

WASTE STREAM	5B333	DCP Vault Store and Extension 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			
Future arisings:	1.4.2025 - 31.3.2026	= 30.7		
	1.4.2026 - 31.3.2027	= 30.7		
	1.4.2027 - 31.3.2028	= 30.7		
	1.4.2028 - 31.3.2029	= 30.8		
	1.4.2029 - 31.3.2030	= 30.7		
	1.4.2030 - 31.3.2031	= 30.7		
	1.4.2031 - 31.3.2032	= 30.7		
	1.4.2032 - 31.3.2033	= 30.8		
	1.4.2033 - 31.3.2034	= 30.7		
	1.4.2034 - 31.3.2035	= 30.7		
	1.4.2035 - 31.3.2036	= 30.7		
	1.4.2036 - 31.3.2037	= 30.8		
	1.4.2037 - 31.3.2038	= 30.7		
	1.4.2038 - 31.3.2039	= 30.7		
	1.4.2039 - 31.3.2040	= 30.7		
	1.4.2040 - 31.3.2041	= 30.8		
	1.4.2041 - 31.3.2042	= 30.7		
	1.4.2042 - 31.3.2043	= 30.7		
	1.4.2043 - 31.3.2044	= 30.7		
	1.4.2044 - 31.3.2045	= 30.8		
	1.4.2045 - 31.3.2046	= 30.7		
	1.4.2046 - 31.3.2047	= 30.7		
	1.4.2047 - 31.3.2048	= 30.7		
	1.4.2048 - 31.3.2049	= 30.8		
	1.4.2049 - 31.3.2050	= 30.7		
	1.4.2050 - 31.3.2051	= 30.7		
	1.4.2051 - 31.3.2052	= 30.7		
	1.4.2052 - 31.3.2053	= 38.9		
	1.4.2053 - 31.3.2054	= 37.5		
	1.4.2054 - 31.3.2055	= 32.2		
	1.4.2055 - 31.3.2056	= 32.2		
	1.4.2056 - 31.3.2057	= 32.7		
	1.4.2057 - 31.3.2058	= 33.1		
	1.4.2058 - 31.3.2059	= 37.1		
	1.4.2059 - 31.3.2060	= 41.1		
	1.4.2060 - 31.3.2061	= 37.7		
	1.4.2061 - 31.3.2062	= 39.8		
	1.4.2062 - 31.3.2063	= 36.8		
	1.4.2063 - 31.3.2064	= 30.9		
	1.4.2064 - 31.3.2065	= 31.0		
	1.4.2065 - 31.3.2066	= 30.9		
	1.4.2066 - 31.3.2067	= 15.4		
	1.4.2100 - 31.3.2101	= 116.5		
Total future arisings:	1453.6			
Total waste volume:	1453.6			

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

Comment on arising rates: Programme data is based on Life Time Plan 2024 dataset generated in December 2023. Arisings have been revised in line with the Predictive Waste Inventory walk round exercise. Stocks have been removed: these will be captured under 5B15 and 5B16. Note that the gap in the arisings dates is due to the main DCP facility being decommissioned early in the programme and the demolition of the store that is still required for long term management of Higher Active Waste as per Scottish Government Policy.

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 Decommissioning of cementation plant and associated store.

PHYSICAL CHARACTERISTICS

General description: -

Changes since waste generated: -

Bulk density (t/m³): = 0.23

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): Aluminium (0.03%), Brick/Rubble (1.09%), Cementitious material (e.g. concrete) (3.82%), Copper (0.02%), Fibreglass (0.12%), Fluorescent Tubes (TR), Glass (0.43%), Lead (0.33%), Mild Steel (14.17%), Other (1.62%), Paper (32.31%), Plastic (32.97%), Rubber (6.00%), Stainless steel (3.14%), Wood/ Wood composite (3.96%),

Chemical state: Neutral

Sheet metal proportion / thickness: 7.41% 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.
4.81% by wt of all metals will be bulk from tanks and gloveboxes.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 3.1	-	
Other ferrous metals.....	= 14.2	-	
Iron.....	0	-	
Aluminium.....	= 0.03	-	
Beryllium.....	0	-	
Cobalt.....	0	-	
Copper.....	= 0.02	-	
Lead.....	= 0.33	-	
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 cellulose.....	= 36.3	-	
Paper, cotton.....	= 32.3	-	
Wood.....	= 4.0	-	
Halogenated plastics.....	= 16.5	-	
Total non-halogenated plastics.....	= 16.5	-	
Condensation polymers.....	NE	-	
Others.....	NE	-	
Organic ion exchange materials.....	0	-	
Total rubber.....	= 6.0	-	
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.....	= 1.6	Other 1.62%,	

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.....	= 1.1	-	
Cementitious material.....	= 3.8	-	
Sand.....	0	-	
Glass/Ceramics.....	= 0.56	Glass 0.43%, Fibreglass 0.12%, Fluorescent Tubes 0.01%,	
Graphite.....	0	-	
Desiccants/Catalysts.....	0	-	
Asbestos.....	0	-	
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.....	-	-
Iodide.....	-	-
Cyanide.....	= 0	-
Carbonate.....	-	-
Nitrate.....	-	-
Nitrite.....	-	-
Phosphate.....	= 0	-
Sulphate.....	= 0	-
Sulphide.....	-	-

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.....	= 1	Solid
Electronic & Electrical Equipment (EEE)		
EEE Type 1.....	= 2	-
EEE Type 2.....		-
EEE Type 3.....		-
EEE Type 4.....	= 1	-
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	= 84.5
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation	On-site	= 92.0
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification	Off-site	~ 8.0
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments:

84% of waste stream will be supercompacted in 200l drums before being placed in HHISOs. HHISOs filled with Bulk waste, compacted drums, or a mix of both will be encapsulated before final disposal. 8% of the waste stream is estimated to be produced outwith the Interim End Date Point, during the re-building of the LLW Stores and therefore the route is not yet determined. These dates remain under review.

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:

~35% water and plasticiser
3:1 PFA:OPC

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)	92.0	26.4	15.6	51	-
Not yet determined	8.0	-	-	-	-

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.

Other information on packaging and conditioning:

The waste will be loaded into an alternative non-IP2 rated LLW Disposal HHISO for transfer to the DSRL LLW Disposal Facility. Each HHISO may have LLW items from other waste streams in the final HHISO. There are currently no assumptions on waste disposal for any waste generated post site closure. High waste loading vol due to majority of waste stream being compactable drums.

Conditioned density (t/m³):

= 0.020

Conditioned density comment:

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 LLW Disposal Vaults

Management Routes:

Disposal Route	Stream volume %	Raw density t/m ³	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)	= 92.0		
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	~ 8.0		
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
Unknown	Unknown	~ 8.0	RED	It should be noted that only long term arisings are being reported here. The waste stream is not fully developed as the new stores are still under construction. There is a requirement to carry out further work to underpin the waste categories predicted in UKRWI. This may lead to a recategorisation of the predicted waste volumes to OoSoR or lower.
Dounreay LLWDV	Incineration facility	< 84.5	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.
Dounreay LLWDV	Metal treatment facility	~ 7.5	GREEN	Trial is currently underway to open the Metal Treatment Route

RADIOACTIVITY

Source: The radioactivity arises from contamination of cementation plant and associated store.

Uncertainty: Within a factor of ten.

Measurement of radioactivities: Specific activity derived using consignor's records.

Chemical form of radionuclides:

- H-3: May be present at extremely low concentrations
- C-14: May be present at extremely low concentrations
- Cl-36: May be present at extremely low concentrations
- Se-79: May be present at extremely low concentrations
- Tc-99: May be present at extremely low concentrations
- I-129: May be present at extremely low concentrations
- Ra: May be present at extremely low concentrations
- Th: May be present at extremely low concentrations
- U: Likely to be present as nitrate at low concentrations
- Np: May be present at extremely low concentrations
- Pu: Likely to be present as nitrate at low concentrations

WASTE STREAM 5B333 DCP Vault Store and Extension 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					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			= 3.10E-10	C C 2
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63			= 2.17E-09	C C 2	Po 210			= 2.83E-10	C C 2
Zn 65					Ra 223			= 5.07E-22	C C 2
Se 79					Ra 225			= 4.78E-19	C C 2
Kr 81					Ra 226			= 1.81E-09	C C 2
Kr 85					Ra 228			= 5.47E-26	C C 2
Rb 87					Ac 227			= 5.38E-22	C C 2
Sr 90			= 8.59E-05	C C 2	Th 227			= 5.12E-22	C C 2
Zr 93					Th 228			= 2.09E-26	C C 2
Nb 91					Th 229			= 4.88E-19	C C 2
Nb 92					Th 230			= 1.20E-16	C C 2
Nb 93m			= 7.94E-06	C C 2	Th 232			= 2.69E-25	C C 2
Nb 94					Th 234			= 8.57E-24	C C 2
Mo 93			= 8.15E-06	C C 2	Pa 231			= 8.86E-21	C C 2
Tc 97					Pa 233			= 6.87E-11	C C 2
Tc 99			= 6.65E-08	C C 2	U 232				
Ru 106					U 233			= 2.04E-15	C C 2
Pd 107					U 234			= 2.95E-12	C C 2
Ag 108m					U 235			= 1.40E-16	C C 2
Ag 110m					U 236			1.82E-15	C C 2
Cd 109					U 238			8.84E-24	C C 2
Cd 113m					Np 237			= 6.87E-11	C C 2
Sn 119m					Pu 236				
Sn 121m			= 6.16E-08	C C 2	Pu 238			= 9.09E-08	C C 2
Sn 123					Pu 239			= 2.36E-08	C C 2
Sn 126					Pu 240			= 1.04E-08	C C 2
Sb 125					Pu 241			= 1.02E-07	C C 2
Sb 126					Pu 242			= 3.18E-15	C C 2
Te 125m					Am 241			= 3.09E-07	C C 2
Te 127m					Am 242m			= 1.67E-09	C C 2
I 129					Am 243			= 1.46E-10	C C 2
Cs 134					Cm 242			= 1.40E-09	C C 2
Cs 135					Cm 243			= 8.72E-10	C C 2
Cs 137			= 9.20E-05	C C 2	Cm 244			= 2.51E-09	C C 2
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147			= 1.06E-09	C C 2	Cf 251				
Sm 147			1.02E-19	C C 2	Cf 252				
Sm 151			= 3.74E-07	C C 2	Unsp a				
Eu 152					Unsp b/g				
Eu 154			= 4.25E-08	C C 2	Total a	0	*	4.41E-07	*
Eu 155			= 1.90E-09	C C 2	Total b/g	0	*	1.95E-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