

<b>WASTE STREAM</b>	<b>2C932</b>	<b>Graphite Handling Facility LLW</b>
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**SITE** Chapelcross  
**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.....	20.7 m <sup>3</sup>
Total future arisings:		0 m <sup>3</sup>
Total waste volume:		20.7 m <sup>3</sup>
Comment on volumes:	-	
Uncertainty factors on volumes:	Stock (upper):	x 1.2
	Stock (lower):	x 0.8
	Arisings (upper):	x
	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:** The waste does not contain sealed sources.

**Bulk density (t/m<sup>3</sup>):** ~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):** -

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....			
Other ferrous metals.....			
Iron.....	9.3	In metals	
Aluminium.....			
Beryllium.....			
Cobalt.....			
Copper.....	0.32	Pipes	
Lead.....			
Magnox/Magnesium.....			

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Nickel.....	0.01	In metals	
Titanium.....			
Uranium.....			
Zinc.....	0.31	In galvanised steel	
Zircaloy/Zirconium.....			
Other metals.....			
Organics (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
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%)		
	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..			
Inorganic sludges and flocs.....			
Soil.....			
Brick/Stone/Rubble.....	3.0	Plasterboard	
Cementitious material.....	42.0		
Sand.....			
Glass/Ceramics.....	6.0		
Graphite.....			
Desiccants/Catalysts.....			
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			

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Highly friable.....  
 Free aqueous liquids.....  
 Free non-aqueous liquids.....  
 Powder/Ash.....

Inorganic anions (%wt): -

(%wt) Type(s) and comment

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

Materials of interest for waste acceptance criteria: -

(%wt) Type(s) and comment

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.....  
 Higher activity particles.....  
 Soluble solids as bulk chemical compounds.....

0  
  
  
  
  
  
  
  
  
  
  
P 0.02m2

Hazardous substances / non hazardous pollutants: -

(%wt) Type(s) and comment

Acrylamide.....  
 Benzene.....  
 Chlorinated solvents.....  
 Formaldehyde.....

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Organometallics.....		
Phenol.....		
Styrene.....		
Tri-butyl phosphate.....		
Other organophosphates.....		
Vinyl chloride.....		
Arsenic.....		
Barium.....		
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
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):

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....		
Total complexing agents.....		

Potential for the waste to contain discrete items:      Yes. Large Concrete Items (LCIs) may be DIs; drummed (ungROUTED)/"rubbleised" wastes assumed NOT DIs. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIsVLLW - n/a, DI concept applies only to Disposal at LLWR; by definition LLWR will not accept VLLW materials

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**TREATMENT, PACKAGING AND DISPOSAL**

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

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

Comment on planned treatments:

96% is assumed to go VLLW landfill

**Disposal Routes:**

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	96.0	2.1
Expected to be consigned to a Landfill Facility		
Expected to be consigned to an On-Site Disposal Facility	4.0	1.4
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		

Classification codes for waste expected to be consigned to a landfill facility: 17 04 07, 17 01 01, 17 02 02, 17 02 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 m <sup>3</sup>	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: -

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:• 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 <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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	3.78E-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	2.73E-08	CC 1			Pb 210		8		
Co 60	4.42E-08	CC 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63	2.13E-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	9.40E-08	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	3.29E-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	1.91E-07	CC 2			Cm 244		8		
Ba 133	7.85E-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			<b>Total a</b>	<b>3.29E-09</b>	<b>CC 1</b>	<b>0</b>	
Eu 155		8			<b>Total b/g</b>	<b>1.46E-06</b>	<b>CC 1</b>	<b>0</b>	

**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