

WASTE STREAM	5B309	Materials Test Reactor 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 - 31.3.2022.....	364.0 m ³
Total future arisings:		364.0 m ³
Total waste volume:		364.0 m ³

Comment on volumes: Waste arisings align with Predictive Waste Inventory. Stocks have been removed; these will be captured under 5B15 and 5B16. It should be noted that the 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 Reactor decommissioning.

PHYSICAL CHARACTERISTICS

General description: Hard decommissioning waste produced from dismantling items of plant and concrete from the Materials Test Reactor bioshield. There may be several large items that may require special consideration either for weight or size reasons.

Physical components (%wt): Aluminium (0.07%), Asbestos (0.01%), Cementitious material (e.g. concrete) (30.78%), Copper (1.39%), Lead (2.07%), Mild Steel (64.88%), Other (0.02%), Paper (0.06%), Plastic (0.22%), Rubber (0.07%), Stainless steel (0.35%), Wood/ Wood composite (0.08%),

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.65

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

CHEMICAL COMPOSITION

General description and components (%wt): Aluminium (0.07%), Asbestos (0.01%), Cementitious material (e.g. concrete) (30.78%), Copper (1.39%), Lead (2.07%), Mild Steel (64.88%), Other (0.02%), Paper (0.06%), Plastic (0.22%), Rubber (0.07%), Stainless steel (0.35%), Wood/ Wood composite (0.08%),

Chemical state: Neutral

Chemical form of radionuclides: H-3: Likely to be present.
 C-14: Likely to be present.
 Cl-36: Likely to be present.
 I-129: Not expected to be present.
 Ra: Not expected to be present.
 Th: Not expected to be present.
 U: Not expected to be present.
 Np: Not expected to be present.
 Pu: Not expected to be present.

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

Stainless steel.....	0.35
Other ferrous metals.....	64.9
Iron.....	
Aluminium.....	0.07
Beryllium.....	
Cobalt.....	NE
Copper.....	1.4
Lead.....	2.1
Magnox/Magnesium.....	NE

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	Nickel.....	NE	
	Titanium.....		
	Uranium.....		
	Zinc.....	NE	
	Zircaloy/Zirconium.....	NE	
	Other metals.....	0.02	Not specified.
Organics (%wt):	The waste contains trace quantities of halogenated and non-halogenated plastics, rubber and cellulosic material. Not specified.		
	Total cellulose.....	0.14	
	Paper, cotton.....	0.06	
	Wood.....	0.08	
	Halogenated plastics	0.11	
	Total non-halogenated plastics.....	0.11	
	Condensation polymers.....	NE	
	Others.....	0.11	
	Organic ion exchange materials....	0	
	Total rubber.....	0.07	
	Halogenated rubber	0.04	
	Non-halogenated rubber.....	0.04	
	Hydrocarbons.....		
	Oil or grease		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar)....		
	Bitumen.....		
	Others.....		
	Other organics.....	TR	
Other materials (%wt):	-		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs.....	0	
	Soil.....	0	
	Brick/Stone/Rubble.....	0	
	Cementitious material.....	30.8	
	Sand.....		
	Glass/Ceramics.....		
	Graphite.....	TR	
	Desiccants/Catalysts.....	0	
	Asbestos.....	0.01	Site asbestos register does not specify friability
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....	0	
	Free non-aqueous liquids.....	0	

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	Powder/Ash.....	0
Inorganic anions (%wt):	Trace quantities of inorganic anions may be present dependent on operations undertaken.	
	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:	Asbestos is present.	
	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
	Active particles.....	NE
	Soluble solids as bulk chemical compounds.....	0
Hazardous substances / non hazardous pollutants:	Lead and asbestos are present	
	Acrylamide.....	
	Benzene.....	NE
	Chlorinated solvents.....	
	Formaldehyde.....	
	Organometallics.....	
	Phenol.....	NE
	Styrene.....	
	Tri-butyl phosphate.....	NE
	Other organophosphates.....	
	Vinyl chloride.....	NE
	Arsenic.....	NE

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Barium.....
 Boron..... NE
 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):

No
 EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants.....
 Total complexing agents..... 0

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	On-site	7.0
Supercompaction (HFC)		
Incineration	On-site	100.0
Solidification		
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**5B309****Materials Test Reactor 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	37

Other information:

The waste, when consigned, will mainly consist of large uncompactable items and a few compacted 200 litre drums. 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: -

WASTE STREAM**5B309****Materials Test Reactor LLW****RADIOACTIVITY**

Source:	Activation products in reactor structure and contamination of reactor components.
Uncertainty:	-
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:	Derived activity from consignment information
Other information:	Specific activity has been re-evaluated since 2016. The PWI gathers radiological information through averaging all historical consignments from MTR. This is an alternate strategy to what may have been previously used in the UKRWI.

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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			4.18E-06	C C 2	Gd 153				
Be 10					Ho 163				
C 14			1.36E-06	C C 2	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			3.26E-08	C C 2	Bi 208				
Ni 59					Bi 210m				
Ni 63			9.09E-07	C C 2	Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					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			2.17E-08	C C 2	U 235				
Ag 110m					U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137			8.76E-08	C C 2	Cm 244				
Ba 133			1.45E-07	C C 2	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					Total a	0		0	C C 2
Eu 155					Total b/g	0		6.74E-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