

WASTE STREAM	5B333	DCP Vault Store and Extension 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.....	0 m ³
Future arisings -	1.4.2022 - 31.3.2023.....	33.2 m ³
	1.4.2023 - 31.3.2024.....	33.2 m ³
	1.4.2024 - 31.3.2025.....	33.3 m ³
	1.4.2025 - 31.3.2026.....	33.2 m ³
	1.4.2026 - 31.3.2027.....	33.2 m ³
	1.4.2027 - 31.3.2028.....	33.2 m ³
	1.4.2028 - 31.3.2029.....	33.3 m ³
	1.4.2029 - 31.3.2030.....	45.6 m ³
	1.4.2030 - 31.3.2031.....	49.8 m ³
	1.4.2031 - 31.3.2032.....	49.8 m ³
	1.4.2032 - 31.3.2033.....	49.9 m ³
	1.4.2033 - 31.3.2034.....	49.8 m ³
	1.4.2034 - 31.3.2035.....	49.8 m ³
	1.4.2035 - 31.3.2036.....	49.8 m ³
	1.4.2036 - 31.3.2037.....	71.0 m ³
	1.4.2037 - 31.3.2038.....	46.4 m ³
	1.4.2078 - 31.3.2080.....	1116.9 m ³
Total future arisings:		1811.4 m ³
Total waste volume:		1811.4 m ³

Comment on volumes: It should be noted that DSRL are using a provisional LifeTime Plan (LTP) programme and future arisings dates are subject to change. Arisings have been revised in line with the Predictive Waste Inventory walk round exercise. Stocks have been removed: these will be captured under 5B15 and 5B16. Note that the gap in the arisings dates is due to the main DCP facility being decommissioned early in the programme and the demolition of the store that is still required for long term management of Higher Active Waste as per Scottish Government Policy. These figures do not include the new store currently under construction as waste types for this have yet to be assessed.

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

WASTE SOURCE Decommissioning of cementation plant and associated store.

PHYSICAL CHARACTERISTICS

General description: -
 Physical components (%vol): Aluminium (0.07%), Brick/Rubble (0.92%), Cementitious material (e.g. concrete) (7.98%), Copper (0.03%), Fibreglass (0.26%), Fluorescent Tubes (0.01%), Glass (0.89%), Lead (0.68%), Mild Steel (17.15%), Other (1.37%), Paper (27.37%), Plastic (28.24%), Rubber (5.09%), Stainless steel (6.57%), Wood/ Wood composite (3.35%),
 Sealed sources: The waste does not contain sealed sources.
 Bulk density (t/m³): 0.24
 Comment on density: The bulk density is approximately based on consignor's records (D3100 Disposed Inventory Report 2020).

CHEMICAL COMPOSITION

General description and components (%wt): Aluminium (0.06%), Brick/Rubble (0.66%), Cementitious material (e.g. concrete) (6.89%), Copper (0.10%), Fibreglass (0.24%), Glass (0.80%), Lead (2.78%), Mild Steel (48.50%), Other (0.49%), Paper (7.88%), Plastic (9.35%), Rubber (2.79%), Stainless steel (18.58%), Wood/ Wood composite (0.86%),

WASTE STREAM	5B333	DCP Vault Store and Extension LLW
---------------------	--------------	--

Chemical state: Neutral

Chemical form of radionuclides: H-3: May be present at extremely low concentrations.
 C-14: May be present at extremely low concentrations.
 Cl-36: May be present at extremely low concentrations.
 Se-79: May be present at extremely low concentrations.
 Tc-99: May be present at extremely low concentrations.
 I-129: May be present at extremely low concentrations.
 Ra: May be present at extremely low concentrations.
 Th: May be present at extremely low concentrations.
 U: Likely to be present as nitrate at low concentrations.
 Np: May be present at extremely low concentrations.
 Pu: Likely to be present as nitrate at low concentrations.

Metals and alloys (%wt): Both bulk and sheet metals are likely to be present, proportions not specified.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	18.6	M316	
Other ferrous metals.....	48.5	mild steel/stainless steel, proportions are unknown	
Iron.....			
Aluminium.....	0.06		
Beryllium.....	P		
Cobalt.....	NE		
Copper.....	0.10		
Lead.....	2.8		
Magnox/Magnesium.....	NE		
Nickel.....	NE		
Titanium.....			
Uranium.....	P		
Zinc.....	NE		
Zircaloy/Zirconium.....	NE		
Other metals.....	0.51	Misc routine arisings wastes. Corrected to make 100%	

Organics (%wt): PVC and neoprene are likely to be present.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	8.7		
Paper, cotton.....	7.9		
Wood.....	0.86		
Halogenated plastics	~4.7		
Total non-halogenated plastics.....	~4.7		
Condensation polymers.....	NE		
Others.....	<4.7		
Organic ion exchange materials....	0		
Total rubber.....	2.8		
Halogenated rubber	~1.4		
Non-halogenated rubber.....	~1.4		
Hydrocarbons.....			
Oil or grease			
Fuel.....			

WASTE STREAM	5B333	DCP Vault Store and Extension LLW
---------------------	--------------	--

Asphalt/Tarmac (cont.coal tar)...
 Asphalt/Tarmac (no coal tar)....
 Bitumen.....
 Others.....
 Other organics.....

Other materials (%wt): Fluorescent tubes

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	0		
Brick/Stone/Rubble.....	0.66		
Cementitious material.....	6.9		
Sand.....			
Glass/Ceramics.....	1.0	inc fibreglass	
Graphite.....	0		
Desiccants/Catalysts.....	0		
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): Inorganic anions are present at approximately 3%.

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

Materials of interest for waste acceptance criteria: -

WASTE STREAM	5B333	DCP Vault Store and Extension LLW
---------------------	--------------	--

	(%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.....		
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	

WASTE STREAM 5B333 DCP Vault Store and Extension LLW

Mercury compounds.....
 Others..... NE
 Electronic Electrical Equipment (EEE)
 EEE Type 1.....
 EEE Type 2.....
 EEE Type 3.....
 EEE Type 4.....
 EEE Type 5.....

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. Durable Engineered Steel Structures, Hand Tools

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction Supercompaction (HFC)	On-site	30.0
Incineration Solidification	On-site	39.0
Decontamination Metal treatment Size reduction Decay storage Recycling / reuse Other / various None	Off-site	61.0

Comment on planned treatments:

Uncompacted drums will be supercompacted before being placed in HHISOs. The waste will be encapsulated before final disposal. DSRL has begun trialling alternative waste treatment routes in particular Metal Treatment. These opportunities, however, are not yet fully established waste routes. No decisions have yet been made regarding treatment of waste to be disposed after the closure of DSRL vaults.

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	39.0	1.8
	61.0	0.24

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

WASTE STREAM 5B333 DCP Vault Store and Extension LLW

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			

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	Incineration	<28.0	-	Low	This opportunity is still at an early stage of development. A small scale trial is expected to take place in FY22/23. The timing is dependent on the non-containerised waste tasks which will generate the wastes.
Onsite disposal	Metal treatment	<3.0	2022	High	Trial is currently underway to open the Metal Treatment Route
Unknown	Mixed Management Route	61.0		Low	It should be noted that only long term arisings are being reported here. The waste stream is not fully developed as the new stores are still under construction. There is a requirement to carry out further work to underpin the waste categories predicted in UKRW1. This may lead to a recategorisation of the predicted waste volumes to OoSoR or lower.

Waste Packaging for Disposal:

Container	Stream volume %	Waste loading m ³	Number of packages
1/3 Height IP-1 ISO	39.0	19.92	36
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			

Other information: The waste will be loaded into an alternative non-IP2 rated LLW Disposal HHISO for transfer to the DSRL LLW Disposal Facility. Each HHISO may have LLW items from other waste streams in the final HHISO. There are currently no assumptions on waste disposal for any waste generated post site closure. High waste loading vol due to majority of waste stream being compactable drums.

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

Container voidage: -

Waste Characterisation Form (WCH): -

WASTE STREAM**5B333****DCP Vault Store and Extension LLW**

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 radioactivity arises from contamination of cementation plant and associated store.

Uncertainty: Within a factor of ten.

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: Specific activity derived using consignor's records.

Other information: Specific Activities are from UKRWI 2019 decayed to 2022

WASTE STREAM 5B333 DCP Vault Store and Extension 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					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			2.51E-09	CC 2	Po 210		3.66E-11	CC 2	
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226		3.04E-10	CC 2	
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90			1.05E-05	CC 2	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m			8.36E-07	CC 2	Th 232				
Nb 94					Th 234				
Mo 93			8.44E-07	CC 2	Pa 231				
Tc 97					Pa 233				
Tc 99			7.17E-09	CC 2	U 232				
Ru 106					U 233				
Pd 107					U 234		1.63E-12	CC 2	
Ag 108m					U 235				
Ag 110m					U 236				
Cd 109					U 238				
Cd 113m					Np 237		1.11E-11	CC 2	
Sn 119m					Pu 236				
Sn 121m			7.04E-09	CC 2	Pu 238		1.91E-08	CC 2	
Sn 123					Pu 239		5.22E-09	CC 2	
Sn 126					Pu 240		2.40E-09	CC 2	
Sb 125					Pu 241		1.70E-08	CC 2	
Sb 126					Pu 242				
Te 125m					Am 241		1.41E-07	CC 2	
Te 127m					Am 242m		1.92E-09	CC 2	
I 129					Am 243		1.64E-10	CC 2	
Cs 134					Cm 242		2.18E-09	CC 2	
Cs 135					Cm 243		1.09E-09	CC 2	
Cs 137			1.14E-05	CC 2	Cm 244		3.30E-09	CC 2	
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147			4.03E-09	CC 2	Cf 251				
Sm 147			4.47E-20	CC 2	Cf 252				
Sm 151			7.87E-08	CC 2	Other a				
Eu 152					Other b/g				
Eu 154			8.91E-09	CC 2	Total a	0	1.75E-07	CC 2	
Eu 155			4.16E-09	CC 2	Total b/g	0	2.37E-05	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