

<b>WASTE STREAM</b>	<b>5B332</b>	<b>RHILW Retrievable Drum Store 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.....	8.8 m <sup>3</sup>
Total future arisings:	0 m <sup>3</sup>
Total waste volume:	8.8 m <sup>3</sup>
Comment on volumes:	There will be no further arisings of this waste stream. The definition of "The Retrievable Drum Store" has been redefined for this submission.
Uncertainty factors on volumes:	Stock (upper): x 1.05 Arisings (upper) x Stock (lower): x 0.95 Arisings (lower) x

**WASTE SOURCE** POCO & Decommissioning of shielded drum store and associated Cave/Cell Suite.

**PHYSICAL CHARACTERISTICS**

General description: The waste consists of primary air filters and decontamination liquid filters, plus other contaminated items. There are no large items that will influence packaging selection.  
 Physical components (%vol): Filter casings (20%), filter elements, swabs, etc. (80%).  
 Sealed sources: The waste does not contain sealed sources.  
 Bulk density (t/m<sup>3</sup>): 0.89  
 Comment on density: The density is based on consignor's records.

**CHEMICAL COMPOSITION**

General description and components (%wt): Metals (24%), paper/cloth (76%).  
 Chemical state: Neutral  
 Chemical form of radionuclides: Cl-36: Not likely to be present  
 Se-79: Likely to be present.  
 I-129: Likely to be present.  
 U: May be present as oxide or other forms.  
 Np: Likely to be present.  
 Pu: May be present as oxide or other forms.  
 Metals and alloys (%wt): Total metals are 24%, likely to be mostly steels with some aluminium. Both sheet and bulk metals likely to be present, proportions not specified.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	NE		
Other ferrous metals.....	24.0		
Iron.....			
Aluminium.....	NE		
Beryllium.....	0		
Cobalt.....	0		
Copper.....	0		
Lead.....	0		
Magnox/Magnesium.....	0		
Nickel.....	0		

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Titanium.....  
 Uranium..... P  
 Zinc..... 0  
 Zircaloy/Zirconium..... 0  
 Other metals..... NE Other metals not specified.

Organics (%wt): Organic materials are mostly paper and cloth. Traces of plastics and rubbers may also be present. PVC and neoprene may be present.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	76.0		
Paper, cotton.....	76.0		
Wood.....	0		
Halogenated plastics .....	TR	PVC	
Total non-halogenated plastics.....	TR		
Condensation polymers.....	NE		
Others.....	NE		
Organic ion exchange materials....	0		
Total rubber.....	TR		
Halogenated rubber .....	NE	Neoprene	
Non-halogenated rubber.....	NE		
Hydrocarbons.....			
Oil or grease .....			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	NE		

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....			
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....	0		
Glass/Ceramics.....			
Graphite.....	0		
Desiccants/Catalysts.....	0		
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			

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Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

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

	(%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: -

	(%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	

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....	NE	
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		

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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

Potential for the waste to contain discrete items:      No.

**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

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

Target start date for packaging this stream: -

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

Other information: CHILW and RHILW Repacking plant are in design phase

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	~0.310	0.5	29

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: CHILW waste loading = 1m<sup>3</sup>, RHILW waste loading = 0.3m<sup>3</sup>

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/m<sup>3</sup>

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 main sources of activity are contaminated equipment.

Uncertainty: The estimates given for stocks are taken directly from consignors records.

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: From consignment data.

Other information: Specific activity uses UKRWI 2019 data 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	1.74E-05	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					Pt 193				
Mn 53					Tl 204				
Mn 54					Pb 205				
Fe 55	5.59E-06	CC 2			Pb 210				
Co 60	5.62E-01	CC 2			Bi 208				
Ni 59	2.23E-04	CC 2			Bi 210m				
Ni 63	3.65E-04	CC 2			Po 210	7.72E-10	CC 2		
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	1.05E-08	CC 2		
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	1.8E-01	CC 2			Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m	1.42E-04	CC 2			Th 232				
Nb 94	4.31E-07	CC 2			Th 234				
Mo 93	1.93E-04	CC 2			Pa 231				
Tc 97					Pa 233				
Tc 99	2.34E-07	CC 2			U 232				
Ru 106	1.59E-07	CC 2			U 233				
Pd 107					U 234	5.88E-06	CC 2		
Ag 108m					U 235	2.25E-07	CC 2		
Ag 110m					U 236	1.25E-07	CC 2		
Cd 109					U 238	8.59E-07	CC 2		
Cd 113m					Np 237	4.84E-07	CC 2		
Sn 119m					Pu 236	4.27E-06	CC 2		
Sn 121m	2.01E-07	CC 2			Pu 238	1.26E-04	CC 2		
Sn 123					Pu 239	6.38E-03	CC 2		
Sn 126					Pu 240	8.20E-03	CC 2		
Sb 125	2.00E-06	CC 2			Pu 241	1.10E-01	CC 2		
Sb 126					Pu 242	3.55E-06	CC 2		
Te 125m	5.01E-07	CC 2			Am 241	1.25E-01	CC 2		
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	1.61E-05	CC 2			Cm 242	1.37E-15	CC 2		
Cs 135					Cm 243				
Cs 137	5.07E-01	CC 2			Cm 244	5.04E-09	CC 2		
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	1.11E-09	CC 2			Cf 249				
Pm 145					Cf 250				
Pm 147	1.71E-05	CC 2			Cf 251				
Sm 147	5.13E-16	CC 2			Cf 252				
Sm 151	3.98E-05	CC 2			Other a				
Eu 152	3.89E-04	CC 2			Other b/g				
Eu 154	6.05E-03	CC 2			<b>Total a</b>	<b>1.39E-01</b>	<b>CC 2</b>	<b>0</b>	
Eu 155	2.15E-03	CC 2			<b>Total b/g</b>	<b>1.37E+00</b>	<b>CC 2</b>	<b>0</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