

WASTE STREAM	5B334	DCP, Vault Store and Extension ILW
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SITE Dounreay

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025 = 9.2			
Future arisings:	1.4.2052 - 31.3.2053 = 0.7			
	1.4.2053 - 31.3.2054 = 0.8			
	1.4.2054 - 31.3.2055 = 0.6			
	1.4.2055 - 31.3.2056 = 0.6			
	1.4.2056 - 31.3.2057 = 8.5			
	1.4.2057 - 31.3.2058 = 16.1			
	1.4.2058 - 31.3.2059 = 12.1			
	1.4.2059 - 31.3.2060 = 4.5			
	1.4.2060 - 31.3.2061 = 0.6			
	1.4.2061 - 31.3.2062 = 0.6			
	1.4.2062 - 31.3.2063 = 0.3			
Total future arisings:	45.2			
Total waste volume:	54.4			

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

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

Additional information on quantities: -

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

WASTE SOURCE Waste arisings will be from the decommissioning of the DCP itself only (short term) with the Stores being decommissioned in around 80 years time.

PHYSICAL CHARACTERISTICS

General description: Drum conveying and manipulation equipment, pressure vessels and pipework. There are no large items that will influence packaging selection.

Changes since waste generated: -

Bulk density (t/m³): = 0.27

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): Stainless steel (100.00%),

Chemical state: Neutral

Sheet metal proportion / thickness: 86.26% 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.....	= 100.0	-	
Other ferrous metals.....	= 0	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	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 0	-	
Paper, cotton.....	= 0	-	
Wood.....	= 0	-	
Halogenated plastics.....	= 0	-	
Total non-halogenated plastics.....	= 0	-	
Condensation polymers.....	NE	-	
Others.....	NE	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	= 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.....	= 0	-	

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.....	= 0	-	
Sand.....	= 0	-	
Glass/Ceramics.....	= 0	-	
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.....	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.....	= 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	On-site	= 100.0
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		

Comments on planned treatments:

Waste will be conditioned using a grout matrix into 500L drums. This will be done through a dedicated ILW repackaging facility, which will handle both RHILW and CHILW drums. This facility will produce conditioned 500 L drums.

Conditioning method:

Waste will be conditioned using a grout matrix into 500l drums. This will be done through a dedicated ILW repackaging facility, which will handle both RHILW and CHILW 200l drums. This facility will produce conditioned 500l drums

Conditioning plants:

Plant Name	Location
Combined ILW Repackaging Facility	Dounreay

Likely conditioning matrix:

Non-standard

Further information on the conditioning matrix:

Dounreay uses: Cement OPC 1:3 PFA ~42% water

Waste Packaging:

Likely container type:	Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	500 l drum (basket for waste)	100.0	0.23	0.50	234	-

Range in container waste loading: It is estimated that between 2 and 8 CHILW pucks will be placed into each 500l drum with the average being 5 drums per 500L drum. A small percentage of drums may not be suitable for supercompaction and will be directly immobilised into the 500l drum. Assume 3:2 Z6033 to 500L drum ratio.

Other information on packaging and conditioning: -

Conditioned density (t/m³): ~ 2.5

Conditioned density comment: The density is likely to be around 2-3 te/m3

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
Non-NSDF HAW	Dounreay LLWDV	NE	RED	There is potential for LLW to be diverted out of this stream during repackaging of ILW into 500 L Drums. However, detail of this will be confirmed through the design process of the repackaging facility.

RADIOACTIVITY

Source: The main sources of activity are contaminated equipment/structures.

Uncertainty: The activities given are best estimates.

Measurement of radioactivities: Stocks and Arisings specific activity has been calculated using consignors records.

Chemical form of radionuclides:

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

WASTE STREAM 5B334 DCP, Vault Store and Extension 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					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	= 3.83E-09	C C 2	= 3.83E-09	C C 2
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210	= 3.49E-09	C C 2	= 3.49E-09	C C 2
Zn 65					Ra 223	= 5.95E-21	C C 2	= 5.95E-21	C C 2
Se 79					Ra 225	= 5.83E-18	C C 2	= 5.83E-18	C C 2
Kr 81					Ra 226	= 2.24E-08	C C 2	= 2.24E-08	C C 2
Kr 85					Ra 228	= 6.36E-25	C C 2	= 6.36E-25	C C 2
Rb 87					Ac 227	= 6.31E-21	C C 2	= 6.31E-21	C C 2
Sr 90	= 1.13E-03	C C 2	= 1.13E-03	C C 2	Th 227	= 6.01E-21	C C 2	= 6.01E-21	C C 2
Zr 93					Th 228	= 2.43E-25	C C 2	= 2.43E-25	C C 2
Nb 91					Th 229	= 5.95E-18	C C 2	= 5.95E-18	C C 2
Nb 92					Th 230	= 5.20E-16	C C 2	= 5.20E-16	C C 2
Nb 93m	= 1.05E-04	C C 2	= 1.05E-04	C C 2	Th 232	= 3.13E-24	C C 2	= 3.13E-24	C C 2
Nb 94					Th 234				
Mo 93	= 1.08E-04	C C 2	= 1.08E-04	C C 2	Pa 231	= 1.04E-19	C C 2	= 1.04E-19	C C 2
Tc 97					Pa 233	= 8.36E-10	C C 2	= 8.36E-10	C C 2
Tc 99	= 8.76E-07	C C 2	= 8.76E-07	C C 2	U 232				
Ru 106					U 233	= 2.49E-14	C C 2	= 2.49E-14	C C 2
Pd 107					U 234	= 1.87E-11	C C 2	= 1.87E-11	C C 2
Ag 108m					U 235	= 1.64E-15	C C 2	= 1.64E-15	C C 2
Ag 110m					U 236	= 2.11E-14	C C 2	= 2.11E-14	C C 2
Cd 109					U 238				
Cd 113m					Np 237	= 8.36E-10	C C 2	= 8.36E-10	C C 2
Sn 119m					Pu 236				
Sn 121m	= 8.12E-07	C C 2	= 8.12E-07	C C 2	Pu 238	= 1.08E-06	C C 2	= 1.08E-06	C C 2
Sn 123					Pu 239	= 2.77E-07	C C 2	= 2.77E-07	C C 2
Sn 126					Pu 240	= 1.20E-07	C C 2	= 1.20E-07	C C 2
Sb 125					Pu 241	= 1.31E-06	C C 2	= 1.31E-06	C C 2
Sb 126					Pu 242				
Te 125m					Am 241	= 2.68E-06	C C 2	= 2.68E-06	C C 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137	= 1.21E-03	C C 2	= 1.21E-03	C C 2	Cm 244	= 6.59E-10	C C 2	= 6.59E-10	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					Cf 251				
Sm 147					Cf 252				
Sm 151	= 4.46E-06	C C 2	= 4.46E-06	C C 2	Unsp a				
Eu 152					Unsp b/g				
Eu 154	= 5.40E-07	C C 2	= 5.40E-07	C C 2	Total a	4.19E-06	*	4.19E-06	*
Eu 155					Total b/g	2.56E-03	*	2.56E-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