

WASTE STREAM	5B334	DCP, Vault Store and Extension ILW
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SITE Dounreay
SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Dounreay Site Restoration Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: Yes

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	9.2 m ³
Future arisings -	1.4.2029 - 31.3.2030.....	4.7 m ³
	1.4.2030 - 31.3.2031.....	6.3 m ³
	1.4.2031 - 31.3.2032.....	6.3 m ³
	1.4.2032 - 31.3.2033.....	6.3 m ³
	1.4.2033 - 31.3.2034.....	6.3 m ³
	1.4.2034 - 31.3.2035.....	6.3 m ³
	1.4.2035 - 31.3.2036.....	6.3 m ³
	1.4.2036 - 31.3.2037.....	2.8 m ³
Total future arisings:		45.3 m ³
Total waste volume:		54.5 m ³

Comment on volumes: It should be noted that the DSRL is using a provisional LifeTime Plan and arisings dates are subject to change. Arisings have been revised in line with the Predictive Waste Inventory walk round exercise. Waste stream is mainly RHILW but this facility is also beginning to consign CHILW too.

Uncertainty factors on volumes: Stock (upper): x 1.2 Arisings (upper) x 1.2
 Stock (lower): x 0.8 Arisings (lower) x 0.8

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.

Physical components (%vol): Stainless steel (100%)

Sealed sources: Not yet determined.

Bulk density (t/m³): 0.27

Comment on density: The bulk density is approximately based on consignor's records.

CHEMICAL COMPOSITION

General description and components (%wt): Stainless steel pipework and vessels (100%)

Chemical state: Neutral

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 at low concentrations.
 Np: May be present at very low concentrations.
 Pu: May be present as nitrate at low concentrations.

Metals and alloys (%wt): Both sheet and bulk metals likely to be present, proportions not specified.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	100.0	Stainless steel assumed to be M316.	
Other ferrous metals.....			
Iron.....			
Aluminium.....			
Beryllium.....	P		
Cobalt.....	0		
Copper.....	NE		
Lead.....	NE		
Magnox/Magnesium.....	NE		
Nickel.....			
Titanium.....			
Uranium.....	P		
Zinc.....	NE		
Zircaloy/Zirconium.....	NE		
Other metals.....	NE	Other metals not specified.	
Organics (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0		
Paper, cotton.....	0		
Wood.....			
Halogenated plastics	0		
Total non-halogenated plastics.....			
Condensation polymers.....	NE		
Others.....	NE		
Organic ion exchange materials....			
Total rubber.....	0		
Halogenated rubber	0		
Non-halogenated rubber.....			
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	NE		
Other materials (%wt):	-		

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	0		
Brick/Stone/Rubble.....	NE		
Cementitious material.....			
Sand.....	0		
Glass/Ceramics.....	0		
Graphite.....	0		
Desiccants/Catalysts.....	0		
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): Inorganic anions are present at approximately 3%.

	(%wt)	Type(s) and comment
Fluoride.....	NE	
Chloride.....	NE	
Iodide.....	NE	
Cyanide.....	0	
Carbonate.....	NE	
Nitrate.....	TR	
Nitrite.....	NE	
Phosphate.....	NE	
Sulphate.....	NE	
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	

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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.....		
Benzene.....	NE	
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....	NE	
Styrene.....		
Tri-butyl phosphate.....	NE	
Other organophosphates.....		
Vinyl chloride.....	NE	
Arsenic.....	NE	
Barium.....		
Boron.....	NE	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....	NE	
Caesium.....		
Selenium.....	NE	
Chromium.....	NE	
Molybdenum.....	NE	
Thallium.....		
Tin.....	NE	
Vanadium.....	NE	
Mercury compounds.....		
Others.....	NE	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....		
EEE Type 2.....		
EEE Type 3.....		
EEE Type 4.....		
EEE Type 5.....		

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Complexing agents (%wt): No

(%wt) Type(s) and comment

EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants.....
 Total complexing agents..... 0

Potential for the waste to contain discrete items: Yes. Durable engineered steel structures

PACKAGING AND CONDITIONING

Conditioning method: RHILW will be packaged into 500l drums for long term storage. CHILW will be supercompacted with the pucks being encapsulated into 500L drums.

Plant Name: RHILW and CHILW Repackaging Facilities

Location: Dounreay

Plant startup date: 2026 & 2028

Total capacity (m³/y incoming waste): -

Target start date for packaging this stream: 2026

Throughput for this stream (m³/y incoming waste): ~7.0

Other information: CHILW and RHILW Repacking plant are in design phase. Assume throughput unconstrained.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m³)	Payload (m³)	Number of packages
	500 l drum	100.0	0.211	0.5	259

Likely container type comment: The conditioning factor for RHILW will be about 1.7 while that for CHILW is about 0.5.

Range in container waste volume: 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 containers: This wastestream is majority RHILW with some CHILW being produced from maintenance/operational activities.

Likely conditioning matrix: Cement

Other information: -

Conditioned density (t/m³): ~2.5

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

Other information on conditioning: -

Opportunities for alternative disposal routing: No

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Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

RADIOACTIVITY

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

Uncertainty: The activities given are best estimates.

Definition of total alpha and total beta/gamma: Where totals are shown on the table of radionuclide activities they are the sums of the listed alpha or beta/gamma emitting radionuclides plus 'other alpha' or 'other beta/gamma'.

Measurement of radioactivities: Stocks data has been calculated from combined ILW LoC radionuclide information. Arisings specific activity has been calculated using consignors records.

Other information: Specific activities are from UKRWI 2019 decayed to 2022

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	9.45E-02	CC 2			Gd 153				
Be 10	5.48E-07	CC 2			Ho 163				
C 14	1.02E-02	CC 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	1.44E-05	CC 2			Pt 193				
Mn 53	8.76E-03	CC 2			Tl 204				
Mn 54	6.64E-09	CC 2			Pb 205				
Fe 55	8.90E-02	CC 2			Pb 210	6.17E-13	CC 2	1.64E-08	CC 2
Co 60	8.05E+00	CC 2			Bi 208				
Ni 59	3.41E-02	CC 2			Bi 210m				
Ni 63	9.04E+00	CC 2			Po 210	5.67E-13	CC 2	1.37E-08	CC 2
Zn 65	6.58E-14	CC 2			Ra 223	4.69E-11	CC 2	1.37E-20	CC 2
Se 79	1.84E-05	CC 2			Ra 225	3.61E-09	CC 2	7.23E-18	CC 2
Kr 81					Ra 226	3.77E-12	CC 2	1.84E-07	CC 2
Kr 85					Ra 228	5.97E-17	CC 2	2.43E-24	CC 2
Rb 87					Ac 227	4.74E-11	CC 2	1.55E-20	CC 2
Sr 90	1.09E+00	CC 2	4.29E-02	CC 2	Th 227	4.64E-11	CC 2	1.42E-20	CC 2
Zr 93	1.68E-04	CC 2			Th 228	1.02E-09	CC 2	5.47E-25	CC 2
Nb 91					Th 229	3.62E-09	CC 2	7.53E-18	CC 2
Nb 92					Th 230	1.02E-09	CC 2	1.22E-14	CC 2
Nb 93m	4.06E-02	CC 2	8.8E-04	CC 2	Th 232	1.22E-16	CC 2	2.20E-23	CC 2
Nb 94	3.17E-03	CC 2			Th 234	1.04E-05	CC 2		
Mo 93	1.89E-02	CC 2	8.93E-04	CC 2	Pa 231	1.95E-10	CC 2	4.98E-19	CC 2
Tc 97					Pa 233	5.98E-06	CC 2	4.39E-09	CC 2
Tc 99	9.09E-04	CC 2	3.79E-06	CC 2	U 232				
Ru 106	1.13E-06	CC 2			U 233	1.82E-06	CC 2	6.43E-14	CC 2
Pd 107					U 234	7.98E-06	CC 2	8.78E-10	CC 2
Ag 108m	1.47E-04	CC 2			U 235	4.99E-07	CC 2	1.57E-14	CC 2
Ag 110m	2.40E-13	CC 2			U 236	2.4E-07	CC 2	2.97E-13	CC 2
Cd 109			5.13E-06	CC 2	U 238	1.04E-05	CC 2		
Cd 113m	1.31E-03	CC 2			Np 237	6.00E-06	CC 2	4.39E-09	CC 2
Sn 119m					Pu 236				
Sn 121m			3.78E-06	CC 2	Pu 238	8.87E-02	CC 2	1.03E-04	CC 2
Sn 123					Pu 239	4.19E-01	CC 2	5.32E-06	CC 2
Sn 126	3.32E-05	CC 2			Pu 240	3.89E-01	CC 2	3.39E-06	CC 2
Sb 125	7.66E-04	CC 2			Pu 241	6.17E+00	CC 2	9.86E-04	CC 2
Sb 126	4.64E-06	CC 2			Pu 242	3.38E-04	CC 2		
Te 125m	1.92E-04	CC 2			Am 241	6.27E-01	CC 2	3.45E-05	CC 2
Te 127m					Am 242m	5.84E-02	CC 2		
I 129	1.55E-06	CC 2			Am 243	5.69E-04	CC 2		
Cs 134	3.20E-04	CC 2	8.73E-05	CC 2	Cm 242	4.81E-02	CC 2		
Cs 135	2.90E-05	CC 2			Cm 243	2.88E-03	CC 2		
Cs 137	3.17E+00	CC 2	4.72E-02	CC 2	Cm 244	2.26E-01	CC 2	3.72E-09	CC 2
Ba 133					Cm 245	7.95E-06	CC 2		
La 137					Cm 246	7.94E-07	CC 2		
La 138					Cm 248				
Ce 144	3.49E-10	CC 2			Cf 249				
Pm 145					Cf 250				
Pm 147	5.70E-03	CC 2			Cf 251				
Sm 147	1.64E-11	CC 2			Cf 252				
Sm 151	1.23E-01	CC 2	1.49E-04	CC 2	Other a			5.51E-07	CC 2
Eu 152	8.14E-02	CC 2	3.22E-05	CC 2	Other b/g			8.75E-02	CC 2
Eu 154	3.71E-02	CC 2	6.54E-05	CC 2	Total a	1.80E+00	CC 2	1.47E-04	CC 2
Eu 155	1.58E-02	CC 2			Total b/g	2.81E+01	CC 2	1.81E-01	CC 2

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 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