

<b>WASTE STREAM</b>	<b>5C326</b>	<b>Active Handling Facility Decommissioning VLLW and LA-LLW</b>
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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 <sup>3</sup>
Future arisings -	1.4.2022 - 31.3.2027.....	480.0 m <sup>3</sup>
Total future arisings:		480.0 m <sup>3</sup>
Total waste volume:		480.0 m <sup>3</sup>
Comment on volumes:	VLLW and LA-LLW soil and rubble arising from building decommissioning 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:** Low level and Very Low Level waste from post operational clear out work within the facility. The waste mainly comprises materials which have been removed during these activities, such as metal support structures and shielded cells, and various waste materials from the decommissioning of redundant plant. There are also secondary materials such as used PPE, swabs etc., associated with the management of these wastes. Land and buildings on the Harwell site, contaminated as a result of past operations.

**Physical components (%wt):** Metal ~25%, 2% concrete/rubble, 4% biodegradable, 37% plastics, 15% rubber, 10% wood, 7% other

**Sealed sources:** The waste does not contain sealed sources.

**Bulk density (t/m<sup>3</sup>):** ~0.11

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

**CHEMICAL COMPOSITION**

**General description and components (%wt):** Metal ~25%, 2% concrete/rubble, 4% biodegradable, 37% plastics, 15% rubber, 10% wood, 7% other including zinc bromide (0.5%)

**Chemical state:** -

**Chemical form of radionuclides:** -

**Metals and alloys (%wt):** -

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~11.0	Solid sheet, tubes, crushed drums	
Other ferrous metals.....	~9.0	Mild Steel - Solid sheet, tubes, crushed drums	
Iron.....			
Aluminium.....	~0.02	Solid metal sheet, tubes	
Beryllium.....	NE		
Cobalt.....			
Copper.....	~0.01	Solid metal wire, sheet	
Lead.....	~0.05	Block, sheet, container	

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Magnox/Magnesium.....	NE		
Nickel.....			
Titanium.....			
Uranium.....	TR	Traces of UDEP	
Zinc.....	~0.10	Wire, crushed drum (galvanisation) (0.1%)	
Zircaloy/Zirconium.....	NE		
Other metals.....	~4.8	Undefined	
Organics (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	~10.0		
Paper, cotton.....	0		
Wood.....	~10.0		
Halogenated plastics .....	~2.0	Sheeting, packaging, bags	
Total non-halogenated plastics.....	~35.0		
Condensation polymers.....	~17.5	Sheeting, packaging, bags	
Others.....	~17.5	Sheeting, packaging, bags	
Organic ion exchange materials....	NE		
Total rubber.....	~15.0		
Halogenated rubber .....	~7.5		
Non-halogenated rubber.....	~7.5		
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.....			
Brick/Stone/Rubble.....	~2.0		
Cementitious material.....			
Sand.....			
Glass/Ceramics.....	NE		
Graphite.....	NE		
Desiccants/Catalysts.....			
Asbestos.....	~1.0		
Non/low friable.....	~1.0	Cladding / electrical chrysotile	

(white)

- Moderately friable.....
- Highly friable.....
- 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.....	~4.0	
Putrescible wastes.....	~2.0	
Non-putrescible wastes.....	~2.0	
Corrosive materials.....		
Pyrophoric materials.....		
Generating toxic gases.....		
Reacting with water.....		
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances / non hazardous pollutants: -

	(%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..... P      100 off computers

    EEE Type 2.....

    EEE Type 3..... P      50 off Hand tools - including drills, saws etc

    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. In & of itself not a DI; waste stream may include DIs as defined elsewhere (notably any stainless steel components)

**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	Off-site	~77.0           ~23.0

Comment on planned treatments:

It is intended that 23% of 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	23.0	0.11
Expected to be consigned to a Landfill Facility		
Expected to be consigned to an On-Site Disposal Facility	77.0	0.40
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		

Classification codes for waste expected to be consigned to a landfill facility: 17 04 07, 17 06 01\*, 17 02 01, 17 02 03

**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 <sup>3</sup>	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: Data taken from WCH - 1MXN-2HAR-0-WCH-0-4355 V1 and decayed five years to start date of first arising in 2022 from 2017.

Other information: -

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**5C326**

**Active Handling Facility Decommissioning VLLW and LA-LLW**

Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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				8	Gd 153				8
Be 10				8	Ho 163				8
C 14				8	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				8	Pt 193				8
Mn 53				8	Tl 204				8
Mn 54				8	Pb 205				8
Fe 55				8	Pb 210				8
Co 60			5.18E-07	CC 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63				8	Po 210				8
Zn 65				8	Ra 223				8
Se 79				8	Ra 225				8
Kr 81				8	Ra 226				8
Kr 85				8	Ra 228				8
Rb 87				8	Ac 227				8
Sr 90			2.22E-06	CC 2	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				8
Nb 94				8	Th 234		1.2E-09	CC 2	8
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				8
Ag 110m				8	U 236				8
Cd 109				8	U 238		1.2E-09	CC 2	8
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238		9.61E-09	CC 2	8
Sn 123				8	Pu 239		2E-08	CC 2	8
Sn 126				8	Pu 240		2E-08	CC 2	8
Sb 125				8	Pu 241		7.86E-07	CC 2	8
Sb 126				8	Pu 242				8
Te 125m				8	Am 241		1.56E-07	CC 2	8
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			8.91E-06	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				8
Eu 152				8	Other b/g				8
Eu 154			2E-07	CC 2	<b>Total a</b>	<b>0</b>	<b>2.07E-07</b>	<b>CC 2</b>	<b>8</b>
Eu 155				8	<b>Total b/g</b>	<b>0</b>	<b>1.26E-05</b>	<b>CC 2</b>	<b>8</b>

**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