

WASTE STREAM	2C932	Graphite Handling Facility LLW
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SITE Chapelcross
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Magnox Limited
WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	23.6 m ³
Total future arisings:		0 m ³
Total waste volume:		23.6 m ³
Comment on volumes:	-	
Uncertainty factors on volumes:	Stock (upper): x 1.2	Arisings (upper) x
	Stock (lower): x 0.8	Arisings (lower) x

WASTE SOURCE Wastes from the demolition of the Graphite Handling Facility (GHF) will incorporate a number of different materials. All waste will be segregated into its constituent material.

PHYSICAL CHARACTERISTICS

General description: Wastes from the demolition of the Graphite Handling Facility (GHF) will incorporate a number of different materials. All waste will be segregated into its constituent material. The constituents of the building that have been assessed as active waste include steel crane runway rails, steel crane parts, steel floor chequer plates, galvanised steel vent ducting, doors/windows frames, concrete floor slabs, bricks and concrete, glass/porcelain and redundant plant. The waste will also include the PPE used for the final demolition of the building, which will take the form of PVC gloves, polythene sheeting, disposable wipes/swabs and PVC tape.

Physical components (%wt): Metals (10%), concrete/rubble (42%), Plasterboard (3%), Plastics (non-halogenated) (7%), Rubber (7%), Wood (21%), other organic (4%), Glass/porcelain (6%)

Sealed sources: -

Bulk density (t/m³): ~2.1

Comment on density: Calculated from WCH mass and volume

CHEMICAL COMPOSITION

General description and components (%wt): Metals (10%), concrete/rubble (42%), Plasterboard (3%), Plastics (non-halogenated) (7%), Rubber (7%), Wood (21%), other organic (4%), Glass/porcelain (6%)

Chemical state: Neutral

Chemical form of radionuclides: -

Metals and alloys (%wt): -

Stainless steel.....		
Other ferrous metals.....		
Iron.....	9.3	In metals
Aluminium.....		
Beryllium.....		
Cobalt.....		
Copper.....	0.32	Pipes
Lead.....		
Magnox/Magnesium.....		
Nickel.....	0.01	In metals
Titanium.....		
Uranium.....		

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	Zinc.....	0.31	In galvanised steel
	Zircaloy/Zirconium.....		
	Other metals.....		
Organics (%wt):	-		
	Total cellulosics.....	21.0	
	Paper, cotton.....		
	Wood.....	21.0	
	Halogenated plastics		
	Total non-halogenated plastics.....	7.0	Polythene sheeting
	Condensation polymers.....	3.5	Polythene sheeting
	Others.....	3.5	Polythene sheeting
	Organic ion exchange materials....		
	Total rubber.....	7.0	
	Halogenated rubber	3.5	
	Non-halogenated rubber.....	3.5	
	Hydrocarbons.....		
	Oil or grease		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar)....		
	Bitumen.....		
	Others.....		
	Other organics.....	4.0	
Other materials (%wt):	Plasterboard (3%)		
	Inorganic ion exchange materials.		
	Inorganic sludges and flocs.....		
	Soil.....		
	Brick/Stone/Rubble.....		
	Cementitious material.....	42.0	
	Sand.....		
	Glass/Ceramics.....	6.0	
	Graphite.....		
	Desiccants/Catalysts.....		
	Asbestos.....		
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....		
	Free non-aqueous liquids.....		
	Powder/Ash.....		
Inorganic anions (%wt):	-		

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Fluoride.....
 Chloride.....
 Iodide.....
 Cyanide.....
 Carbonate.....
 Nitrate.....
 Nitrite.....
 Phosphate.....
 Sulphate.....
 Sulphide.....

Materials of interest for
 waste acceptance criteria:

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

0.02m2

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..... 0.02 In metals
 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.....

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	Off-site	4.0
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		96.0

Comment on planned treatments:

96% is assumed to go VLLW landfill

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Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	96.0
Expected to be consigned to a Landfill Facility	
Expected to be consigned to an On-Site Disposal Facility	4.0
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	

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 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			
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:	-
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:	Samples were taken including a mixture of concrete floor scabble samples, twin cores (for depth profiles) and swabs of areas that could accumulate activity such as the ventilation ducting, the crane rails and floor chequer plates. The location of the samples was determined by following a DQO process. Analysis included: <ul style="list-style-type: none">• Gamma spectrometry;• Measurement via liquid scintillation counting for C-14, Cl-36, Ca-41, Ca-45, Fe-55, Ni-63, Sr-90, total tritium content; and• Gross alpha and beta determination in solids by gas flow proportional counting.
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	4.48E-07	CC 1		Gd 153		8	
Be 10		8		Ho 163		8	
C 14	4.43E-07	CC 1		Ho 166m		8	
Na 22		8		Tm 170		8	
Al 26		8		Tm 171		8	
Cl 36	6.5E-08	CC 1		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	5.84E-08	CC 1		Pb 210		8	
Co 60	6.55E-08	CC 2		Bi 208		8	
Ni 59		8		Bi 210m		8	
Ni 63	2.18E-07	CC 1		Po 210		8	
Zn 65		8		Ra 223		8	
Se 79		8		Ra 225		8	
Kr 81		8		Ra 226		8	
Kr 85		8		Ra 228		8	
Rb 87		8		Ac 227		8	
Sr 90	1.01E-07	CC 1		Th 227		8	
Zr 93		8		Th 228		8	
Nb 91		8		Th 229		8	
Nb 92		8		Th 230		8	
Nb 93m		8		Th 232		8	
Nb 94		8		Th 234		8	
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		8	
Ag 108m		8		U 235		8	
Ag 110m		8		U 236		8	
Cd 109		8		U 238		8	
Cd 113m		8		Np 237		8	
Sn 119m		8		Pu 236		8	
Sn 121m		8		Pu 238		8	
Sn 123		8		Pu 239		8	
Sn 126		8		Pu 240		8	
Sb 125		8		Pu 241		8	
Sb 126		8		Pu 242		8	
Te 125m		8		Am 241	3.31E-09	CC 2	
Te 127m		8		Am 242m		8	
I 129		8		Am 243		8	
Cs 134		8		Cm 242		8	
Cs 135		8		Cm 243		8	
Cs 137	2.04E-07	CC 2		Cm 244		8	
Ba 133	9.56E-09	CC 2		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		8		Other b/g			
Eu 154		8		Total a	3.31E-09	CC 1	0
Eu 155		8		Total b/g	1.61E-06	CC 1	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