2.02E-01	*
Eu 155	< 1.22E-06	A 3	< 1.22E-06	A 3	Total b/g	4.36E-03	*	4.36E-03	*

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