

WASTE STREAM	5B342	Pu Fuels Examination Facility 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.....	63.4 m ³
Future arisings -	1.4.2031 - 31.3.2032.....	0.7 m ³
	1.4.2032 - 31.3.2033.....	5.5 m ³
	1.4.2033 - 31.3.2034.....	5.5 m ³
	1.4.2034 - 31.3.2035.....	5.5 m ³
	1.4.2035 - 31.3.2036.....	5.5 m ³
	1.4.2036 - 31.3.2037.....	5.5 m ³
	1.4.2037 - 31.3.2038.....	5.5 m ³
	1.4.2038 - 31.3.2039.....	5.5 m ³
	1.4.2039 - 31.3.2040.....	3.9 m ³
Total future arisings:		43.1 m ³
Total waste volume:		106.5 m ³

Comment on volumes: It should be noted that the DSRL are using a provisional site programme and arisings dates are subject to change. Arisings have been revised in line with the Predictive Waste Inventory walk round exercise. Stock volumes have been re-evaluated according to DMS. RHILW= 306 drums; CHILW=11drums

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 Decommissioning of plutonium fuels examination facility.

PHYSICAL CHARACTERISTICS

General description: Metallic cell waste and decontamination waste. Some items may be size reduced during decommissioning operations.

Physical components (%vol): Aluminium (0.03%), Glass (1.16%), Inorganic sludges and flocs (0.02%), Iron (34.49%), Lead (5.13%), Mild Steel (26.58%), Other organics (0.07%), Paper (0.22%), Plastic (6.56%), Sources (0.01%), Stainless steel (25.71%),

Sealed sources: The waste contains sealed sources. Information is not yet available.

Bulk density (t/m³): 0.55

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

CHEMICAL COMPOSITION

General description and components (%wt): Aluminium (0.01%), Glass (0.39%), Iron (36.20%), Lead (7.73%), Mild Steel (27.87%), Paper (0.02%), Plastic (0.80%), Sources (0.01%), Stainless steel (26.95%),

Chemical state: Neutral

Chemical form of radionuclides: H-3: Likely to be present in steel.
 C-14: Likely to be present in steel.
 Cl-36: Not likely to be present
 I-129: Not likely to be present
 U: Likely to be present as oxide.
 Np: Likely to be present.
 Pu: Likely to be present as oxide.

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

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	27.0	assumed M316	
Other ferrous metals.....	27.9	mild steel	
Iron.....	36.2		
Aluminium.....	0.01		
Beryllium.....	NE		
Cobalt.....	NE		
Copper.....	NE		
Lead.....	7.7		
Magnox/Magnesium.....	NE		
Nickel.....	NE		
Titanium.....			
Uranium.....	P		
Zinc.....	NE		
Zircaloy/Zirconium.....	NE		
Other metals.....	NE	source 0.01%, adjusted to get to 100%	

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0.02		
Paper, cotton.....	0.02		
Wood.....			
Halogenated plastics	0.80		
Total non-halogenated plastics.....	NE		
Condensation polymers.....	NE		
Others.....	NE		
Organic ion exchange materials....	0		
Total rubber.....	NE		
Halogenated rubber	NE		
Non-halogenated rubber.....	NE		
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.....	0		
Sand.....	0		
Glass/Ceramics.....	0.39		
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): Inorganic anions unlikely to be present in significant 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 Hazardous materials unlikely to be present.
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 / Toxic metals unlikely to be present in significant quantities.
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): Not yet determined

	(%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. There is the potential for the waste to contain durable engineered structures or contaminated hand tools.

PACKAGING AND CONDITIONING

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

Plant Name: CHILW Repack Facility; RHILW Repack Facility

Location: Dounreay

Plant startup date: 2026; 2028 respectively

Total capacity (m³/y incoming waste): ~5.5

Target start date for packaging this stream: 2031

Throughput for this stream (m³/y incoming waste): ~5.0

Other information: The CHILW and RHILW Repackaging Facilities are still in design phase

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	500 l drum	100.0	0.252	0.5	423

Likely container type comment: The conditioning factor for RHILW will be about 1.7, while that for CHILW will be about 0.5.

Range in container waste volume: It is estimated that between 2 and 8 CHILW compacted drums will be packaged into each 500 l drum with the average being 5 drums per 500 ltr drum. A small percentage of drums may not be suitable for supercompaction and will be immobilised directly into the 500 ltr drum. Assume 3:2 Z6033 to 500L drum ratio.

Other information on containers: Stainless Steel

Likely conditioning matrix: Pulverised fuel ash/Ordinary Portland cement mixture

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

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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: The main sources of activity are contaminated equipment/structure and activated scrap.

Uncertainty: Stocks data is taken from RHILW Soil and CHILW drummed LoCs. These LoCs provide a generic activity for all CHILW/RHILW wastes in store.

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: Stocks is based on LoC data for ILW in stocks. Arisings is based on consignors data.

Other information: Specific Activity is based on 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	9.12E-02	CC 2			Gd 153				
Be 10	5.29E-07	CC 2			Ho 163				
C 14	9.89E-03	CC 2	1.19E-03	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	1.38E-05	CC 2			Pt 193				
Mn 53	8.45E-03	CC 2			Tl 204				
Mn 54	6.40E-09	CC 2			Pb 205				
Fe 55	8.59E-02	CC 2	3.73E-03	CC 2	Pb 210	1.92E-12	CC 2	3.43E-15	CC 2
Co 60	7.77E+00	CC 2	7.89E-03	CC 2	Bi 208				
Ni 59	3.29E-02	CC 2	1.52E-02	CC 2	Bi 210m				
Ni 63	8.72E+00	CC 2	2.65E-02	CC 2	Po 210	1.78E-12	CC 2	2.07E-15	CC 2
Zn 65	6.35E-14	CC 2			Ra 223	9.61E-11	CC 2	1.23E-12	CC 2
Se 79	1.78E-05	CC 2			Ra 225	3.48E-09	CC 2	9.21E-18	CC 2
Kr 81					Ra 226	1.03E-11	CC 2	1.14E-13	CC 2
Kr 85					Ra 228	3.7E-11	CC 2	8.22E-22	CC 2
Rb 87					Ac 227	9.70E-11	CC 2	1.33E-12	CC 2
Sr 90	1.05E+00	CC 2	1.86E-01	CC 2	Th 227	9.51E-11	CC 2	1.25E-12	CC 2
Zr 93	1.62E-04	CC 2			Th 228	7.08E-09	CC 2	1.44E-21	CC 2
Nb 91					Th 229	3.49E-09	CC 2	9.78E-18	CC 2
Nb 92					Th 230	2.46E-09	CC 2	1.76E-10	CC 2
Nb 93m	3.92E-02	CC 2	4.73E-03	CC 2	Th 232	4.25E-11	CC 2	4.41E-21	CC 2
Nb 94	3.06E-03	CC 2	2.94E-05	CC 2	Th 234	1.02E-05	CC 2	8.47E-06	CC 2
Mo 93	1.83E-02	CC 2	9.62E-03	CC 2	Pa 231	3.54E-10	CC 2	2.89E-11	CC 2
Tc 97					Pa 233	5.78E-06	CC 2	1.72E-08	CC 2
Tc 99	8.77E-04	CC 2			U 232	5.89E-09	CC 2		
Ru 106	1.09E-06	CC 2			U 233	1.76E-06	CC 2	1.07E-13	CC 2
Pd 107					U 234	1.57E-05	CC 2	6.39E-06	CC 2
Ag 108m	1.42E-04	CC 2			U 235	8.32E-07	CC 2	4.55E-07	CC 2
Ag 110m	2.32E-13	CC 2			U 236	6.40E-07	CC 2	5.96E-11	CC 2
Cd 109					U 238	1.02E-05	CC 2	8.48E-06	CC 2
Cd 113m	1.27E-03	CC 2			Np 237	5.81E-06	CC 2	1.78E-08	CC 2
Sn 119m					Pu 236				
Sn 121m					Pu 238	8.6E-02	CC 2	5.23E-03	CC 2
Sn 123					Pu 239	4.04E-01	CC 2	4.78E-02	CC 2
Sn 126	3.2E-05	CC 2			Pu 240	3.76E-01	CC 2	6.79E-04	CC 2
Sb 125	7.39E-04	CC 2	5.88E-03	CC 2	Pu 241	5.96E+00	CC 2	1.73E-01	CC 2
Sb 126	4.48E-06	CC 2			Pu 242	3.27E-04	CC 2		
Te 125m	1.85E-04	CC 2	1.39E-03	CC 2	Am 241	6.07E-01	CC 2	1.87E-02	CC 2
Te 127m					Am 242m	5.63E-02	CC 2		
I 129	1.50E-06	CC 2			Am 243	5.49E-04	CC 2		
Cs 134	3.09E-04	CC 2	2.28E-03	CC 2	Cm 242	4.65E-02	CC 2	1.91E-06	CC 2
Cs 135	2.80E-05	CC 2			Cm 243	2.78E-03	CC 2		
Cs 137	3.06E+00	CC 2	1.87E-01	CC 2	Cm 244	2.18E-01	CC 2	1.22E-04	CC 2
Ba 133					Cm 245	7.67E-06	CC 2		
La 137					Cm 246	7.66E-07	CC 2		
La 138					Cm 248			8.03E-02	CC 2
Ce 144	3.37E-10	CC 2			Cf 249				
Pm 145					Cf 250				
Pm 147	5.50E-03	CC 2	4.53E-02	CC 2	Cf 251				
Sm 147	1.58E-11	CC 2	1.35E-12	CC 2	Cf 252			4.56E+01	CC 2
Sm 151	1.19E-01	CC 2	9.58E-03	CC 2	Other a			2.08E-09	CC 2
Eu 152	7.86E-02	CC 2	2.36E-02	CC 2	Other b/g	3.74E-08	CC 2	3.62E-01	CC 2
Eu 154	3.58E-02	CC 2	5.97E-03	CC 2	Total a	1.74E+00	CC 2	4.57E+01	CC 2
Eu 155	1.52E-02	CC 2	8.91E-03	CC 2	Total b/g	2.72E+01	CC 2	1.08E+00	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