

<b>WASTE STREAM</b>	<b>5B305</b>	<b>Site Drains and Ducts LLW</b>
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**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.....	0 m <sup>3</sup>
Future arisings -	1.4.2039 - 31.3.2040.....	3.8 m <sup>3</sup>
	1.4.2040 - 31.3.2041.....	18.4 m <sup>3</sup>
	1.4.2041 - 31.3.2042.....	18.3 m <sup>3</sup>
	1.4.2042 - 31.3.2043.....	18.3 m <sup>3</sup>
	1.4.2043 - 31.3.2044.....	18.3 m <sup>3</sup>
	1.4.2044 - 31.3.2045.....	18.4 m <sup>3</sup>
	1.4.2045 - 31.3.2046.....	18.3 m <sup>3</sup>
	1.4.2046 - 31.3.2047.....	18.3 m <sup>3</sup>
	1.4.2047 - 31.3.2048.....	3.6 m <sup>3</sup>
Total future arisings:		135.7 m <sup>3</sup>
Total waste volume:		135.7 m <sup>3</sup>

**Comment on volumes:** The arising rate has been revised following a plant waste inventory walk round exercise. It should be noted that data is based upon a provisional DSRL Site Programme The volumes are based on the current drains system. No allowance has been made for any new drains.

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

**WASTE SOURCE** General site services decommissioning of Low Active Drain (LAD), High Active Drain (HAD), Liquid Effluent Discharge System (LEDS).

**PHYSICAL CHARACTERISTICS**

**General description:** The waste will consist mainly of stainless steel pipework, along with valves, pumps, concrete and plastic. Items will be size reduced at source.

**Physical components (%vol):** Cementitious material (e.g. concrete) (56.71%), Iron (4.71%), Mild Steel (0.53%), Plastic (8.25%), Stainless steel (29.78%),

**Sealed sources:** Not yet determined.

**Bulk density (t/m<sup>3</sup>):** 0.42

**Comment on density:** Based off consignor's records for Low Active Drains; D3100 Disposed Inventory Report 2020

**CHEMICAL COMPOSITION**

**General description and components (%wt):** Cementitious material (e.g. concrete) (32.47%), Iron (8.85%), Lead (0.02%), Mild Steel (0.99%), Plastic (1.81%), Stainless steel (55.85%),

**Chemical state:** Neutral

**Chemical form of radionuclides:** H-3: Likely to be present as contamination.  
C-14: Likely to be present as contamination.  
Ra: Not likely to be present.  
Th: Likely to be present as contamination.  
U: Likely to be present as contamination.  
Np: Likely to be present as contamination.  
Pu: Likely to be present as contamination.

**Metals and alloys (%wt):** Metal is mainly in the form of pipework.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	55.9	likely M316	
Other ferrous metals.....	0.99		
Iron.....	8.9		
Aluminium.....			
Beryllium.....	0		
Cobalt.....	0		
Copper.....			
Lead.....	0.02		
Magnox/Magnesium.....	0		
Nickel.....			
Titanium.....			
Uranium.....	0		
Zinc.....	0		
Zircaloy/Zirconium.....	0		
Other metals.....	0.01	adjusted for rounding	
Organics (%wt):		Trace quantities of oil/cutting fluid may be present due to decommissioning operations. Cellulose will only be present in trace quantities. Trace quantities may be present.	
	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	TR		
Paper, cotton.....	TR		
Wood.....	TR		
Halogenated plastics .....	0		
Total non-halogenated plastics.....	1.8		
Condensation polymers.....	0		
Others.....	1.8	High density polyethylene	
Organic ion exchange materials....	0		
Total rubber.....	TR		
Halogenated rubber .....	NE		
Non-halogenated rubber.....	NE		
Hydrocarbons.....			
Oil or grease .....			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	TR		

Other materials (%wt):

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	TR		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	32.5		
Sand.....			
Glass/Ceramics.....			
Graphite.....	0		
Desiccants/Catalysts.....			
Asbestos.....	TR		
Non/low friable.....	TR		
Moderately friable.....	TR		
Highly friable.....	TR		
Free aqueous liquids.....	NE		
Free non-aqueous liquids.....	NE		
Powder/Ash.....	0		

Inorganic anions (%wt):           Trace quantities may be present dependent on operations undertaken.

	(%wt)	Type(s) and comment
Fluoride.....	0	
Chloride.....	0	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	0	
Nitrate.....	0	
Nitrite.....	0	
Phosphate.....	0	
Sulphate.....	0	
Sulphide.....	0	

Materials of interest for waste acceptance criteria:           -

	(%wt)	Type(s) and comment
Combustible metals.....	0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	0	
Putrescible wastes.....	0	
Non-putrescible wastes.....	0	

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Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	0
Higher activity particles.....	NE
Soluble solids as bulk chemical compounds.....	0

Hazardous substances / non hazardous pollutants:      Lead is present in trace quantities.

	(%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.....		
EEE Type 3.....		
EEE Type 4.....		
EEE Type 5.....		

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Complexing agents (%wt): No

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

Potential for the waste to contain discrete items: Yes. The waste has the potential to contain durable engineered structures such as pipework

**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	On-site	100.0

Comment on planned treatments:

The waste will be encapsulated before final disposal. DSRL is investigating the feasibility of alternative waste treatment routes, in particular Metal Treatment. These opportunities however, are not yet fully established waste routes.

**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 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	100.0	1.8

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):**

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			

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Opportunities for alternative disposal routing: Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
Onsite disposal	Metal treatment	30.0	-	High	Trial is currently underway to open the Metal Treatment Route

**Waste Packaging for Disposal:**

Container	Stream volume %	Waste loading m <sup>3</sup>	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	100.0	7.78	18

Other information: The waste will consist of large uncompactable items. The waste will be loaded into alternative non-IP2 rated LLW Disposal HHISO for transfer to the DSRL LLW Disposal Facility. Each HHISO may have other LLW items in the final HHISO.

**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: Contamination of internal surfaces due to active liquor passing through pipework.  
Uncertainty: Within a factor of 10.  
Definition of total alpha and total beta/gamma: Other beta/gamma nuclides not specified.  
Measurement of radioactivities: -  
Other information: Specific activities uses UKRWI 2019 data decayed to 2022.

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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					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					Tl 204				
Mn 54					Pb 205				
Fe 55					Pb 210				
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90			4.59E-06	CC 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m					U 235				
Ag 110m					U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238		2.18E-08	CC 2	
Sn 123					Pu 239		1.69E-08	CC 2	
Sn 126					Pu 240		2.71E-08	CC 2	
Sb 125					Pu 241		4.03E-07	CC 2	
Sb 126					Pu 242				
Te 125m					Am 241		2.96E-08	CC 2	
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137			1.31E-06	CC 2	Cm 244				
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					Other a				
Eu 152					Other b/g				
Eu 154					<b>Total a</b>	<b>0</b>	<b>9.54E-08</b>	<b>CC 2</b>	
Eu 155					<b>Total b/g</b>	<b>0</b>	<b>6.30E-06</b>	<b>CC 2</b>	

**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