WASTE STREAM 5B355 Demolition LLW

SITE	Dounreay
SITE OWNER	Nuclear Decommissioning Authority
WASTE CUSTODIAN	Dounreay Site Restoration Limited
WASTE TYPE	LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	2382.1 m³
Future arisings -	1.4.2019 - 31.3.2029.....	11004.0 m³
Total future arisings:		11004.0 m³
Total waste volume:		13386.1 m³

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 HVLA (Demolition Waste) limits

PHYSICAL CHARACTERISTICS

General description: The main constituent of this waste will be demolition rubble such as concrete together with metal reinforcing bars.

Physical components (%wt): Aluminium (0.04%), Asphalt (0.09%), Brick/Rubble (0.04%), Cementitious material (e.g. concrete) (69.15%), Lead (0.62%), Mild Steel (29.42%), Rubber (0.20%), Stainless steel (0.42%),

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~3.05

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Aluminium (0.04%), Asphalt (0.09%), Brick/Rubble (0.04%), Cementitious material (e.g. concrete) (69.15%), Lead (0.62%), Mild Steel (29.42%), Rubber (0.20%), Stainless steel (0.42%),

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.

Stainless steel.....	0.42	M316
Other ferrous metals.....	29.4	
Iron.....		
Aluminium.....	0.04	
Beryllium.....	NE	
Cobalt.....	0	
Copper.....	TR	
Lead.....	0.62	
Magnox/Magnesium.....	0	
Nickel.....		
Titanium.....		
Uranium.....	P	

WASTE STREAM	5B355 Demolition LLW		
	Zinc	TR	
	Zircaloy/Zirconium	0	
	Other metals		
Organics (%wt):	-		
	Total cellulosics	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	0.20	
	Halogenated rubber		
	Non-halogenated rubber		
	Hydrocarbons	0.09	
	Oil or grease		
	Fuel		
	Asphalt/Tarmac (cont.coal tar)	0.04	
	Asphalt/Tarmac (no coal tar)	0.05	
	Bitumen		
	Others		
	Other organics	NE	
Other materials (%wt):	contaminated soils to go under 5B323		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs	0	
	Soil	NE	
	Brick/Stone/Rubble	0.06	+ rounding (0.02%) to ensure 100%
	Cementitious material	69.2	
	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):	-		

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: -

Combustible metals	
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	
Reacting with water	0
Active 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.

Acrylamide	
Benzene	NE
Chlorinated solvents	
Formaldehyde	
Organometallics	
Phenol	NE
Styrene	
Tri-butyl phosphate	NE
Other organophosphates	
Vinyl chloride	NE
Arsenic	NE
Barium	
Boron	NE

WASTE STREAM 5B355 Demolition LLW

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.....

Complexing agents (%wt): Not yet determined

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants..... Complexing agents are unlikely to be present.

Total complexing agents.....

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		
Recyling / reuse		
Other / various		
None		100.0

Comment on planned treatments: -

WASTE STREAM 5B355 Demolition LLW

Disposal Routes:

Disposal Route	Stream volume %
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

Upcoming (2019/20-2021/22) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2019/20	2020/21	2021/22
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			

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			

Other information: It is expected that the waste will be bagged before being disposed of to the proposed new LLW facilities in dedicated vaults without being packaged in HHISOs.

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: -

Potential for the waste to contain discrete items: -

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: -

WASTE STREAM 5B355 Demolition LLW

RADIOACTIVITY

Source:	The activity is associated with contamination of building structures and contaminated soil, resulting from a variety of operations.
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/m³. 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/m³. 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:	There are no unlisted radionuclides present at significant concentrations. Radionuclide data has been re-evaluated since the 2016 UK Inventory.

WASTE STREAM 5B355 Demolition LLW

Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3			1.45E-07	C C 2	Gd 153				
Be 10					Ho 163				
C 14			1.74E-08	C C 2	Ho 166m			4.53E-18	C C 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					Tl 204				
Mn 54			5.39E-12	C C 2	Pb 205				
Fe 55			1.75E-13	C C 2	Pb 210				
Co 60	1.04E-07	B B 2	1.46E-07	C C 2	Bi 208				
Ni 59			9.30E-17	C C 2	Bi 210m				
Ni 63			1.18E-08	C C 2	Po 210			5.19E-12	C C 2
Zn 65			7.20E-16	C C 2	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226			1.06E-11	C C 2
Kr 85			9.9E-17	C C 2	Ra 228			2.40E-11	C C 2
Rb 87					Ac 227				
Sr 90	3.79E-07	B B 2	1.30E-06	C C 2	Th 227				
Zr 93					Th 228			1.28E-11	C C 2
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m			2.94E-08	C C 2	Th 232			4.49E-11	C C 2
Nb 94			6.91E-11	C C 2	Th 234			4.13E-17	C C 2
Mo 93			2.94E-08	C C 2	Pa 231				
Tc 97					Pa 233				
Tc 99			2.50E-10	C C 2	U 232			3.42E-10	C C 2
Ru 106			2.11E-09	C C 2	U 233				
Pd 107					U 234	1.22E-08	B B 2	1.02E-07	C C 2
Ag 108m			2.78E-10	C C 2	U 235	1.11E-10	B B 2	2.36E-09	C C 2
Ag 110m					U 236	5.05E-10	B B 2	1.22E-08	C C 2
Cd 109			8.49E-10	C C 2	U 238	1.02E-09	B B 2	4.10E-10	C C 2
Cd 113m			1.15E-18	C C 2	Np 237			3.84E-13	C C 2
Sn 119m					Pu 236				
Sn 121m			2.50E-10	C C 2	Pu 238	2.38E-08	B B 2	4.17E-08	C C 2
Sn 123					Pu 239	2.93E-08	B B 2	1.75E-07	C C 2
Sn 126					Pu 240	2.77E-08	B B 2	5.34E-08	C C 2
Sb 125			5.94E-08	C C 2	Pu 241	1.48E-07	B B 2	1.01E-06	C C 2
Sb 126					Pu 242			8.38E-11	C C 2
Te 125m					Am 241	3.10E-08	B B 2	1.19E-07	C C 2
Te 127m					Am 242m	8.78E-12	B B 2	2.13E-09	C C 2
I 129					Am 243	2.69E-13	B B 2	5.71E-11	C C 2
Cs 134			2.23E-08	C C 2	Cm 242	7.33E-12	B B 2	2.48E-09	C C 2
Cs 135					Cm 243	1.54E-12	B B 2	4.16E-10	C C 2
Cs 137	2.30E-06	B B 2	2.02E-06	C C 2	Cm 244	4.11E-12	B B 2	5.62E-09	C C 2
Ba 133			1.86E-09	C C 2	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144			3.10E-14	C C 2	Cf 249				
Pm 145					Cf 250				
Pm 147	2.11E-09	B B 2	3.51E-07	C C 2	Cf 251				
Sm 147					Cf 252				
Sm 151	8.46E-11	B B 2	5.43E-08	C C 2	Other a				
Eu 152	2.05E-08	B B 2	1.72E-07	C C 2	Other b/g				
Eu 154	1.54E-08	B B 2	1.66E-07	C C 2	**Total a**	**1.26E-07**	**B B 2**	**<5.15E-07**	**C C 2**
Eu 155	2.39E-11	B B 2	5.06E-08	C C 2	**Total b/g**	**2.97E-06**	**B B 2**	**<5.59E-06**	**C C 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