

WASTE STREAM	5B315	MTR Reprocessing Plant LLW
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SITE Dounreay
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Dounreay Site Restoration Limited
WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m ³
Future arisings -	1.4.2019 - 31.3.2021.....	355.0 m ³
Total future arisings:		355.0 m ³
Total waste volume:		355.0 m ³

Comment on volumes: Arisings have been revised in line with plant waste inventory walk round exercise. Stocks have been removed. Stocks will be captured under 5B15 and 5B16. 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 Arisings (upper) x 1.2
 Stock (lower): x Arisings (lower) x 0.8

WASTE SOURCE LLW contaminated fuel reprocessing plant hardware, concrete shielding.

PHYSICAL CHARACTERISTICS

General description: Fuel reprocessing plant hardware, e.g. vessels, ducting and pipework and concrete shielding. Steel vessels will be cut to an economic size and concrete shielding will be size reduced.

Physical components (%vol): Vessels, pipework, ventilation systems, concrete, together with small quantities of paper (mainly filters), wood and plastic wrapping materials.

Sealed sources: Not yet determined.

Bulk density (t/m³): 0.41

Comment on density: The bulk density is based on consignor's records.

CHEMICAL COMPOSITION

General description and components (%wt): Aluminium (2.04%), Asbestos (0.39%), Asphalt (1.03%), Brick/Rubble (1.65%), Cementitious material (e.g. concrete) (5.19%), Copper (0.17%), Glass (0.07%), Gypsum Plasterboard/ Fibreboard (0.04%), Lead (10.51%), Mild Steel (61.32%), Paper (1.15%), Plastic (5.71%), Rubber (3.46%), Sand (0.11%), Stainless steel (6.10%), Tin (0.04%), Titanium (0.21%), WEEE containing hazardous components (0.06%), WEEE not containing hazardous components (0.19%), Wood/ Wood composite (0.64%),

Chemical state: Neutral

Chemical form of radionuclides: Cl-36: Not likely to be present
 I-129: Not likely to be present
 U: Likely to be present as oxide and/or nitrate as very low level contamination.
 Pu: Likely to be present as oxide and/or nitrate as very low level contamination.

Metals and alloys (%wt): Mild steel drums, other ferrous items, such as chequer plate and small pieces of supporting steelwork.

Stainless steel.....	6.1
Other ferrous metals.....	61.3
Iron.....	
Aluminium.....	2.0
Beryllium.....	
Cobalt.....	0
Copper.....	0.17
Lead.....	10.5
Magnox/Magnesium.....	0

WASTE STREAM

5B315

MTR Reprocessing Plant LLW

	Nickel.....		
	Titanium.....	0.21	
	Uranium.....		
	Zinc.....	TR	
	Zircaloy/Zirconium.....	0	
	Other metals.....	0.25	WEEE
Organics (%wt):	Significant quantities of organics may be present, with 5.7% plastics.		
	Total cellulose.....	1.8	
	Paper, cotton.....	1.2	
	Wood.....	0.64	
	Halogenated plastics	2.9	Assume 50% split as no further breakdown can be provided
	Total non-halogenated plastics.....	2.9	Assume 50% split as no further breakdown can be provided
	Condensation polymers.....		
	Others.....		
	Organic ion exchange materials....	0	
	Total rubber.....	3.5	No further information is available on the type of rubber at this time
	Halogenated rubber	P	
	Non-halogenated rubber.....	P	
	Hydrocarbons.....	1.0	
	Oil or grease		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...	-0.52	
	Asphalt/Tarmac (no coal tar)....	-0.52	
	Bitumen.....		
	Others.....		
	Other organics.....	TR	
Other materials (%wt):	-		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs.....	0	
	Soil.....	0	
	Brick/Stone/Rubble.....	1.7	includes plasterboard
	Cementitious material.....	5.2	
	Sand.....	0.11	
	Glass/Ceramics.....	0.07	
	Graphite.....	0	
	Desiccants/Catalysts.....	0	
	Asbestos.....	0.39	Asbestos may be present however Friability not known at this time
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		

WASTE STREAM**5B315 MTR Reprocessing Plant LLW**

	Free aqueous liquids.....	0
	Free non-aqueous liquids.....	0
	Powder/Ash.....	TR
Inorganic anions (%wt):	Trace quantities of inorganic anions may be present dependent on operations undertaken.	
	Fluoride.....	0
	Chloride.....	0
	Iodide.....	0
	Cyanide.....	0
	Carbonate.....	TR
	Nitrate.....	TR
	Nitrite.....	0
	Phosphate.....	0
	Sulphate.....	TR
	Sulphide.....	0
Materials of interest for waste acceptance criteria:	Asbestos may be present. Possible trace contamination of material from future unforeseen spillage of Nitric HF or potentially picked up on filters.	
	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.....	
	Pyrophoric materials.....	0
	Generating toxic gases.....	0
	Reacting with water.....	
	Active particles.....	NE
	Soluble solids as bulk chemical compounds.....	0
Hazardous substances / non hazardous pollutants:	Mercury may be present in trace quantities. Lead is present at 10.51% mostly in the form of contaminated bricks used for shielding. Asbestos may be present in trace quantities.	
	Acrylamide.....	
	Benzene.....	NE
	Chlorinated solvents.....	
	Formaldehyde.....	
	Organometallics.....	
	Phenol.....	NE
	Styrene.....	
	Tri-butyl phosphate.....	NE
	Other organophosphates.....	

WASTE STREAM

5B315 MTR Reprocessing Plant LLW

Vinyl chloride..... NE
 Arsenic..... NE
 Barium.....
 Boron..... NE
 Cadmium..... NE
 Caesium.....
 Selenium..... NE
 Chromium..... NE
 Molybdenum..... NE
 Thallium.....
 Tin..... P
 Vanadium..... NE
 Mercury compounds.....
 Others..... NE

Electronic Electrical Equipment (EEE)

EEE Type 1.....
 EEE Type 2..... ~1.0
 EEE Type 3..... ~1.0
 EEE Type 4.....
 EEE Type 5.....

Control Panels
 Envirovacs

Complexing agents (%wt):

Yes
 EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants..... TR

Trace contamination may only be possible from potential spills of decontamination agents e.g. DECON90, GRAMOS.

Total complexing agents..... TR

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	35.0
Incineration Solidification	On-site	100.0
Decontamination Metal treatment Size reduction Decay storage Recycling / reuse Other / various None		

Comment on planned treatments:

Uncompacted drums will be supercompacted before being placed in HHISOs. The waste will be encapsulated before final disposal. DSRL is investigating the feasibility of alternative waste treatment routes but no decision has been made on their use yet.

WASTE STREAM**5B315****MTR Reprocessing Plant 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	100.0	10	36

Other information:

The waste will consist of large uncompactable items and 200 litre drums that have already been compacted. DSRL is investigating the feasibility of alternative LLW Disposal Container.

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: -

RADIOACTIVITY

Source:	The source of radioactivity is from MTR fuel reprocessing work previously carried out in the facility (and also from other research reactors).
Uncertainty:	Within a factor of three.
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:	The fingerprint for the waste will be consistent with the composition of Uranyl Nitrate product liquor which typically contained U235, U234 and U238 as the predominant radionuclides by mass. To confirm the relative compositions of these species a swab of the Product Cabinet floor and a sample of contaminated concrete were taken for analysis.
Other information:	Specific Activities have been re-evaluated since the 2016 UK Inventory.

WASTE STREAM

5B315

MTR Reprocessing Plant LLW

Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2019	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			2.14E-10	CC 2	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			3.89E-05	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		1.07E-08	CC 2	
Ru 106					U 233				
Pd 107					U 234		1.10E-06	CC 2	
Ag 108m					U 235		2.93E-08	CC 2	
Ag 110m					U 236		1.40E-07	CC 2	
Cd 109			2.79E-07	CC 2	U 238		3.04E-09	CC 2	
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238		1.13E-06	CC 2	
Sn 123					Pu 239		3.95E-08	CC 2	
Sn 126					Pu 240		4.13E-08	CC 2	
Sb 125					Pu 241		2.14E-06	CC 2	
Sb 126					Pu 242				
Te 125m					Am 241		3.00E-07	CC 2	
Te 127m					Am 242m				
I 129					Am 243		1.02E-12	CC 2	
Cs 134			1.86E-09	CC 2	Cm 242				
Cs 135					Cm 243				
Cs 137			4.79E-05	CC 2	Cm 244		1.08E-08	CC 2	
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147			7.97E-08	CC 2	Cf 251				
Sm 147					Cf 252				
Sm 151			1.76E-07	CC 2	Other a				
Eu 152					Other b/g				
Eu 154			2.94E-07	CC 2	Total a	0	2.8E-06	CC 2	
Eu 155			2.18E-08	CC 2	Total b/g	0	8.97E-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