

WASTE STREAM	2F31	MSSS Compartment 11
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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	= 74.4		
Future arisings:				
Total future arisings:		0.0		
Total waste volume:		74.4		

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

Comment on arising rates: There are no future arisings.

Additional information on quantities: Waste volume does not include cover liquor (520m³).

Uncertainty factors on volumes:

Stock (upper):	x 2.00	Arisings (upper):	x -
Stock (lower):	x 0.50	Arisings (lower):	x -

WASTE SOURCE Leached oxide fuel hulls from reprocessing campaigns the head end plant from 1969 to 1974.

PHYSICAL CHARACTERISTICS

General description: The waste is Zircaloy fuel cladding from the reprocessing of Zircaloy clad oxide fuel. Also associated with the Zircaloy are fragments of undissolved uranium oxide fuel and stainless steel sheaths from the fuel assemblies. The waste is stored under water. Corrosion of Zircaloy is negligible. The waste includes some Beta/Gamma Waste which may include 2 m lengths of steel tubing.

Changes since waste generated: -

Bulk density (t/m³): = 0.58

Comment on density: Oxide Fuel Hulls and Sand

CHEMICAL COMPOSITION

General description and components (%wt): The main components are Zircaloy, Stainless Steel, Sand, Inconel, Uranium oxide and Aluminium oxide.

Chemical state: Alkali

Sheet metal proportion / thickness: The waste comprises mainly short lengths of fuel cladding tube, typically 50-150mm long and 10-16mm in diameter.

Metals and alloys (%wt):

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

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....	= 0	-	
Paper, cotton.....	-	-	
Wood.....	-	-	
Halogenated plastics.....	P	-	
Total non-halogenated plastics.....	P	-	
Condensation polymers.....	NE	-	
Others.....	P	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	NE	-	
Halogenated rubber.....	-	-	
Non-halogenated rubber.....	-	-	
Hydrocarbons.....	NE	-	
Oil or grease.....	NE	-	
Fuel.....	NE	-	
Asphalt/Tarmac (cont.coal tar).....	NE	-	
Asphalt/Tarmac (no coal tar).....	NE	-	
Bitumen.....	NE	-	
Others.....	NE	-	
Other organics.....	NE	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	-	
Inorganic sludges and flocs.....	= 0	-	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	P	-	
Cementitious material.....	= 0	-	
Sand.....	P	-	
Glass/Ceramics.....	NE	-	
Graphite.....	NE	-	
Desiccants/Catalysts.....	NE	-	
Asbestos.....	NE	-	
Non/low friable.....	-	-	
Moderately friable.....	-	-	
Highly friable.....	-	-	
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.....	NE	-
Chloride.....	P	-
Iodide.....	NE	-
Cyanide.....	NE	-
Carbonate.....	NE	-
Nitrate.....	NE	-
Nitrite.....	NE	-
Phosphate.....	NE	-
Sulphate.....	NE	-
Sulphide.....	NE	-

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.....	P	-
Soluble solids as bulk chemical compounds.....	NE	-

Hazardous substances / non hazardous pollutants:

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

Complexing agents (%wt):

No		
	(%wt)	Type(s) and comment
EDTA.....		-
DPTA.....		-
NTA.....		-
Polycarboxylic acids.....		-
Other organic complexants.....		-
Total complexing agents.....		-

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		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:

-

Conditioning method: This waste stream is outside of the current cLoC. It is currently envisaged that it will be possible to use the same processing facility and package type as is the case for the other MSSS waste streams.

Conditioning plants:

Plant Name	Location
Magnox Swarf Storage Silo (MSSS) Final Conditioning Plant	Sellafield

Likely conditioning matrix:

Non-standard

Further information on the conditioning matrix:

5:1 GGBS/CEM 1

Waste Packaging:

Likely container type:	Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	Sellafield enhanced 3 m³ box	100.0	2.0	2.1	38	-

Range in container waste loading: There will be considerable variability in unconditioned waste volume per package due to variations in skip loading and content. The actual number of packages produced is identified in the Sellafield Retrievals Product and Secondary Waste Plan.

Other information on packaging and conditioning: Waste matrix (as retrieved) will be in-filled with grout. A second pour of capping grout will be added. Void spaces between Skip wall and Box wall will be filled with grout.

Conditioned density (t/m³): ~ 2.0
Conditioned density comment: Density of conditioned waste will be fairly uniform.

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: No

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

RADIOACTIVITY

Source: The main sources are fission and activation products from fuel carry-over.

Uncertainty: The best available. Based on a short term oxide fuel reprocessing programme carried out between 1969 and 1974.

Measurement of radioactivities: -

Chemical form of radionuclides:

- H-3: Present in reacted forms.
- C-14: Present in reacted forms.
- Cl-36: Present in reacted forms.
- Se-79: Present in reacted forms.
- Tc-99: Present in reacted forms.
- I-129: Present in reacted forms.
- Ra: Present in reacted forms.
- Th: Present in reacted forms.
- U: Present in reacted forms.
- Np: Present in reacted forms.
- Pu: Present in reacted forms.

WASTE STREAM 2F31 MSSS Compartment 11									
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	1.26E-01	C C 2			Gd 153				
Be 10	3.80E-10	C C 2			Ho 163				
C 14	9.64E-03	C C 2			Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36	1.07E-05	C C 2			Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41	4.92E-06	C C 2			Pt 193				
Mn 53					Ti 204				
Mn 54					Pb 205				
Fe 55	8.35E-05	C C 2			Pb 210	7.81E-10	C C 2		
Co 60	6.75E-02	C C 2			Bi 208				
Ni 59	1.22E-01	C C 2			Bi 210m				
Ni 63	1.04E+01	C C 2			Po 210	7.57E-10	C C 2		
Zn 65					Ra 223	1.44E-09			
Se 79	1.66E-06	C C 2			Ra 225	1.56E-11			
Kr 81					Ra 226	2.25E-09	C C 2		
Kr 85					Ra 228	1.32E-15			
Rb 87					Ac 227	1.50E-09			
Sr 90	1.67E+00	C C 2			Th 227	1.44E-09			
Zr 93	2.04E-03	C C 2			Th 228	3.81E-16			
Nb 91					Th 229	1.57E-11	C C 2		
Nb 92					Th 230	2.42E-07	C C 2		
Nb 93m	1.91E-03	C C 2			Th 232	8.26E-15			
Nb 94	4.43E-03	C C 2			Th 234	1.97E-04			
Mo 93	3.41E-04	C C 2			Pa 231	1.71E-08	C C 2		
Tc 97					Pa 233	2.23E-05			
Tc 99	1.85E-02	C C 2			U 232				
Ru 106	4.47E-13	C C 2			U 233	4.59E-09	C C 2		
Pd 107					U 234	7.03E-04	C C 2		
Ag 108m					U 235	1.90E-05	C C 2		
Ag 110m					U 236	5.58E-05	C C 2		
Cd 109					U 238	1.97E-04	C C 2		
Cd 113m					Np 237	2.23E-05	C C 2		
Sn 119m					Pu 236				
Sn 121m	4.07E-03	C C 2			Pu 238	5.75E-02	C C 2		
Sn 123					Pu 239	7.11E-02	C C 2		
Sn 126	1.54E-05	C C 2			Pu 240	2.43E-02	C C 2		
Sb 125					Pu 241	3.96E-01	C C 2		
Sb 126	2.15E-06				Pu 242	4.20E-05	C C 2		
Te 125m					Am 241	1.88E-01	C C 2		
Te 127m					Am 242m	2.97E-04	C C 2		
I 129	1.99E-06	C C 2			Am 243	1.92E-04	C C 2		
Cs 134	3.69E-08	C C 2			Cm 242	2.45E-04	C C 2		
Cs 135	4.21E-05	C C 2			Cm 243	4.95E-05	C C 2		
Cs 137	5.19E+00	C C 2			Cm 244	1.20E-03	C C 2		
Ba 133					Cm 245	6.09E-07	C C 2		
La 137					Cm 246	7.02E-05	C C 2		
La 138					Cm 248				
Ce 144	8.14E-20	C C 2			Cf 249				
Pm 145					Cf 250				
Pm 147	2.57E-06	C C 2			Cf 251				
Sm 147	7.69E-17				Cf 252				
Sm 151	1.98E-02	C C 2			Unsp a	7.34E-07	C C 2		
Eu 152	1.84E-05	C C 2			Unsp b/g	1.19E+01	C C 2		
Eu 154	1.75E-03	C C 2			Total a	3.44E-01	*	0	*
Eu 155	2.92E-05	C C 2			Total b/g	2.99E+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