

WASTE STREAM	5B342	Pu Fuels Examination Facility 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	= 65.9		
Future arisings:	1.4.2041 - 31.3.2042	= 3.2		
	1.4.2048 - 31.3.2049	= 0.5		
	1.4.2049 - 31.3.2050	= 0.5		
	1.4.2050 - 31.3.2051	= 1.5		
	1.4.2051 - 31.3.2052	= 0.5		
	1.4.2052 - 31.3.2053	= 0.7		
	1.4.2053 - 31.3.2054	= 0.2		
	1.4.2054 - 31.3.2055	= 17.8		
	1.4.2056 - 31.3.2057	= 2.5		
	1.4.2059 - 31.3.2060	= 2.9		
	1.4.2060 - 31.3.2061	= 6.9		
	1.4.2061 - 31.3.2062	= 5.8		
Total future arisings:		43.0		
Total waste volume:		108.9		

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

Comment on arising rates: Arisings dates are based on the Dounreay Lifetime Plan 2024 dataset generated in December 2023.

Additional information on quantities: 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 1.20
Stock (lower): x 0.98 Arisings (lower): x 0.80

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.

Changes since waste generated: -

Bulk density (t/m³): = 0.50

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): Aluminium (0.03%), Glass (1.16%), Inorganic sludges and flocs (0.02%), Iron (34.48%), Lead (5.12%), Mild Steel (26.58%), Other (TR), Other organics (0.07%), Paper (0.22%), Plastic (6.56%), Sources (0.01%), Stainless steel (25.70%), Unhalogenated Plastic (0.03%),

Chemical state: Neutral

Sheet metal proportion / thickness: The waste is unsuitable for further treatment. Therefore, it has not been assessed as sheet metal or bulk metal.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 25.7	assumed M316	
Other ferrous metals.....	= 26.6	mild steel	
Iron.....	= 34.5	-	
Aluminium.....	= 0.03	-	
Beryllium.....	= 0	-	
Cobalt.....	= 0	-	
Copper.....	= 0	-	
Lead.....	= 5.1	-	
Magnox/Magnesium.....	= 0	-	
Nickel.....	= 0	-	
Titanium.....	= 0	-	
Uranium.....	= 0	-	
Zinc.....	= 0	-	
Zircaloy/Zirconium.....	= 0	-	
Other metals.....	= 0.01	Sources 0.01%	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....	= 0.22	-	
Paper, cotton.....	= 0.22	-	
Wood.....	= 0	-	
Halogenated plastics.....	= 3.3	-	
Total non-halogenated plastics.....	= 3.3	-	
Condensation polymers.....	NE	-	
Others.....	NE	Glass 1.16%	
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.....	= 0.08	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	-	
Inorganic sludges and flocs.....	= 0.02	-	
Soil.....	= 0	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	= 0	-	
Sand.....	= 0	-	
Glass/Ceramics.....	= 1.2	-	
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):

No

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

Physical components:

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

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off-site	Stream volume %
Size reduction 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	On-site	= 100.0

Comments on planned treatments:

Stocks and Arisings waste will be conditioned using a grout matrix into 500L drums. This waste will be processed through a dedicated ILW repackaging facility which will produce 500 L drums.

Conditioning method:

Waste will be conditioned using 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:

42% Water, 1:3 OPC:PFA

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)	98.0	0.25	0.40	429	-
500 l drum (pucks)	2.0	0.73	0.40	3	-

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) 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	= 100.0		

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 the repacking into 500 L drums. However, details of this will be confirmed through the design of the the repackaging facility.

RADIOACTIVITY

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

Uncertainty: Stocks and Arisings activities are based on consignor's data for the Pu Fuels Examination Facility

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

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.
Se-79: -
Tc-99: -
I-129: Not likely to be present.
Ra: -
Th: -
U: Likely to be present as oxide.
Np: Likely to be present.
Pu: Likely to be present as oxide.

WASTE STREAM 5B342 Pu Fuels Examination Facility 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	= 4.68E-04	C C 2	= 4.68E-04	C C 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					Ti 204				
Mn 54					Pb 205				
Fe 55	= 6.89E-04	C C 2	= 6.89E-04	C C 2	Pb 210	= 1.07E-14	C C 2	= 1.07E-14	C C 2
Co 60	= 2.09E-03	C C 2	= 2.09E-03	C C 2	Bi 208				
Ni 59	= 6.01E-03	C C 2	= 6.01E-03	C C 2	Bi 210m				
Ni 63	= 1.03E-02	C C 2	= 1.03E-02	C C 2	Po 210	= 8.19E-15	C C 2	= 8.19E-15	C C 2
Zn 65					Ra 223	= 1.97E-12	C C 2	= 1.97E-12	C C 2
Se 79					Ra 225	= 3.20E-17	C C 2	= 3.20E-17	C C 2
Kr 81					Ra 226	= 1.81E-13	C C 2	= 1.81E-13	C C 2
Kr 85					Ra 228	= 1.55E-21	C C 2	= 1.55E-21	C C 2
Rb 87					Ac 227	= 2.04E-12	C C 2	= 2.04E-12	C C 2
Sr 90	= 6.84E-02	C C 2	= 6.84E-02	C C 2	Th 227	= 1.97E-12	C C 2	= 1.97E-12	C C 2
Zr 93					Th 228	= 9.37E-22	C C 2	= 9.37E-22	C C 2
Nb 91					Th 229	= 3.30E-17	C C 2	= 3.30E-17	C C 2
Nb 92					Th 230	= 1.39E-10	C C 2	= 1.39E-10	C C 2
Nb 93m	= 2.04E-03	C C 2	= 2.04E-03	C C 2	Th 232	= 6.96E-21	C C 2	= 6.96E-21	C C 2
Nb 94	= 1.16E-05	C C 2	= 1.16E-05	C C 2	Th 234	= 3.34E-06	C C 2	= 3.34E-06	C C 2
Mo 93	= 3.80E-03	C C 2	= 3.80E-03	C C 2	Pa 231	= 2.28E-11	C C 2	= 2.28E-11	C C 2
Tc 97					Pa 233	= 1.41E-08	C C 2	= 1.41E-08	C C 2
Tc 99					U 232				
Ru 106					U 233	= 1.79E-13	C C 2	= 1.79E-13	C C 2
Pd 107					U 234	= 2.54E-06	C C 2	= 2.54E-06	C C 2
Ag 108m					U 235	= 1.80E-07	C C 2	= 1.80E-07	C C 2
Ag 110m					U 236	= 4.70E-11	C C 2	= 4.70E-11	C C 2
Cd 109					U 238	= 3.35E-06	C C 2	= 3.35E-06	C C 2
Cd 113m					Np 237	= 1.44E-08	C C 2	= 1.44E-08	C C 2
Sn 119m					Pu 236				
Sn 121m					Pu 238	= 2.02E-03	C C 2	= 2.02E-03	C C 2
Sn 123					Pu 239	= 1.89E-02	C C 2	= 1.89E-02	C C 2
Sn 126					Pu 240	= 2.68E-04	C C 2	= 2.68E-04	C C 2
Sb 125	= 1.09E-03	C C 2	= 1.09E-03	C C 2	Pu 241	= 5.91E-02	C C 2	= 5.91E-02	C C 2
Sb 126					Pu 242				
Te 125m	= 2.58E-04	C C 2	= 2.58E-04	C C 2	Am 241	= 7.67E-03	C C 2	= 7.67E-03	C C 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	= 3.28E-04	C C 2	= 3.28E-04	C C 2	Cm 242	= 7.10E-09	C C 2	= 7.10E-09	C C 2
Cs 135					Cm 243				
Cs 137	= 6.88E-02	C C 2	= 6.88E-02	C C 2	Cm 244	= 4.30E-05	C C 2	= 4.30E-05	C C 2
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248	= 3.18E-02	C C 2	= 3.18E-02	C C 2
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147	= 8.09E-03	C C 2	= 8.09E-03	C C 2	Cf 251				
Sm 147	= 7.77E-13	C C 2	= 7.77E-13	C C 2	Cf 252	= 8.19E+00	C C 2	= 8.19E+00	C C 2
Sm 151	= 3.70E-03	C C 2	= 3.70E-03	C C 2	Unsp a				
Eu 152	= 7.99E-03	C C 2	= 7.99E-03	C C 2	Unsp b/g				
Eu 154	= 1.85E-03	C C 2	= 1.85E-03	C C 2	Total a	8.00E+00	*	8.00E+00	*
Eu 155	= 2.27E-03	C C 2	= 2.27E-03	C C 2	Total b/g	5.03E-01	*	5.03E-01	*

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