

WASTE STREAM	5B351	Changerooms LLW
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SITE Dounreay

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE LLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	= 0		
Future arisings:	1.4.2051 - 31.3.2052	= 1.2		
	1.4.2052 - 31.3.2053	= 5.0		
	1.4.2053 - 31.3.2054	= 4.0		
	1.4.2054 - 31.3.2055	= 17.8		
	1.4.2055 - 31.3.2056	= 10.2		
Total future arisings:		38.3		
Total waste volume:		38.3		

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

Comment on arising rates: Arisings are based on Dounreay's Lifetime Plan 2024 as generated at December 2023.

Additional information on quantities: -

Uncertainty factors on volumes: Stock (upper): x - Arisings (upper): x 1.20
Stock (lower): x - Arisings (lower): x 0.80

WASTE SOURCE Waste from the building decommissioning of the changerooms.

PHYSICAL CHARACTERISTICS

General description: Mixture of building structure materials.

Changes since waste generated: -

Bulk density (t/m³): = 0.26

Comment on density: Based on actuals data from Dounreay's waste consignment system . Data considered acceptable for 2025 submission.

CHEMICAL COMPOSITION

General description and components (%wt): Asbestos (0.41%), Asphalt (2.04%), Cementitious material (e.g. concrete) (67.05%), Gypsum Plasterboard/ Fibreboard (3.71%), Mild Steel (0.35%), Paper (TR), Plastic (0.34%), Rubber (26.10%), Sources (TR).

Chemical state: Neutral

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	0	-	
Other ferrous metals.....	= 0.35	Mild Steel	
Iron.....	0	-	
Aluminium.....	0	-	
Beryllium.....	0	-	
Cobalt.....	0	-	
Copper.....	0	-	
Lead.....	0	-	
Magnox/Magnesium.....	0	-	
Nickel.....	0	-	
Titanium.....	0	-	
Uranium.....	0	-	
Zinc.....	0	-	
Zircaloy/Zirconium.....	0	-	
Other metals.....	< 0.01	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	< 0.01	-	
Paper, cotton.....	< 0.01	-	
Wood.....	0	-	
Halogenated plastics.....	= 0.17	-	
Total non-halogenated plastics.....	= 0.17	-	
Condensation polymers.....	NE	-	
Others.....	NE	-	
Organic ion exchange materials.....	0	-	
Total rubber.....	= 26.1	-	
Halogenated rubber.....	NE	-	
Non-halogenated rubber.....	NE	-	
Hydrocarbons.....	= 2.0	-	
Oil or grease.....	0	-	
Fuel.....	NE	-	
Asphalt/Tarmac (cont.coal tar).....	0	-	
Asphalt/Tarmac (no coal tar).....	= 2.0	-	
Bitumen.....	0	-	
Others.....	NE	-	
Other organics.....	0	Other 4.27%,	

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.....	= 3.7	-	
Cementitious material.....	= 67.0	-	
Sand.....	0	-	
Glass/Ceramics.....	0	-	
Graphite.....	0	-	
Desiccants/Catalysts.....	0	-	
Asbestos.....	= 0.41	-	
Non/low friable.....	NE	-	
Moderately friable.....	NE	-	
Highly friable.....	NE	-	
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.....	NE	-
Iodide.....	NE	-
Cyanide.....	0	-
Carbonate.....	NE	-
Nitrate.....	NE	-
Nitrite.....	NE	-
Phosphate.....	0	-
Sulphate.....	0	-
Sulphide.....	NE	-

Materials of interest for waste acceptance criteria:

	(%wt)	Type(s) and comment
Combustible metals.....	NE	-
Low flash point liquids.....	NE	-
Explosive materials.....	NE	-
Phosphorus.....	NE	-
Hydrides.....	NE	-
Biological etc. materials.....	NE	-
Biodegradable materials.....	0	-
Putrescible wastes.....	NE	-
Non-putrescible wastes.....	NE	-
Corrosive materials.....	NE	-
Pyrophoric materials.....	NE	-
Generating toxic gases.....	NE	-
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.....	0	-
Chlorinated solvents.....	NE	-
Formaldehyde.....	NE	-
Organometallics.....	NE	-
Phenol.....	NE	-
Styrene.....	NE	-
Tri-butyl phosphate.....	NE	-
Other organophosphates.....	NE	-
Vinyl chloride.....	NE	-
Arsenic.....	0	-
Barium.....	NE	-
Boron.....	0	-
Boron (in Boral).....	NE	-
Boron (non-Boral).....	NE	-
Cadmium.....	0	-
Caesium.....	NE	-
Selenium.....	0	-
Chromium.....	0	-
Molybdenum.....	0	-
Thallium.....	NE	-
Tin.....	0	-
Vanadium.....	0	-
Mercury compounds.....	0	-
Others.....	NE	-

Complexing agents (%wt):

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

Physical components:

	Number	Type(s) and comment
Sources.....	= 16	Solid LLW
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....		-
EEE Type 2.....		-
EEE Type 3.....	= 1	Vacuum
EEE Type 4.....		-
EEE Type 5.....		-

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off-site	Stream volume %
Size reduction	On-site	= 26.8
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation	On-site	= 100.0
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:

26% of the waste stream will be supercompacted in 200 L drums before being placed in HHISOs. HHISOs filled with bulk waste, compacted waste or a mix of both will be encapsulated before final disposal.

Conditioning method:

For LLW, waste will be grouted into non IP rated HHISOs through a dedicated grouting facility.

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

Non-standard

Further information on the conditioning matrix:

NRS Dounreay uses 3:1 PFA:OPC ~35% water and plasticiser content.

Waste Packaging:

Likely container type:	Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	Non IP-2 rated 1/2 Height ISO (DC02)	100.0	9.6	15.6	4	-

Range in container waste loading: The waste loading value is a rough average using previously consigned waste data. Waste loading per ISO can vary significantly, based on how the container is loaded. In general, bulk items leads to a lower waste loading value where as compactable leads to a higher one. Most containers contain a mix of the two.

Other information on packaging and conditioning: The waste will consist of uncompactable items as well as supercompacted pucks. The waste will be loaded into alternative non-IP2 rated LLW Disposal HHISO for transfer to the Dounreay LLW Disposal Facility. Each HHISO may have other LLW items in the final HHISO.

Conditioned density (t/m³): ~ 2.0
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
Dounreay LLWDV	Incineration facility	~ 26.0	GREEN	This opportunity is still at an early stage of development. A small scale trial has taken place. This can potentially divert up to all compactable LLW. The incinerables waste route 26% is theoretical maximum based on 100% drummed LLW being suitable for incineration. The 26% is subject to further review by NRS Dounreay.

RADIOACTIVITY

Source: -

Uncertainty: -

Measurement of radioactivities: Specific Activities were derived from consignor's records for operational LLW consigned from the facility.

Chemical form of radionuclides:

- H-3: -
- C-14: -
- Cl-36: Not likely to be present.
- Se-79: -
- Tc-99: -
- I-129: Not likely to be present.
- Ra: -
- Th: -
- U: Uranium contamination is likely.
- Np: -
- Pu: -

WASTE STREAM 5B351 Changerooms LLW									
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			= 9.90E-08	C C 2	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			= 2.53E-14	C C 2
Co 60			= 1.14E-07	C C 2	Bi 208				
Ni 59					Bi 210m				
Ni 63			= 3.13E-08	C C 2	Po 210			= 2.30E-14	C C 2
Zn 65					Ra 223			= 4.36E-14	C C 2
Se 79					Ra 225			= 7.13E-22	C C 2
Kr 81					Ra 226			= 1.56E-13	C C 2
Kr 85					Ra 228			= 4.76E-19	C C 2
Rb 87					Ac 227			= 4.53E-14	C C 2
Sr 90			= 1.90E-06	C C 2	Th 227			= 4.36E-14	C C 2
Zr 93					Th 228			= 7.01E-09	C C 2
Nb 91					Th 229			= 7.32E-22	C C 2
Nb 92					Th 230			= 9.14E-12	C C 2
Nb 93m			= 6.02E-10	C C 2	Th 232			= 1.65E-18	C C 2
Nb 94				C C 2	Th 234			= 2.97E-09	C C 2
Mo 93			= 6.19E-10	C C 2	Pa 231			= 5.06E-13	C C 2
Tc 97				C C 2	Pa 233			= 2.36E-13	C C 2
Tc 99			= 5.01E-12	C C 2	U 232			= 7.75E-09	C C 2
Ru 106					U 233			= 3.64E-18	C C 2
Pd 107					U 234			= 1.66E-07	C C 2
Ag 108m					U 235			= 3.98E-09	C C 2
Ag 110m					U 236			= 5.57E-09	C C 2
Cd 109					U 238			= 2.97E-09	C C 2
Cd 113m					Np 237			= 2.40E-13	C C 2
Sn 119m					Pu 236				
Sn 121m			= 4.65E-12	C C 2	Pu 238			= 2.69E-08	C C 2
Sn 123					Pu 239			= 7.48E-08	C C 2
Sn 126					Pu 240			= 7.59E-08	C C 2
Sb 125			= 5.45E-11	C C 2	Pu 241			= 3.29E-07	C C 2
Sb 126					Pu 242			= 1.76E-16	C C 2
Te 125m			1.29E-11	C C 2	Am 241			= 1.06E-07	C C 2
Te 127m					Am 242m			= 9.27E-11	C C 2
I 129					Am 243			= 6.13E-13	C C 2
Cs 134			= 1.75E-10	C C 2	Cm 242			= 7.73E-11	C C 2
Cs 135					Cm 243			= 3.70E-12	C C 2
Cs 137			= 2.50E-06	C C 2	Cm 244			= 1.67E-09	C C 2
Ba 133			= 2.81E-09	C C 2	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147			= 2.54E-09	C C 2	Cf 251				
Sm 147			= 2.44E-19	C C 2	Cf 252				
Sm 151			= 1.58E-08	C C 2	Unsp a				
Eu 152			= 2.51E-09	C C 2	Unsp b/g				
Eu 154			= 1.25E-09	C C 2	Total a	0	*	4.78E-07	*
Eu 155			= 8.80E-10	C C 2	Total b/g	0	*	5.00E-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