

WASTE STREAM	5B312	Development Laboratory 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.....	80.3 m ³
Future arisings -	1.4.2022 - 31.3.2023.....	0.2 m ³
	1.4.2023 - 31.3.2024.....	0.2 m ³
	1.4.2024 - 31.3.2025.....	0.2 m ³
	1.4.2025 - 31.3.2026.....	0.2 m ³
	1.4.2026 - 31.3.2027.....	0.2 m ³
	1.4.2027 - 31.3.2028.....	0.2 m ³
	1.4.2028 - 31.3.2029.....	0.2 m ³
	1.4.2029 - 31.3.2030.....	0.2 m ³
	1.4.2030 - 31.3.2031.....	0.2 m ³
	1.4.2031 - 31.3.2032.....	0.2 m ³
	1.4.2032 - 31.3.2033.....	0.2 m ³
	1.4.2033 - 31.3.2034.....	0.2 m ³
	1.4.2034 - 31.3.2035.....	0.2 m ³
1.4.2035 - 31.3.2036.....	0.2 m ³	
	1.4.2036 - 31.3.2037.....	< 0.1 m ³
Total future arisings:		2.8 m ³
Total waste volume:		83.1 m ³

Comment on volumes: It should be noted that the programme is based on a provisional DSRL site programme and that arisings dates are subject to change. Arisings have been revised in line with the plant waste inventory exercise. Stocks volumes calculated from 371 x 200 l drums (CHILW) plus 31 drums RHILW. Arisings have been revised in line with the plant waste inventory exercise.

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 Experimental laboratories including gloveboxes and cells together with wastes produced from general plant decommissioning.

PHYSICAL CHARACTERISTICS

General description: Experimental and production facilities associated with fuel technology. In-cell process equipment, decommissioning process arisings and miscellaneous vessels, containers, gloveboxes and fume cupboard equipment. Large items will be size reduced during decommissioning.

Physical components (%vol): Glass (4.23%), Mild Steel (68.99%), Other organics (0.28%), Plastic (11.25%), Paper / Cardboard (15.24%),

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.31

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

CHEMICAL COMPOSITION

General description and components (%wt): Glass (1.88%), Mild Steel (96.23%), Other organics (0.05%), Plastic (1.84%),

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Chemical state: Neutral

Chemical form of radionuclides: H-3: May be present as contamination.
 Cl-36: Not likely to be present
 Se-79: May be present as contamination.
 Tc-99: May be present as contamination.
 I-129: May be present as contamination.
 Ra: May be present as contamination.
 Th: May be present as contamination.
 U: May be present as contamination.
 Np: May be present as contamination.
 Pu: May be present as contamination.

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

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	96.2		
Iron.....			
Aluminium.....	0		
Beryllium.....	0		
Cobalt.....	0		
Copper.....	0		
Lead.....	TR		
Magnox/Magnesium.....	0		
Nickel.....			
Titanium.....			
Uranium.....	TR		
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	0.92	PVC	
Total non-halogenated plastics.....	0.92		
Condensation polymers.....	NE		
Others.....	0		
Organic ion exchange materials....	0		
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)....			

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Bitumen.....
 Others.....
 Other organics..... 0.05 Vent Cell Contents - no further info at this time

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	NE		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....			
Glass/Ceramics.....	1.9		
Graphite.....	0		
Desiccants/Catalysts.....			
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 may be present in trace quantities.

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

Materials of interest for waste acceptance criteria: Nitric acid swabs may be present in trace quantities, having been used for spillages.

	(%wt)	Type(s) and comment
Combustible metals.....	0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	

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Hydrides.....	0
Biological etc. materials.....	0
Biodegradable materials.....	0
Putrescible wastes.....	0
Non-putrescible wastes.....	0
Corrosive materials.....	
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: Lead is present, but only in trace quantities.

	(%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.....		

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EEE Type 3.....
 EEE Type 4.....
 EEE Type 5.....

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. In-cell items

PACKAGING AND CONDITIONING

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

Plant Name: CHILW Repacking Facility ; RHILW Repacking Facility

Location: Dounreay

Plant startup date: 2026 for CHILW; 2028 for RHILW repack Facility

Total capacity (m³/y incoming waste): -

Target start date for packaging this stream: 2026

Throughput for this stream (m³/y incoming waste): <1.0

Other information: Repacking Plants are currently in design phase. Assume throughput is unconstrained.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	500 l drum	100.0	0.798	0.5	105

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 in a 500 l 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/m³): ~2.5

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

Other information on conditioning: -

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Opportunities for alternative disposal routing: No

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

RADIOACTIVITY

Source: Originally from irradiated PFR fuel. Radioactivity is principally associated with second cycle raffinate.

Uncertainty: The activities for arisings are best estimates and are considered to be worst case. The activity of the stocks is based on consignor's declarations for waste resulting from the Pulse Column Lab (PCL) decommissioning.

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: Specific activities for stocks has come from Letter of Compliance information. Specific activities from UKRWI 2019 data decayed to 2022.

Other information: Specific activities from UKRWI 2019 data 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	8.50E-03	CC 2			Gd 153				
Be 10	4.17E-08	CC 2			Ho 163				
C 14	7.79E-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	1.09E-06	CC 2			Pt 193				
Mn 53	6.66E-04	CC 2			Tl 204				
Mn 54	5.75E-09	CC 2			Pb 205				
Fe 55	1.45E-02	CC 2			Pb 210	2.33E-11	CC 2	3.41E-16	CC 2
Co 60	9.07E-01	CC 2	6.36E-02	CC 2	Bi 208				
Ni 59	2.59E-03	CC 2			Bi 210m				
Ni 63	7.01E-01	CC 2			Po 210	2.15E-11	CC 2	1.82E-16	CC 2
Zn 65	1.12E-13	CC 2			Ra 223	1.07E-09	CC 2	2.58E-16	CC 2
Se 79	1.40E-06	CC 2			Ra 225	2.35E-10	CC 2	3.05E-15	CC 2
Kr 81					Ra 226	1.30E-10	CC 2	1.51E-14	CC 2
Kr 85					Ra 228	9.09E-10	CC 2	7.17E-20	CC 2
Rb 87					Ac 227	1.08E-09	CC 2	2.91E-16	CC 2
Sr 90	8.96E-02	CC 2	1.86E+01		Th 227	1.06E-09	CC 2	2.66E-16	CC 2
Zr 93	1.28E-05	CC 2			Th 228	1.65E-07	CC 2	1.61E-20	CC 2
Nb 91					Th 229	2.36E-10	CC 2	3.24E-15	CC 2
Nb 92					Th 230	3.30E-08	CC 2	3.48E-11	CC 2
Nb 93m	3.32E-03	CC 2			Th 232	1.11E-09	CC 2	6.50E-19	CC 2
Nb 94	2.41E-04	CC 2			Th 234	4.92E-06	CC 2	3.61E-18	CC 2
Mo 93	1.44E-03	CC 2			Pa 231	3.78E-09	CC 2	9.35E-15	CC 2
Tc 97					Pa 233	7.11E-07	CC 2	5.61E-06	CC 2
Tc 99	6.90E-05	CC 2			U 232	1.59E-07	CC 2		
Ru 106	6.60E-07	CC 2	4.83E-03	CC 2	U 233	1.38E-07	CC 2	3.54E-11	CC 2
Pd 107					U 234	2.11E-04	CC 2	2.51E-06	CC 2
Ag 108m	1.12E-05	CC 2			U 235	9.24E-06	CC 2	2.96E-10	CC 2
Ag 110m	3.82E-13	CC 2			U 236	1.07E-05	CC 2	8.78E-09	CC 2
Cd 109					U 238	4.92E-06	CC 2	3.85E-18	CC 2
Cd 113m	1.16E-04	CC 2			Np 237	7.14E-07	CC 2	5.82E-06	CC 2
Sn 119m					Pu 236				
Sn 121m					Pu 238	1.93E-02	CC 2	2.94E-01	CC 2
Sn 123					Pu 239	4.72E-02	CC 2	1.00E-01	CC 2
Sn 126	2.52E-06	CC 2			Pu 240	5.24E-02	CC 2	1.00E-01	CC 2
Sb 125	1.24E-04	CC 2	1.41E-01	CC 2	Pu 241	8.76E-01	CC 2	7.78E-01	CC 2
Sb 126	3.53E-07	CC 2			Pu 242	4.62E-05	CC 2	2.77E-09	CC 2
Te 125m	3.10E-05	CC 2	3.34E-02	CC 2	Am 241	8.79E-02	CC 2	5.98E+00	CC 2
Te 127m					Am 242m	4.5E-03	CC 2	2.95E-03	CC 2
I 129	1.18E-07	CC 2			Am 243	4.32E-05	CC 2	1.87E-08	CC 2
Cs 134	6.66E-05	CC 2	1.83E-01	CC 2	Cm 242	3.71E-03	CC 2	3.38E-03	CC 2
Cs 135	2.21E-06	CC 2			Cm 243	2.35E-04	CC 2	2.68E-02	CC 2
Cs 137	2.59E-01	CC 2	3.73E+01	CC 2	Cm 244	1.93E-02	CC 2	3.56E-01	CC 2
Ba 133					Cm 245	6.04E-07	CC 2		
La 137					Cm 246	6.03E-08	CC 2		
La 138					Cm 248				
Ce 144	3.81E-10	CC 2			Cf 249				
Pm 145					Cf 250				
Pm 147	9.58E-04	CC 2			Cf 251				
Sm 147	1.23E-12	CC 2			Cf 252				
Sm 151	9.59E-03	CC 2			Other a			5.70E-14	CC 2
Eu 152	7.22E-03	CC 2			Other b/g	9.82E-07	CC 2	5.39E+01	CC 2
Eu 154	3.60E-03	CC 2	5.50E-01	CC 2	Total a	2.30E-01	CC 2	6.86E+00	CC 2
Eu 155	1.86E-03	CC 2	3.87E-01	CC 2	Total b/g	2.89E+00	CC 2	1.12E+02	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