

WASTE STREAM	5B341	Pu Fuels Examination Facility LLW
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SITE Dounreay

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE LLW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	0		
Future arisings:	1.4.2025 - 31.3.2026	= 28.5		
	1.4.2026 - 31.3.2027	= 28.5		
	1.4.2027 - 31.3.2028	= 28.5		
	1.4.2028 - 31.3.2029	= 28.6		
	1.4.2029 - 31.3.2030	= 35.5		
	1.4.2030 - 31.3.2031	= 39.6		
	1.4.2031 - 31.3.2032	= 28.5		
	1.4.2032 - 31.3.2033	= 28.6		
	1.4.2033 - 31.3.2034	= 28.5		
	1.4.2034 - 31.3.2035	= 28.5		
	1.4.2035 - 31.3.2036	= 28.5		
	1.4.2036 - 31.3.2037	= 28.6		
	1.4.2037 - 31.3.2038	= 28.5		
	1.4.2038 - 31.3.2039	= 28.5		
	1.4.2039 - 31.3.2040	= 28.5		
	1.4.2040 - 31.3.2041	= 28.6		
	1.4.2041 - 31.3.2042	= 28.8		
	1.4.2042 - 31.3.2043	= 31.2		
	1.4.2043 - 31.3.2044	= 31.7		
	1.4.2044 - 31.3.2045	= 31.8		
	1.4.2045 - 31.3.2046	= 31.7		
	1.4.2046 - 31.3.2047	= 31.7		
	1.4.2047 - 31.3.2048	= 31.5		
	1.4.2048 - 31.3.2049	= 28.9		
	1.4.2049 - 31.3.2050	= 32.8		
	1.4.2050 - 31.3.2051	= 28.6		
	1.4.2051 - 31.3.2052	= 28.8		
	1.4.2052 - 31.3.2053	= 29.1		
	1.4.2053 - 31.3.2054	= 29.0		
	1.4.2054 - 31.3.2055	= 36.5		
	1.4.2055 - 31.3.2056	= 28.5		
	1.4.2056 - 31.3.2057	= 30.9		
	1.4.2057 - 31.3.2058	= 28.5		
	1.4.2058 - 31.3.2059	= 28.5		
	1.4.2059 - 31.3.2060	= 53.6		
	1.4.2060 - 31.3.2061	= 94.1		
	1.4.2061 - 31.3.2062	= 85.1		
	1.4.2062 - 31.3.2063	= 28.5		
	1.4.2063 - 31.3.2064	= 28.5		
	1.4.2064 - 31.3.2065	= 38.2		
	1.4.2065 - 31.3.2066	= 33.1		
Total future arisings:	1384.6			
Total waste volume:	1384.6			

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

Comment on arising rates: Arisings dates are based on NRS Dounreay's Lifetime Plan 2024 as generated as December 2023.

Additional information on quantities: -

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

WASTE SOURCE Decommissioning of plutonium fuels examination facility.

PHYSICAL CHARACTERISTICS

General description: Metallic cell waste, concrete and rubble. Items will be size reduced where practicable during decommissioning.

Changes since waste generated: -

Bulk density (t/m³): = 0.27

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 (0.38%), Asbestos (TR), Batteries and Accumulators (TR), Cementitious material (e.g. concrete) (1.88%), Ceramics (0.06%), Copper (TR), Fabric (TR), Glass (0.36%), Iron (0.84%), Lead (2.04%), Mild Steel (31.61%), MMF Insulation Materials (nonHaz) (TR), Other (2.37%), Other Liquid (0.41%), Other metal (TR), Other organics (0.19%), Paper (13.74%), Plastic (34.61%), Rubber (8.40%), Sources (TR), Stainless steel (0.57%), Wood/ Wood composite (2.53%),

Chemical state: Neutral

Sheet metal proportion / thickness: 1.05% 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.
0.24% 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.....	= 0.57	-	
Other ferrous metals.....	= 31.6	-	
Iron.....	= 0.84	-	
Aluminium.....	= 0.38	-	
Beryllium.....	0	-	
Cobalt.....	0	-	
Copper.....	= 0.01	-	
Lead.....	= 2.0	-	
Magnox/Magnesium.....	0	-	
Nickel.....	0	-	
Titanium.....	0	-	
Uranium.....	0	-	
Zinc.....	0	-	
Zircaloy/Zirconium.....	0	-	
Other metals.....	< 0.01	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 16.3	-	
Paper, cotton.....	= 13.8	-	
Wood.....	= 2.5	-	
Halogenated plastics.....	= 17.3	-	
Total non-halogenated plastics.....	= 17.3	-	
Condensation polymers.....	NE	-	
Others.....	NE	-	
Organic ion exchange materials.....	0	-	
Total rubber.....	= 8.4	-	
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.....	= 2.6	-	

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.....	= 1.9	-	
Sand.....	0	-	
Glass/Ceramics.....	= 0.42	Ceramics 0.06%, Glass 0.36%, MMF Insulation Materials (nonHaz) 0.00%,	
Graphite.....	0	-	
Desiccants/Catalysts.....	0	-	
Asbestos.....	< 0.01	-	
Non/low friable.....	NE	-	
Moderately friable.....	NE	-	
Highly friable.....	NE	-	
Free aqueous liquids.....	= 0.41	-	
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.....	= 88	Solid LLW
Electronic & Electrical Equipment (EEE)		-
EEE Type 1.....	= 1	Computer
EEE Type 2.....	= 14	Vacuums, power pack, instrument cases
EEE Type 3.....	= 5	Vices, Drills
EEE Type 4.....	= 1	Fluorescent tubes
EEE Type 5.....	= 0	-

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

Comments on planned treatments:

Conditioning method:

Conditioning plants:

Likely conditioning matrix:

Further information on the conditioning matrix:

Waste Packaging:

Range in container waste loading:

Other information on packaging and conditioning:

Conditioned density (t/m³):

Conditioned density comment:

Management Routes:

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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
Dounreay LLW DV	Incineration facility	~ 87.0	GREEN	This opportunity is still at an early stage of development. A small scale trial has taken place. This can potentially divert up to all compactable LLW. The incinerables waste route 87% is theoretical maximum based on 100% drummed LLW being suitable for incineration. The 87% is subject to further review by NRS Dounreay.
Dounreay LLW DV	Metal treatment facility	~ 10.2	GREEN	Trials have progressed to open the Metal Treatment Route. It is expected that the waste route will open in 2025. The metallic waste treatment route 10.2% remains indicative and is subject to further review and characterisation by NRS Dounreay.

RADIOACTIVITY

Source: The radioactivity is derived from irradiated PFR sub-assemblies which were broken down in the PIE Cells.

Uncertainty: Best estimate available.

Measurement of radioactivities: Based on Consignor's records

Chemical form of radionuclides:

- H-3: -
- C-14: -
- Cl-36: Not likely to be present
- Se-79: -
- Tc-99: -
- I-129: Likely to be present
- Ra: -
- Th: -
- U: May be present as oxide
- Np: -
- Pu: May be present as oxide

WASTE STREAM 5B341 Pu Fuels Examination Facility LLW									
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			= 4.79E-13	C C 2	Pb 210			= 1.09E-19	C C 2
Co 60			= 2.69E-07	C C 2	Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210			= 8.31E-20	C C 2
Zn 65					Ra 223			= 3.20E-16	C C 2
Se 79					Ra 225			= 1.02E-20	C C 2
Kr 81					Ra 226			= 1.91E-18	C C 2
Kr 85					Ra 228			= 2.86E-25	C C 2
Rb 87					Ac 227			= 3.33E-16	C C 2
Sr 90			= 1.75E-05	C C 2	Th 227			= 3.20E-16	C C 2
Zr 93					Th 228			= 1.09E-25	C C 2
Nb 91					Th 229			= 1.05E-20	C C 2
Nb 92					Th 230			= 1.58E-15	C C 2
Nb 93m					Th 232			= 1.41E-24	C C 2
Nb 94					Th 234			= 4.09E-09	C C 2
Mo 93					Pa 231			= 3.71E-15	C C 2
Tc 97					Pa 233			= 4.47E-12	C C 2
Tc 99					U 232				
Ru 106					U 233			= 5.68E-17	C C 2
Pd 107					U 234			= 3.44E-11	C C 2
Ag 108m					U 235			= 2.93E-11	C C 2
Ag 110m					U 236			= 9.51E-15	C C 2
Cd 109					U 238			= 4.09E-09	C C 2
Cd 113m					Np 237			= 4.55E-12	C C 2
Sn 119m					Pu 236				
Sn 121m					Pu 238			= 6.63E-07	C C 2
Sn 123					Pu 239			= 5.97E-06	C C 2
Sn 126					Pu 240			= 5.42E-08	C C 2
Sb 125			= 3.76E-07	C C 2	Pu 241			= 1.43E-05	C C 2
Sb 126					Pu 242				
Te 125m			= 8.88E-08	C C 2	Am 241			= 2.40E-06	C C 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134			= 1.13E-07	C C 2	Cm 242			= 2.42E-12	C C 2
Cs 135					Cm 243				
Cs 137			= 1.99E-05	C C 2	Cm 244			= 1.44E-08	C C 2
Ba 133			= 7.86E-11	C C 2	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147			= 3.12E-06	C C 2	Cf 251				
Sm 147			3.00E-16	C C 2	Cf 252				
Sm 151			= 1.13E-06	C C 2	Unsp a				
Eu 152			= 2.34E-06	C C 2	Unsp b/g				
Eu 154			= 6.26E-07	C C 2	Total a	0	*	9.11E-06	*
Eu 155			= 7.77E-07	C C 2	Total b/g	0	*	6.06E-05	*

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