

WASTE STREAM	5C314	LETP Decommissioning LLW
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SITE Harwell
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Magnox Limited
WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	855.6 m ³
Total future arisings:		0 m ³
Total waste volume:		855.6 m ³
Comment on volumes:	-	
Uncertainty factors on volumes:	Stock (upper): x 1.05	Arisings (upper) x
	Stock (lower): x 0.95	Arisings (lower) x

WASTE SOURCE Decommissioning of LETP facility.

PHYSICAL CHARACTERISTICS

General description: Building rubble, concrete, metal and organic material from the decommissioning of buildings, tanks, over-ground and underground structures at the LETP.

Physical components (%vol): Metal (36%), concrete/building rubble (19%), Soil (13%), biodegradables (3%), plasterboard (1%), plastics (15%), rubber (2%), wood (2%), other organic (3%), others (6%) including asbestos and glass.

Sealed sources: -

Bulk density (t/m³): ~1.01

Comment on density: Taken from WCH mass divided by volume

CHEMICAL COMPOSITION

General description and components (%wt): Metal (36%), concrete/building rubble (19%), Soil (13%), biodegradables (3%), plasterboard (1%), plastics (15%), rubber (2%), wood (2%), other organic (3%), others (6%) including asbestos and glass

Chemical state: Neutral

Chemical form of radionuclides: Ra: Present as a decay product of fuel.
U: Present as a metal or an oxide.
Pu: Present as metal, oxide or nitrate

Metals and alloys (%wt): -

Stainless steel.....	~17.4	Plate pieces, pipework
Other ferrous metals.....	~17.4	Mild steel - Drums, tank pieces, pipework
Iron.....	~1.1	Plant, equipment, tank pieces, pipework
Aluminium.....	TR	Contaminant in grout, vent work
Beryllium.....		
Cobalt.....		
Copper.....	TR	Alloy in metals
Lead.....	P	
Magnox/Magnesium.....	TR	Steel and grout
Nickel.....	TR	Alloy in metals
Titanium.....	TR	Alloy in metals
Uranium.....		
Zinc.....	TR	Alloy in metals
Zircaloy/Zirconium.....	TR	

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	Other metals.....	TR	Trace amounts of uranium metal may be present.
Organics (%wt):	The halogenated plastics present are PVC and PTFE. The halogenated rubbers present are hypalon and neoprene.		
	Total cellulotics.....	2.0	
	Paper, cotton.....	P	
	Wood.....	~2.0	
	Halogenated plastics	~1.0	Soft waste / PPE / Wrapping PVC and PTFE
	Total non-halogenated plastics.....	7.0	
	Condensation polymers.....	~0	
	Others.....	~7.0	Soft waste / PPE / Wrapping
	Organic ion exchange materials....	7.0	Soft waste / PPE / Wrapping
	Total rubber.....	~2.0	
	Halogenated rubber	~1.0	Hypalon and neoprene
	Non-halogenated rubber.....	~1.0	
	Hydrocarbons.....		
	Oil or grease		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar)....		
	Bitumen.....		
	Others.....		
	Other organics.....	3.0	Undefined
Other materials (%wt):	-		
	Inorganic ion exchange materials.	NE	
	Inorganic sludges and flocs.....	NE	
	Soil.....	13.0	
	Brick/Stone/Rubble.....	~19.0	
	Cementitious material.....		
	Sand.....		
	Glass/Ceramics.....	~5.0	Mylar and glass. Glass reinforced plastic (GRP) from removal of the HLA tanks
	Graphite.....	0	
	Desiccants/Catalysts.....		
	Asbestos.....	0.05	
	Non/low friable.....	~0.05	Building cladding (bound) chrysotile (white)
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....	0	
	Free non-aqueous liquids.....	0	
	Powder/Ash.....	0	
Inorganic anions (%wt):	Carbonates present in concrete.		

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Fluoride.....	0	
Chloride.....	0	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	P	
Nitrate.....	0	
Nitrite.....	0	
Phosphate.....	TR	Grout
Sulphate.....	0	
Sulphide.....	0	

Materials of interest for waste acceptance criteria:

Trace amounts of uranium metal may be present.

Combustible metals.....	TR
Low flash point liquids.....	0
Explosive materials.....	0
Phosphorus.....	0
Hydrides.....	0
Biological etc. materials.....	0
Biodegradable materials.....	3.0
Putrescible wastes.....	~1.0
Non-putrescible wastes.....	~2.0
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.....

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Cadmium.....		
Caesium.....		
Selenium.....		
Chromium.....	TR	Alloy in metals
Molybdenum.....	TR	Alloy in metals
Thallium.....		
Tin.....	TR	Alloy in metals
Vanadium.....	TR	Alloy in metals
Mercury compounds.....		
Others.....		
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	P	15 off Wiring and removal of ECU from grouting plant, small components from Brokk.
EEE Type 2.....	P	30 off Wiring and removal of ECU from grouting plant, small components from Brokk.
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	Off-site	~~7.0
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		~~93.0

Comment on planned treatments:

92% of this stream is expected to be disposed to landfill

WASTE STREAM**5C314****LETP Decommissioning LLW****Disposal Routes:**

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	1.0
Expected to be consigned to a Landfill Facility	92.0
Expected to be consigned to an On-Site Disposal Facility	
Expected to be consigned to an Incineration Facility	7.0
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	

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:

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	1.0	10	< 1
2m box (no shielding)			
4m box (no shielding)			
Other			

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 has a current WCH.

WCF needs to be revised to cover the full range of decommissioning wastes.

Waste consigned for disposal to LLWR in year of generation:

Yes.

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: -

WASTE STREAM**5C314****LETP Decommissioning LLW****RADIOACTIVITY**

Source:	Activity in waste has arisen from the treatment of liquid effluent.
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:	Rad data taken from WCH - 1RSR-2HAR-0-WCH-0-4034 and decayed 2 years.
Other information:	-

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Nuclide	Mean radioactivity, TBq/m ³			Nuclide	Mean radioactivity, TBq/m ³		
	Waste at 1.4.2019	Bands and Code	Future arisings		Waste at 1.4.2019	Bands and Code	Future arisings
H 3	5.00E-06	CC 1		Gd 153		8	
Be 10		8		Ho 163		8	
C 14	4.76E-08	CC 1		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	8.61E-07	CC 1		Pb 210	2.85E-08	CC 2	
Co 60	6.79E-08	CC 2		Bi 208		8	
Ni 59		8		Bi 210m		8	
Ni 63	7.24E-06	CC 1		Po 210	2.10E-08	CC 2	
Zn 65		8		Ra 223		8	
Se 79		8		Ra 225		8	
Kr 81		8		Ra 226	4.80E-07	CC 1	
Kr 85		8		Ra 228	1.95E-08	CC 2	
Rb 87		8		Ac 227		8	
Sr 90	1.24E-05	CC 1		Th 227		8	
Zr 93		8		Th 228	5.94E-09	CC 1	
Nb 91		8		Th 229		8	
Nb 92		8		Th 230		8	
Nb 93m		8		Th 232	9.1E-08	CC 1	
Nb 94		8		Th 234	7.53E-07	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	7.54E-07	CC 1	
Ag 108m		8		U 235	3.25E-08	CC 1	
Ag 110m		8		U 236	2.37E-09	CC 1	
Cd 109		8		U 238	7.53E-07	CC 1	
Cd 113m		8		Np 237		8	
Sn 119m		8		Pu 236		8	
Sn 121m		8		Pu 238	7.28E-07	CC 1	
Sn 123		8		Pu 239	5.69E-06	CC 1	
Sn 126		8		Pu 240	2.97E-06	CC 1	
Sb 125		8		Pu 241	7.58E-06	CC 1	
Sb 126		8		Pu 242		8	
Te 125m		8		Am 241	6.22E-06	CC 2	
Te 127m		8		Am 242m		8	
I 129		8		Am 243		8	
Cs 134		8		Cm 242	2.19E-09	CC 1	
Cs 135		8		Cm 243	7.05E-07	CC 1	
Cs 137	8.84E-06	CC 2		Cm 244	6.73E-07	CC 1	
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	1.38E-09	CC 2		Other b/g			
Eu 154	6.48E-09	CC 2		Total a	1.91E-05	CC 2	0
Eu 155	3.99E-09	CC 2		Total b/g	4.28E-05	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