

WASTE STREAM	2C921	Ponds 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.....	0 m ³
Future arisings -	1.4.2019 - 31.3.2026.....	1900.6 m ³
Total future arisings:		1900.6 m ³
Total waste volume:		1900.6 m ³

Comment on volumes: The four reactors at Chapelcross ceased generating in the period from August 2001 (R1) to February 2004 (R2).

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 1.2
 Stock (lower): x Arisings (lower) x 0.8

WASTE SOURCE Waste from Chapelcross Ponds Areas and also from decontamination centre, active workshop, loco shed and rail system. Soil is from remediation of 6 km effluent line.

PHYSICAL CHARACTERISTICS

General description: Much of this is concrete arising from main Pond Complex building. Other wastes include non compactable plant from decontamination centre, active workshop, flask cleaning area and pond corridors etc. There will be some secondary waste.

Physical components (%wt): Metal (~68%), incinerables (plastic non halogenated (~7%), rubber (~7%), wood (~7%), other organics (~7%), concrete/rubble (~2%) & soil (~2%)

Sealed sources: -

Bulk density (t/m³): ~0.7

Comment on density: Density of 0.7t/m³ is an initial estimate subject to confirmation.

CHEMICAL COMPOSITION

General description and components (%wt): Metal (~68%), incinerables (plastic non halogenated (~7%), rubber (~7%), wood (~7%), other organics (~7%), concrete/rubble (~2%) & soil (~2%)

Chemical state: Neutral

Chemical form of radionuclides: H-3: The chemical form of tritium has not been determined.
 C-14: The chemical form of carbon 14 has not been determined.
 Se-79: The chemical form of selenium has not been determined.
 Tc-99: The chemical form of technetium has not been determined.
 Ra: Radium isotope content is expected to be insignificant.
 Th: The thorium content is insignificant.
 U: Uranium isotope content is expected to be insignificant.
 Np: Neptunium isotope content is expected to be insignificant.
 Pu: Chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): This waste stream will contain waste of various sizes and thicknesses.

Stainless steel.....	NE	
Other ferrous metals.....	~67.6	
Iron.....		
Aluminium.....	0.40	Cable Trays, Scaffolding poles
Beryllium.....	NE	
Cobalt.....		
Copper.....	TR	
Lead.....	0	
Magnox/Magnesium.....	0	

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	Nickel.....	
	Titanium.....	
	Uranium.....	NE
	Zinc.....	0
	Zircaloy/Zirconium.....	0
	Other metals.....	NE
Organics (%wt):	-	
	Total cellulose.....	7.0
	Paper, cotton.....	0
	Wood.....	~7.0
	Halogenated plastics	0
	Total non-halogenated plastics.....	~7.0
	Condensation polymers.....	~3.5
	Others.....	~3.5
	Organic ion exchange materials....	0
	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.....	~7.0
Other materials (%wt):	-	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs.....	0
	Soil.....	~2.0
	Brick/Stone/Rubble.....	0
	Cementitious material.....	~2.0
	Sand.....	
	Glass/Ceramics.....	0
	Graphite.....	0
	Desiccants/Catalysts.....	
	Asbestos.....	<1.0
	Non/low friable.....	<1.0
	Moderately friable.....	
	Highly friable.....	
	Free aqueous liquids.....	0
	Free non-aqueous liquids.....	0

Asbestos in cement cladding
chrysotile (white)

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	Powder/Ash.....	0
Inorganic anions (%wt):	-	
	Fluoride.....	NE
	Chloride.....	NE
	Iodide.....	NE
	Cyanide.....	NE
	Carbonate.....	NE
	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:	Asbestos (inconsequential quantity).	
	Acrylamide.....	
	Benzene.....	
	Chlorinated solvents.....	
	Formaldehyde.....	
	Organometallics.....	
	Phenol.....	
	Styrene.....	
	Tri-butyl phosphate.....	
	Other organophosphates.....	
	Vinyl chloride.....	
	Arsenic.....	

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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 Solidification Decontamination	Off-site	~25.0
Metal treatment Size reduction Decay storage Recycling / reuse Other / various	Off-site	~10.0
None		~65.0

Comment on planned treatments:

50% of the stream is expected to be disposed of as VLLW to landfill

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Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository	15.0
Expected to be consigned to a Landfill Facility	50.0
Expected to be consigned to an On-Site Disposal Facility	
Expected to be consigned to an Incineration Facility	25.0
Expected to be consigned to a Metal Treatment Facility	10.0
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:

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	~15.0	~10	29
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.

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:	Activation and contamination of materials.
Uncertainty:	Activity values are current best estimates. Specific activity is a function of operating history. The values are indicative of the activities that would be expected.
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:	WCH REF: 1MXN-1CHA-0-WCH-0-4199
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	Bands and Code		Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3			7.61E-07	CC 1	Gd 153				8
Be 10				8	Ho 163				8
C 14			1.04E-06	CC 1	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			6.6E-09	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			5.89E-07	CC 1	Pb 210				8
Co 60			3.51E-07	CC 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			1.75E-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			6.6E-06	CC 1	Th 227				8
Zr 93				8	Th 228		5.51E-09	CC 2	
Nb 91				8	Th 229				8
Nb 92				8	Th 230				8
Nb 93m				8	Th 232				8
Nb 94				8	Th 234		2.09E-09	CC 2	
Mo 93				8	Pa 231				8
Tc 97				8	Pa 233				8
Tc 99			9.31E-09	CC 1	U 232		1.06E-08	CC 1	
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		2.09E-09	CC 2	
Cd 113m				8	Np 237				8
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238		1.42E-07	CC 2	
Sn 123				8	Pu 239		1.81E-07	CC 2	
Sn 126				8	Pu 240		2.23E-07	CC 2	
Sb 125			6.6E-09	CC 2	Pu 241		5.09E-06	CC 1	
Sb 126				8	Pu 242				8
Te 125m			1.65E-09	CC 2	Am 241		1.01E-06	CC 2	
Te 127m				8	Am 242m				8
I 129				8	Am 243				8
Cs 134			7.21E-09	CC 2	Cm 242				8
Cs 135				8	Cm 243				8
Cs 137			1.69E-05	CC 2	Cm 244		6.24E-09	CC 2	
Ba 133			1.75E-08	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			1.63E-08	CC 1	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151			1.21E-07	CC 1	Other a				
Eu 152			2.09E-09	CC 2	Other b/g				
Eu 154			3.59E-08	CC 2	Total a	0	1.58E-06	CC 2	
Eu 155			1.07E-08	CC 2	Total b/g	0	3.17E-05	CC 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