

WASTE STREAM	5B323	Decommissioning Contaminated Soil
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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:	1.4.2041 - 31.3.2042	= 164.2		
	1.4.2042 - 31.3.2043	= 213.6		
	1.4.2043 - 31.3.2044	= 160.2		
Total future arisings:		538.0		
Total waste volume:		538.0		

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

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

Additional information on quantities: It should be noted that site assumption for the arisings of LLW from this stream have changed since last submission. The current assumption is that the majority of contaminated soils will be consigned to the Dounreay Demolition Low Level Waste Vault under stream 5B355.

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

WASTE SOURCE Concrete foundation slabs and sub-slab soils for active buildings. Also contaminated soil which has arisen from accidental releases of activity from historical operations. The soil will be excavated during new build or site remediation operations.

PHYSICAL CHARACTERISTICS

General description: Mainly soil with smaller amounts of rubble (broken up sub slab pieces). There are no large items to influence package choice.

Changes since waste generated: -

Bulk density (t/m³): = 0.60

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): Cementitious material (e.g. concrete) (37.36%), Soil/Stone (62.64%), □

Chemical state: Neutral

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	= 0	-	
Other ferrous metals.....	= 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.....	= 0	-	
Paper, cotton.....	= 0	-	
Wood.....	= 0	-	
Halogenated plastics.....	= 0	-	
Total non-halogenated plastics.....	= 0	-	
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	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	-	
Inorganic sludges and flocs.....	= 0	-	
Soil.....	= 62.6	-	
Brick/Stone/Rubble.....	= 0	-	
Cementitious material.....	= 37.4	-	
Sand.....	= 0	-	
Glass/Ceramics.....	= 0	-	
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:

Contaminated soil will be loaded into HHISOs and encapsulated before final disposal

Conditioning method:

Contaminated soil will be grouted into non IP rated HHISOs through a dedicated grouting facility.

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

Non-standard

Further information on the conditioning matrix:

Dounreay uses 3:1 PFA:OPC with ~35% water and plasticiser.

Waste Packaging:

Likely container type:	Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	Non IP-2 rated 1/2 Height ISO (DC02)	100.0	7.8	15.6	69	-

Range in container waste loading: The waste loading is a rough average using previously consigned waste data. Waste loading per ISO can vary significantly, based on how the container is loaded. In general bulk items lead to a lower waste loading factor, whereas compacted items lead to a higher one. Most containers contain a mix of the two.

Other information on packaging and conditioning: Disposability options under GRR will also be considered.

Conditioned density (t/m³): ~ 2.0

Conditioned density comment: This value is a midpoint between a range of densities going from 1.49 to 2.47. These were taken from HHISOs disposed of in NRSD LLW Disposal Vaults

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
Dounreay LLWDV	In-situ / on-site disposal	= 100.0	RED	There is an opportunity for this waste to be left in-situ according to GRR guidance. Further characterisation data will be required.

RADIOACTIVITY

Source: The source of the activity is accidental releases of a historic nature. The main radionuclides expected are Cs-137 and Sr-90

Uncertainty: -

Measurement of radioactivities: From Consignor's records

Chemical form of radionuclides:

- H-3: -
- C-14: -
- Cl-36: Possibly present as general contamination
- Se-79: -
- Tc-99: -
- I-129: Possibly present as general contamination
- Ra: -
- Th: Possibly present as general contamination
- U: Possibly present as discrete particles or general contamination
- Np: -
- Pu: Possibly present as general contamination

WASTE STREAM 5B323 Decommissioning Contaminated Soil									
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			= 1.08E-17	C C 2
Co 60			= 4.62E-08	C C 2	Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210			= 8.27E-18	C C 2
Zn 65					Ra 223			= 5.11E-16	C C 2
Se 79					Ra 225			= 4.61E-22	C C 2
Kr 81					Ra 226			= 1.82E-16	C C 2
Kr 85					Ra 228			= 1.56E-20	C C 2
Rb 87					Ac 227			= 5.31E-16	C C 2
Sr 90			= 1.81E-05	C C 2	Th 227			= 5.11E-16	C C 2
Zr 93					Th 228			= 7.41E-21	C C 2
Nb 91					Th 229			= 4.75E-22	C C 2
Nb 92					Th 230			= 1.40E-13	C C 2
Nb 93m					Th 232			= 5.43E-20	C C 2
Nb 94					Th 234				
Mo 93					Pa 231			= 5.92E-15	C C 2
Tc 97					Pa 233			= 1.99E-13	C C 2
Tc 99					U 232				
Ru 106					U 233			= 2.56E-18	C C 2
Pd 107					U 234			= 2.54E-09	C C 2
Ag 108m					U 235			= 4.67E-11	C C 2
Ag 110m					U 236			= 1.83E-10	C C 2
Cd 109					U 238				
Cd 113m					Np 237			= 2.03E-13	C C 2
Sn 119m					Pu 236				
Sn 121m					Pu 238			= 8.92E-08	C C 2
Sn 123					Pu 239			= 1.76E-07	C C 2
Sn 126					Pu 240			= 4.80E-11	C C 2
Sb 125					Pu 241			= 3.46E-08	C C 2
Sb 126					Pu 242				
Te 125m					Am 241			= 1.04E-07	C C 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137			= 2.19E-05	C C 2	Cm 244			= 6.73E-08	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					Total a	0	*	4.39E-07	*
Eu 155					Total b/g	0	*	4.01E-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