

WASTE STREAM	5B352	Waste Receipt, Assay, Characterisation and Supercompaction Facility 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:	1.4.2025 - 31.3.2026	= 2.9		
	1.4.2026 - 31.3.2027	= 2.9		
	1.4.2027 - 31.3.2028	= 2.9		
	1.4.2028 - 31.3.2029	= 2.9		
	1.4.2029 - 31.3.2030	= 2.9		
	1.4.2030 - 31.3.2031	= 2.9		
	1.4.2031 - 31.3.2032	= 2.9		
	1.4.2032 - 31.3.2033	= 2.9		
	1.4.2033 - 31.3.2034	= 2.9		
	1.4.2034 - 31.3.2035	= 2.9		
	1.4.2035 - 31.3.2036	= 2.9		
	1.4.2036 - 31.3.2037	= 2.9		
	1.4.2037 - 31.3.2038	= 2.9		
	1.4.2038 - 31.3.2039	= 2.9		
	1.4.2039 - 31.3.2040	= 2.9		
	1.4.2040 - 31.3.2041	= 2.9		
	1.4.2041 - 31.3.2042	= 2.9		
	1.4.2042 - 31.3.2043	= 2.9		
	1.4.2043 - 31.3.2044	= 2.9		
	1.4.2044 - 31.3.2045	= 2.9		
	1.4.2045 - 31.3.2046	= 2.9		
	1.4.2046 - 31.3.2047	= 2.9		
	1.4.2047 - 31.3.2048	= 2.9		
	1.4.2048 - 31.3.2049	= 2.9		
	1.4.2049 - 31.3.2050	= 2.9		
	1.4.2050 - 31.3.2051	= 2.9		
	1.4.2051 - 31.3.2052	= 2.9		
	1.4.2052 - 31.3.2053	= 2.9		
	1.4.2053 - 31.3.2054	= 2.9		
	1.4.2054 - 31.3.2055	= 4.7		
	1.4.2055 - 31.3.2056	= 30.8		
	1.4.2056 - 31.3.2057	= 2.9		
	1.4.2057 - 31.3.2058	= 0.3		
Total future arisings:	122.1			
Total waste volume:	122.1			

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

Comment on arising rates: Arisings have been updated in line with NRS 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 This waste will arise from the operation and decommissioning of the Low Level Waste Receipt, Assay, Characterisation and Supercompaction facility.

PHYSICAL CHARACTERISTICS

General description: The waste will consist of : secondary wastes, floor screed, ventilation system, supercompactor, hoists, lifting frame, conveyor items, low active drain pump and sources.

Changes since waste generated: -

Bulk density (t/m³): = 0.78

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

CHEMICAL COMPOSITION

General description and components (%wt):

Asbestos (TR), Cementitious material (e.g. concrete) (2.69%), Copper (0.91%), Mild Steel (39.10%), Other (4.27%), Paper (15.49%), Plastic (29.07%), Rubber (5.48%), Wood/ Wood composite (3.00%).

Chemical state:

Neutral

Sheet metal proportion / thickness: 0.31% by wt of all metals will be sheet from ventilation and ducting. Assumed sheet metal thickness is of a range between 1.6-2.5mm.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	0	M316	
Other ferrous metals.....	= 39.1	-	
Iron.....	= 0	-	
Aluminium.....	= 0	-	
Beryllium.....	= 0	-	
Cobalt.....	= 0	-	
Copper.....	= 0.91	-	
Lead.....	= 0	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	= 0	-	
Titanium.....	= 0	-	
Uranium.....	= 0	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	= 0	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....	= 18.5	-	
Paper, cotton.....	= 15.5	-	
Wood.....	= 3.0	-	
Halogenated plastics.....	= 14.5	-	
Total non-halogenated plastics.....	= 14.5	-	
Condensation polymers.....	NE	-	
Others.....	NE	-	
Organic ion exchange materials.....	0	-	
Total rubber.....	= 5.5	-	
Halogenated rubber.....	NE	-	
Non-halogenated rubber.....	NE	-	
Hydrocarbons.....	= 0	-	
Oil or grease.....	= 0	-	
Fuel.....	NE	-	
Asphalt/Tarmac (cont.coal tar).....	= 0	-	
Asphalt/Tarmac (no coal tar).....	= 0	-	
Bitumen.....	= 0	-	
Others.....	NE	-	
Other organics.....	= 4.3	-	

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.....	= 0	-	
Cementitious material.....	= 2.7	-	
Sand.....	= 0	-	
Glass/Ceramics.....	= 0	-	
Graphite.....	= 0	-	
Desiccants/Catalysts.....	= 0	-	
Asbestos.....	< 0.01	-	
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.....	= 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.....	= 0	-
Corrosive materials.....	= 0	-
Pyrophoric materials.....	= 0	-
Generating toxic gases.....	= 0	-
Reacting with water.....	= 0	-
Higher activity particles.....	NE	-
Soluble solids as bulk chemical compounds.....	= 0	-

Hazardous substances / non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....	NE	-
Benzene.....	NE	-
Chlorinated solvents.....	NE	-
Formaldehyde.....	NE	-
Organometallics.....	NE	-
Phenol.....	NE	-
Styrene.....	NE	-
Tri-butyl phosphate.....	NE	-
Other organophosphates.....	NE	-
Vinyl chloride.....	NE	-
Arsenic.....	NE	-
Barium.....	NE	-
Boron.....	NE	-
Boron (in Boral).....	NE	-
Boron (non-Boral).....	NE	-
Cadmium.....	NE	-
Caesium.....	NE	-
Selenium.....	NE	-
Chromium.....	NE	-
Molybdenum.....	NE	-
Thallium.....	NE	-
Tin.....	NE	-
Vanadium.....	NE	-
Mercury compounds.....	NE	-
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.....	= 18	Plant Calibration Solid LLW Source + Pu239, Unat, Cf252, Eu152, Cs137, Co60
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....	= 0	-
EEE Type 2.....	= 0	-
EEE Type 3.....	= 0	-
EEE Type 4.....	= 0	-
EEE Type 5.....	= 0	-

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

Comments on planned treatments:

76% of the waste stream will be supercompacted before being placed in HHISOs. HHISOs filled with Bulk waste, compacted drums or a mix of both will be encapsulated before final disposal.

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

Plant Name	Location

Non-standard

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

Likely container type:

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 lead to a lower waste loading value whereas compactable items lead to a higher one. Most containers contain a mix of the two.

The waste will consist of large uncompactable items and 200 litre drums that have already been compacted. The waste will be loaded into alternative non IP2 rated LLW disposal containers for transfer to the DSRL LLW Disposal Facility. Each Container may have other LLW items in the final HHISO.

~ 2.0

This value is the midpoint between a range of densities going from 1.49-2.47. These were taken from HHISOs disposed of in NRSD Disposal Vaults.

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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	Metal treatment facility	P	RED	Trial is currently underway to open the Metal Treatment Route. The metallic waste treatment route % remains indicative and is subject to further review and characterisation by NRS Dounreay.
Dounreay LLWDV	Incineration facility	< 76.0	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 76% is theoretical maximum based on 100% drummed LLW being suitable for incineration. The 76% is subject to further review by NRS Dounreay.
Dounreay LLWDV	Landfill	P	RED	Cementitious materials and brickwork potentially available for offsite diversion to landfill. Further characterisation of the waste is required to ensure suitability for this wasteroute.

RADIOACTIVITY

Source: The radioactivity arises from contamination of WRACS. The waste results from a wide variety of site operations. The radioactivity mainly results from irradiation and reprocessing PFR fuel. For the most part it will be actinides and fission products, few activation products are expected to be present.

Uncertainty: -

Measurement of radioactivities: From Consignor's records.

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: Possibly present at very low concentrations.
- Np: -
- Pu: Possibly present at very low concentrations.

WASTE STREAM		5B352		Waste Receipt, Assay, Characterisation and Supercompaction Facility 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			= 1.96E-06	C C 2	Gd 153				
Be 10					Ho 163				
C 14			= 3.96E-08	C C 2	Ho 166m				
Na 22			= 4.49E-10	C C 2	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					Tl 204				
Mn 54					Pb 205				
Fe 55					Pb 210			= 1.75E-09	C C 2
Co 60			= 1.19E-07	C C 2	Bi 208				
Ni 59					Bi 210m				
Ni 63			= 6.03E-09	C C 2	Po 210			= 1.60E-09	C C 2
Zn 65					Ra 223			= 1.41E-13	C C 2
Se 79					Ra 225			= 2.72E-18	C C 2
Kr 81					Ra 226			= 1.02E-08	C C 2
Kr 85					Ra 228			= 5.72E-11	C C 2
Rb 87					Ac 227			= 1.47E-13	C C 2
Sr 90			= 5.16E-04	C C 2	Th 227			= 1.42E-13	C C 2
Zr 93					Th 228			= 2.86E-10	C C 2
Nb 91					Th 229			= 2.77E-18	C C 2
Nb 92					Th 230			= 2.78E-11	C C 2
Nb 93m			= 4.78E-05	C C 2	Th 232			= 1.11E-10	C C 2
Nb 94					Th 234			= 2.77E-09	C C 2
Mo 93			= 4.91E-05	C C 2	Pa 231			= 1.64E-12	C C 2
Tc 97					Pa 233			= 3.90E-10	C C 2
Tc 99			= 3.99E-07	C C 2	U 232			= 2.62E-10	C C 2
Ru 106			= 4.43E-12	C C 2	U 233			= 1.16E-14	C C 2
Pd 107					U 234			= 5.04E-07	C C 2
Ag 108m					U 235			= 1.29E-08	C C 2
Ag 110m					U 236			= 6.29E-08	C C 2
Cd 109			= 1.61E-10	C C 2	U 238			= 2.77E-09	C C 2
Cd 113m					Np 237			= 3.90E-10	C C 2
Sn 119m					Pu 236				
Sn 121m			= 3.69E-07	C C 2	Pu 238			= 6.97E-07	C C 2
Sn 123					Pu 239			= 5.49E-07	C C 2
Sn 126					Pu 240			= 5.09E-07	C C 2
Sb 125			= 1.54E-09	C C 2	Pu 241			= 2.42E-06	C C 2
Sb 126					Pu 242			= 7.67E-09	C C 2
Te 125m			3.65E-10	C C 2	Am 241			= 1.45E-06	C C 2
Te 127m					Am 242m			= 8.76E-10	C C 2
I 129					Am 243			= 1.68E-16	C C 2
Cs 134			= 5.36E-10	C C 2	Cm 242			= 7.32E-10	C C 2
Cs 135					Cm 243			= 1.16E-10	C C 2
Cs 137			= 5.52E-04	C C 2	Cm 244			= 5.03E-09	C C 2
Ba 133			= 5.80E-10	C C 2	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147			= 1.29E-08	C C 2	Cf 251				
Sm 147			1.24E-18	C C 2	Cf 252				
Sm 151			= 2.05E-06	C C 2	Unsp a				
Eu 152			= 5.42E-08	C C 2	Unsp b/g				
Eu 154			= 3.06E-07	C C 2	Total a	0	*	3.81E-06	*
Eu 155			= 4.84E-09	C C 2	Total b/g	0	*	1.17E-03	*

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