

<b>WASTE STREAM</b>	<b>9C51</b>	<b>Contaminated Zinc Bromide</b>
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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.....	0.1 m <sup>3</sup>
Total future arisings:		0 m <sup>3</sup>
Total waste volume:		0.1 m <sup>3</sup>
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** Zinc bromide from the upper maintenance cell window where remote handling of fuel related plant is undertaken.

**PHYSICAL CHARACTERISTICS**

General description: Zinc bromide solution from the upper maintenance cell window.

Physical components (%vol): Aqueous Zinc bromide solution (100%).

Sealed sources: -

Bulk density (t/m<sup>3</sup>): ~2.5

Comment on density: The density of the aqueous zinc bromide solution is 2.5 t/m<sup>3</sup>.

**CHEMICAL COMPOSITION**

General description and components (%wt): Zinc bromide and water. The relative percentage weight for the components is currently not known.

Chemical state: -

Chemical form of radionuclides: -

Metals and alloys (%wt):

Zinc will be present as a constituent of zinc bromide.	
Stainless steel.....	0
Other ferrous metals.....	0
Iron.....	
Aluminium.....	0
Beryllium.....	
Cobalt.....	
Copper.....	0
Lead.....	0
Magnox/Magnesium.....	0
Nickel.....	
Titanium.....	
Uranium.....	
Zinc.....	P
Zircaloy/Zirconium.....	0
Other metals.....	0

Organics (%wt): -

Zinc will be present as a constituent of zinc bromide.

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Total celluloseics.....	0
Paper, cotton.....	0
Wood.....	0
Halogenated plastics .....	0
Total non-halogenated plastics.....	0
Condensation polymers.....	0
Others.....	0
Organic ion exchange materials....	0
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.....	0
Inorganic ion exchange materials.	0
Inorganic sludges and flocs.....	0
Soil.....	0
Brick/Stone/Rubble.....	0
Cementitious material.....	0
Sand.....	
Glass/Ceramics.....	0
Graphite.....	0
Desiccants/Catalysts.....	
Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	<100.0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Aqueous Zinc bromide solution  
(100%).

Other materials (%wt):

-

Inorganic anions (%wt):

Bromide will be present since the waste stream is contaminated zinc bromide solution.

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

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:

Zinc bromide.	
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):

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 Metal treatment Size reduction Decay storage Recycling / reuse Other / various None	Off-site	100.0

Comment on planned treatments:

-

**WASTE STREAM****9C51****Contaminated Zinc Bromide****Disposal Routes:**

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:** (Not applicable to this waste stream)

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: -

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**

**WASTE STREAM****9C51****Contaminated Zinc Bromide**

Source:	Unknown, but possibly contamination from the handling of fuel related plant in the upper maintenance cell.
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:	-
Other information:	There is a possibility that activity may be out of scope of Regulations.

**WASTE STREAM**

**9C51**

**Contaminated Zinc Bromide**

Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			Nuclide	Mean radioactivity, TBq/m <sup>3</sup>		
	Waste at 1.4.2019	Bands and Code	Future arisings		Waste at 1.4.2019	Bands and Code	Future arisings
H 3	1.08E-07	CC 2		Gd 153		8	
Be 10		8		Ho 163		8	
C 14	3E-08	CC 2		Ho 166m		8	
Na 22		8		Tm 170		8	
Al 26		8		Tm 171		8	
Cl 36	1E-08	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	6.22E-08	CC 2		Pb 210		8	
Co 60	2.37E-08	CC 2		Bi 208		8	
Ni 59		8		Bi 210m		8	
Ni 63	3.7E-08	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	3.07E-06	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		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	1E-09	CC 2	
Ag 108m	<9.82E-09	C 3		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	9.19E-09	CC 2	
Sn 123		8		Pu 239	1E-08	CC 2	
Sn 126		8		Pu 240	1E-08	CC 2	
Sb 125	5.08E-09	CC 2		Pu 241	5.89E-07	CC 2	
Sb 126		8		Pu 242		8	
Te 125m	1.27E-09	CC 2		Am 241	3.32E-08	CC 2	
Te 127m		8		Am 242m		8	
I 129		8		Am 243		8	
Cs 134	5.19E-08	CC 2		Cm 242		8	
Cs 135		8		Cm 243		8	
Cs 137	6.98E-06	CC 2		Cm 244	1.97E-09	CC 2	
Ba 133	<4.86E-09	C 3		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	2.81E-08	CC 2		Cf 251		8	
Sm 147		8		Cf 252		8	
Sm 151		8		Other a			
Eu 152	<1.7E-08	C 3		Other b/g			
Eu 154	3.71E-08	CC 2		<b>Total a</b>	<b>6.54E-08</b>	<b>CC 2</b>	<b>0</b>
Eu 155	1.48E-08	CC 2		<b>Total b/g</b>	<b>1.11E-05</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