

WASTE STREAM	5B350	Uranium Recovery Plant 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.....	6.0 m ³
Future arisings -	1.4.2022 - 31.3.2023.....	0 m ³
	1.4.2023 - 31.3.2024.....	0 m ³
	1.4.2024 - 31.3.2025.....	0 m ³
	1.4.2025 - 31.3.2026.....	< 0.1 m ³
	1.4.2026 - 31.3.2027.....	0.1 m ³
	1.4.2027 - 31.3.2028.....	< 0.1 m ³
Total future arisings:		0.2 m ³
Total waste volume:		6.2 m ³

Comment on volumes: It should be noted that the DSRL is currently using a provisional site programme site programme and that arisings dates are subject to change. Arisings volumes have been updated after Predictive Inventory Walkdown exercise. Stock volumes have been re-evaluated based on information in DMS: 30 CHILW Drums.

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 The material will mainly be as metal items and some small items of plant equipment, all CHILW. Excludes any new facilities associated with Exotic Fuels management.

PHYSICAL CHARACTERISTICS

General description: The waste is varied in nature consisting of general soft wastes such as tissue, paper, PVC etc., and other more dense materials, e.g. contaminated pumps, motors, valves, pipework, extract filter housings etc.
 Physical components (%vol): Other organics (31.32%), Sources (21.70%), Stainless steel (46.98%),
 Sealed sources: The waste contains sealed sources. Further details are not yet available
 Bulk density (t/m³): 0.35
 Comment on density: The bulk density is based on Consignor's records

CHEMICAL COMPOSITION

General description and components (%wt): Other organics (5.48%), Sources (29.86%), Stainless steel (64.66%),
 Chemical state: Neutral
 Chemical form of radionuclides: Cl-36: Not likely to be present
 I-129: Not likely to be present
 Th: Present as oxide.
 U: Present as metal and oxide.
 Metals and alloys (%wt): -

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	64.7		
Other ferrous metals.....			
Iron.....			
Aluminium.....			
Beryllium.....			

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Cobalt.....
 Copper.....
 Lead.....
 Magnox/Magnesium.....
 Nickel.....
 Titanium.....
 Uranium.....
 Zinc.....
 Zircaloy/Zirconium.....
 Other metals..... 29.9 sources

Organics (%wt): No breakdown of plastics/rubbers is available.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose			
Paper, cotton			
Wood			
Halogenated plastics			
Total non-halogenated plastics			
Condensation polymers			
Others			
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	5.5		

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials			
Inorganic sludges and flocs			
Soil			
Brick/Stone/Rubble			
Cementitious material			
Sand			
Glass/Ceramics			
Graphite			

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Desiccants/Catalysts.....
 Asbestos.....
 Non/low friable.....
 Moderately friable.....
 Highly friable.....
 Free aqueous liquids.....
 Free non-aqueous liquids.....
 Powder/Ash.....

Inorganic anions (%wt): -

	(%wt)	Type(s) and comment
Fluoride.....	0	
Chloride.....	NE	
Iodide.....	NE	
Cyanide.....	NE	
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	
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	

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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.....		

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....		
Total complexing agents.....	0	

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Potential for the waste to contain discrete items: Yes. Potential to include contaminated hand tools.

PACKAGING AND CONDITIONING

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

Plant Name: CHILW repack facility;

Location: Dounreay

Plant startup date: CHILW 2026;

Total capacity (m³/y incoming waste): 0.2

Target start date for packaging this stream: 2022

Throughput for this stream (m³/y incoming waste): 0.1

Other information: Plants are currently in design phase.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m³)	Payload (m³)	Number of packages
	500 l drum	100.0	0.98	0.5	7

Likely container type comment: Conditioning factor 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 500 ltr 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 500 ltr drum.

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: -

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: The material processed through the facility is of varying enrichments, ranging from depleted uranium through to 93 % enriched uranium.

Uncertainty: Stocks data is taken from CHILW drummed LoC.

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'.

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Measurement of
radioactivities:

Arisings data has been taken from Consignors records; Stocks data is taken from CHILW
drummed LoC.

Other information:

Specific Activity uses 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					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	8.11E-13	CC 2			Pb 205				
Fe 55					Pb 210	2.18E-11	CC 2	3.58E-12	CC 2
Co 60	4.21E-06	CC 2			Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210	2.01E-11	CC 2	2.16E-12	CC 2
Zn 65					Ra 223	1.06E-09	CC 2	2.65E-10	CC 2
Se 79					Ra 225	1.67E-14	CC 2		
Kr 81					Ra 226	1.25E-10	CC 2	1.19E-10	CC 2
Kr 85					Ra 228	9.55E-10	CC 2	2.18E-14	CC 2
Rb 87					Ac 227	1.07E-09	CC 2	2.87E-10	CC 2
Sr 90	7.49E-04	CC 2			Th 227	1.05E-09	CC 2	2.69E-10	CC 2
Zr 93					Th 228	1.80E-07	CC 2	6.28E-15	CC 2
Nb 91					Th 229	1.68E-14	CC 2		
Nb 92					Th 230	3.35E-08	CC 2	1.83E-07	CC 2
Nb 93m					Th 232	1.21E-09	CC 2	1.35E-13	CC 2
Nb 94					Th 234	4.46E-06	CC 2	9.09E-06	CC 2
Mo 93					Pa 231	3.87E-09	CC 2	6.20E-09	CC 2
Tc 97					Pa 233	3.12E-07	CC 2		
Tc 99					U 232	1.74E-07	CC 2		
Ru 106	3.24E-11	CC 2			U 233	1.88E-11	CC 2		
Pd 107					U 234	2.27E-04	CC 2	6.64E-03	CC 2
Ag 108m					U 235	9.96E-06	CC 2	9.78E-05	CC 2
Ag 110m					U 236	1.16E-05	CC 2	9.13E-04	CC 2
Cd 109					U 238	4.46E-06	CC 2	9.09E-06	CC 2
Cd 113m					Np 237	3.13E-07	CC 2		
Sn 119m					Pu 236				
Sn 121m					Pu 238	1.37E-02	CC 2		
Sn 123					Pu 239	1.67E-02	CC 2		
Sn 126					Pu 240	2.48E-02	CC 2		
Sb 125	6.83E-08	CC 2			Pu 241	3.80E-01	CC 2		
Sb 126					Pu 242	2.22E-05	CC 2		
Te 125m	1.71E-08	CC 2			Am 241	4.55E-02	CC 2		
Te 127m					Am 242m	1.13E-06	CC 2		
I 129					Am 243	1.57E-10	CC 2		
Cs 134	9.59E-08	CC 2			Cm 242	9.34E-07	CC 2		
Cs 135					Cm 243	8.51E-10	CC 2		
Cs 137	1.01E-03	CC 2			Cm 244	8.42E-06	CC 2		
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147	1.48E-06	CC 2			Cf 251				
Sm 147	1.90E-15	CC 2			Cf 252				
Sm 151	2.07E-05	CC 2			Other a			1.15E-09	CC 2
Eu 152	2.48E-06	CC 2			Other b/g	1.06E-06	CC 2	1.07E-04	CC 2
Eu 154	7.78E-06	CC 2			Total a	1.01E-01	CC 2	7.66E-03	CC 2
Eu 155	2.51E-06	CC 2			Total b/g	3.81E-01	CC 2	1.16E-04	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