

WASTE STREAM	2S308/C	Conditioned WAGR Decommissioning ILW
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SITE Windscale

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		= 610.6	1243.5
Future arisings:	1.4.2025 - 31.3.2042		~ 6.0	12.2
Total future arisings:			6.0	12.2
Total waste volume:			616.6	1255.8

Number of waste packages in stock: At 1.4.2025..... 106 packages

Comment on arising rates: The arisings have now been moved to align with the remaining retrieval operations within the facility.

Additional information on quantities: Volume is number of packages x payload. Volume uncertainty takes into account that some boxes may be reclassified to LLW by the time export to GDF takes place. Future arisings can no longer be treated/conditioned with the same methodology of historic wastes. Future treatment options are yet to be determined.

Uncertainty factors on volumes:

Stock (upper):	x 1.00	Arisings (upper):	x 1.25
Stock (lower):	x 0.75	Arisings (lower):	x 0.75

WASTE SOURCE Decommissioning of the Windscale Advanced Gas Cooled Reactor (WAGR).

PHYSICAL CHARACTERISTICS

General description: Reactor structural components, size reduced to fit in WAGR boxes.

Changes since waste generated: The waste has been size-reduced as necessary to package as waste, and encapsulated in disposal packages.

Bulk density (t/m³): = 2.7

Comment on density: Total wasteform masses divided by volume.

CHEMICAL COMPOSITION

General description and components (%wt): Stainless steel (1%), Mild steel (30%), Graphite (11%) and Cement grout (58%).

Chemical state: -

Sheet metal proportion / thickness: Thermal shield plates (~38% of mild steel) are 50mm thick. Waste furniture (typically 10mm thick) forms ~46% of mild steel mass.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 1.0	-	
Other ferrous metals.....	= 30.0	Range of steel grades present.	
Iron.....	-	-	
Aluminium.....	= 0	-	
Beryllium.....	-	-	
Cobalt.....	= 0	-	
Copper.....	= 0	-	
Lead.....	= 0	-	
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.....	= 0	-	
Paper, cotton.....	= 0	-	
Wood.....	= 0	-	
Halogenated plastics.....	= 0	-	
Total non-halogenated plastics.....	= 0	-	
Condensation polymers.....	= 0	-	
Others.....	= 0	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	= 0	-	
Halogenated rubber.....	= 0	-	
Non-halogenated rubber.....	= 0	-	
Hydrocarbons.....		-	
Oil or grease.....		-	
Fuel.....		-	
Asphalt/Tarmac (cont.coal tar).....		-	
Asphalt/Tarmac (no coal tar).....		-	
Bitumen.....		-	
Others.....		-	
Other organics.....	TR	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	-	100.0
Inorganic sludges and flocs.....	= 0	-	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	= 58.0	-	
Sand.....		-	
Glass/Ceramics.....	= 0	-	
Graphite.....	= 11.0	-	
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.....	P	-
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.....	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.....	= 0	-

Physical components:

	Number	Type(s) and comment
Sources.....	= 0	-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....	TR	-
EEE Type 2.....	TR	-
EEE Type 3.....	= 0	-
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		
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		= 100.0

Comments on planned treatments:

-

Conditioning method:

Historic treatment facility for this waste is no longer available. The treatment/conditioning methodology for the final 1 % of material has not yet been determined.

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

-

Further information on the conditioning matrix:

PFA/OPC (>1.7t/m3) and magnetite/RHPC (>3t/m3) used according to shielding requirements

Waste Packaging:

Likely container type:	Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	6 m³ concrete box (SD)	99.0	5.8	5.8	106	-
	Not yet determined	1.0	-	-	-	-

Range in container waste loading:

Other information on packaging and conditioning: -

Conditioned density (t/m³): = 2.7
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		
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: Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
GDF	LLWR	< 50.0	AMBER	Potential for up to 50% to be disposed to LLWR. Project assessment is in progress for 14 %.

RADIOACTIVITY

Source: Activation of reactor components. Minor contamination with volatile fission products (Cs137).

Uncertainty: -

Measurement of radioactivities: Gamma spectrometry used on waste items/ baskets to measure Co60. Other isotopes calculated from fingerprints derived from neutronics codes. Supplemented by Cs137 analysis.

Chemical form of radionuclides: H-3: Atomic/ molecular in graphite matrix.
C-14: Graphite.
Cl-36: -
Se-79: -
Tc-99: -
I-129: -
Ra: -
Th: -
U: -
Np: -
Pu: -

WASTE STREAM 2S308/C Conditioned WAGR Decommissioning ILW									
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	= 7.85E-03	A A 2	5.01E-03	A A 2	Gd 153				
Be 10					Ho 163				
C 14	= 6.04E-03	A A 2	6.03E-03	A A 2	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36	= 1.14E-04	A A 2	1.14E-04	A A 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	= 4.67E-15	A B 2	7.09E-18	A A 2	Pb 205				
Fe 55	= 1.20E-03	A A 2	1.62E-04	A A 2	Pb 210				
Co 60	= 2.17E-02	A A 1	7.60E-03	A A 2	Bi 208				
Ni 59					Bi 210m				
Ni 63	= 9.44E-01	A A 2	8.92E-01	A A 2	Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94	= 1.34E-04	A A 2	1.34E-04	A A 2	Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m					U 235				
Ag 110m					U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137	= 3.11E-04	A A 2	2.59E-04	A A 2	Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Unsp a				
Eu 152	= 1.00E-06	A A 2	6.70E-07	A A 2	Unsp b/g				
Eu 154	= 1.83E-04	A A 2	9.61E-05	A A 2	Total a	0	*	0	*
Eu 155					Total b/g	9.81E-01	*	9.11E-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