

WASTE STREAM	5B355	Demolition LLW
---------------------	--------------	-----------------------

SITE Dounreay
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Dounreay Site Restoration Limited
WASTE TYPE LLW
 Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	2198.0 m ³
Future arisings -	1.4.2022 - 31.3.2023.....	103.7 m ³
	1.4.2023 - 31.3.2024.....	76.4 m ³
	1.4.2024 - 31.3.2025.....	0 m ³
	1.4.2025 - 31.3.2026.....	0.1 m ³
	1.4.2026 - 31.3.2027.....	54.0 m ³
	1.4.2027 - 31.3.2028.....	1135.1 m ³
	1.4.2028 - 31.3.2029.....	215.7 m ³
	1.4.2029 - 31.3.2030.....	0 m ³
	1.4.2030 - 31.3.2031.....	112.0 m ³
	1.4.2031 - 31.3.2032.....	191.7 m ³
	1.4.2032 - 31.3.2033.....	271.4 m ³
	1.4.2033 - 31.3.2034.....	391.6 m ³
	1.4.2034 - 31.3.2035.....	216.5 m ³
	1.4.2035 - 31.3.2036.....	229.1 m ³
	1.4.2036 - 31.3.2037.....	997.1 m ³
	1.4.2037 - 31.3.2038.....	973.7 m ³
	1.4.2038 - 31.3.2039.....	223.6 m ³
	1.4.2039 - 31.3.2040.....	1559.8 m ³
	1.4.2040 - 31.3.2041.....	2769.4 m ³
	1.4.2041 - 31.3.2042.....	852.6 m ³
	1.4.2042 - 31.3.2043.....	1587.2 m ³
	1.4.2043 - 31.3.2044.....	586.1 m ³
	1.4.2044 - 31.3.2045.....	424.7 m ³
	1.4.2045 - 31.3.2046.....	291.4 m ³
	1.4.2046 - 31.3.2047.....	174.6 m ³
	1.4.2047 - 31.3.2048.....	174.6 m ³
	1.4.2048 - 31.3.2049.....	27.7 m ³
Total future arisings:		13639.8 m ³
Total waste volume:		15837.8 m ³

Comment on volumes: Arising rates have been amended in line with PWI after inventory walkdowns. Stocks have been amended in line with the Dounreay Waste Management System (DMS); demo bags in Vaults plus in store. Work is on-going to recategorise a number of containers to OoSoR. It should be noted that DSRL site programme is currently under review and future arisings dates are subject to change.

Uncertainty factors on volumes: Stock (upper): x 1.02 Arisings (upper) x 1.2
 Stock (lower): x 0.98 Arisings (lower) x 0.8

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.
 Physical components (%vol): Asphalt (0.08%), Brick/Rubble (2.69%), Cementitious material (e.g. concrete) (71.53%), Lead (0.12%), Mild Steel (5.07%), Other (3.61%), Soil/Stone (16.79%), Stainless steel (0.11%),
 Sealed sources: The waste does not contain sealed sources.

WASTE STREAM	5B355	Demolition LLW
---------------------	--------------	-----------------------

Bulk density (t/m³): ~3.05

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Asphalt (0.07%), Brick/Rubble (2.09%), Cementitious material (e.g. concrete) (66.94%), Lead (0.52%), Mild Steel (15.52%), Other (1.41%), Soil/Stone (13.10%), Stainless steel (0.35%),

Chemical state: Neutral

Chemical form of radionuclides: Cl-36: Not likely to be present.
I-129: Present in very small quantities.

Metals and alloys (%wt): Metals are most likely to be present in the form of concrete reinforcing bars.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0.35	M316	
Other ferrous metals.....	15.5		
Iron.....			
Aluminium.....	0		
Beryllium.....	NE		
Cobalt.....	0		
Copper.....	TR		
Lead.....	0.52		
Magnox/Magnesium.....	0		
Nickel.....			
Titanium.....			
Uranium.....	P		
Zinc.....	TR		
Zircaloy/Zirconium.....	0		
Other metals.....	1.4		

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	TR		
Paper, cotton.....	TR		
Wood.....	TR		
Halogenated plastics	NE		
Total non-halogenated plastics.....	NE		
Condensation polymers.....	NE		
Others.....	NE		
Organic ion exchange materials....	0		
Total rubber.....	0		
Halogenated rubber			
Non-halogenated rubber.....			
Hydrocarbons.....	0.07		
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...	0.04		

WASTE STREAM	5B355	Demolition LLW
---------------------	--------------	-----------------------

Asphalt/Tarmac (no coal tar).....	0.03
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.....	0
Soil.....	13.1
Brick/Stone/Rubble.....	2.1
Cementitious material.....	66.9
Sand.....	
Glass/Ceramics.....	P
Graphite.....	0
Desiccants/Catalysts.....	0
Asbestos.....	P
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	TR

Inorganic anions (%wt): -

(%wt)	Type(s) and comment
-------	---------------------

Fluoride.....	NE
Chloride.....	NE
Iodide.....	NE
Cyanide.....	NE
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.....	
Low flash point liquids.....	0
Explosive materials.....	0
Phosphorus.....	0

WASTE STREAM	5B355	Demolition LLW
---------------------	--------------	-----------------------

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.....	
Reacting with water.....	0
Higher activity particles.....	NE
Soluble solids as bulk chemical compounds.....	0

Hazardous substances / non hazardous pollutants: Small amounts of hazardous materials may be present, however information on these is not available at present.

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

WASTE STREAM 5B355 Demolition LLW

EEE Type 3.....

EEE Type 4.....

EEE Type 5.....

Complexing agents (%wt): Not yet determined

(%wt) Type(s) and comment

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids.....

Other organic complexants.....

Complexing agents are unlikely to be present.

Total complexing agents.....

Potential for the waste to contain discrete items: Yes. There is the potential for discreet items (cut concrete blocks).

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		100.0

Comment on planned treatments:

-

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository		
Expected to be consigned to a Landfill Facility		
Expected to be consigned to an On-Site Disposal Facility	100.0	3.1
Expected to be consigned to an Incineration Facility		
Expected to be consigned to a Metal Treatment Facility		
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known		

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

Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):

WASTE STREAM 5B355 Demolition LLW

Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be consigned to an On-Site Disposal Facility			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be consigned as Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Opportunities for alternative disposal routing: No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

Waste Packaging for Disposal:

Container	Stream volume %	Waste loading m ³	Number of packages
1/3 Height IP-1 ISO			
2/3 Height IP-2 ISO			
1/2 Height WAMAC IP-2 ISO			
1/2 Height IP-2 Disposal/Re-usable ISO			
2m box (no shielding)			
4m box (no shielding)			
Other (1 Tonne Bags)	90.1	0.7	

Other information: The 90.08% will be placed in 1 tonne bags and disposed of in an engineered demolition vault. The 9.92% remaining is demolition waste that has been cut in to blocks and will be placed directly in to the vault with out any containment. This vault will be backfilled using sand and other inert materials instead of in-vault grouting.

Waste Planned for Disposal at the LLW Repository: (Not applicable to this waste stream)

Container voidage: -
 Waste Characterisation Form (WCH): -
 Waste consigned for disposal to LLWR in year of generation: -

Non-Containerised Waste for In-Vault Grouting: (Not applicable to this waste stream)

Stream volume (%): -
 Waste stream variation: -
 Bounding cuboidal volume:
 Inaccessible voidage: -
 Other information: -

RADIOACTIVITY

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

WASTE STREAM**5B355****Demolition LLW**

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 6.1 MBq/m ³ . The activity data for stocks are based on consignor's declarations though it is recognised that there is a great deal of uncertainty with these.
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:	Arisings uses an average specific activity of 6.1MBq/m ³ . This is calculated from the activities of the demolition waste which has already gone to the vaults. This was calculated in LLW Stocks and Arisings spreadsheet. Stocks uses only consignors data. Stocks data has been decayed based on the average date each waste item was consigned. Some facilities have yet to produce any demolition waste, and thus have not influenced the stocks fingerprint. This is why the fingerprints do not match.
Other information:	Specific Activity uses UKRWI 2019 data decayed to 2022.

WASTE STREAM 5B355 Demolition LLW

Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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	7.76E-08	CC 2	1.23E-07	CC 2	Gd 153				
Be 10					Ho 163				
C 14	1.01E-08	CC 2	1.74E-08	CC 2	Ho 166m	2.63E-18	CC 2	4.53E-18	CC 2
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	1.17E-12	CC 2	4.73E-13	CC 2	Pb 205				
Fe 55	7.12E-14	CC 2	8.18E-14	CC 2	Pb 210	2.76E-13	CC 2	9.45E-13	CC 2
Co 60	9.92E-08	CC 2	9.81E-08	CC 2	Bi 208				
Ni 59	5.40E-17	CC 2	9.30E-17	CC 2	Bi 210m				
Ni 63	6.76E-09	CC 2	1.15E-08	CC 2	Po 210	7.40E-13	CC 2	7.93E-13	CC 2
Zn 65	1.29E-16	CC 2	3.21E-17	CC 2	Ra 223			6.4E-15	CC 2
Se 79		CC 2			Ra 225			6.96E-22	CC 2
Kr 81		CC 2			Ra 226	6.16E-12	CC 2	1.06E-11	CC 2
Kr 85	5.23E-17	CC 2	8.16E-17	CC 2	Ra 228	1.59E-11	CC 2	3.03E-11	CC 2
Rb 87		CC 2			Ac 227			6.93E-15	CC 2
Sr 90	8.73E-07	CC 2	1.20E-06	CC 2	Th 227			6.51E-15	CC 2
Zr 93					Th 228	8.71E-11	CC 2	2.45E-10	CC 2
Nb 91					Th 229			7.26E-22	CC 2
Nb 92					Th 230			2.81E-12	CC 2
Nb 93m	1.69E-08	CC 2	2.90E-08	CC 2	Th 232	2.61E-11	CC 2	4.49E-11	CC 2
Nb 94	4.01E-11	CC 2	6.91E-11	CC 2	Th 234	6.56E-10	CC 2	4.10E-10	CC 2
Mo 93	1.71E-08	CC 2	2.94E-08	CC 2	Pa 231			1.50E-13	CC 2
Tc 97					Pa 233			4.97E-13	CC 2
Tc 99	1.45E-10	CC 2	2.50E-10	CC 2	U 232	1.95E-10	CC 2	3.31E-10	CC 2
Ru 106	5.18E-10	CC 2	2.75E-10	CC 2	U 233		CC 2	6.35E-18	CC 2
Pd 107					U 234	6.42E-08	CC 2	1.02E-07	CC 2
Ag 108m	1.61E-10	CC 2	2.77E-10	CC 2	U 235	1.42E-09	CC 2	2.36E-09	CC 2
Ag 110m					U 236	7.27E-09	CC 2	1.22E-08	CC 2
Cd 109	2.42E-10	CC 2	1.64E-10	CC 2	U 238	6.64E-10	CC 2	4.10E-10	CC 2
Cd 113m	6.18E-19	CC 2	9.89E-19	CC 2	Np 237	2.70E-13	CC 2	5.02E-13	CC 2
Sn 119m					Pu 236		CC 2		
Sn 121m	1.42E-10	CC 2	2.41E-10	CC 2	Pu 238	3.37E-08	CC 2	4.08E-08	CC 2
Sn 123					Pu 239	1.14E-07	CC 2	1.75E-07	CC 2
Sn 126					Pu 240	4.26E-08	CC 2	5.34E-08	CC 2
Sb 125	2.42E-08	CC 2	2.79E-08	CC 2	Pu 241	5.98E-07	CC 2	8.71E-07	CC 2
Sb 126					Pu 242	4.86E-11	CC 2	8.38E-11	CC 2
Te 125m			6.60E-09	CC 2	Am 241	8.37E-08	CC 2	1.23E-07	CC 2
Te 127m					Am 242m	1.23E-09	CC 2	2.09E-09	CC 2
I 129					Am 243	3.33E-11	CC 2	5.71E-11	CC 2
Cs 134	8.18E-09	CC 2	8.16E-09	CC 2	Cm 242	1.10E-09	CC 2	1.75E-09	CC 2
Cs 135		CC 2			Cm 243	2.34E-10	CC 2	3.88E-10	CC 2
Cs 137	2.03E-06	CC 2	1.89E-06	CC 2	Cm 244	3.09E-09	CC 2	5.01E-09	CC 2
Ba 133	9.78E-10	CC 2	1.52E-09	CC 2	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	6.28E-15	CC 2	2.15E-15	CC 2	Cf 249				
Pm 145		CC 2			Cf 250				
Pm 147	1.41E-07	CC 2	1.59E-07		Cf 251				
Sm 147		CC 2	4.76E-18	CC 2	Cf 252				
Sm 151	3.12E-08	CC 2	5.30E-08	CC 2	Other a			9.22E-10	CC 2
Eu 152	1.00E-07	CC 2	1.48E-07	CC 2	Other b/g			2.99E-06	CC 2
Eu 154	9.08E-08	CC 2	1.30E-07	CC 2	Total a	3.52E-07	CC 2	5.18E-07	CC 2
Eu 155	2.39E-08	CC 2	3.27E-08	CC 2	Total b/g	4.16E-06	CC 2	7.83E-06	CC 2

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