

WASTE STREAM	2F21/C	Encapsulated Maintenance Scrap
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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		103.0	117.6
Future arisings:	1.4.2025 - 31.3.2026		0	0.0
	1.4.2026 - 31.3.2027		10.0	11.4
	1.4.2027 - 31.3.2028		5.0	5.7
Total future arisings:			15.0	17.1
Total waste volume:			118.0	134.8

Number of waste packages in stock: At 1.4.2025..... 206 packages

Comment on arising rates: MEP Baseline and Opportunity Feeds - March 2024.

Additional information on quantities: Stocks are counted as per annual stock take.

Uncertainty factors on volumes:

Stock (upper):	x 1.00	Arisings (upper):	x 2.00
Stock (lower):	x 1.00	Arisings (lower):	x 1.00

WASTE SOURCE Scrap equipment from shearing operations in THORP.

PHYSICAL CHARACTERISTICS

General description: Scrap equipment from shear cave maintenance, basket handling cave crane maintenance and miscellaneous items. This is then encapsulated in grout.

Changes since waste generated: The waste has not undergone any change since it was generated.

Bulk density (t/m³): = 2.6

Comment on density: Density of conditioned waste. Raw waste density ~ 1.6 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): Stainless steel (13%), tool steel/mild steel (11%), grout (76%).

Chemical state: Alkali

Sheet metal proportion / thickness: The size and shape of scrap is very variable, depending on the operations being carried out. 75% of other ferrous metals comprises baskets.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 13.0	Grades 316L and 304.	
Other ferrous metals.....	= 11.0	Tool steel, mild steel.	
Iron.....	-	-	
Aluminium.....	= 0	-	
Beryllium.....	TR	-	
Cobalt.....	= 0	-	
Copper.....	= 0	-	
Lead.....	0	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	= 0	-	
Titanium.....	-	-	
Uranium.....	< 0.01	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	TR	-	
Other metals.....	= 0	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 0	-	
Paper, cotton.....	= 0	-	
Wood.....	= 0	-	
Halogenated plastics.....	TR	-	
Total non-halogenated plastics.....	TR	-	
Condensation polymers.....	TR	-	
Others.....	= 0	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	TR	-	
Halogenated rubber.....	= 0	-	
Non-halogenated rubber.....	TR	-	
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.....	= 0	-	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	= 76.0	-	
Sand.....	= 0	No sand is present in encapsulation grout.	
Glass/Ceramics.....	= 0	-	
Graphite.....	= 0	-	
Desiccants/Catalysts.....		-	
Asbestos.....	= 0	-	
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.....	NE	-
Iodide.....	NE	-
Cyanide.....	NE	-
Carbonate.....	NE	-
Nitrate.....	P	-
Nitrite.....	TR	-
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.....		-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	= 0	-
Reacting with water.....	= 0	-
Higher activity particles.....	P	Small fraction immobilised in grout.
Soluble solids as bulk chemical compounds.....	P	Some calcium compounds from grout.

Hazardous substances / non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....	= 0	-
Benzene.....		-
Chlorinated solvents.....		-
Formaldehyde.....		-
Organometallics.....	= 0	-
Phenol.....		-
Styrene.....		-
Tri-butyl phosphate.....		-
Other organophosphates.....	= 0	-
Vinyl chloride.....		-
Arsenic.....	= 0	-
Barium.....		-
Boron.....	= 0	-
Boron (in Boral).....		-
Boron (non-Boral).....		-
Cadmium.....	= 0	-
Caesium.....		-
Selenium.....	= 0	-
Chromium.....		P Small amount present in encapsulation grout OPC.
Molybdenum.....	= 0	-
Thallium.....		-
Tin.....	P	Trace amount in encapsulation grout OPC.
Vanadium.....		= 0
Mercury compounds.....	= 0	-
Others.....		-

Complexing agents (%wt):

No		
	(%wt)	Type(s) and comment
EDTA.....		-
DPTA.....		-
NTA.....		-
Polycarboxylic acids.....		-
Other organic complexants.....	= 0	No complexing agents are present.
Total complexing agents.....	= 0	

Physical components:

	Number	Type(s) and comment
Sources.....	= 0	-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....		= 0
EEE Type 2.....		= 0
EEE Type 3.....		= 0
EEE Type 4.....		= 0
EEE Type 5.....		= 0

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:

Encapsulated in cementitious grout.

Conditioning method:

Flood grout encapsulation in Wastes Encapsulation Plant.

Conditioning plants:

Plant Name	Location
Wastes Encapsulation Plant (WEP)	Sellafield

Likely conditioning matrix:

Non-standard

Further information on the conditioning matrix:

BFS/OPC 3:1 to 5.67:1 (4.5:1) @ 0.33:1 – 0.37:1 (0.35:1) w/s. Conditioning matrix approx 76% of immobilised waste.

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	0.50	0.50	236	-

Range in container waste loading: Volume will be dependant on items in drum prior to conditioning, however, optimum packing fraction will be attempted in all cases.

Other information on packaging and conditioning: The waste is already conditioned.

Conditioned density (t/m³): ~ 2.6

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		2077
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 source of activity is fuel dust contamination.

Uncertainty: -

Measurement of radioactivities: The activities are calculated.

Chemical form of radionuclides: H-3: Not estimated.
C-14: Not estimated.
Cl-36: Present as trace amounts of clathrate compounds of metallic salts readily lost to aqueous solution.

Se-79: Not estimated.
Tc-99: Not estimated.
I-129: Present as trace amounts of clathrate compounds of metallic salts readily lost to aqueous solution.

Ra: Not estimated.
Th: Not estimated.
U: UO2.
Np: Not estimated.
Pu: PuO2.

WASTE STREAM 2F21/C Encapsulated Maintenance Scrap									
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					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	9.07E-17	5	9.07E-17	5
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210	5.51E-17	5	5.51E-17	5
Zn 65					Ra 223	2.01E-18	5	2.01E-18	5
Se 79					Ra 225	3.91E-17	5	3.91E-17	5
Kr 81					Ra 226	3.08E-15	5	3.08E-15	5
Kr 85					Ra 228	1.16E-20	5	1.16E-20	5
Rb 87					Ac 227	2.32E-18	5	2.32E-18	5
Sr 90	6.57E-02	C C 2	6.57E-02	C C 2	Th 227	2.06E-18	5	2.06E-18	5
Zr 93					Th 228	3.27E-21	5	3.27E-21	5
Nb 91					Th 229	4.08E-17	5	4.08E-17	5
Nb 92					Th 230	4.87E-12	5	4.87E-12	5
Nb 93m					Th 232	7.46E-20	5	7.46E-20	5
Nb 94					Th 234	1.35E-15	5	1.35E-15	5
Mo 93					Pa 231	7.50E-17	5	7.50E-17	5
Tc 97					Pa 233	2.51E-08	C C 2	2.51E-08	C C 2
Tc 99					U 232				
Ru 106	4.06E-06	C C 2	4.06E-06	C C 2	U 233	2.98E-13	5	2.98E-13	5
Pd 107					U 234	1.91E-07	C C 2	1.91E-07	C C 2
Ag 108m					U 235	2.36E-12	5	2.36E-12	5
Ag 110m					U 236	5.48E-10	C C 2	5.48E-10	C C 2
Cd 109					U 238	1.40E-15	5	1.40E-15	5
Cd 113m					Np 237	2.52E-08	C C 2	2.52E-08	C C 2
Sn 119m					Pu 236				
Sn 121m					Pu 238	3.46E-03	C C 2	3.46E-03	C C 2
Sn 123					Pu 239	8.00E-04	C C 2	8.00E-04	C C 2
Sn 126	1.00E-06	C C 2	1.00E-06	C C 2	Pu 240	9.99E-04	C C 2	9.99E-04	C C 2
Sb 125					Pu 241	4.50E-02	C C 2	4.50E-02	C C 2
Sb 126	1.40E-07	C C 2	1.40E-07	C C 2	Pu 242	3.00E-06	C C 2	3.00E-06	C C 2
Te 125m					Am 241	4.71E-03	C C 2	4.71E-03	C C 2
Te 127m					Am 242m	9.14E-06	C C 2	9.14E-06	C C 2
I 129					Am 243	2.00E-05	C C 2	2.00E-05	C C 2
Cs 134	2.95E-04	C C 2	2.95E-04	C C 2	Cm 242	7.54E-06	C C 2	7.54E-06	C C 2
Cs 135					Cm 243	1.33E-05	C C 2	1.33E-05	C C 2
Cs 137	1.34E-01	C C 2	1.34E-01	C C 2	Cm 244	5.21E-04	C C 2	5.21E-04	C C 2
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147	1.18E-03	C C 2	1.18E-03	C C 2	Cf 251				
Sm 147	3.53E-14	5	3.53E-14	5	Cf 252				
Sm 151					Unsp a	1.00E-03	C C 2	1.00E-03	C C 2
Eu 152	2.99E-06	C C 2	2.99E-06	C C 2	Unsp b/g				
Eu 154	1.74E-03	C C 2	1.74E-03	C C 2	Total a	1.15E-02	*	1.15E-02	*
Eu 155	4.54E-04	C C 2	4.54E-04	C C 2	Total b/g	2.48E-01	*	2.48E-01	*

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