WASTE STREAM	5B305	Site Drains and Ducts LLW

SITE Dounreay

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE LLW

WASTE VOLUMES

		Reported (m^3)
Stocks:	At 1.4.2025	0
Future arisings:	1.4.2037 - 31.3.2038	1.1
	1.4.2038 - 31.3.2039	2.2
	1.4.2039 - 31.3.2040	1.1
	1.4.2064 - 31.3.2065	11.6
	1.4.2065 - 31.3.2066	12.3
	1.4.2066 - 31.3.2067	12.3
	1.4.2067 - 31.3.2068	12.3
	1.4.2068 - 31.3.2069	12.3
	1.4.2069 - 31.3.2070	12.3
	1.4.2070 - 31.3.2071	12.3
	1.4.2071 - 31.3.2072	12.3
	1.4.2072 - 31.3.2073	9.0
	1.4.2073 - 31.3.2074	7.8
	1.4.2074 - 31.3.2075	7.8
	1.4.2075 - 31.3.2076	7.8
	1.4.2076 - 31.3.2077	1.2
Total future arisings:		**135.6**
Total waste volume:		**135.6**

OR

Conditioned (m^3)	Packaged (m^3)

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

Comment on arising rates: -

Additional information on quantities: The volumes are based on the current drains systems. No allowance has been made for any new drains.

Uncertainty factors on volumes:

Stock (upper):	x -	Arisings (upper):	x 1.20
Stock (lower):	x -	Arisings (lower):	x 0.80

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 and drip trays, along with valves, pumps, concrete and plastic. Items will be size reduced at source.

Changes since waste generated: -

Bulk density (t/m^3): = 0.42

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): Asbestos (TR), Cementitious material (e.g. concrete) (56.05%), Iron (4.66%), Lead (TR), Mild Steel (0.52%), Plastic (8.15%), Rubber (TR), Stainless steel (29.44%), Unhalogenated Plastic (1.16%),

Chemical state: Neutral

Sheet metal proportion / thickness: 98% of bulk metal present will be drip trays and pipework.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel	= 29.4	likely M316	
Other ferrous metals	= 0.52	-	
Iron	= 4.7	-	
Aluminium	= 0	-	
Beryllium	= 0	-	
Cobalt	= 0	-	
Copper	0	-	
Lead	= 0.01	-	
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 cellulosics	= 0	-	
Paper, cotton	= 0	-	
Wood	= 0	-	
Halogenated plastics	= 4.1	-	
Total non-halogenated plastics	= 5.2	High density polyethylene	
Condensation polymers	NE	-	
Others	NE	-	
Organic ion exchange materials	= 0	-	
Total rubber	= 0.01	-	
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	= 0	-	
Brick/Stone/Rubble	= 0	-	
Cementitious material	= 56.0	-	
Sand	= 0	-	
Glass/Ceramics	= 0	-	
Graphite	= 0	-	
Desiccants/Catalysts	= 0	-	
Asbestos	< 0.01	-	
Non/low friable	TR	-	
Moderately friable	TR	-	
Highly friable	TR	-	
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	= 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	-
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: -

	(%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): No

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

Physical components:

	Number	Type(s) and comment
Sources	0	-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1		-
EEE Type 2		-
EEE Type 3		-
EEE Type 4		-
EEE Type 5		-

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 None	On-site	= 100.0

Comments on planned treatments: The waste will be encapsulated before final disposal.

Conditioning method: Current strategy is for pipework to be size reduced and grouted internally before being grouted into a non IP rated HHISO

Conditioning plants:

Plant Name	Location

Likely conditioning matrix: Non-standard

Further information on the conditioning matrix: Dounreay uses: cement OPC 1:3 PFA ~35% water content and plasticiser

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m^3)	Payload (m^3)	Number of packages	Estimated start date for packaging
Non IP-2 rated 1/2 Height ISO (DC02)	100.0	7.8	15.6	18	-

Range in container waste loading: The waste loading value 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 leads to a lower waste loading value where as compactable leads to a higher one. Most containers contain a mix of the two.

Other information on packaging and conditioning: 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 Dounreay LLW Disposal Facility. Each HHISO may have other LLW items in the final HHISO.

Conditioned density (t/m^3): ~ 2.0

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

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) 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	= 100.0		

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

Opportunities for alternative disposal routing: Not yet determined

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
-	-	-	-	-

RADIOACTIVITY

Source: Contamination of internal surfaces due to active liquor passing through pipework

Uncertainty: Within a factor of 10

Measurement of radioactivities: Specific activities are derived from the extrapolation of consigned waste data.

Chemical form of radionuclides:

H-3: Likely to be present as contamination.
C-14: Likely to be present as contamination.
Cl-36: -
Se-79: -
Tc-99: -
I-129: -
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.

WASTE STREAM **5B305** **Site Drains and Ducts LLW**

Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ 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					Tl 204				
Mn 54					Pb 205				
Fe 55					Pb 210			= 3.96E-22	C C 2
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210			= 2.81E-22	C C 2
Zn 65					Ra 223			= 3.62E-22	C C 2
Se 79					Ra 225			= 1.31E-22	C C 2
Kr 81					Ra 226			= 8.82E-21	C C 2
Kr 85					Ra 228			= 1.43E-25	C C 2
Rb 87					Ac 227			= 3.84E-22	C C 2
Sr 90			= 4.11E-06	C C 2	Th 227			= 3.65E-22	C C 2
Zr 93					Th 228			= 5.45E-26	C C 2
Nb 91					Th 229			= 1.35E-22	C C 2
Nb 92					Th 230			= 1.01E-17	C C 2
Nb 93m					Th 232			= 7.04E-25	C C 2
Nb 94					Th 234				
Mo 93					Pa 231			= 6.32E-21	C C 2
Tc 97					Pa 233			= 5.81E-14	C C 2
Tc 99					U 232				
Ru 106					U 233			= 7.32E-19	C C 2
Pd 107					U 234			= 3.65E-13	C C 2
Ag 108m					U 235			= 9.96E-17	C C 2
Ag 110m					U 236			= 4.75E-15	C C 2
Cd 109					U 238				
Cd 113m					Np 237			= 5.92E-14	C C 2
Sn 119m					Pu 236				
Sn 121m					Pu 238			= 2.10E-08	C C 2
Sn 123					Pu 239			= 1.69E-08	C C 2
Sn 126					Pu 240			= 2.71E-08	C C 2
Sb 125					Pu 241			= 3.24E-07	C C 2
Sb 126					Pu 242				
Te 125m					Am 241			= 3.20E-08	C C 2
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137			= 1.18E-06	C C 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					Unsp a				
Eu 152					Unsp b/g				
Eu 154					**Total a**	**0**	*	**9.70E-08**	*
Eu 155					**Total b/g**	**0**	*	**5.62E-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