WASTE STREAM 5C332 Harwell Care & Maintenance VLLW and LA-LLW

SITE Harwell

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE VLLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	2.2 m³
Future arisings -	1.4.2019 - 31.3.2027.....	~21.8 m³
Total future arisings:		21.8 m³
Total waste volume:		24.0 m³

Comment on volumes: Arisings dependent on future C&M programme. Arisings from future C&M operations have been estimated based on other Magnox sites.

Uncertainty factors on volumes:				
	Stock (upper):	x 1.5	Arisings (upper)	x 1.5
	Stock (lower):	x 0.5	Arisings (lower)	x 0.5

WASTE SOURCE Secondary wastes associated with C&M operations.

PHYSICAL CHARACTERISTICS

General description: Comprises waste meeting the requirements of LA-LLW or VLLW.

Physical components (%vol): Approximate estimate - Metals 35%; Organics 42.6%; Other (Soil/Rubble/Concrete/Glass/plastics/rubber) 22.4%.

Sealed sources: -

Bulk density (t/m³): 0.25

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Approximate densities have been assumed based on likely makeup of waste

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Unknown.
C-14: Unknown.
Cl-36: Probably chlorides
I-129: Probably iodides
Ra: Unknown.
Th: Probably metal, oxide or nitrate.
U: Probably metal, oxide or nitrate.
Np: Expected to be either oxide or nitrate.
Pu: Probably metal, oxide or nitrate.

Metals and alloys (%wt): Not known. Typically small items.

Stainless steel.....	~20.0
Other ferrous metals.....	~6.0
Iron.....	
Aluminium.....	~0.30
Beryllium.....	NE
Cobalt.....	
Copper.....	~4.5
Lead.....	<4.2
Magnox/Magnesium.....	NE
Nickel.....	
Titanium.....	
Uranium.....	NE

	Zinc	TR	
	Zircaloy/Zirconium	NE	
	Other metals	TR	Other unspecified metals assumed largely to be other ferrous based or stainless steel alloys.
Organics (%wt):	Miscellaneous organic liquid is listed, <0.2%.		
	Total cellulosics	~4.9	
	Paper, cotton	~4.7	
	Wood	~0.20	
	Halogenated plastics	~34.7	All unidentified plastic is assumed to be halogenated plastic (e.g. PVC).
	Total non-halogenated plastics	~2.8	
	Condensation polymers	<1.4	
	Others	<1.4	
	Organic ion exchange materials	0	
	Total rubber	~0.20	
	Halogenated rubber	<0.20	
	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):	-		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs	0	
	Soil	10.0	
	Brick/Stone/Rubble	10.0	
	Cementitious material	<1.2	
	Sand		
	Glass/Ceramics	<1.2	
	Graphite	0	
	Desiccants/Catalysts		
	Asbestos	0	
	Non/low friable		
	Moderately friable		
	Highly friable		
	Free aqueous liquids	0	
	Free non-aqueous liquids	TR	
	Powder/Ash	~0.10	

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Inorganic anions (%wt): N/A

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: Waste may contain low levels of powdery contamination (e.g from hoover bags).

Combustible metals	0
Low flash point liquids	0
Explosive materials	0
Phosphorus	0
Hydrides	0
Biological etc. materials	0
Biodegradable materials	
Putrescible wastes	0
Non-putrescible wastes	
Corrosive materials	0
Pyrophoric materials	0
Generating toxic gases	0
Reacting with water	0
Active particles	
Soluble solids as bulk chemical compounds	

Hazardous substances / non hazardous pollutants: A quantity of lead is present (~4.2%).

Acrylamide	
Benzene	
Chlorinated solvents	
Formaldehyde	
Organometallics	
Phenol	
Styrene	
Tri-butyl phosphate	
Other organophosphates	
Vinyl chloride	
Arsenic	
Barium	

Boron.....

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):

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents..... NE

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		
Recyling / reuse		
Other / various		
None		100.0

Comment on planned treatments: It is intended that that waste stream will be disposed of via controlled burial to an off-site landfill, therefore no waste containers will be produced.

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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: (Not applicable to this waste stream)

Container	Stream volume %	Waste loading m³	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: -

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

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Source:	Principally contamination from a range of operations.
Uncertainty:	The fingerprint for future C&M operations is not likely to be significantly different from past wastes, and will be derived for wastes as appropriate.
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:	Fingerprints are confirmed for individual operations using direct and indirect monitoring processes allied to specific analyses and historical knowledge.
Other information:	-

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3		8		8	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	2.94E-09	B B 2	2.94E-09	B B 2	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26		8		8	Tm 171		8		8
Cl 36		8		8	Lu 174		8		8
Ar 39		8		8	Lu 176		8		8
Ar 42		8		8	Hf 178n		8		8
K 40		8		8	Hf 182		8		8
Ca 41		8		8	Pt 193		8		8
Mn 53		8		8	Tl 204		8		8
Mn 54		8		8	Pb 205		8		8
Fe 55		8		8	Pb 210		8		8
Co 60		8		8	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63		8		8	Po 210		8		8
Zn 65		8		8	Ra 223		8		8
Se 79		8		8	Ra 225		8		8
Kr 81		8		8	Ra 226		8		8
Kr 85		8		8	Ra 228		8		8
Rb 87		8		8	Ac 227		8		8
Sr 90	4.01E-08	B B 2	4.01E-08	B B 2	Th 227		8		8
Zr 93		8		8	Th 228		8		8
Nb 91		8		8	Th 229		8		8
Nb 92		8		8	Th 230		8		8
Nb 93m		8		8	Th 232		8		8
Nb 94		8		8	Th 234		8		8
Mo 93		8		8	Pa 231		8		8
Tc 97		8		8	Pa 233		8		8
Tc 99		8		8	U 232		8		8
Ru 106		8		8	U 233		8		8
Pd 107		8		8	U 234		8		8
Ag 108m		8		8	U 235		8		8
Ag 110m		8		8	U 236		8		8
Cd 109		8		8	U 238		8		8
Cd 113m		8		8	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	2.31E-07	B B 2	2.31E-07	B B 2
Sn 123		8		8	Pu 239	1.1E-06	B B 2	1.1E-06	B B 2
Sn 126		8		8	Pu 240	1.08E-06	B B 2	1.08E-06	B B 2
Sb 125		8		8	Pu 241	2.94E-05	B B 2	2.94E-05	B B 2
Sb 126		8		8	Pu 242		8		8
Te 125m		8		8	Am 241	3.78E-06	B B 2	3.78E-06	B B 2
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134		8		8	Cm 242		8		8
Cs 135		8		8	Cm 243		8		8
Cs 137	1.57E-07	B B 2	1.57E-07	B B 2	Cm 244	1.74E-09	B B 2	1.74E-09	B B 2
Ba 133		8		8	Cm 245		8		8
La 137		8		8	Cm 246		8		8
La 138		8		8	Cm 248		8		8
Ce 144		8		8	Cf 249		8		8
Pm 145		8		8	Cf 250		8		8
Pm 147		8		8	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151		8		8	Other a				
Eu 152		8		8	Other b/g				
Eu 154		8		8	**Total a**	**6.19E-06**	**B B 2**	**6.19E-06**	**B B 2**
Eu 155		8		8	**Total b/g**	**2.96E-05**	**B B 2**	**2.96E-05**	**B B 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