

WASTE STREAM	2A309	Final Dismantling & Site Clearance: Secondary LLW
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SITE Calder Hall

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:	1.4.2107 - 31.3.2111	~ 1113.0		
Total future arisings:		1113.0		
Total waste volume:		1113.0		

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

Comment on arising rates: Waste arisings are assumed to occur at a uniform rate.

Additional information on quantities: Final Dismantling & Site Clearance is assumed to commence in 2104, with dismantling of the plant associated with this waste stream commencing in 2107, and lasting for ten years. Volumes and radioactivity have been calculated for 100 years after reactor shutdown, i.e. 2103, but the volume in this stream would not change for decommissioning in 2107.

Uncertainty factors on volumes: Stock (upper): x - Arisings (upper): x 5.00
Stock (lower): x - Arisings (lower): x 0.20

WASTE SOURCE Wastes arising from contamination control procedures during plant dismantling.

PHYSICAL CHARACTERISTICS

General description: A variety of combustible and non-combustible materials. No large items are expected.

Changes since waste generated: -

Bulk density (t/m³): = 1.0

Comment on density: The density is likely to lie between 0.5 and 1.5 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): The waste is expected to include cloth (~5%vol), plastics (~15%vol), paper (~15%vol), wood (~5%vol), rubber (~5%vol), encapsulated sludge (~5%vol), metals (~50%vol). Percentages of constituents are very uncertain.

Chemical state: Neutral

Sheet metal proportion / thickness: ~ 50%wt Metal thicknesses will probably be typically 1-3 mm. However some hand tools and cabling are also assumed to be present.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	< 10.0	-	
Other ferrous metals.....	~ 50.0	-	
Iron.....		-	
Aluminium.....	<< 1.0	-	
Beryllium.....	NE	-	
Cobalt.....	NE	-	
Copper.....	<< 1.0	-	
Lead.....	= 0	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	NE	-	
Titanium.....		-	
Uranium.....	NE	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	<< 1.0	There may be "other" metals present.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~ 25.0	-	
Paper, cotton.....	~ 20.0	-	
Wood.....	~ 5.0	-	
Halogenated plastics.....	~ 5.0	-	
Total non-halogenated plastics.....	~ 10.0	-	
Condensation polymers.....	~ 5.0	-	
Others.....	~ 5.0	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	~ 5.0	-	
Halogenated rubber.....	< 5.0	-	
Non-halogenated rubber.....	< 5.0	-	
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	-	
Inorganic sludges and flocs.....	= 0	-	
Soil.....	TR	-	
Brick/Stone/Rubble.....	TR	-	
Cementitious material.....	NE	-	
Sand.....		-	
Glass/Ceramics.....	= 0	-	
Graphite.....	TR	-	
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.....	TR	-
Chloride.....	TR	-
Iodide.....	= 0	-
Cyanide.....	= 0	-
Carbonate.....	TR	-
Nitrate.....	TR	-
Nitrite.....	TR	-
Phosphate.....	TR	-
Sulphate.....	TR	-
Sulphide.....	TR	-

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):

Not yet determined		
	(%wt)	Type(s) and comment
EDTA.....	-	-
DPTA.....	-	-
NTA.....	-	-
Polycarboxylic acids.....	-	-
Other organic complexants.....	-	-
Total complexing agents.....	NE	-

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	Off-site	~ 40.0
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation	Off-site	~ 48.0
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification		~ 12.0
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments:

It has been assumed for the 2025 UK RWI that the organic wastes will be incinerated with residues returned to LLWR. It has also been assumed that 80% of the metallic waste will be treated by the supply chain and will subsequently be 'out of scope', with the remaining 20% consigned to LLWR for disposal as non-compactable LLW. The encapsulated sludge is assumed to be non-compactable LLW that requires no further treatment.

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)	12.0	10.0	18.3	14	-

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	= 12.0	= 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	= 40.0	= 0.14	
Expected to be consigned to a Metal Treatment Facility	= 48.0	= 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: Contamination by activation products from the reactor structure.

Uncertainty: The activities quoted are those at the time of Final Dismantling & Site Clearance.

Measurement of radioactivities: The specific activity has been calculated from the weighted average of all the other ILW and LLW streams assuming a total specific activity for the beta/gamma component.

Chemical form of radionuclides:

- H-3: The chemical form of tritium has not been assessed.
- C-14: The chemical form of carbon 14 has not been assessed.
- Cl-36: The chemical form of chlorine has not been assessed.
- Se-79: The selenium content is insignificant.
- Tc-99: The technetium content is insignificant.
- I-129: The iodine content is insignificant.
- Ra: The radium content is insignificant.
- Th: The thorium content is insignificant.
- U: The uranium content is insignificant.
- Np: The neptunium content is insignificant.
- Pu: The plutonium content is insignificant.

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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			= 1.00E-07	C C 2	Gd 153				8
Be 10				8	Ho 163				8
C 14			= 1.00E-05	C C 2	Ho 166m			= 6.00E-09	C C 2
Na 22					Tm 170				8
Al 26			= 1.00E-09	C C 2	Tm 171				8
Cl 36			= 1.00E-07	C C 2	Lu 174				8
Ar 39				8	Lu 176				8
Ar 42				8	Hf 178n				8
K 40				8	Hf 182				8
Ca 41			= 1.00E-07	C C 2	Pt 193				8
Mn 53				8	Ti 204				8
Mn 54				8	Pb 205				8
Fe 55				8	Pb 210				8
Co 60			= 5.00E-09	C C 2	Bi 208				8
Ni 59			= 2.00E-06	C C 2	Bi 210m				8
Ni 63			= 9.00E-05	C C 2	Po 210				8
Zn 65				8	Ra 223				8
Se 79				8	Ra 225				8
Kr 81				8	Ra 226				8
Kr 85				8	Ra 228				8
Rb 87				8	Ac 227				8
Sr 90				8	Th 227				8
Zr 93				8	Th 228				8
Nb 91				8	Th 229				8
Nb 92				8	Th 230				8
Nb 93m				8	Th 232				8
Nb 94			= 2.00E-08	C C 2	Th 234				8
Mo 93			= 1.00E-07	C C 2	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99			= 1.00E-09	C C 2	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m			= 2.00E-08	C C 2	U 235				8
Ag 110m				8	U 236				8
Cd 109				8	U 238				8
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m			= 6.00E-08	C C 2	Pu 238				8
Sn 123				8	Pu 239				8
Sn 126				8	Pu 240				8
Sb 125				8	Pu 241				8
Sb 126				8	Pu 242				8
Te 125m				8	Am 241				8
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134				8	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137				8	Cm 244				8
Ba 133				8	Cm 245				8
La 137				8	Cm 246				8
La 138				8	Cm 248				8
Ce 144				8	Cf 249				8
Pm 145				8	Cf 250				8
Pm 147				8	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Unsp a				8
Eu 152			= 3.00E-09	C C 2	Unsp b/g				8
Eu 154				8	Total a	0	*	0	*
Eu 155				8	Total b/g	0	*	1.03E-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