

<b>WASTE STREAM</b>	<b>5B306</b>	<b>Site Drains and Ducts 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.....	0 m <sup>3</sup>
Future arisings -	1.4.2039 - 31.3.2040.....	0.2 m <sup>3</sup>
	1.4.2040 - 31.3.2041.....	1.0 m <sup>3</sup>
	1.4.2041 - 31.3.2042.....	1.0 m <sup>3</sup>
	1.4.2042 - 31.3.2043.....	1.0 m <sup>3</sup>
	1.4.2043 - 31.3.2044.....	1.0 m <sup>3</sup>
	1.4.2044 - 31.3.2045.....	1.0 m <sup>3</sup>
	1.4.2045 - 31.3.2046.....	1.0 m <sup>3</sup>
	1.4.2046 - 31.3.2047.....	1.0 m <sup>3</sup>
	1.4.2047 - 31.3.2048.....	0.2 m <sup>3</sup>
Total future arisings:		7.4 m <sup>3</sup>
Total waste volume:		7.4 m <sup>3</sup>

Comment on volumes: It should be noted that the DSRL are using a provisional LifeTime Plan (LTP) and arisings dates are subject to change. Arisings are in line with PWI update. Initial indications show ~2m<sup>3</sup> CHILW from Zone H2 which contains declarable Pu. Also ~6m<sup>3</sup> RHILW from a high active drain.

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

**WASTE SOURCE** Contamination and activation from years of operations and discharges via drainage system

**PHYSICAL CHARACTERISTICS**

General description: Pipework, drip tray  
 Physical components (%vol): Iron (4.49%), Mild Steel (74.73%), Plastic (6.98%), Stainless steel (13.80%),  
 Sealed sources: The waste does not contain sealed sources.  
 Bulk density (t/m<sup>3</sup>): 0.42  
 Comment on density: No consignor's records for ILW. Therefore, use LLW (5B305).

**CHEMICAL COMPOSITION**

General description and components (%wt): Iron (4.79%), Mild Steel (79.63%), Plastic (0.87%), Stainless steel (14.71%).  
 Chemical state: Neutral  
 Chemical form of radionuclides: H-3: Likely to be present as contamination.  
 C-14: Likely to be present as contamination.  
 Ra: Not likely to be present.  
 Th: Likely to be present as contamination.  
 U: Likely to be present as contamination.  
 Np: Likely to be present as contamination.  
 Pu: Likely to be present as contamination.  
 Metals and alloys (%wt): Pipework is typically 3mm

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	14.7		
Other ferrous metals.....	79.6	Mild Steel	
Iron.....	4.8		
Aluminium.....			
Beryllium.....			
Cobalt.....			
Copper.....			
Lead.....			
Magnox/Magnesium.....			
Nickel.....			
Titanium.....			
Uranium.....			
Zinc.....			
Zircaloy/Zirconium.....			
Other metals.....			

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....			
Paper, cotton.....			
Wood.....			
Halogenated plastics .....			
Total non-halogenated plastics.....	0.87		
Condensation polymers.....			
Others.....	0.87		
Organic ion exchange materials....			
Total rubber.....			
Halogenated rubber .....			
Non-halogenated rubber.....			
Hydrocarbons.....			
Oil or grease .....			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....			

Other materials (%wt): -

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

Inorganic anions (%wt):           Trace quantities may be present dependent on operations undertaken.

	(%wt)	Type(s) and comment
Fluoride.....	NE	
Chloride.....	NE	
Iodide.....	NE	
Cyanide.....	NE	
Carbonate.....	NE	
Nitrate.....	NE	
Nitrite.....	NE	
Phosphate.....	NE	
Sulphate.....	NE	
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.....	NE	
Putrescible wastes.....	NE	
Non-putrescible wastes.....	NE	

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Corrosive materials.....	NE
Pyrophoric materials.....	NE
Generating toxic gases.....	NE
Reacting with water.....	NE
Higher activity particles.....	NE
Soluble solids as bulk chemical compounds.....	NE

Hazardous substances / non hazardous pollutants:      Lead is present in trace quantities.

	(%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	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	NE	
EEE Type 2.....	NE	
EEE Type 3.....	NE	
EEE Type 4.....	NE	
EEE Type 5.....	NE	

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Complexing agents (%wt):      No

(%wt)      Type(s) and comment

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

Potential for the waste to contain discrete items:      Yes. Waste contains durable engineered structures: pipework and possibly a tank

**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 (m<sup>3</sup>/y incoming waste):      -

Target start date for packaging this stream:      2039

Throughput for this stream (m<sup>3</sup>/y incoming waste):      1.0

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

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	~0.225	0.5	33

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:      -

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 te/m3

Other information on conditioning:      -

Opportunities for alternative disposal routing:      Not yet determined

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

### RADIOACTIVITY

Source: From reactors and reprocessing facilities

Uncertainty: -

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: -

Other information: Specific Activities used are from UKRWI 2019 decayed to 2022

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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					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					Tl 204				
Mn 54					Pb 205				
Fe 55					Pb 210				
Co 60			3.26E-04	CC 2	Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90			7.84E-02	CC 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234		9.86E-06	CC 2	
Ag 108m					U 235		1.79E-07	CC 2	
Ag 110m					U 236		7.16E-07	CC 2	
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238		3.59E-04	CC 2	
Sn 123					Pu 239		6.83E-04	CC 2	
Sn 126					Pu 240				
Sb 125					Pu 241		1.67E-04	CC 2	
Sb 126					Pu 242				
Te 125m					Am 241		4.05E-04	CC 2	
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137			9.41E-02	CC 2	Cm 244		3.11E-04	CC 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					Other a				
Eu 152					Other b/g				
Eu 154					<b>Total a</b>	<b>0</b>	<b>1.77E-03</b>	<b>CC 2</b>	
Eu 155					<b>Total b/g</b>	<b>0</b>	<b>1.73E-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