

WASTE STREAM	5C55	Miscellaneous Legacy LLW
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SITE Harwell
SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE LLW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	141.0m ³
Total future arisings:		0m ³
Total waste volume:		141.0m ³

Comment on volumes: -

Uncertainty factors on volumes:	Stock (upper):	x 1.1	Arisings (upper)	x
	Stock (lower):	x 0.9	Arisings (lower)	x

WASTE SOURCE Miscellaneous items arising from operations and experiments on the Harwell site. Some NDS items.

PHYSICAL CHARACTERISTICS

General description: Range of items, most not large. None.
 Physical components (%wt): Metal 94.3%; Organics 2.6%; Powder 0.3%; Inorganic anions 0.3%; Others 2.5%;
 Sealed sources: The waste does not contain sealed sources.
 Bulk density (t/m³): ~2
 Comment on density: Average density for material types

CHEMICAL COMPOSITION

General description and components (%wt): Approximate densities have been assumed to derive this from the inventory information which is in volume format. Metal 94.3%; Organics 2.6%; Powder 0.3%; Inorganic anions 0.3%; Others 2.5%;
 Chemical state: Neutral
 Chemical form of radionuclides: H-3: Unknown
 Ra: Unknown
 Th: Probably metal, oxide or nitrate.
 U: Probably metal, oxide or nitrate.
 Np: Unknown
 Pu: Probably metal, oxide or nitrate.
 Metals and alloys (%wt): Sheet metal is present in a large range of thicknesses.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	~~52.4	Steel is ~80%, the stainless/ non-stainless split is not known and has been estimated from similar streams.	
Other ferrous metals.....	~~28.0	Steel is ~80%, the stainless/ non-stainless split is not known and has been estimated from similar streams.	
Iron.....			
Aluminium.....	<0.10		
Beryllium.....			
Cobalt.....			
Copper.....	TR		
Lead.....	~2.4		
Magnox/Magnesium.....	NE		

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Nickel.....
Titanium.....
Uranium..... ~3.4 Depleted uranium ~3.4%.
Zinc..... TR
Zircaloy/Zirconium..... NE
Other metals..... ~8.0 Other unspecified metals ~8%.

Organics (%wt): The cellulose content of the waste comprises paper, cotton cloth and wood. All unidentified plastic is assumed to be halogenated plastic (e.g. PVC).

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	~0.60		
Paper, cotton.....	~0.50		
Wood.....	~0.10		
Halogenated plastics	~1.8	Halogenated plastics are PVC and PTFE	
Total non-halogenated plastics.....	TR		
Condensation polymers.....	NE		
Others.....	TR		
Organic ion exchange materials....	TR		
Total rubber.....	<0.20		
Halogenated rubber	<0.20	Rubbers are neoprene and hypalon.	
Non-halogenated rubber.....	TR		
Hydrocarbons.....			
Oil or grease			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	TR		

Other materials (%wt): Name of ion exchange resins is not known.

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	~0.50	unknown type	
Inorganic sludges and flocs.....	~0.20		
Soil.....	~0.80		
Brick/Stone/Rubble.....	~0.50		
Cementitious material.....	~0.20		
Sand.....			
Glass/Ceramics.....	~0.30		
Graphite.....	0		
Desiccants/Catalysts.....			
Asbestos.....	TR		
Non/low friable.....			

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Moderately friable.....

Highly friable.....

Free aqueous liquids..... 0

Free non-aqueous liquids..... 0

Powder/Ash..... ~0.30

Inorganic anions (%wt): TEC powder consists of chlorides. Anion content should be negligible, except as component of concrete

	(%wt)	Type(s) and comment
Fluoride.....	NE	
Chloride.....	~0.30	
Iodide.....	NE	
Cyanide.....	NE	
Carbonate.....	NE	
Nitrate.....	NE	
Nitrite.....	NE	
Phosphate.....	NE	
Sulphate.....	NE	
Sulphide.....	NE	

Materials of interest for waste acceptance criteria: Trace combustible metals mainly comprise uranium and other finely divided metals. Powder is ~0.3% TEC powder (BaCl₂/ KCl/ NaCl) and hoover bag dust.

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

Hazardous substances / non hazardous pollutants: Lead (~2.4%). Trace quantities of asbestos, barium compounds and uranium may be present.

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		

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- Chlorinated solvents.....
- Formaldehyde.....
- Organometallics.....
- Phenol.....
- Styrene.....
- Tri-butyl phosphate.....
- Other organophosphates.....
- Vinyl chloride.....
- Arsenic.....
- Barium.....
- Boron.....
 - 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): Yes

(%wt) Type(s) and comment

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

Potential for the waste to contain discrete items: No. In & of itself not a DI; waste stream may include DIs (notably any stainless steel components)

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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:

-

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	2.0

Classification codes for waste expected to be consigned to a landfill facility:

-

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:

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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	100.0	10	15

Other information: -

Waste Planned for Disposal at the LLW Repository:

Container voidage: -

Waste Characterisation Form (WCH): The waste meets the LLWR's Waste Acceptance Criteria (WAC).
The waste does not have a current WCH.

Waste consigned for disposal to LLWR in year of generation: No. Timing of waste disposal is not yet known

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 from range of waste management operations

Uncertainty: Arisings content will vary with site operations.

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: Activities measured/ estimated by a range of methods including sampling/analysis and radiation measurements.

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	1.96E-05	CC 2			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	1.17E-08	CC 2			Pb 210	2.55E-06	CC 2		
Co 60	4.01E-06	CC 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63	2.25E-05	CC 2			Po 210	2.41E-06	CC 2		
Zn 65		8			Ra 223		8		
Se 79		8			Ra 225		8		
Kr 81		8			Ra 226	1.06E-05	CC 2		
Kr 85		8			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	3.12E-04	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	1.41E-06	CC 2		
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	1.12E-06	CC 2		
Ag 108m		8			U 235	2.82E-08	CC 2		
Ag 110m		8			U 236		8		
Cd 109		8			U 238	1.41E-06	CC 2		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	7.14E-05	CC 2		
Sn 123		8			Pu 239	1.52E-05	CC 2		
Sn 126		8			Pu 240	1.37E-05	CC 2		
Sb 125	1.29E-08	CC 2			Pu 241	5.43E-05	CC 2		
Sb 126		8			Pu 242		8		
Te 125m	3.24E-09	CC 2			Am 241	1.09E-05	CC 2		
Te 127m		8			Am 242m		8		
I 129		8			Am 243		8		
Cs 134	2.23E-08	CC 2			Cm 242		8		
Cs 135		8			Cm 243		8		
Cs 137	3.41E-04	CC 2			Cm 244	1.44E-07	CC 2		
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		8			Other b/g				
Eu 154	9.58E-07	CC 2			Total a	1.27E-04	CC 2	0	
Eu 155	1.82E-07	CC 2			Total b/g	7.58E-04	CC 2	0	

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