

<b>WASTE STREAM</b>	<b>9C13</b>	<b>Magnox Dissolution Plant LLW</b>
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**SITE** Dungeness A  
**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.....	37.1 m <sup>3</sup>
Total future arisings:		0 m <sup>3</sup>
Total waste volume:		37.1 m <sup>3</sup>
Comment on volumes:	The quoted volumes do not take into account possible volume reduction by supercompaction.	
Uncertainty factors on volumes:	Stock (upper): x 1.2	Arisings (upper) x
	Stock (lower): x 0.8	Arisings (lower) x

**WASTE SOURCE** Trash from the Magnox dissolution plant.

**PHYSICAL CHARACTERISTICS**

General description: Metal components, soil/rubble, plastic, rubber, small quantities wood and glass, traces of magnesium carbonate sludge, fine filter cartridges (polypropylene) and drums containing the waste. There are no large items.

Physical components (%vol): Protective covers, decontamination materials, fine filter cartridges, some metal components, and drums containing the waste.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): 0.35

Comment on density: Density based on typical weight of 200 litre drum.

**CHEMICAL COMPOSITION**

General description and components (%wt): The waste comprises metal components, soil/rubble, plastic, rubber, small quantities of wood and glass, traces of magnesium carbonate sludge, fine filter cartridges (polypropylene). Magnesium carbonate is also present in trace quantities. Plastic/rubber (~36% wt), soil/rubble (~20% wt), metal waste (~8% wt) and drums (~29% wt) and Others (~7%). The others comprise wood, soft organic, glass, asbestos/MMMF and polypropylene filter cartridges (~4% wt),

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 but may be graphite.  
 Cl-36: The chemical form of chlorine 36 has not been determined but may be chloride.  
 U: The chemical form of uranium isotopes has not been determined but may be uranium oxides.  
 Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): Metal thickness may vary from 1 mm to 10 mm.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	NE	Nickel and chromium in trace or zero quantities apart from any as constituents of stainless steel.	
Other ferrous metals.....	~37.0		
Iron.....			
Aluminium.....	TR		
Beryllium.....	0		
Cobalt.....			

<b>WASTE STREAM</b>	<b>9C13</b>	<b>Magnox Dissolution Plant LLW</b>
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Copper.....	TR
Lead.....	TR
Magnox/Magnesium.....	TR
Nickel.....	
Titanium.....	
Uranium.....	0
Zinc.....	TR
Zircaloy/Zirconium.....	0
Other metals.....	NE

Organics (%wt):                      The waste contains halogenated and non-halogenated plastics and small quantities of rubber.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	2.0		
Paper, cotton.....	~1.0		
Wood.....	~1.0		
Halogenated plastics .....	~30.0	PVC	
Total non-halogenated plastics.....	~5.0		
Condensation polymers.....	0		
Others.....	~5.0		
Organic ion exchange materials....	0		
Total rubber.....	NE		
Halogenated rubber .....	NE		
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):                      -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	~1.0		
Brick/Stone/Rubble.....	~19.0		
Cementitious material.....	0		
Sand.....			
Glass/Ceramics.....	~1.0		
Graphite.....	NE		
Desiccants/Catalysts.....			

<b>WASTE STREAM</b>	<b>9C13</b>	<b>Magnox Dissolution Plant LLW</b>
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Asbestos.....	<1.0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	<1.0
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt):           Some present in trace quantities.

	(%wt)	Type(s) and comment
Fluoride.....	0	
Chloride.....	TR	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	TR	
Nitrate.....	0	
Nitrite.....	0	
Phosphate.....	0	
Sulphate.....	TR	
Sulphide.....	0	

Materials of interest for waste acceptance criteria:           Magnesium may be present in trace quantities and is not considered to constitute a hazard.

	(%wt)	Type(s) and comment
Combustible metals.....	TR	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	0	
Putrescible wastes.....	0	
Non-putrescible wastes.....		
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	TR	
Higher activity particles.....		
Soluble solids as bulk chemical compounds.....		

Hazardous substances / non hazardous pollutants:           Asbestos present at <1% and lead may be present in trace quantities.

	(%wt)	Type(s) and comment
Acrylamide.....		

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

(%wt)      Type(s) and comment

EDTA.....  
 DPTA.....  
 NTA.....  
 Polycarboxylic acids.....  
 Other organic complexants.....  
 Total complexing agents.....      TR

Potential for the waste to contain discrete items:      Not yet determined. In & of itself not a DI; waste stream may include DIs as defined elsewhere (notably any stainless steel components)

**TREATMENT, PACKAGING AND DISPOSAL**

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

Treatment	On-site / Off site	Stream volume %
Low force compaction	Off-site	23.0
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None	77.0	

Comment on planned treatments:

23% of this waste stream will be sent for Metal Recycle and 16% to Landfill as VLLW.

**Disposal Routes:**

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository	61.0	0.35
Expected to be consigned to a Landfill Facility	16.0	0.35
Expected to be consigned to an On-Site Disposal Facility	23.0	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 05, 17 05 03\*/04, 17 06 01\*, 17 02 03

**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:**

**WASTE STREAM****9C13****Magnox Dissolution Plant LLW**

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	61.0	~8.59	3

Other information: -

**Waste Planned for Disposal at the LLW Repository:**

Container voidage: Expected to be less than 10%.

Waste Characterisation Form (WCH): The waste meets the LLWR's Waste Acceptance Criteria (WAC).  
The waste does not have a current WCH.

Waste consigned for disposal to LLWR in year of generation: No. Processing, packing, activity assessment and ISO container loading may take longer than 1 year.

**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: The waste is contaminated with fission products, activation products and actinides.

Uncertainty: Specific activity is a function of Station 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: The specific activities have been estimated from waste stream fingerprints.

Other information: -

**WASTE STREAM**

**9C13**

**Magnox Dissolution Plant LLW**

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	4.35E-04	CC 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	4.00E-05	CC 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	1E-05	CC 2			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	1.86E-06	CC 2			Pb 210		8		
Co 60	1.14E-05	CC 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63	2.70E-04	CC 2			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	4.21E-05	CC 2			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	3E-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	2E-07	CC 2		
Ag 108m	2.94E-06	CC 2			U 235	1E-09	CC 2		
Ag 110m		8			U 236	5.00E-09	CC 2		
Cd 109		8			U 238	3E-07	CC 2		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	2.67E-06	CC 2		
Sn 123		8			Pu 239	5E-06	CC 2		
Sn 126		8			Pu 240	7.00E-06	CC 2		
Sb 125	4.81E-09	CC 2			Pu 241	9.82E-05	CC 2		
Sb 126		8			Pu 242		8		
Te 125m	1.20E-09	CC 2			Am 241	2.30E-05	CC 2		
Te 127m		8			Am 242m		8		
I 129		8			Am 243		8		
Cs 134	1.42E-08	CC 2			Cm 242		8		
Cs 135		8			Cm 243	1.41E-08	CC 2		
Cs 137	7.11E-05	CC 2			Cm 244	2.27E-07	CC 2		
Ba 133	1.51E-07	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	1.82E-06	CC 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151		8			Other a				
Eu 152	9.34E-08	CC 2			Other b/g				
Eu 154	3.03E-07	CC 2			<b>Total a</b>	<b>3.84E-05</b>	<b>CC 2</b>	<b>0</b>	
Eu 155	3.67E-08	CC 2			<b>Total b/g</b>	<b>9.85E-04</b>	<b>CC 2</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