

WASTE STREAM	2D148	HVLLW from Final Decommissioning
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SITE Sellafield

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Sellafield Ltd

WASTE TYPE VLLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	0		
Future arisings:	1.4.2025 - 31.3.2030	~ 5250.5		
	1.4.2030 - 31.3.2040	~ 66060.7		
	1.4.2040 - 31.3.2050	~ 107847.0		
	1.4.2050 - 31.3.2060	~ 230401.4		
	1.4.2060 - 31.3.2070	~ 170582.2		
	1.4.2070 - 31.3.2080	~ 436539.7		
	1.4.2080 - 31.3.2090	~ 67271.3		
	1.4.2090 - 31.3.2100	~ 307243.7		
	1.4.2100 - 31.3.2110	~ 282139.1		
	1.4.2110 - 31.3.2121	~ 973888.8		
Total future arisings:		2647224.3		
Total waste volume:		2647224.3		

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

Comment on arising rates: Arisings are in line with current decommissioning programmes and strategy. Waste within this stream is generated from a number of decommissioning projects which will commence at a future date. As a result of this, although characterisation of current waste volumes and fingerprints has been carried out, there is a large uncertainty in the potential arisings.

Additional information on quantities: The ACCELS project refined the likely lower and upper bounds to be 1 million and 4 million cubic metres. (Note: This represents between 16% and 65% of all reinforced concrete structures delivered on the Sellafield site). It should be noted that our current best estimate, based on limited decommissioning experience, is that approximately 70% of this material may be 'Out of Scope'. Note the given levels of uncertainty apply to the total volume. The uncertainty associated with the arisings within a specific time period are significantly greater.

Uncertainty factors on volumes:

Stock (upper):	x -	Arisings (upper):	x 1.45
Stock (lower):	x -	Arisings (lower):	x 0.35

WASTE SOURCE Demolition of reprocessing and associated plants, waste storage and treatment plants and site services facilities.

PHYSICAL CHARACTERISTICS

General description: Building structural materials. Most items size reduced in-situ. Some large items may be present.

Changes since waste generated: -

Bulk density (t/m³): = 1.0

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): The physical components of the waste are concrete (75%), brick (15%), metals (5%), wood (1.5%), asbestos (1%), calcium silicate (1%), soil and stone (1% combined), coke (0.5%).

Chemical state: Neutral

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	NE	-	
Other ferrous metals.....	NE	-	
Iron.....		-	
Aluminium.....	NE	-	
Beryllium.....		-	
Cobalt.....	NE	-	
Copper.....	NE	-	
Lead.....	NE	-	
Magnox/Magnesium.....	NE	-	
Nickel.....	NE	-	
Titanium.....		-	
Uranium.....		-	
Zinc.....	NE	-	
Zircaloy/Zirconium.....	NE	-	
Other metals.....	~ 5.0	The composition of the metal waste has not been estimated.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....	~ 1.5	-	
Paper, cotton.....		-	
Wood.....	~ 1.5	-	
Halogenated plastics.....		-	
Total non-halogenated plastics.....		-	
Condensation polymers.....		-	
Others.....		-	
Organic ion exchange materials.....		-	
Total rubber.....		-	
Halogenated rubber.....		-	
Non-halogenated rubber.....		-	
Hydrocarbons.....		-	
Oil or grease.....		-	
Fuel.....		-	
Asphalt/Tarmac (cont.coal tar).....		-	
Asphalt/Tarmac (no coal tar).....		-	
Bitumen.....		-	
Others.....		-	
Other organics.....	~ 0.50	Coke	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....		-	
Inorganic sludges and flocs.....		-	
Soil.....	~ 0.50	-	
Brick/Stone/Rubble.....	~ 15.5	-	
Cementitious material.....	~ 75.0	-	
Sand.....		-	
Glass/Ceramics.....		-	
Graphite.....		-	
Desiccants/Catalysts.....		-	
Asbestos.....	~ 1.0	-	
Non/low friable.....		-	
Moderately friable.....		-	
Highly friable.....		-	
Free aqueous liquids.....	0	-	
Free non-aqueous liquids.....	0	-	
Powder/Ash.....	1.0	Cacium silicate may not be as loose powder	

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

Inorganic anions (%wt):

	(%wt)	Type(s) and comment
Fluoride.....	= 0	-
Chloride.....	= 0	-
Iodide.....	= 0	-
Cyanide.....	= 0	-
Carbonate.....	= 0	-
Nitrate.....	= 0	-
Nitrite.....	= 0	-
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.....		-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	= 0	-
Reacting with water.....	= 0	-
Higher activity particles.....		-
Soluble solids as bulk chemical compounds.....		-

Hazardous substances / non hazardous pollutants:

-

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

Complexing agents (%wt):

No

	(%wt)	Type(s) and comment
EDTA.....		-
DPTA.....		-
NTA.....		-
Polycarboxylic acids.....		-
Other organic complexants.....		Not 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		
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		~ 5.0
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		~ 95.0

Comments on planned treatments:

Based on our current decommissioning experience, it is estimated that around 70% of this waste may be classified as "Out of Scope" if handled in a suitable manner. However at this time a bulk material "Out of Scope" waste route has not been consistently agreed for this type of material.

Conditioning method:

-

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
Not yet determined	100.0	-	-	-	-

Range in container waste loading:

Other information on packaging and conditioning:

-

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	~ 95.0	= 1.0	
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	~ 5.0	= 1.0	
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: Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
Landfill	Out of scope	70.0	AMBER	This waste stream is not expected to be disposed at LLWR. The baseline route is assumed to be authorised landfill. There is potential for a significant proportion to be categorised as out of scope and this will be dependant upon the extent of contamination and demolition techniques deployed. There is potential for ~70% of this waste to be recategorised as out of scope but this is based on limited decommissioning experience. This will be better underpinned when facilities are characterised and broadfront decommissioning commences.

RADIOACTIVITY

Source: The main sources of activity are actinides and fission products.

Uncertainty: Waste within this waste stream is generated from a number of decommissioning projects which will commence at a future date. The uncertainties quoted for each nuclide represent both the uncertainty in quantification without detailed sampling and the likely variation of nuclides in different buildings consigned wastes under this waste stream. It is exceptionally unlikely that all the waste included in this waste stream will have the same variation in nuclide fingerprint. Also activity levels will depend on degree of decontamination achieved.

Measurement of radioactivities: Characterisation data review 2D148 HVVLW stream from final decommissioning.

Chemical form of radionuclides:

- H-3: -
- C-14: -
- Cl-36: -
- Se-79: -
- Tc-99: -
- I-129: -
- Ra: -
- Th: -
- U: -
- Np: -
- Pu: -

WASTE STREAM 2D148 HVVLLW from Final Decommissioning									
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			9.13E-07	C D 2	Gd 153				
Be 10					Ho 163				
C 14			2.33E-08	C D 2	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36			1.28E-08	C D 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			1.13E-09	C D 2	Pb 205				
Fe 55			2.09E-07	C D 2	Pb 210				
Co 60			1.62E-08	C D 2	Bi 208				
Ni 59					Bi 210m				
Ni 63			2.89E-08	C D 2	Po 210				
Zn 65				5	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226			3.10E-08	C D 2
Kr 85				8	Ra 228				
Rb 87					Ac 227				
Sr 90			6.72E-07	C D 2	Th 227				
Zr 93					Th 228			5.09E-09	C D 2
Nb 91					Th 229				8
Nb 92					Th 230			5.36E-09	C D 2
Nb 93m					Th 232			4.08E-09	C D 2
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99			7.97E-08	C D 2	U 232			2.58E-09	C D 2
Ru 106			1.52E-08	C D 2	U 233			1.20E-07	C D 2
Pd 107					U 234			6.91E-07	C D 2
Ag 108m					U 235			1.24E-07	C D 2
Ag 110m				5	U 236			6.44E-08	C D 2
Cd 109					U 238			8.24E-07	C D 2
Cd 113m					Np 237			2.75E-08	C D 2
Sn 119m					Pu 236				
Sn 121m					Pu 238			1.80E-08	C D 2
Sn 123					Pu 239			5.21E-08	C D 2
Sn 126					Pu 240			5.96E-08	C D 2
Sb 125			4.36E-09	C D 2	Pu 241			3.32E-07	C D 2
Sb 126					Pu 242			1.30E-09	C D 2
Te 125m					Am 241			5.52E-08	C D 2
Te 127m					Am 242m				
I 129			2.37E-08	C D 2	Am 243				
Cs 134			3.88E-09	C D 2	Cm 242			6.15E-10	C D 2
Cs 135					Cm 243				5
Cs 137			3.70E-07	C D 2	Cm 244			3.23E-09	C D 2
Ba 133					Cm 245			7.59E-08	C D 2
La 137					Cm 246			6.98E-09	C D 2
La 138					Cm 248				
Ce 144			1.86E-08	C D 2	Cf 249				
Pm 145					Cf 250				
Pm 147			2.89E-08	C D 2	Cf 251				
Sm 147					Cf 252				
Sm 151			2.54E-10	C D 2	Unsp a				
Eu 152				5	Unsp b/g				5
Eu 154			9.10E-10	C D 2	Total a	0	*	2.17E-06	*
Eu 155			2.50E-09	C D 2	Total b/g	0	*	2.76E-06	*

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