

WASTE STREAM	2S303	Windscale Pile 2 LLW
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SITE Windscale

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Sellafield Ltd

WASTE TYPE LLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	= 0		
Future arisings:	1.4.2025 - 31.3.2042	= 0		
	1.4.2042 - 31.3.2044	~ 2117.0		
	1.4.2044 - 31.3.2047	~ 876.0		
	1.4.2047 - 31.3.2052	~ 657.0		
Total future arisings:		3650.0		
Total waste volume:		3650.0		

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

Comment on arising rates: Arisings have been amended from previous declarations and this declaration is congruent with the Hazard Inventory for the plant. The figures have been amended proportionally to the total arisings.

Additional information on quantities: LLW produced as a result of decommissioning activities including operational and secondary waste. Compactable secondary wastes - soft organics, rubber/plastics, PVC, etc. 13 x 205l mild steel drums water duct debris & redundant machinery from Pile 2. Mild steel. Concrete and graphite will be present but not yet determined. Concrete blocks, scabbings, cores, etc. Percentage breakdowns are by weight and based on same rebar to concrete ratio as that in GLEEP and as detailed in PRWI. Activity is that measured in sampling in 2008.

Uncertainty factors on volumes: Stock (upper): x - Arisings (upper): x 1.50
Stock (lower): x - Arisings (lower): x 0.50

WASTE SOURCE Decommissioning of Windscale Pile 2, an air-cooled graphite-moderated reactor.

PHYSICAL CHARACTERISTICS

General description: Wastes from decommissioning comprising bioshield concrete, thermal shield steel work, insulation and duct work. Plastics and rubber wastes will be produced due to operations ongoing as part of decommissioning. No large items of waste will be generated. All reactor components will be size reduced during decommissioning.

Changes since waste generated: Some size reduction may be necessary.

Bulk density (t/m³): = 2.4

Comment on density: The density is for the raw waste and varies considerably across the stream. This may change upon characterisation.

CHEMICAL COMPOSITION

General description and components (%wt): Soil/ Rubble/ Concrete (69%), Carbon Steel (8%), Stainless Steel (<1%), Aluminium (<1%), Wood (3%), Fibreglass (<1%), Soft Organics (7%), Plastic/ Rubber (12%).

Chemical state: Alkali

Sheet metal proportion / thickness: No metal is present as sheet form. The steel is mainly present as plate or girders. This will be clarified upon characterisation.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	< 1.0	-	
Other ferrous metals.....	< 8.0	-	
Iron.....	-	-	
Aluminium.....	< 1.0	-	
Beryllium.....	-	-	
Cobalt.....	= 0	-	
Copper.....	= 0	-	
Lead.....	TR	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	= 0	-	
Titanium.....	-	-	
Uranium.....	P	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	= 0	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....	~ 3.0	-	
Paper, cotton.....	P	-	
Wood.....	~ 3.0	-	
Halogenated plastics.....	P	-	
Total non-halogenated plastics.....	P	-	
Condensation polymers.....	= 0	-	
Others.....	P	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	~ 12.0	-	
Halogenated rubber.....	P	-	
Non-halogenated rubber.....	P	-	
Hydrocarbons.....	-	-	
Oil or grease.....	-	-	
Fuel.....	-	-	
Asphalt/Tarmac (cont.coal tar).....	-	-	
Asphalt/Tarmac (no coal tar).....	-	-	
Bitumen.....	-	-	
Others.....	-	-	
Other organics.....	~ 7.0	Soft organics.	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	-	
Inorganic sludges and flocs.....	= 0	-	
Soil.....	~ 4.0	-	
Brick/Stone/Rubble.....	~ 9.0	-	
Cementitious material.....	~ 56.0	Contains an undeterminable amount of 'REBAR'.	
Sand.....	-	-	
Glass/Ceramics.....	< 1.0	-	
Graphite.....	= 0	-	
Desiccants/Catalysts.....	-	-	
Asbestos.....	P	-	
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.....	= 0	-
Chloride.....	= 0	-
Iodide.....	= 0	-
Cyanide.....	= 0	-
Carbonate.....	P	-
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.....	NE	-
Putrescible wastes.....	= 0	-
Non-putrescible wastes.....	NE	-
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.....		-
Benzene.....	NE	-
Chlorinated solvents.....		-
Formaldehyde.....		-
Organometallics.....		-
Phenol.....	NE	-
Styrene.....		-
Tri-butyl phosphate.....	NE	-
Other organophosphates.....		-
Vinyl chloride.....	NE	-
Arsenic.....	NE	-
Barium.....		-
Boron.....	NE	-
Boron (in Boral).....		-
Boron (non-Boral).....		-
Cadmium.....	NE	-
Caesium.....		-
Selenium.....	NE	-
Chromium.....	NE	-
Molybdenum.....	NE	-
Thallium.....		-
Tin.....	NE	-
Vanadium.....	NE	-
Mercury compounds.....		-
Others.....	NE	-

Complexing agents (%wt):

No

	(%wt)	Type(s) and comment
EDTA.....		-
DPTA.....		-
NTA.....		-
Polycarboxylic acids.....		-
Other organic complexants.....		-
Total complexing agents.....	= 0	-

Physical components:

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

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off-site	Stream volume %
Size reduction	On-site	< 70.0
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration	Off-site	~ 22.0
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment	Off-site	~ 8.0
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		< 70.0

Comments on planned treatments:

Although there are no firm plans in place, based on current experience we have assumed the treatment methods set out in the table for the purposes of the 2025 UK Inventory plus some size reduction to allow packing at source into Half Height ISOs for disposal.

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
1/2 Height IP-2 Disposal/Re-usable ISO (TC01/TC02)	70.0	10.0	18.3	256	-

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	< 70.0	= 1.2	
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	~ 22.0	= 0.14	
Expected to be consigned to a Metal Treatment Facility	~ 8.0	= 1.4	
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: Activity due to activation of concrete and metals and from fuel contamination.

Uncertainty: Total alpha is 2.47E-07 TBq/m³.

Measurement of radioactivities: Samples taken from Pile 1 concrete, soft compactable waste and rubble, and was subject to radiometric analysis in 2003 in order to produce a radiometric fingerprint for both piles.

Chemical form of radionuclides: H-3: Tritium is present as activation within graphite and concrete.
C-14: C-14 is present as activation within steel and concrete.
Cl-36: -
Se-79: Possibly present as a result of contamination.
Tc-99: Possibly present as a result of contamination.
I-129: -
Ra: -
Th: -
U: Originally present as metal, but oxidation likely.
Np: Possibly present as a result of contamination.
Pu: Possibly present as a result of contamination.

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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			= 1.57E-07	B C 1	Gd 153				
Be 10					Ho 163				
C 14			= 1.23E-08	B C 1	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			= 2.21E-14	B C 1	Pb 205				
Fe 55			= 2.21E-09	B C 1	Pb 210				
Co 60			= 2.80E-09	B C 1	Bi 208				
Ni 59					Bi 210m				
Ni 63			= 1.77E-05	B C 1	Po 210				
Zn 65			= 1.40E-15	B C 1	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90			= 2.49E-05	B C 1	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234			= 2.48E-08	B C 1
Mo 93					Pa 231			= 3.48E-13	B C 1
Tc 97					Pa 233			= 6.22E-08	B C 1
Tc 99			= 6.01E-08	B C 1	U 232			= 2.92E-09	B C 1
Ru 106			= 4.21E-13	B C 1	U 233				
Pd 107					U 234			= 3.73E-08	B C 1
Ag 108m					U 235			= 1.49E-09	B C 1
Ag 110m			= 3.74E-15	B C 1	U 236			= 2.34E-10	B C 1
Cd 109					U 238			= 2.48E-08	B C 1
Cd 113m					Np 237			= 6.22E-08	B C 1
Sn 119m					Pu 236				
Sn 121m					Pu 238			= 5.49E-09	B C 1
Sn 123					Pu 239			= 4.08E-08	B C 1
Sn 126					Pu 240			= 5.36E-08	B C 1
Sb 125			= 1.06E-10	B C 1	Pu 241			= 1.24E-07	B C 1
Sb 126					Pu 242			= 4.30E-10	B C 1
Te 125m					Am 241			= 1.63E-08	B C 1
Te 127m					Am 242m				
I 129			= 6.10E-09	B C 1	Am 243				
Cs 134			= 9.93E-12	B C 1	Cm 242			= 1.66E-18	B C 1
Cs 135					Cm 243			= 7.67E-11	B C 1
Cs 137			= 4.10E-04	B C 1	Cm 244			= 1.68E-09	B C 1
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144			= 1.64E-14	B C 1	Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Unsp a				
Eu 152			= 1.46E-09	B C 1	Unsp b/g				
Eu 154			= 5.80E-09	B C 1	Total a	0	*	2.47E-07	*
Eu 155			= 4.41E-10	B C 1	Total b/g	0	*	4.54E-04	*

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