

WASTE STREAM	9D23	Sludge
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SITE Hinkley Point A

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

WASTE VOLUMES

	Reported
Stocks: At 1.4.2019.....	~4.8 m ³
Total future arisings:	0 m ³
Total waste volume:	4.8 m ³

Comment on volumes: Volumes may be between 5 and 15m³ and are still to be confirmed.

Uncertainty factors on volumes:

Stock (upper):	x 1.3	Arisings (upper)	x
Stock (lower):	x 0.5	Arisings (lower)	x

WASTE SOURCE The sludge originates from routine filtration of liquid effluents and cooling pond water and from special clean-up operations on cooling ponds.

PHYSICAL CHARACTERISTICS

General description: The waste consists of fuel pond corrosion products such as magnesium hydroxide and carbonate detached from fuel elements and extraneous materials such as flakes of paint and ion exchange from Caesium Removal units. Also there is some filter sand. Sludge particles may be up to millimetre size, and there will probably be 80-900 kg/m³ of solid material. Once fluidised the sludges should be readily transferred by pumping but reconcentration may be time consuming. There are no large items that may require special handling.

Physical components (%vol): Sand and sludge (35% vol), water (60% vol). No other constituents anticipated.

Sealed sources: -

Bulk density (t/m³): 1.2

Comment on density: The bulk density of the waste ranges from 0.8 to 1.5 t/m³, with an average of about 1.2 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): Water (60% wt), sand and sludge (35% wt). The chemical components of these items are magnesium hydroxide, magnesium carbonate, silica and a range of other materials including ferric oxide and magnetite.

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 chlorine 36 content is insignificant.
 Se-79: The selenium content is insignificant.
 Tc-99: The technetium content is insignificant.
 Ra: The radium isotope content is insignificant.
 Th: The thorium isotope content is insignificant.
 U: The chemical form of uranium isotopes has not been determined but will probably be uranium oxides.
 Np: The chemical form of neptunium has not been determined.
 Pu: The chemical form of plutonium isotopes has not been determined but will probably be plutonium oxides.

Metals and alloys (%wt):

No sheet or bulk metal present.	
Stainless steel.....	0
Other ferrous metals.....	0
Iron.....	
Aluminium.....	<0.10
Beryllium.....	0
Cobalt.....	

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	Copper.....	0	
	Lead.....	0	
	Magnox/Magnesium.....	TR	Some unreacted Magnox is expected.
	Nickel.....		
	Titanium.....		
	Uranium.....		
	Zinc.....	0	
	Zircaloy/Zirconium.....	0	
	Other metals.....	0	There are no "other" metals.
Organics (%wt):	There may be trace quantities of organic material present in the waste. There are no halogenated plastics or rubbers present.		
	Total cellulose.....	0	
	Paper, cotton.....	0	
	Wood.....	0	
	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.....	TR	
Other materials (%wt):	-		
	Inorganic ion exchange materials.	TR	
	Inorganic sludges and flocs.....	~20.0	
	Soil.....	0	
	Brick/Stone/Rubble.....	0	
	Cementitious material.....	0	
	Sand.....	~15.0	
	Glass/Ceramics.....	0	
	Graphite.....	0	
	Desiccants/Catalysts.....		
	Asbestos.....	0	
	Non/low friable.....		
	Moderately friable.....		

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	Highly friable.....	
	Free aqueous liquids.....	60.0
	Free non-aqueous liquids.....	TR
	Powder/Ash.....	0
Inorganic anions (%wt):	Carbonates, sulphates and traces of sodium silicate and alumino-silicates are expected.	
	Fluoride.....	0
	Chloride.....	0
	Iodide.....	0
	Cyanide.....	0
	Carbonate.....	1.7
	Nitrate.....	0
	Nitrite.....	0
	Phosphate.....	0
	Sulphate.....	1.5
	Sulphide.....	0
Materials of interest for waste acceptance criteria:	The waste is unlikely to present a fire hazard but this requires confirmation since Magnox may be present and will ignite under appropriate conditions. There might be trace quantities of biological material.	
	Combustible metals.....	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.....	0
	Active particles.....	
	Soluble solids as bulk chemical compounds.....	
Hazardous substances / non hazardous pollutants:	None expected.	
	Acrylamide.....	
	Benzene.....	
	Chlorinated solvents.....	
	Formaldehyde.....	
	Organometallics.....	
	Phenol.....	
	Styrene.....	
	Tri-butyl phosphate.....	

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Other organophosphates.....

Vinyl chloride.....

Arsenic.....

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): No

 EDTA.....

 DPTA.....

 NTA.....

 Polycarboxylic acids.....

 Other organic complexants.....

 Total complexing agents..... 0

PACKAGING AND CONDITIONING

Conditioning method: Lost paddle grout encapsulation of mobile waste into 196 litre drums, grout 16 drums into RCB.

Plant Name: -

Location: Hinkley Point A Site

Plant startup date: 2022

Total capacity (m³/y incoming waste): -

Target start date for packaging this stream: 2022

Throughput for this stream (m³/y incoming waste): -

Other information: -

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Likely container type:	Container	Waste packaged (%vol)	Waste loading (m³)	Payload (m³)	Number of packages
	6m³ concrete box (SD)	100.0	1.61	5.8	3

Likely container type comment: -

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix: Other information: -

Conditioned density (t/m³): -

Conditioned density comment: -

Other information on conditioning: -

Opportunities for alternative disposal routing:

Treatment	Stream volume (%)	Comment
-	-	-

RADIOACTIVITY

Source: Contaminated sludge. Contamination by fission products, actinides and activation products.

Uncertainty: Specific activity is a function of Station operating history. The values quoted are indicative of the activities that might 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 values quoted were derived by extrapolation from available measurements.

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	1.40E-03	CC 2		8	Gd 153			8	8
Be 10				8	Ho 163			8	8
C 14	8.00E-05	CC 2		8	Ho 166m			8	8
Na 22				8	Tm 170			8	8
Al 26				8	Tm 171			8	8
Cl 36				8	Lu 174			8	8
Ar 39				8	Lu 176			8	8
Ar 42				8	Hf 178n			8	8
K 40				8	Hf 182			8	8
Ca 41				8	Pt 193			8	8
Mn 53				8	Tl 204			8	8
Mn 54	<1.60E-06	C 3		8	Pb 205			8	8
Fe 55	1.41E-02	CC 2		8	Pb 210			8	8
Co 60	6.45E-03	CC 2		8	Bi 208			8	8
Ni 59				8	Bi 210m			8	8
Ni 63	1.85E-03	CC 2		8	Po 210			8	8
Zn 65	<9.19E-07	C 3		8	Ra 223			8	8
Se 79				8	Ra 225			8	8
Kr 81				8	Ra 226			8	8
Kr 85				8	Ra 228			8	8
Rb 87				8	Ac 227			8	8
Sr 90	6.67E-02	CC 2		8	Th 227			8	8
Zr 93				8	Th 228			8	8
Nb 91				8	Th 229			8	8
Nb 92				8	Th 230			8	8
Nb 93m				8	Th 232			8	8
Nb 94				8	Th 234	<9E-06	C 3		8
Mo 93				8	Pa 231			8	8
Tc 97				8	Pa 233	<1.08E-07	C 3		8
Tc 99				8	U 232			8	8
Ru 106	5.59E-04	CC 2		8	U 233			8	8
Pd 107				8	U 234	8.30E-06	CC 2		8
Ag 108m				8	U 235	5E-06	CC 2		8
Ag 110m				8	U 236	5.07E-09	CC 2		8
Cd 109				8	U 238	9E-06	CC 2		8
Cd 113m				8	Np 237	1.09E-07	CC 2		8
Sn 119m				8	Pu 236			8	8
Sn 121m				8	Pu 238	9.40E-03	CC 2		8
Sn 123				8	Pu 239	1.00E-02	CC 2		8
Sn 126				8	Pu 240	1.00E-02	CC 2		8
Sb 125	9.70E-04	CC 2		8	Pu 241	8.74E-01	CC 2		8
Sb 126				8	Pu 242			8	8
Te 125m	2.43E-04	CC 2		8	Am 241	2.83E-02	CC 2		8
Te 127m				8	Am 242m			8	8
I 129				8	Am 243			8	8
Cs 134	4.38E-04	CC 2		8	Cm 242	5.20E-08	CC 2		8
Cs 135				8	Cm 243	2.77E-04	CC 2		8
Cs 137	5.54E-02	CC 2		8	Cm 244	3.75E-03	CC 2		8
Ba 133				8	Cm 245			8	8
La 137				8	Cm 246			8	8
La 138				8	Cm 248			8	8
Ce 144	4.88E-05	CC 2		8	Cf 249			8	8
Pm 145				8	Cf 250			8	8
Pm 147	8.64E-03	CC 2		8	Cf 251			8	8
Sm 147				8	Cf 252			8	8
Sm 151				8	Other a				
Eu 152				8	Other b/g				
Eu 154	1.33E-02	CC 2		8	Total a	6.17E-02	CC 2	0	
Eu 155	5.81E-03	CC 2		8	Total b/g	1.05E+00	CC 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