

WASTE STREAM	9C17	Magnox Dissolution Plant Sludge
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SITE Dungeness A
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Magnox Limited
WASTE TYPE LLW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	29.0 m ³
Total future arisings:		0 m ³
Total waste volume:		29.0 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 The sludge originates from routine filtration of dissolution plant effluents.

PHYSICAL CHARACTERISTICS

General description: Insoluble constituents of Magnox. There are no large items that may require special handling.
Physical components (%wt): Sludge (100%). No other constituents anticipated.
Sealed sources: -
Bulk density (t/m³): 1.1
Comment on density: The bulk density of the waste ranges from 1.05 to 1.15 t/m³. The average is 1.1 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): Insoluble residues from chemical dissolution of Magnox (including Fe, Co, Zn, Zr and Al). Siliceous materials including sand, some oil contamination and a range of other materials.

Chemical state: Alkali

Chemical form of radionuclides:
H-3: Most tritium is expected to be present as water but some may be present in the form of other inorganic compounds or as organic compounds.
C-14: Carbon 14 may be present as graphite.
Cl-36: The chemical form of chlorine 36 may be inorganic chloride.
U: The chemical form of uranium isotopes has not been determined but will probably be uranium oxides.
Pu: The chemical form of plutonium isotopes has not been determined but will probably be plutonium oxides.

Metals and alloys (%wt): No bulk or sheet metal items.

Stainless steel.....	NE
Other ferrous metals.....	NE
Iron.....	
Aluminium.....	NE
Beryllium.....	TR
Cobalt.....	
Copper.....	NE
Lead.....	TR
Magnox/Magnesium.....	<1.0
Nickel.....	
Titanium.....	
Uranium.....	
Zinc.....	NE

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	Zircaloy/Zirconium.....	NE	
	Other metals.....	NE	The "other" metal content has not been fully assessed.
Organics (%wt):	The cellulosic material content of the waste has not been assessed. Ion exchange materials would be expected in only trace amounts. There are no halogenated plastics or rubbers present.		
	Total cellulose.....	NE	
	Paper, cotton.....	NE	
	Wood.....	NE	
	Halogenated plastics	0	
	Total non-halogenated plastics.....	0	
	Condensation polymers.....	0	
	Others.....	0	
	Organic ion exchange materials....	TR	
	Total rubber.....	0	
	Halogenated rubber	0	
	Non-halogenated rubber.....	0	
	Hydrocarbons.....		
	Oil or grease		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar)....		
	Bitumen.....		
	Others.....		
	Other organics.....	~1.0	
Other materials (%wt):	-		
	Inorganic ion exchange materials.	NE	
	Inorganic sludges and flocs.....	~98.0	
	Soil.....	0	
	Brick/Stone/Rubble.....	0	
	Cementitious material.....	0	
	Sand.....		
	Glass/Ceramics.....	0	
	Graphite.....	NE	
	Desiccants/Catalysts.....		
	Asbestos.....	0	
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....	P	
	Free non-aqueous liquids.....	TR	
	Powder/Ash.....	0	
Inorganic anions (%wt):	Not fully assessed. Carbonates are expected to be present.		

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Fluoride.....	NE
Chloride.....	NE
Iodide.....	NE
Cyanide.....	0
Carbonate.....	NE
Nitrate.....	NE
Nitrite.....	NE
Phosphate.....	NE
Sulphate.....	NE
Sulphide.....	NE

Materials of interest for waste acceptance criteria:

There might be trace quantities of biological material. The possible presence of items that are not estimated is to be determined.

Combustible metals.....	<1.0
Low flash point liquids.....	0
Explosive materials.....	0
Phosphorus.....	0
Hydrides.....	0
Biological etc. materials.....	TR
Biodegradable materials.....	
Putrescible wastes.....	0
Non-putrescible wastes.....	
Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	NE
Reacting with water.....	<1.0
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.....

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

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids.....

Other organic complexants.....

Total complexing agents..... TR

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		100.0
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recycling / reuse		
Other / various		
None		

Comment on planned treatments:

Solidification to meet LLWR WAC in HHISO's.

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Disposal Route	Stream volume %
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	100.0

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 2m box (no shielding) 4m box (no shielding) Other	100.0	4.15	7

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 does not have 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:	Contaminated sludge. Contamination by fission products, actinides and activation products.
Uncertainty:	Activity is derived from sample results ref EX09246_06_10_37.
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:	Three samples were taken and activity averaged ref EX09246_06_10_37 and decayed by three years for RWI 2019.
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	1.94E-03	BB 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	4.10E-04	BB 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	2.32E-07	BB 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	7.06E-05	BB 2			Pb 210		8		
Co 60	3.42E-04	BB 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63	4.03E-03	BB 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	5.99E-04	BB 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	4.07E-07	BB 2			Th 234	6.76E-05	BB 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99	2.24E-06	BB 2			U 232		8		
Ru 106	5.01E-07	BB 2			U 233		8		
Pd 107		8			U 234	1.43E-06	BB 2		
Ag 108m	2.33E-05	BB 2			U 235	5.50E-07	BB 2		
Ag 110m		8			U 236	5.50E-07	BB 2		
Cd 109		8			U 238	6.76E-05	BB 2		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	6.60E-05	BB 2		
Sn 123		8			Pu 239	1.74E-04	BB 2		
Sn 126		8			Pu 240	1.74E-04	BB 2		
Sb 125	5.74E-07	BB 2			Pu 241	1.36E-03	BB 2		
Sb 126		8			Pu 242		8		
Te 125m	1.44E-07	BB 2			Am 241	3.05E-04	BB 2		
Te 127m		8			Am 242m		8		
I 129	1.84E-08	BB 2			Am 243		8		
Cs 134	2.40E-07	BB 2			Cm 242	1.44E-08	BB 2		
Cs 135		8			Cm 243	7.62E-07	BB 2		
Cs 137	1.68E-04	BB 2			Cm 244	7.28E-07	BB 2		
Ba 133	6.05E-06	BB 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	9.09E-07	BB 2			Other b/g				
Eu 154	8.79E-06	BB 2			Total a	7.90E-04	BB 2	0	
Eu 155	1.1E-06	BB 2			Total b/g	9.03E-03	BB 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