

WASTE STREAM	5C331	Minor Facilities Decommissioning VLLW and LA-LLW
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SITE Harwell
SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE VLLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0 m ³
Future arisings -	1.4.2022 - 31.3.2027.....	6562.5 m ³
Total future arisings:		6562.5 m ³
Total waste volume:		6562.5 m ³
Comment on volumes:	Soil and rubble will arise as buildings are decommissioned. Volumes updated for 2016 RWI to reflect SMART Inventory Review. This waste was originally part of 5C300 but this has been split to provide greater clarity.	
Uncertainty factors on volumes:	Stock (upper): x	Arisings (upper) x 2.0
	Stock (lower): x	Arisings (lower) x 0.2

WASTE SOURCE -

PHYSICAL CHARACTERISTICS

General description: Solid miscellaneous legacy VLLW and LA-LLW resulting from various legacy decommissioning projects that occurred on the Harwell Site. Minor Facility buildings on the Harwell site, contaminated as a result of past operations.

Physical components (%wt): Metal ~19%, concrete/rubble ~61%, soil ~16%, plastics ~3%, others ~1%

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.69

Comment on density: Data taken from WCH mass divided by volume

CHEMICAL COMPOSITION

General description and components (%wt): Metal ~19%, concrete/rubble ~61%, soil ~16%, plastics ~3%, others ~1%

Chemical state: -

Chemical form of radionuclides: -

Metals and alloys (%wt): There should be no sheet metal or bulk metal items present in the waste stream.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	NE		
Other ferrous metals.....	~7.0	Mild steel	
Iron.....	~11.0	Vent ducting	
Aluminium.....	NE		
Beryllium.....	NE		
Cobalt.....			
Copper.....	NE		
Lead.....	~0.02	Section lead pipe	
Magnox/Magnesium.....	NE		
Nickel.....			
Titanium.....			

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Uranium.....	NE		
Zinc.....	~0.10	Vent ducting	
Zircaloy/Zirconium.....	NE		
Other metals.....	~0.90	Undefined	
Organics (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	NE		
Paper, cotton.....	NE		
Wood.....	NE		
Halogenated plastics	TR		
Total non-halogenated plastics.....	~3.0		
Condensation polymers.....	~1.5	Secondary waste arisings i.e. soft waste which includes plastic wrap, poly sheeting, etc	
Others.....	~1.5	Secondary waste arisings i.e. soft waste which includes plastic wrap, poly sheeting, etc	
Organic ion exchange materials....	NE		
Total rubber.....	NE		
Halogenated rubber	NE		
Non-halogenated rubber.....	NE		
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	NE		
Other materials (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	NE		
Inorganic sludges and flocs.....	NE		
Soil.....	~~16.0		
Brick/Stone/Rubble.....	~61.0		
Cementitious material.....			
Sand.....			
Glass/Ceramics.....	NE		
Graphite.....	NE		
Desiccants/Catalysts.....			
Asbestos.....	~0.05		
Non/low friable.....	~0.01	Asbestos bound in mastic chrysotile (white)	
Moderately friable.....	~0.03	Asbestos rope chrysotile (white)	

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Highly friable.....	~0.01	Asbestos contamination on soft waste (PPE) chrysotile (white)
Free aqueous liquids.....		
Free non-aqueous liquids.....		
Powder/Ash.....		

Inorganic anions (%wt): -

	(%wt)	Type(s) and comment
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: -

	(%wt)	Type(s) and comment
Combustible metals.....		
Low flash point liquids.....		
Explosive materials.....		
Phosphorus.....		
Hydrides.....		
Biological etc. materials.....		
Biodegradable materials.....	0	
Putrescible wastes.....		
Non-putrescible wastes.....		
Corrosive materials.....		
Pyrophoric materials.....		
Generating toxic gases.....		
Reacting with water.....		
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances / non hazardous pollutants: ~ 2% Epoxy resin floor screed material. ~ 0.3% Silt residue from polypropylene pipework.

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		

Organometallics.....
 Phenol.....
 Styrene.....
 Tri-butyl phosphate.....
 Other organophosphates.....
 Vinyl chloride.....
 Arsenic.....
 Barium.....
 Boron..... 0
 Boron (in Boral).....
 Boron (non-Boral).....
 Cadmium.....
 Caesium.....
 Selenium.....
 Chromium.....
 Molybdenum.....
 Thallium.....
 Tin.....
 Vanadium.....
 Mercury compounds.....
 Others.....
 Electronic Electrical Equipment (EEE)
 EEE Type 1.....
 EEE Type 2.....
 EEE Type 3.....
 EEE Type 4.....
 EEE Type 5.....

Complexing agents (%wt):

(%wt) Type(s) and comment

EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants.....
 Total complexing agents.....

Potential for the waste to contain discrete items:

Not yet determined. Large Concrete Items (LCIs) may be DIs; drummed (ungROUTED)/"rubbleised" wastes assumed not DIsSoil - In & of itself not a DILarge Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs

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 Recycling / reuse Other / various None		100.0

Comment on planned treatments:

It is intended that the wastestream will be disposed of via controlled burial to an off-site landfill, therefore no waste containers will be produced.

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	100.0	0.69

Classification codes for waste expected to be consigned to a landfill facility: 17 04 05, 15 02 02*

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: -

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

Waste Packaging for Disposal: (Not applicable to this waste stream)

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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: -

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: -

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: Contamination as a result of past operations.

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: Rad data taken from WCH - 1MXN-2HAR-0-WCH-0-4241 V3 decayed four years from 2018 to 2022 for date of first arising.

Other information: -

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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			5.22E-08	CC 1	Gd 153				8
Be 10				8	Ho 163				8
C 14			4.55E-09	CC 1	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36				8	Lu 174				8
Ar 39				8	Lu 176				8
Ar 42				8	Hf 178n				8
K 40				8	Hf 182				8
Ca 41			2.07E-09	CC 2	Pt 193				8
Mn 53				8	Tl 204				8
Mn 54				8	Pb 205				8
Fe 55				8	Pb 210		2.55E-09	CC 2	
Co 60			1.14E-09	CC 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63				8	Po 210		2.2E-09	CC 2	
Zn 65				8	Ra 223				8
Se 79				8	Ra 225				8
Kr 81				8	Ra 226		2.21E-08	CC 2	
Kr 85				8	Ra 228		1.95E-09	CC 2	
Rb 87				8	Ac 227				8
Sr 90			1.39E-08	CC 1	Th 227				8
Zr 93				8	Th 228				8
Nb 91				8	Th 229				8
Nb 92				8	Th 230				8
Nb 93m				8	Th 232		5.11E-09	CC 1	
Nb 94				8	Th 234		3.68E-08	CC 1	
Mo 93				8	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99				8	U 232				8
Ru 106				8	U 233				8
Pd 107				8	U 234				8
Ag 108m				8	U 235		1.66E-09	CC 1	
Ag 110m				8	U 236				8
Cd 109				8	U 238		3.68E-08	CC 1	
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238				8
Sn 123				8	Pu 239		8E-09	CC 1	
Sn 126				8	Pu 240		8E-09	CC 1	
Sb 125				8	Pu 241		1.64E-08	CC 1	
Sb 126				8	Pu 242				8
Te 125m				8	Am 241		4.51E-09	CC 2	
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134				8	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137			5.57E-08	CC 2	Cm 244				8
Ba 133				8	Cm 245				8
La 137				8	Cm 246				8
La 138				8	Cm 248				8
Ce 144				8	Cf 249				8
Pm 145				8	Cf 250				8
Pm 147				8	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151				8	Other a				
Eu 152			1.43E-08	CC 2	Other b/g				
Eu 154				8	Total a	0	8.84E-08	CC 2	
Eu 155				8	Total b/g	0	2.02E-07	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