

WASTE STREAM	5B24	Operational CHILW
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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

Stocks:	At 1.4.2022.....	Reported 769.8 m ³
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Total future arisings:		0 m ³
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Total waste volume:		769.8 m ³
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Comment on volumes: No future arisings. A remeasurement and recategorisation exercise is underway that may see these package numbers reduce further. Any further arisings of plutonium contaminated material will be covered by decommissioning streams.

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

WASTE SOURCE Reprocessing support, analytical and waste facilities and development work. Wastes from POCO may also be included.

PHYSICAL CHARACTERISTICS

General description: The waste comprises filters, glass, metal, concrete, process residues, tins, isomantles and general wastes such as tissues, swabs, plastic bags and rubber gloves. All waste in this stream is in 200 litre drums. The waste contains no large items.

Physical components (%vol): Stainless steel tanks, sheeting etc. (10.4%), metal consisting of tools, pumps, stands etc. (2.0%), filters (1.8%), glass (2.4%), plastic bags, bottles etc. (12.3%), PVC bottles, sheet etc. (9.9%), rubber gloves (14.5%), swabs, paper and tissues (21.5%), concrete (2.4%), process residues (0.6%) and others including tins, isomantles, centrifuge bowls, lead, asbestos lagging, Windscale suits, soil, rubble and small plant items (22.1%).

Sealed sources: Not yet determined.

Bulk density (t/m³): 0.26

Comment on density: The density has been obtained from the consignor's declarations.

CHEMICAL COMPOSITION

General description and components (%wt): Stainless steel (34%), mild steel (45%), concrete (3%), glass (3.8%), non-halogenated plastics (2%), halogenated plastics (9%), cellulose (0.5%), rubber (1.3%) and others (1.4%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Not likely to be present.
C-14: Not likely to be present.
Cl-36: Not likely to be present.
Tc-99: Not likely to be present.
I-129: Not likely to be present.
Ra: Not likely to be present.
Th: Not likely to be present.
U: Likely to be present as oxides, possibly carbides.
Np: Probably present in trace amounts.
Pu: Likely to be present as oxides.

Metals and alloys (%wt): Both bulk and sheet metal may be present, proportions unknown.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	34.0		
Other ferrous metals.....	45.0		
Iron.....			
Aluminium.....	~0.01		

WASTE STREAM	5B24	Operational CHILW
---------------------	-------------	--------------------------

Beryllium.....	
Cobalt.....	0
Copper.....	TR
Lead.....	~0.07
Magnox/Magnesium.....	TR
Nickel.....	
Titanium.....	
Uranium.....	
Zinc.....	TR
Zircaloy/Zirconium.....	TR
Other metals.....	1.2

Organics (%wt): The waste contains small amounts of organic material. PVC and neoprene are likely to be present.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0.50		
Paper, cotton.....	0.50		
Wood.....	TR		
Halogenated plastics	9.0		
Total non-halogenated plastics.....	2.0		
Condensation polymers.....	TR		
Others.....	2.0		
Organic ion exchange materials....	0		
Total rubber.....	1.3		
Halogenated rubber	1.3		
Non-halogenated rubber.....	TR		
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	0		

Other materials (%wt): -

	(%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.....	3.0		
Sand.....			
Glass/Ceramics.....	3.8		

WASTE STREAM	5B24	Operational CHILW
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Graphite.....	0
Desiccants/Catalysts.....	
Asbestos.....	0.10
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): The waste may contain traces of nitric acid.

	(%wt)	Type(s) and comment
Fluoride.....	NE	
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: The waste contains some asbestos lagging. Traces of flammable liquids may be present absorbed on swabs.

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

WASTE STREAM

5B24

Operational CHILW

Hazardous substances /
non hazardous pollutants:

Materials were identified during a detailed examination of plant records. Asbestos (0.1%).
This is asbestos lagging.

	(%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	

WASTE STREAM**5B24****Operational CHILW**

Potential for the waste to contain discrete items: No.

PACKAGING AND CONDITIONING

Conditioning method: The waste will continue to be stored in 200 litre drums until a conditioning route is available. The current strategy is for this material to be compacted, with the resultant pucks grouted into 500 litre drums. Some waste drums may not be suitable for compaction and these will be directly loaded into 500 l drums. This waste stream will be copackaged into 500L drums alongside all wastes from 5B19 and the CHILW from decommissioning waste streams.

Plant Name: CHILW Repacking Facility

Location: Dounreay

Plant startup date: 2026

Total capacity (m³/y incoming waste): -

Target start date for packaging this stream: 2026

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

Other information: Material may be processed with other CHILW.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	500 l drum	100.0	1	0.5	770

Likely container type comment: The 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 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.

Other information on containers: Stainless Steel. Likely to be 316 stainless steel.

Likely conditioning matrix: Cement

Other information: -

Conditioned density (t/m³): ~2.5

Conditioned density comment: The conditioned density may lie in the range 2- 3 t/m³ dependent on supercompactor performance.

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 activity is in the form of plutonium contamination on materials.

Uncertainty: Activities are known to within a factor of three.

WASTE STREAM**5B24****Operational CHILW**

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:

Alpha activities are based on O and A grade plutonium content from drum records. Beta/gamma activities are based on measurements from a number of drums. Decayed from the 2019 submission

Other information:

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WASTE STREAM

5B24

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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					Pb 205				
Fe 55					Pb 210	5.44E-10	BB 2		
Co 60	1.39E-06	BB 2			Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210	5.27E-10	BB 2		
Zn 65					Ra 223	2.31E-10	BB 2		
Se 79					Ra 225	1.67E-14	BB 2		
Kr 81					Ra 226	1.56E-09	BB 2		
Kr 85					Ra 228	6.82E-18	BB 2		
Rb 87					Ac 227	2.33E-10	BB 2		
Sr 90	6.33E-04	BB 2			Th 227	2.28E-10	BB 2		
Zr 93					Th 228	5.40E-18	BB 2		
Nb 91					Th 229	1.68E-14	BB 2		
Nb 92					Th 230	7.17E-09	BB 2		
Nb 93m	6.18E-06	BB 2			Th 232	1.18E-17	BB 2		
Nb 94					Th 234	3.36E-06	BB 2		
Mo 93	7.39E-06	BB 2			Pa 231	8.46E-10	BB 2		
Tc 97					Pa 233	3.05E-07	BB 2		
Tc 99	6.00E-08	BB 2			U 232				
Ru 106	4.97E-11	BB 2			U 233	1.82E-11	BB 2		
Pd 107					U 234	5.18E-05	BB 2		
Ag 108m					U 235	1.88E-06	BB 2		
Ag 110m					U 236	1.74E-08	BB 2		
Cd 109					U 238	3.36E-06	BB 2		
Cd 113m					Np 237	3.07E-07	BB 2		
Sn 119m					Pu 236				
Sn 121m	5.00E-08	BB 2			Pu 238	1.28E-02	BB 2		
Sn 123					Pu 239	1.48E-02	BB 2		
Sn 126					Pu 240	2.31E-02	BB 2		
Sb 125	1.12E-07	BB 2			Pu 241	3.57E-01	BB 2		
Sb 126					Pu 242	2.07E-05	BB 2		
Te 125m	2.80E-08	BB 2			Am 241	4.37E-02	BB 2		
Te 127m					Am 242m	2.69E-09	BB 2		
I 129					Am 243	1.44E-10	BB 2		
Cs 134	2.65E-10	BB 2			Cm 242	2.22E-09	BB 2		
Cs 135					Cm 243	7.80E-10	BB 2		
Cs 137	6.56E-04	BB 2			Cm 244	4.30E-09	BB 2		
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147	4.94E-08	BB 2			Cf 251				
Sm 147	4.79E-17	BB 2			Cf 252				
Sm 151	4.47E-07	BB 2			Other a				
Eu 152					Other b/g	1.6E-06	BB 2		
Eu 154	9.10E-08	BB 2			Total a	9.45E-02	BB 2	0	
Eu 155	4.58E-08	BB 2			Total b/g	3.58E-01	BB 2	0	

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