

<b>WASTE STREAM</b>	<b>5B344</b>	<b>Other Facilities Decommissioning ILW</b>
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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.....	12.0 m <sup>3</sup>
Future arisings -	1.4.2030 - 31.3.2031.....	5.2 m <sup>3</sup>
	1.4.2031 - 31.3.2032.....	8.3 m <sup>3</sup>
	1.4.2032 - 31.3.2033.....	3.4 m <sup>3</sup>
	1.4.2033 - 31.3.2034.....	< 0.1 m <sup>3</sup>
	1.4.2034 - 31.3.2035.....	0 m <sup>3</sup>
	1.4.2035 - 31.3.2036.....	0 m <sup>3</sup>
	1.4.2036 - 31.3.2037.....	0 m <sup>3</sup>
	1.4.2037 - 31.3.2038.....	0 m <sup>3</sup>
	1.4.2038 - 31.3.2039.....	0 m <sup>3</sup>
	1.4.2039 - 31.3.2040.....	0 m <sup>3</sup>
	1.4.2040 - 31.3.2041.....	<< 0.1 m <sup>3</sup>
	1.4.2041 - 31.3.2042.....	< 0.1 m <sup>3</sup>
	1.4.2042 - 31.3.2043.....	<< 0.1 m <sup>3</sup>
Total future arisings:		17.0 m <sup>3</sup>
Total waste volume:		29.0 m <sup>3</sup>

Comment on volumes: This waste stream covers the decommissioning wastes from facilities not specifically covered in the inventory. Arisings have been revised in line with Predictive Waste Inventory walk round exercise. This includes wastes from Shaft and Silo that are not linked to their contents. It should be noted that the DSRL is currently using a provisional site programme and future arising dates are subject to change.

Uncertainty factors on volumes: Stock (upper): x 1.02 Arisings (upper) x 1.2  
 Stock (lower): x 0.98 Arisings (lower) x 0.8

**WASTE SOURCE** This waste arose from the decommissioning of a fuel fabrication plant (consists mainly of contaminated concrete and rubble) and from the future decommissioning of other facilities.

**PHYSICAL CHARACTERISTICS**

General description: The waste is assumed to be concrete / rubble. With some steel work not listed in other decommissioning waste streams. Also contains sources held in areas of site not listed in other decommissioning waste streams.

Physical components (%vol): Cementitious material (e.g. concrete) (91.10%), Mild Steel (8.45%), Organic ion exchange materials (e.g. IX Resin) (0.19%), Sources (0.25%),

Sealed sources: The waste contains sealed sources. Sealed sources from labs, workshops, and other areas of site not listed in the decommissioning waste streams.

Bulk density (t/m<sup>3</sup>): 0.75

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

**CHEMICAL COMPOSITION**

General description and components (%wt): Cementitious material (e.g. concrete) (76.13%), Mild Steel (23.13%), Organic ion exchange materials (e.g. IX Resin) (0.05%), Sources (0.69%).

Chemical state: Neutral

Chemical form of radionuclides: Cl-36: Not likely to be present.  
 I-129: Not likely to be present.  
 U: Likely to be present as dried nitrate solution.

Metals and alloys (%wt): -

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	23.1		
Iron.....			
Aluminium.....			
Beryllium.....	0		
Cobalt.....	0		
Copper.....			
Lead.....	0		
Magnox/Magnesium.....	0		
Nickel.....			
Titanium.....			
Uranium.....	P		
Zinc.....	0		
Zircaloy/Zirconium.....	0		
Other metals.....	0.69	sources	
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.....	0		
Others.....	0		
Organic ion exchange materials....	0.05		
Total rubber.....	0		
Halogenated rubber .....	0		
Non-halogenated rubber.....	0		
Hydrocarbons.....			
Oil or grease .....			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	0		
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.....	0		
Cementitious material.....	76.1		
Sand.....	0		
Glass/Ceramics.....			
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): -

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

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. It is possible that the waste may contain durable engineered steel structures.

**PACKAGING AND CONDITIONING**

Conditioning method: Remote Handled ILW will be packaged into 500litre drums for long term storage. Contact Handled ILW will be supercompacted with the pucks being encapsulated in 500 litre drums for long term storage.

Plant Name: CHILW Repackaging Facility and RHILW Repackaging Facility

Location: Dounreay

Plant startup date: 2026 and 2028 respectively

Total capacity (m<sup>3</sup>/y incoming waste): 8.3

Target start date for packaging this stream: -

Throughput for this stream (m<sup>3</sup>/y incoming waste): 1.3

Other information: Plants are currently in design phase

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages
	500 l drum	100.0	0.269	0.5	108

Likely container type comment: The conditioning factor for RHILW is 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: Stainless Steel.

Likely conditioning matrix: Cement

Other information: -

Conditioned density (t/m<sup>3</sup>): >2.5

Conditioned density comment: The density is likely to be around 2 - 3 t/m<sup>3</sup>.

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
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**RADIOACTIVITY**

Source: Contamination of operating facilities.

Uncertainty: Stocks data is taken from the RHILW Solid and CHILW drummed LoCs. These LoCs provide a generic activity for all CHILW/RHILW wastes in store. Arisings data is an extrapolation based on consignors data. Due to very limited sample data, the only information is based on Ion Exchange columns for Shaft and Silo. However, the majority of the volume originates from Silo, so it will remain a reasonable approximation. No radionuclide information for sources are available in the PWI at the time of doing this report. Factor of 10.

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: From LoC data and consignment data.

Other information: Specific activity has been derived from UKRWI 2019 data decayed to 2022. Different facilities are represented between stocks and arisings. (i.e. Stocks represents mainly demolished buildings, arisings represents facilities yet to generate ILW)

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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	5.59E-03	CC 2			Gd 153				
Be 10	2.74E-08	CC 2			Ho 163				
C 14	5.13E-04	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	7.18E-07	CC 2			Pt 193				
Mn 53	4.38E-04	CC 2			Tl 204				
Mn 54	3.78E-09	CC 2			Pb 205				
Fe 55	9.52E-03	CC 2			Pb 210	2.39E-11	CC 2		
Co 60	5.97E-01	CC 2			Bi 208				
Ni 59	1.70E-03	CC 2			Bi 210m				
Ni 63	4.61E-01	CC 2			Po 210	2.21E-11	CC 2		
Zn 65	7.38E-14	CC 2			Ra 223	1.10E-09	CC 2	5.84E-17	CC 2
Se 79	9.22E-07	CC 2			Ra 225	1.55E-10	CC 2	8.55E-22	CC 2
Kr 81					Ra 226	1.33E-10	CC 2		
Kr 85					Ra 228	9.34E-10	CC 2	5.41E-21	CC 2
Rb 87					Ac 227	1.11E-09	CC 2	6.58E-17	CC 2
Sr 90	5.92E-02	CC 2	6.86E-02	CC 2	Th 227	1.08E-09	CC 2	6.03E-17	CC 2
Zr 93	8.41E-06	CC 2			Th 228	1.69E-07	CC 2	1.22E-21	CC 2
Nb 91					Th 229	1.55E-10	CC 2	9.23E-22	CC 2
Nb 92					Th 230	3.39E-08	CC 2		
Nb 93m	2.18E-03	CC 2			Th 232	1.15E-09	CC 2	4.90E-20	CC 2
Nb 94	1.59E-04	CC 2			Th 234	4.76E-06	CC 2		
Mo 93	9.46E-04	CC 2			Pa 231	3.88E-09	CC 2	2.12E-15	CC 2
Tc 97					Pa 233	5.80E-07	CC 2	3.13E-12	CC 2
Tc 99	4.54E-05	CC 2			U 232	1.64E-07	CC 2		
Ru 106	4.35E-07	CC 2			U 233	9.12E-08	CC 2	1.33E-17	CC 2
Pd 107					U 234	2.16E-04	CC 2		
Ag 108m	7.38E-06	CC 2			U 235	9.49E-06	CC 2	6.69E-11	CC 2
Ag 110m	2.52E-13	CC 2			U 236	1.10E-05	CC 2	6.62E-10	CC 2
Cd 109					U 238	4.76E-06	CC 2		
Cd 113m	7.61E-05	CC 2			Np 237	5.82E-07	CC 2	3.36E-12	CC 2
Sn 119m					Pu 236				
Sn 121m					Pu 238	1.73E-02	CC 2		
Sn 123					Pu 239	3.68E-02	CC 2	2.26E-02	CC 2
Sn 126	1.66E-06	CC 2			Pu 240	4.30E-02	CC 2	7.55E-03	CC 2
Sb 125	8.14E-05	CC 2			Pu 241	7.00E-01	CC 2	1.31E-03	CC 2
Sb 126	2.32E-07	CC 2			Pu 242	3.8E-05	CC 2		
Te 125m	2.04E-05	CC 2			Am 241	7.36E-02	CC 2	6.74E-06	CC 2
Te 127m					Am 242m	2.96E-03	CC 2		
I 129	7.77E-08	CC 2			Am 243	2.85E-05	CC 2		
Cs 134	4.39E-05	CC 2			Cm 242	2.44E-03	CC 2		
Cs 135	1.45E-06	CC 2			Cm 243	1.54E-04	CC 2		
Cs 137	1.71E-01	CC 2	8.68E-03	CC 2	Cm 244	1.27E-02	CC 2		
Ba 133					Cm 245	3.97E-07	CC 2		
La 137					Cm 246	3.97E-08	CC 2		
La 138					Cm 248				
Ce 144	2.51E-10	CC 2			Cf 249				
Pm 145					Cf 250				
Pm 147	6.31E-04	CC 2			Cf 251				
Sm 147	8.13E-13	CC 2			Cf 252				
Sm 151	6.32E-03	CC 2			Other a			1.76E-16	CC 2
Eu 152	4.75E-03	CC 2			Other b/g	1.01E-06	CC 2	7.68E-02	CC 2
Eu 154	2.37E-03	CC 2			<b>Total a</b>	<b>1.86E-01</b>	<b>CC 2</b>	<b>3.02E-02</b>	<b>CC 2</b>
Eu 155	1.22E-03	CC 2			<b>Total b/g</b>	<b>2.03E+00</b>	<b>CC 2</b>	<b>1.55E-01</b>	<b>CC 2</b>

**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