

WASTE STREAM	5B355	Demolition 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			
Future arisings:	1.4.2025 - 31.3.2026			
	1.4.2026 - 31.3.2027			
	1.4.2027 - 31.3.2028			
	1.4.2028 - 31.3.2029			
	1.4.2029 - 31.3.2030			
	1.4.2030 - 31.3.2031			
	1.4.2031 - 31.3.2032			
	1.4.2032 - 31.3.2033			
	1.4.2033 - 31.3.2034			
	1.4.2034 - 31.3.2035			
	1.4.2035 - 31.3.2036			
	1.4.2036 - 31.3.2037			
	1.4.2037 - 31.3.2038			
	1.4.2038 - 31.3.2039			
	1.4.2039 - 31.3.2040			
	1.4.2040 - 31.3.2041			
	1.4.2041 - 31.3.2042			
	1.4.2042 - 31.3.2043			
	1.4.2043 - 31.3.2044			
	1.4.2044 - 31.3.2045			
	1.4.2045 - 31.3.2046			
	1.4.2046 - 31.3.2047			
	1.4.2047 - 31.3.2048			
	1.4.2048 - 31.3.2049			
	1.4.2049 - 31.3.2050			
	1.4.2050 - 31.3.2051			
	1.4.2051 - 31.3.2052			
	1.4.2052 - 31.3.2053			
	1.4.2053 - 31.3.2054			
	1.4.2054 - 31.3.2055			
	1.4.2055 - 31.3.2056			
	1.4.2056 - 31.3.2057			
	1.4.2057 - 31.3.2058			
	1.4.2058 - 31.3.2059			
	1.4.2059 - 31.3.2060			
	1.4.2060 - 31.3.2061			
	1.4.2061 - 31.3.2062			
	1.4.2062 - 31.3.2063			
	1.4.2063 - 31.3.2064			
	1.4.2064 - 31.3.2065			
	1.4.2065 - 31.3.2066			
	1.4.2066 - 31.3.2067			
	1.4.2067 - 31.3.2068			
	1.4.2068 - 31.3.2069			
	1.4.2069 - 31.3.2070			
	1.4.2070 - 31.3.2071			
	1.4.2071 - 31.3.2072			
	1.4.2072 - 31.3.2073			
	1.4.2073 - 31.3.2074			
	1.4.2074 - 31.3.2075			
	1.4.2075 - 31.3.2076			
	1.4.2076 - 31.3.2077			
	1.4.2077 - 31.3.2078			
	1.4.2078 - 31.3.2079			
	1.4.2079 - 31.3.2080			
	1.4.2100 - 31.3.2101			
Total future arisings:	31823.2			
Total waste volume:	33912.0			

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

Comment on arising rates: Arisings rates are based upon NRS Dounreay's Lifetime Plan 2024 as generated at December 2023. Stocks figures have been updated in line with the Dounreay Management System. Note that stocks figures exclude waste in vaults and from ILW Store re-build

Additional information on quantities: Arisings volume lower uncertainty set to 64.5%. This represents a volume of contaminated land and floorslab which may potentially be left in situ based on GRR and characterisation work

Uncertainty factors on volumes: Stock (upper): x 1.02 Arisings (upper): x 1.20
Stock (lower): x 0.98 Arisings (lower): x 0.65

WASTE SOURCE Decommissioning waste that contains activity above the limits of Out of Scope of Regulation but below specific activities of 0.01 MBq/kg alpha and 0.4MBq/Kg Beta Gamma.

PHYSICAL CHARACTERISTICS

General description: The main constituent of this waste will be demolition rubble such as concrete together with metal reinforcing bars.

Changes since waste generated: -

Bulk density (t/m³): ~ 0.92

Comment on density: Based on actuals data from Dounreay's waste consignment system between 2010-2019. Data considered acceptable for 2025 submission

CHEMICAL COMPOSITION

General description and components (%wt): Asphalt (0.04%), Brick/Rubble (1.05%), Cementitious material (e.g. concrete) (39.95%), Fabric (TR), Glass (TR), Lead (0.05%), Mild Steel (1.23%), Other (1.41%), Paper (TR), Plastic (TR), Soil/Stone (56.13%), Stainless steel (0.05%), Wood/ Wood composite (TR), Halogenated Plastic (0.03%), Unhalogenated Plastic (0.05%),

Chemical state: Neutral

Sheet metal proportion / thickness: This waste is unsuitable for further treatment. Therefore, the proportion of sheet metal has not been assessed.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 0.05	M316	
Other ferrous metals.....	= 1.2	-	
Iron.....	= 0	-	
Aluminium.....	= 0	-	
Beryllium.....	= 0	-	
Cobalt.....	= 0	-	
Copper.....	= 0	-	
Lead.....	= 0.05	-	
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.....	< 0.01	-	
Paper, cotton.....	< 0.01	-	
Wood.....	< 0.01	-	
Halogenated plastics.....	= 0.03	-	
Total non-halogenated plastics.....	= 0.05	-	
Condensation polymers.....	NE	-	
Others.....	NE	-	
Organic ion exchange materials.....	= 0	-	
Total rubber.....	= 0	-	
Halogenated rubber.....	NE	-	
Non-halogenated rubber.....	NE	-	
Hydrocarbons.....	= 0.04	-	
Oil or grease.....	= 0	-	
Fuel.....	NE	-	
Asphalt/Tarmac (cont.coal tar).....	= 0	-	
Asphalt/Tarmac (no coal tar).....	= 0.04	-	
Bitumen.....	= 0	-	
Others.....	NE	-	
Other organics.....	= 1.4	Other 1.41%,	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	-	
Inorganic sludges and flocs.....	= 0	-	
Soil.....	= 56.1	-	
Brick/Stone/Rubble.....	= 1.1	-	
Cementitious material.....	= 39.9	-	
Sand.....	= 0	-	
Glass/Ceramics.....	< 0.01	Glass 0.00%,	
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	Complexing agents are unlikely to be present.
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		
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	Off-site	= 1.0
None	On-site	= 99.0

Comments on planned treatments:

No treatment of demolition waste is required. 1% of waste will be generated after the closure of the NRS Dounreay Disposal Vaults and will need an alternative disposal route.

Conditioning method:

No conditioning of demolition waste is required. Waste will be consigned in one tonne bags or as concrete blocks

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

None

Further information on the conditioning matrix:

-

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
1 t flexible intermediate bulk container (FIBC)	95.0	0.70	0.70	45786	-
Non-containerised	5.0	-	-	-	-

Range in container waste loading: Not yet determined

Other information on packaging and conditioning:

95% of the waste will be placed in one tonne bags and disposed of in an engineered demolition vault. The remaining 5% is waste that has been cut into blocks and will be placed into the vault without any containment or using bespoke packaging. The vault will be backfilled with sand and other inert materials instead of in-vault grouting.

Conditioned density (t/m³):

-

Conditioned density comment:

-

Management Routes:

Disposal Route	Stream volume %	Raw density t/m ³	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)	= 99.0		
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	= 1.0		
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
Dounreay LLWDV	Landfill	< 100.0	RED	There is an opportunity for the waste to be disposed to a Landfill facility. However, further characterisation will be required.
Dounreay LLWDV	In-situ / on-site disposal	< 100.0	RED	There is an opportunity for the waste to be left in-situ on site or used as backfill for voids or as backfill for vaults when full. Further characterisation and strategy work is required to develop this opportunity.

RADIOACTIVITY

Source: The activity is associated with contamination of building structures and contaminated soil resulting from a variety of operations.

Uncertainty: The estimate for the arisings has been based on LLW compactable fingerprints for each facility but with a defined average total specific activity of 6.1MBq/m³.

Measurement of radioactivities: Arisings uses a specific activity of 6.1MBq/m³. This is calculated from the activities of the demolition waste which has already been disposed to the vaults.

Chemical form of radionuclides:

- H-3: -
- C-14: -
- Cl-36: Not likely to be present.
- Se-79: -
- Tc-99: -
- I-129: Present in very small quantities.
- Ra: -
- Th: -
- U: -
- Np: -
- Pu: -

WASTE STREAM		5B355		Demolition 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	= 3.08E-08	C C 2	= 3.08E-08	C C 2	Gd 153				
Be 10					Ho 163				
C 14	= 5.65E-09	C C 2	= 5.65E-09	C C 2	Ho 166m	= 1.47E-18	C C 2	= 1.47E-18	C C 2
Na 22	= 5.67E-13	C C 2	= 5.67E-13	C C 2	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	= 1.42E-14	C C 2	= 1.42E-14	C C 2	Pb 205				
Fe 55	= 1.24E-14	C C 2	= 1.24E-14	C C 2	Pb 210	= 5.88E-13	C C 2	5.88E-13	C C 2
Co 60	= 2.06E-08	C C 2	= 2.06E-08	C C 2	Bi 208				
Ni 59	= 3.02E-17	C C 2	= 3.02E-17	C C 2	Bi 210m				
Ni 63	= 3.66E-09	C C 2	= 3.66E-09	C C 2	Po 210	= 5.37E-13	C C 2	= 5.37E-13	C C 2
Zn 65	= 4.63E-19	C C 2	= 4.63E-19	C C 2	Ra 223	= 9.15E-13	C C 2	= 9.15E-13	C C 2
Se 79					Ra 225	= 4.36E-18	C C 2	= 4.36E-18	C C 2
Kr 81					Ra 226	= 3.44E-12	C C 2	= 3.44E-12	C C 2
Kr 85	= 2.18E-17	C C 2	= 2.18E-17	C C 2	Ra 228	= 1.70E-11	C C 2	= 1.70E-11	C C 2
Rb 87					Ac 227	= 9.51E-13	C C 2	= 9.51E-13	C C 2
Sr 90	= 7.36E-07	C C 2	= 7.36E-07	C C 2	Th 227	= 9.15E-13	C C 2	= 9.15E-13	C C 2
Zr 93					Th 228	= 9.89E-11	C C 2	= 9.89E-11	C C 2
Nb 91					Th 229	= 4.41E-18	C C 2	= 4.41E-18	C C 2
Nb 92					Th 230	= 1.89E-12	C C 2	= 1.89E-12	C C 2
Nb 93m	= 9.29E-09	C C 2	= 9.29E-09	C C 2	Th 232	= 2.57E-11	C C 2	= 2.57E-11	C C 2
Nb 94	= 2.41E-11	C C 2	= 2.41E-11	C C 2	Th 234	= 4.21E-08	C C 2	= 4.21E-08	C C 2
Mo 93	= 9.54E-09	C C 2	= 9.54E-09	C C 2	Pa 231	= 1.06E-11	C C 2	= 1.06E-11	C C 2
Tc 97					Pa 233	= 5.02E-12	C C 2	= 5.02E-12	C C 2
Tc 99	= 1.55E-10	C C 2	= 1.55E-10	C C 2	U 232	= 9.47E-11	C C 2	= 9.47E-11	C C 2
Ru 106	= 1.18E-11	C C 2	= 1.18E-11	C C 2	U 233	= 7.85E-15	C C 2	= 7.85E-15	C C 2
Pd 107					U 234	= 3.42E-08	C C 2	= 3.42E-08	C C 2
Ag 108m	= 8.94E-11	C C 2	= 8.94E-11	C C 2	U 235	= 8.36E-08	C C 2	= 8.36E-08	C C 2
Ag 110m					U 236	= 1.89E-08	C C 2	= 1.89E-08	C C 2
Cd 109	= 9.36E-12	C C 2	= 9.36E-12	C C 2	U 238	= 4.21E-08	C C 2	= 4.21E-08	C C 2
Cd 113m	= 2.77E-19	C C 2	= 2.77E-19	C C 2	Np 237	= 5.04E-12	C C 2	= 5.04E-12	C C 2
Sn 119m					Pu 236				
Sn 121m	= 7.53E-11	C C 2	= 7.53E-11	C C 2	Pu 238	= 7.06E-08	C C 2	= 7.06E-08	C C 2
Sn 123					Pu 239	= 7.96E-07	C C 2	= 7.96E-07	C C 2
Sn 126					Pu 240	= 2.09E-07	C C 2	= 2.09E-07	C C 2
Sb 125	= 4.27E-09	C C 2	= 4.27E-09	C C 2	Pu 241	= 9.46E-07	C C 2	= 9.46E-07	C C 2
Sb 126					Pu 242	= 2.72E-11	C C 2	= 2.72E-11	C C 2
Te 125m	= 1.01E-09	C C 2	= 1.01E-09	C C 2	Am 241	= 5.29E-07	C C 2	= 5.29E-07	C C 2
Te 127m					Am 242m	= 5.74E-10	C C 2	= 5.74E-10	C C 2
I 129					Am 243	= 1.63E-11	C C 2	= 1.63E-11	C C 2
Cs 134	= 9.79E-10	C C 2	= 9.79E-10	C C 2	Cm 242	= 4.79E-10	C C 2	= 4.79E-10	C C 2
Cs 135					Cm 243	= 1.05E-10	C C 2	= 1.05E-10	C C 2
Cs 137	= 1.53E-06	C C 2	= 1.53E-06	C C 2	Cm 244	= 1.11E-09	C C 2	= 1.11E-09	C C 2
Ba 133	= 4.06E-10	C C 2	= 4.06E-10	C C 2	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	= 4.86E-17	C C 2	= 4.86E-17	C C 2	Cf 249				
Pm 145					Cf 250				
Pm 147	= 2.35E-08	C C 2	= 2.35E-08	C C 2	Cf 251				
Sm 147	= 2.25E-18	C C 2	= 2.25E-18	C C 2	Cf 252				
Sm 151	= 1.59E-08	C C 2	= 1.59E-08	C C 2	Unsp a				
Eu 152	= 3.81E-08	C C 2	= 3.81E-08	C C 2	Unsp b/g				
Eu 154	= 3.11E-08	C C 2	= 3.11E-08	C C 2	Total a	1.79E-06	*	1.79E-06	*
Eu 155	= 7.21E-09	C C 2	= 7.21E-09	C C 2	Total b/g	3.46E-06	*	3.46E-06	*

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