

WASTE STREAM	5B312	Development Laboratory ILW
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SITE Dounreay

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025 = 80.3			
Future arisings:	1.4.2029 - 31.3.2030 = 0.3			
	1.4.2030 - 31.3.2031 = 0.3			
	1.4.2044 - 31.3.2045 = 1.1			
	1.4.2045 - 31.3.2046 = 0.9			
Total future arisings:	2.5			
Total waste volume:	82.8			

Number of waste packages in stock: At 1.4.2025..... - packages

Comment on arising rates: Arisings have been revised in line with the Predictive Waste Inventory walk round exercise. It should be noted that programme data is based on Dounreay's LTP24 as at December 2023 and future arisings have increased due to extended programme date.

Additional information on quantities: -

Uncertainty factors on volumes: Stock (upper): x 1.02 Arisings (upper): x 1.20
Stock (lower): x 0.98 Arisings (lower): x 0.80

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.

Changes since waste generated: -

Bulk density (t/m³): = 0.31

Comment on density: Based on actuals data from Dounreay's waste consignment system. Data considered acceptable for 2025 submission.

CHEMICAL COMPOSITION

General description and components (%wt): Glass (4.23%), Mild Steel (68.99%), Other organics (0.28%), Paper (15.24%), Plastic (11.25%),

Chemical state: Neutral

Sheet metal proportion / thickness: 4.09% by wt of all metals will be sheet from ventilation and ducting. Assumed sheet metal thickness is of a range between 1.6-2.5mm.
8.77% by wt of all metals will be bulk from tanks and gloveboxes.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	0	-	
Other ferrous metals.....	= 69.0	-	
Iron.....	0	-	
Aluminium.....	0	-	
Beryllium.....	0	-	
Cobalt.....	0	-	
Copper.....	0	-	
Lead.....	0	-	
Magnox/Magnesium.....	0	-	
Nickel.....	0	-	
Titanium.....	0	-	
Uranium.....	0	-	
Zinc.....	0	-	
Zircaloy/Zirconium.....	0	-	
Other metals.....	0	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 15.2	-	
Paper, cotton.....	= 15.2	-	
Wood.....	0	-	
Halogenated plastics.....	= 5.6	-	
Total non-halogenated plastics.....	= 5.6	-	
Condensation polymers.....	NE	-	
Others.....	NE	-	
Organic ion exchange materials.....	0	-	
Total rubber.....	0	-	
Halogenated rubber.....	NE	-	
Non-halogenated rubber.....	NE	-	
Hydrocarbons.....	0	-	
Oil or grease.....	0	-	
Fuel.....	NE	-	
Asphalt/Tarmac (cont.coal tar).....	0	-	
Asphalt/Tarmac (no coal tar).....	0	-	
Bitumen.....	0	-	
Others.....	NE	-	
Other organics.....	= 0.28	-	

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.....	0	-	
Sand.....	0	-	
Glass/Ceramics.....	= 4.2	-	
Graphite.....	0	-	
Desiccants/Catalysts.....	0	-	
Asbestos.....	0	-	
Non/low friable.....	NE	-	
Moderately friable.....	NE	-	
Highly friable.....	NE	-	
Free aqueous liquids.....	0	-	
Free non-aqueous liquids.....	0	-	
Powder/Ash.....	0	-	

COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

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

Materials of interest for waste acceptance criteria:

	(%wt)	Type(s) and comment
Combustible metals.....	NE	-
Low flash point liquids.....	NE	-
Explosive materials.....	NE	-
Phosphorus.....	NE	-
Hydrides.....	NE	-
Biological etc. materials.....	NE	-
Biodegradable materials.....	0	-
Putrescible wastes.....	NE	-
Non-putrescible wastes.....	NE	-
Corrosive materials.....	NE	-
Pyrophoric materials.....	NE	-
Generating toxic gases.....	NE	-
Reacting with water.....	0	-
Higher activity particles.....	NE	-
Soluble solids as bulk chemical compounds.....	NE	-

Hazardous substances / non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....	NE	-
Benzene.....	0	-
Chlorinated solvents.....	NE	-
Formaldehyde.....	NE	-
Organometallics.....	NE	-
Phenol.....	NE	-
Styrene.....	NE	-
Tri-butyl phosphate.....	NE	-
Other organophosphates.....	NE	-
Vinyl chloride.....	NE	-
Arsenic.....	0	-
Barium.....	NE	-
Boron.....	0	-
Boron (in Boral).....	NE	-
Boron (non-Boral).....	NE	-
Cadmium.....	0	-
Caesium.....	NE	-
Selenium.....	0	-
Chromium.....	0	-
Molybdenum.....	0	-
Thallium.....	NE	-
Tin.....	0	-
Vanadium.....	0	-
Mercury compounds.....	0	-
Others.....	NE	-

Complexing agents (%wt):

Not yet determined		
	(%wt)	Type(s) and comment
EDTA.....	NE	-
DPTA.....	NE	-
NTA.....	NE	-
Polycarboxylic acids.....	NE	-
Other organic complexants.....	NE	-
Total complexing agents.....	NE	-

Physical components:

	Number	Type(s) and comment
Sources.....	= 0	-
Electronic & Electrical Equipment (EEE)		
EEE Type 1.....	= 0	-
EEE Type 2.....	= 0	-
EEE Type 3.....	= 0	-
EEE Type 4.....	= 0	-
EEE Type 5.....	= 0	-

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off-site	Stream volume %
Size reduction	On-site	= 100.0
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments:

Waste will be conditioned using a grout matrix into 500L drums. This will be done through a dedicated ILW repackaging facility, which will handle both RHILW and CHILW drums. This facility will produce conditioned 500 L drums.

Conditioning method:

Waste will be conditioned using a grout matrix into 500l drums. This will be done through a dedicated ILW repackaging facility, which will handle both RHILW and CHILW 200l drums. This facility will produce conditioned 500l drums

Conditioning plants:

Plant Name	Location
Combined ILW Repackaging Facility	Dounreay

Likely conditioning matrix:

Non-standard

Further information on the conditioning matrix:

Dounreay uses OPC/PFA (rather than BFS)
~42% water

Waste Packaging:

Likely container type:	Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	500 l drum (basket for waste)	9.3	0.27	0.40	29	-
	500 l drum (pucks)	90.7	0.98	0.40	77	-

Range in container waste loading: 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 packaging and conditioning: -

Conditioned density (t/m³):

~ 2.5

Conditioned density comment:

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

Management Routes:

Disposal Route	Stream volume %	Raw density t/m³	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)	= 100.0		
Expected to be Non-NSD HAW managed under Scottish Government's policy			
Expected to be disposed to LLW Vaults NRS Dounreay			
Expected to be consigned to the Geological Disposal Facility			
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Classification codes for waste expected to be consigned to a landfill facility:

Opportunities for alternative disposal routing: Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
Near-site NSDF	Dounreay LLWDV	NE	RED	There is potential for LLW to be diverted out of this stream during repacking of ILW into 500 L drums. However, details of this will be confirmed through the design process of the repackaging plant.

RADIOACTIVITY

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

Uncertainty: The activity of the stocks and the arisings is based on consignor's declarations for waste resulting from the Pulse Column Lab (PCL) decommissioning.

Measurement of radioactivities: Stocks and Arisings is based on consignors' data for the Development Lab.

Chemical form of radionuclides:

- H-3: May be present as contamination
- C-14: -
- 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

WASTE STREAM 5B312 Development Laboratory ILW									
Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code		Waste at 1.4.2025	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					Ti 204				
Mn 54					Pb 205				
Fe 55					Pb 210	= 4.40E-16	C C 2	= 4.40E-16	C C 2
Co 60	= 7.97E-04	C C 2	= 7.97E-04	C C 2	Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210	= 3.31E-16	C C 2	= 3.31E-16	C C 2
Zn 65					Ra 223	= 2.96E-14	C C 2	= 2.96E-14	C C 2
Se 79					Ra 225	= 4.93E-16	C C 2	= 4.93E-16	C C 2
Kr 81					Ra 226	= 7.98E-15	C C 2	= 7.98E-15	C C 2
Kr 85					Ra 228	= 4.26E-19	C C 2	= 4.26E-19	C C 2
Rb 87					Ac 227	= 3.08E-14	C C 2	= 3.08E-14	C C 2
Sr 90	= 3.22E-01	C C 2	3.22E-01	C C 2	Th 227	= 2.97E-14	C C 2	= 2.97E-14	C C 2
Zr 93					Th 228	= 2.01E-19	C C 2	= 2.01E-19	C C 2
Nb 91					Th 229	= 5.08E-16	C C 2	= 5.08E-16	C C 2
Nb 92					Th 230	= 7.02E-12	C C 2	= 7.02E-12	C C 2
Nb 93m					Th 232	= 1.49E-18	C C 2	= 1.49E-18	C C 2
Nb 94					Th 234	= 1.12E-07	C C 2	= 1.12E-07	C C 2
Mo 93					Pa 231	= 3.44E-13	C C 2	= 3.44E-13	C C 2
Tc 97					Pa 233	= 2.13E-07	C C 2	= 2.13E-07	C C 2
Tc 99					U 232	=	C C 2		
Ru 106	= 1.17E-05	C C 2	= 1.17E-05	C C 2	U 233	= 2.73E-12	C C 2	= 2.73E-12	C C 2
Pd 107					U 234	= 1.75E-07	C C 2	= 1.75E-07	C C 2
Ag 108m					U 235	= 2.71E-09	C C 2	= 2.71E-09	C C 2
Ag 110m					U 236	= 5.23E-09	C C 2	= 5.23E-09	C C 2
Cd 109					U 238	= 1.12E-07	C C 2	= 1.12E-07	C C 2
Cd 113m					Np 237	= 2.17E-07	C C 2	= 2.17E-07	C C 2
Sn 119m					Pu 236				
Sn 121m					Pu 238	= 5.51E-03	C C 2	= 5.51E-03	C C 2
Sn 123					Pu 239	= 2.08E-03	C C 2	= 2.08E-03	C C 2
Sn 126					Pu 240	= 2.12E-03	C C 2	= 2.12E-03	C C 2
Sb 125	= 1.24E-03	C C 2	= 1.24E-03	C C 2	Pu 241	= 1.59E-02	C C 2	= 1.59E-02	C C 2
Sb 126	=				Pu 242	= 1.62E-07	C C 2	= 1.62E-07	C C 2
Te 125m	= 2.92E-04	C C 2	= 2.92E-04	C C 2	Am 241	= 1.11E-01	C C 2	= 1.11E-01	C C 2
Te 127m					Am 242m	= 5.41E-05	C C 2	= 5.41E-05	C C 2
I 129	=				Am 243	= 6.73E-10	C C 2	= 6.73E-10	C C 2
Cs 134	= 1.24E-03	C C 2	= 1.24E-03	C C 2	Cm 242	= 4.53E-05	C C 2	= 4.53E-05	C C 2
Cs 135	=				Cm 243	= 4.65E-04	C C 2	= 4.65E-04	C C 2
Cs 137	= 6.48E-01	C C 2	= 6.48E-01	C C 2	Cm 244	= 5.91E-03	C C 2	= 5.91E-03	C C 2
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Unsp a				
Eu 152					Unsp b/g				
Eu 154	= 8.03E-03	C C 2	= 8.03E-03	C C 2	Total a	1.27E-01	*	1.27E-01	*
Eu 155	= 4.65E-03	C C 2	= 4.65E-03	C C 2	Total b/g	1.00E+00	*	1.00E+00	*

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 the 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
* Total calculated from the 114 declared radionuclides