WASTE STREAM 5C309 Minor Facilities Decommissioning LLW

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.....	19.1 m³
Future arisings -	1.4.2022 - 31.3.2023.....	21.5 m³
	1.4.2023 - 31.3.2027.....	107.4 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: The waste does not contain 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): -

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
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		

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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.

	(%wt)	Type(s) and comment	% of total C14 activity
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.

	(%wt)	Type(s) and comment	% of total C14 activity
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.

	(%wt)	Type(s) and comment
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.

	(%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.....	0	
Putrescible wastes.....	0	
Non-putrescible wastes.....		
Corrosive materials.....	0	
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: -

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

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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): 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: Not yet determined. Large Concrete Items (LCIs) may be DIs; drummed (ungrouted)/"rubbleised" wastes assumed NOT DIsLarge Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIs

TREATMENT, PACKAGING AND DISPOSAL

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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: -

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	65.0	2.0
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility	3.0	0.40
Expected to be consigned to a Metal Treatment Facility		
Expected to be consigned as Out of Scope	32.0	2.0
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 01 01

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 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: -

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: 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 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3		8		8	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	4.29E-06	B B 2	4.29E-06	B B 2
Co 60	5.27E-07	B B 2	5.27E-07	B B 2	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63		8		8	Po 210	4.12E-06	B B 2	4.12E-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	4.28E-07	B B 2	4.28E-07	B B 2
Rb 87		8		8	Ac 227		8		8
Sr 90	2.37E-06	B B 2	2.37E-06	B B 2	Th 227		8		8
Zr 93		8		8	Th 228	3.66E-07	B B 2	3.66E-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	2.05E-07	B B 2	2.05E-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	3.01E-09	B B 2	3.01E-09	B B 2	Pu 241	6.34E-06	B B 2	6.34E-06	B B 2
Sb 126		8		8	Pu 242		8		8
Te 125m		8		8	Am 241	5.1E-06	B B 2	5.1E-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	8.5E-06	B B 2	8.5E-06	B B 2	Cm 244	2.02E-08	B B 2	2.02E-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	1.12E-08	B B 2	1.12E-08	B B 2	Other b/g				
Eu 154	2.8E-08	B B 2	2.8E-08	B B 2	**Total a**	**3.31E-05**	**B B 2**	**3.31E-05**	**B B 2**
Eu 155	6.49E-09	B B 2	6.49E-09	B B 2	**Total b/g**	**2.5E-05**	**B B 2**	**2.5E-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