WASTE STREAM 5C316 Solid Waste Complex Decommissioning LLW

SITE Harwell

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	0 m³
Future arisings -	1.4.2023 - 31.3.2049.....	2771.0 m³
Total future arisings:		2771.0 m³
Total waste volume:		2771.0 m³

Comment on volumes: Arisings due to decommissioning in the Solid Waste Complex. Volumes updated for 2016 RWI to reflect SMART Inventory Review

Uncertainty factors on volumes:

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

WASTE SOURCE Decommissioning of the solid waste complex.

PHYSICAL CHARACTERISTICS

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

Physical components (%vol): Metal, concrete and building rubble, cellulose, plastics and rubber.

Sealed sources: -

Bulk density (t/m³): ~2

Comment on density: Density based on density of a similar waste stream.

CHEMICAL COMPOSITION

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

Chemical state: Neutral

Chemical form of radionuclides: H-3: Activation product.
Ra: Decay product of fuel and sources.
Th: Present due to contamination as a metal or oxide
U: Present due to fuel contamination as metal or oxide.
Pu: Activation of fuel.

Metals and alloys (%wt): -

Stainless steel.....	P
Other ferrous metals.....	~30.0
Iron.....	
Aluminium.....	P
Beryllium.....	
Cobalt.....	
Copper.....	P
Lead.....	P
Magnox/Magnesium.....	TR
Nickel.....	
Titanium.....	
Uranium.....	
Zinc.....	NE
Zircaloy/Zirconium.....	TR

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	Other metals	NE	Antimony and uranium may also be present.
Organics (%wt):	-		
	Total cellulosics	10.0	
	Paper, cotton	P	
	Wood	~10.0	
	Halogenated plastics	P	PVC and PTFE
	Total non-halogenated plastics	NE	
	Condensation polymers	NE	
	Others	NE	
	Organic ion exchange materials	NE	
	Total rubber	P	
	Halogenated rubber	P	Hypalon and neoprene
	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):	-		
	Inorganic ion exchange materials.	NE	
	Inorganic sludges and flocs	NE	
	Soil	NE	
	Brick/Stone/Rubble	P	
	Cementitious material	~60.0	
	Sand		
	Glass/Ceramics	0	
	Graphite	0	
	Desiccants/Catalysts		
	Asbestos	0	
	Non/low friable		
	Moderately friable		
	Highly friable		
	Free aqueous liquids	0	
	Free non-aqueous liquids	0	
	Powder/Ash	0	
Inorganic anions (%wt):	Carbonate present in concrete.		

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: -

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: -

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	Off-site	~~1.0
Solidification		
Decontamination		
Metal treatment	Off-site	~2.0
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		97.0

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	97.0
Expected to be consigned to an On-Site Disposal Facility	
Expected to be consigned to an Incineration Facility	1.0
Expected to be consigned to a Metal Treatment Facility	2.0
Expected to be consigned as Out of Scope	
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

WASTE STREAM	5C316	Solid Waste Complex Decommissioning LLW

Source:	The radionuclide fingerprint (future arisings only) for this waste stream has been updated using data from waste stream 5C39.
Uncertainty:	The above radionuclides are expected to be present but dominated by Co60 and Cs137. Full characterisation will be undertaken near to the start of decommissioning.
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:	The above radionuclides are expected to be present but dominated by Co60 and Cs137. Full characterisation will be undertaken near to the start of decommissioning.
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			3.86E-06	C C 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			1.19E-08	C C 2	Pb 205				8
Fe 55				6	Pb 210				8
Co 60			2.23E-05	C C 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63				6	Po 210				8
Zn 65			2.45E-08	C C 2	Ra 223				8
Se 79				8	Ra 225				8
Kr 81				8	Ra 226			1.42E-08	C C 2
Kr 85				8	Ra 228			9.97E-08	C C 2
Rb 87				8	Ac 227				8
Sr 90			3.31E-05	C C 2	Th 227				8
Zr 93				8	Th 228			4.09E-08	C C 2
Nb 91				8	Th 229				8
Nb 92				8	Th 230				8
Nb 93m				8	Th 232			3.29E-07	C C 2
Nb 94				8	Th 234			3.14E-07	C C 2
Mo 93				8	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99				8	U 232				8
Ru 106			1.29E-07	C C 2	U 233				8
Pd 107				8	U 234			9.71E-08	C C 2
Ag 108m				8	U 235			2.37E-08	C C 2
Ag 110m				8	U 236				6
Cd 109				8	U 238			3.14E-07	C C 2
Cd 113m				6	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238			5.66E-07	C C 2
Sn 123				8	Pu 239			3.29E-06	C C 2
Sn 126				8	Pu 240			3E-07	C C 2
Sb 125				8	Pu 241			4.74E-05	C C 2
Sb 126				8	Pu 242				8
Te 125m				8	Am 241			5.6E-06	C C 2
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134			1.74E-07	C C 2	Cm 242				6
Cs 135				8	Cm 243				8
Cs 137			5.2E-05	C C 2	Cm 244			1.53E-07	C C 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				6	Other b/g				
Eu 154			1.3E-06	C C 2	**Total a**	**0**		**1.07E-05**	**C C 2**
Eu 155			5.4E-07	C C 2	**Total b/g**	**0**		**1.61E-04**	**C C 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