WASTE STREAM 5C309 Minor Facilities Decommissioning LLW

SITE Harwell

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	19.1 m³
Future arisings -	1.4.2019 - 31.3.2026.....	128.9 m³
Total future arisings:		128.9 m³
Total waste volume:		148.0 m³

Comment on volumes: Volumes updated for 2016 RWI to reflect SMART Inventory Review

Uncertainty factors on volumes:

Stock (upper):	x 1.05	Arisings (upper)	x 1.3
Stock (lower):	x 0.95	Arisings (lower)	x 0.7

WASTE SOURCE Decommissioning waste from redundant facilities.

PHYSICAL CHARACTERISTICS

General description: Hard metallic waste from decommissioning of cells, gloveboxes, ventilation systems and pipework in facilities. The waste also includes concrete and building rubble. The waste will contain large items.

Physical components (%vol): -

Sealed sources: -

Bulk density (t/m³): ~2

Comment on density: Average density based on material types

CHEMICAL COMPOSITION

General description and components (%wt): Metal (49%), concrete and building rubble (50%), cellulose, plastics and rubber (1%).

Chemical state: Neutral

Chemical form of radionuclides: U: Form of uranium is not known, but probably comprises mainly oxide and metal plus small amounts of nitrates.

Metals and alloys (%wt): -

Stainless steel.....	P	
Other ferrous metals.....	~47.0	
Iron.....		
Aluminium.....	~0.50	
Beryllium.....	0	
Cobalt.....		
Copper.....	P	
Lead.....	~1.5	
Magnox/Magnesium.....	0	
Nickel.....		
Titanium.....		
Uranium.....	TR	
Zinc.....	NE	
Zircaloy/Zirconium.....	0	
Other metals.....	NE	Other metals includes antimony.

Organics (%wt): The waste will contain paper, wood, plastics and rubber. Halogenated plastics are PVC

and PTFE, and rubbers are hypalon and neoprene.

Total cellulosics	P
Paper, cotton	P
Wood	P
Halogenated plastics	P
Total non-halogenated plastics	P
Condensation polymers	P
Others	P
Organic ion exchange materials	NE
Total rubber	P
Halogenated rubber	P
Non-halogenated rubber	NE
Hydrocarbons	
Oil or grease	
Fuel	
Asphalt/Tarmac (cont.coal tar)	
Asphalt/Tarmac (no coal tar)	
Bitumen	
Others	
Other organics	TR

Other materials (%wt): Content of ion exchange materials expected to be (near) zero. Any sludges/ flocs will be immobilised prior to consignment as waste.

Inorganic ion exchange materials.	NE
Inorganic sludges and flocs	NE
Soil	0
Brick/Stone/Rubble	0
Cementitious material	50.0
Sand	
Glass/Ceramics	0
Graphite	0
Desiccants/Catalysts	
Asbestos	NE
Non/low friable	
Moderately friable	
Highly friable	
Free aqueous liquids	0
Free non-aqueous liquids	0
Powder/Ash	0

Inorganic anions (%wt): Waste is not expected to contain significant quantities of inorganic anions, except as a component of cement.

Fluoride	NE
Chloride	NE
Iodide	NE
Cyanide	NE
Carbonate	P
Nitrate	NE
Nitrite	NE
Phosphate	NE
Sulphate	NE
Sulphide	NE

Materials of interest for waste acceptance criteria: Lead is present as a metal and asbestos, but further investigations will be carried out as decommissioning arises. Small quantities of asbestos may be present in the waste. Trace levels of uranium are present.

Combustible metals	TR
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: -

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): Yes

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids……

Other organic complexants.....

Total complexing agents..... TR

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)		
Incineration	Off-site	~3.0
Solidification		
Decontamination	On-site	~32.0
Metal treatment		
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		~65.0

Comment on planned treatments: -

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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	65.0
Expected to be consigned to an On-Site Disposal Facility	
Expected to be consigned to an Incineration Facility	3.0
Expected to be consigned to a Metal Treatment Facility	
Expected to be consigned as Out of Scope	32.0
Expected to be recycled / reused	
Disposal route not known	

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:	Activity will principally be due to contamination from a wide range of sources.
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:	-
Other information:	The quantity of 'other beta/gamma' radionuclides in future arisings will be present in insignificant activities.

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Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	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	1.12E-09	B B 2	1.12E-09	B B 2	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14		8		8	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	3.36E-06	B B 2	3.36E-06	B B 2
Co 60	7.82E-07	B B 2	7.82E-07	B B 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63		8		8	Po 210	3.18E-06	B B 2	3.18E-06	B B 2
Zn 65		8		8	Ra 223		8		8
Se 79		8		8	Ra 225		8		8
Kr 81		8		8	Ra 226	1.4E-05	B B 2	1.4E-05	B B 2
Kr 85		8		8	Ra 228	3.71E-07	B B 2	3.71E-07	B B 2
Rb 87		8		8	Ac 227		8		8
Sr 90	2.55E-06	B B 2	2.55E-06	B B 2	Th 227		8		8
Zr 93		8		8	Th 228	2.87E-07	B B 2	2.87E-07	B B 2
Nb 91		8		8	Th 229		8		8
Nb 92		8		8	Th 230		8		8
Nb 93m		8		8	Th 232	5.6E-07	B B 2	5.6E-07	B B 2
Nb 94		8		8	Th 234	2.4E-06	B B 2	2.4E-06	B B 2
Mo 93		8		8	Pa 231		8		8
Tc 97		8		8	Pa 233	3E-08	B B 2	3E-08	B B 2
Tc 99		8		8	U 232		8		8
Ru 106		8		8	U 233		8		8
Pd 107		8		8	U 234	1.2E-06	B B 2	1.2E-06	B B 2
Ag 108m		8		8	U 235	4.5E-06	B B 2	4.5E-06	B B 2
Ag 110m		8		8	U 236		8		8
Cd 109		8		8	U 238	2.4E-06	B B 2	2.4E-06	B B 2
Cd 113m		8		8	Np 237	3E-08	B B 2	3E-08	B B 2
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	2.1E-07	B B 2	2.1E-07	B B 2
Sn 123		8		8	Pu 239	3.9E-07	B B 2	3.9E-07	B B 2
Sn 126		8		8	Pu 240	2.3E-07	B B 2	2.3E-07	B B 2
Sb 125	6.4E-09	B B 2	6.4E-09	B B 2	Pu 241	7.33E-06	B B 2	7.33E-06	B B 2
Sb 126		8		8	Pu 242		8		8
Te 125m	1.6E-09	B B 2	1.6E-09	B B 2	Am 241	5.09E-06	B B 2	5.09E-06	B B 2
Te 127m		8		8	Am 242m		8		8
I 129	6.8E-08	B B 2	6.8E-08	B B 2	Am 243		8		8
Cs 134		8		8	Cm 242		8		8
Cs 135		8		8	Cm 243		8		8
Cs 137	9.11E-06	B B 2	9.11E-06	B B 2	Cm 244	2.26E-08	B B 2	2.26E-08	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	1.3E-08	B B 2	1.3E-08	B B 2	Other b/g				
Eu 154	3.57E-08	B B 2	3.57E-08	B B 2	**Total a**	**3.21E-05**	**B B 2**	**3.21E-05**	**B B 2**
Eu 155	9.96E-09	B B 2	9.96E-09	B B 2	**Total b/g**	**2.61E-05**	**B B 2**	**2.61E-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