

<b>WASTE STREAM</b>	<b>9E56/C</b>	<b>Ion Siv Unit Cartridges &amp; Post Filters</b>
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**SITE** Berkeley

**SITE OWNER** Nuclear Decommissioning Authority

**WASTE CUSTODIAN** Magnox Limited

**WASTE TYPE** ILW

**WASTE VOLUMES**

		Conditioned	Packaged
Stocks:	At 1.4.2019.....	0.8 m <sup>3</sup>	5.3 m <sup>3</sup>
Total future arisings:		0 m <sup>3</sup>	0 m <sup>3</sup>
Total waste volume:		0.8 m <sup>3</sup>	5.3 m <sup>3</sup>
Number of waste packages in stock:	At 1.4.2019.....	4 package(s)	

Comment on volumes: Each cartridge/filter has a volume of 0.053 m3. Total of 14 cartridges and 2 x post filters.

Uncertainty factors on volumes:

Stock (upper):	x 1.1	Arisings (upper)	x
Stock (lower):	x 0.9	Arisings (lower)	x

**WASTE SOURCE** Filtration of cooling pond water.

**PHYSICAL CHARACTERISTICS**

General description: Spent IONSIV cartridges (and two post filters) that formed part of the submersible caesium removal unit.

Physical components (%wt): Spent IONSIV Cartridges and post filters (100%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): ~1.2

Comment on density: The density of 1.2 t/m<sup>3</sup> assumes that each cartridge will contain 10 kg of water, giving a total mass of 66.2 kg for each cartridge.

**CHEMICAL COMPOSITION**

General description and components (%wt): The waste is primarily spent IONSIV cartridges, which are composed principally of a stainless steel hollow cylinder containing IONSIV material. IONSIV ion exchange material (~53%), stainless steel (~32%), water (~15%) and EPDM seal material (<1%). IONSIV is a crystalline silicotitanate. (EPDM is ethylene diene terpolymer). There are also two post filters.

Chemical state: Neutral

Chemical form of radionuclides:

H-3: Any tritium is likely to be present as water.  
 C-14: The carbon 14 content is insignificant.  
 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 uranium isotope content is insignificant.  
 Np: The neptunium isotope content is insignificant.  
 Pu: The chemical form of plutonium isotopes may be plutonium oxides.

Metals and alloys (%wt): The stainless steel forms a hollow cylinder with dimensions: internal diameter 122mm, external diameter 296mm and height 640mm.

Stainless steel..... ~32.0

The Stainless steel is SS316L; nickel and chromium will be major constituents of the stainless steel cartridge housing.

Other ferrous metals..... NE

Iron.....

Aluminium..... NE

Beryllium..... TR

Cobalt.....

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**Ion Siv Unit Cartridges & Post Filters**

	Copper.....	NE	
	Lead.....	NE	
	Magnox/Magnesium.....	NE	
	Nickel.....		
	Titanium.....		
	Uranium.....		
	Zinc.....	NE	
	Zircaloy/Zirconium.....	NE	
	Other metals.....	NE	
Organics (%wt):	EPDM seal material (<1%wt) is present in the waste. Halogenated plastics and rubbers are not expected in the waste.		
	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....	0	
	Total rubber.....	<1.0	
	Halogenated rubber .....	0	
	Non-halogenated rubber.....	<1.0	EPDM seal material
	Hydrocarbons.....		
	Oil or grease .....		
	Fuel.....		
	Asphalt/Tarmac (cont.coal tar)...		
	Asphalt/Tarmac (no coal tar)....		
	Bitumen.....		
	Others.....		
	Other organics.....	NE	
Other materials (%wt):	-		
	Inorganic ion exchange materials.	~53.0	
	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.....		

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	Highly friable.....	
	Free aqueous liquids.....	<15.0
	Free non-aqueous liquids.....	0
	Powder/Ash.....	0
Inorganic anions (%wt):	The inorganic anion content of the waste has not been assessed.	
	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:	Each cartridge will contain about 10 kg of water, less than 10% of this is expected to be free water, the rest is absorbed into the resin beads.	
	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:	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):

Yes

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids.....

Other organic complexants.....

Total complexing agents..... TR

**PACKAGING AND CONDITIONING**

Container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages
	500 l RS drum (0mm Pb)	100.0	0.212	0.212	4

Container type comment:

-

Range in container waste volume:

-

Other information on containers:

4 x IP-2 MOSAIKs.

Conditioned density (t/m<sup>3</sup>):

NE

Conditioned density comment:

-

Other information on conditioning:

-

**RADIOACTIVITY**

Source:	Spent cartridges and post filters from the submersible caesium removal unit, used for the removal of caesium isotopes from cooling pond water. 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:	Estimated from available data, taken from WD-CALC-1923.
Other information:	-

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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	Bands and Code		Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3	6.36E-05	BB 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	6.52E-05	BB 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	7.24E-08	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	7.87E-06	BB 2			Pb 210		8		
Co 60	8.01E-06	BB 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63	4.96E-05	BB 2			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79	7.71E-09	BB 2			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85	1.41E-05	BB 2			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	4.23E-01	BB 2			Th 227		8		
Zr 93	4.23E-08	BB 2			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	3.56E-08	BB 2			Th 232		8		
Nb 94		8			Th 234	7.4E-08	BB 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233	4.26E-07	BB 2		
Tc 99	3.37E-07	BB 2			U 232		8		
Ru 106		8			U 233		8		
Pd 107	2E-09	BB 2			U 234	6.8E-08	BB 2		
Ag 108m	6.79E-08	BB 2			U 235	1.94E-09	BB 2		
Ag 110m		8			U 236	7.26E-09	BB 2		
Cd 109		8			U 238	7.4E-08	BB 2		
Cd 113m	5.7E-08	BB 2			Np 237	4.26E-07	BB 2		
Sn 119m		8			Pu 236		8		
Sn 121m	3.29E-07	BB 2			Pu 238	1.44E-05	BB 2		
Sn 123		8			Pu 239	2.06E-05	BB 2		
Sn 126	1.55E-08	BB 2			Pu 240	2.15E-05	BB 2		
Sb 125	1.09E-08	BB 2			Pu 241	3.31E-04	BB 2		
Sb 126	2.17E-09	BB 2			Pu 242	1.94E-07	BB 2		
Te 125m	2.72E-09	BB 2			Am 241	7.85E-05	BB 2		
Te 127m		8			Am 242m	7.12E-08	BB 2		
I 129	1.52E-09	BB 2			Am 243	1.94E-08	BB 2		
Cs 134	1.96E-02	BB 2			Cm 242	5.87E-08	BB 2		
Cs 135	1.74E-08	BB 2			Cm 243	7.54E-08	BB 2		
Cs 137	4.11E+00	BB 2			Cm 244	8.79E-07	BB 2		
Ba 133	6.02E-08	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	1.62E-07	BB 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	4.64E-06	BB 2			Other a				
Eu 152	2.22E-07	BB 2			Other b/g				
Eu 154	2.05E-06	BB 2			<b>Total a</b>	<b>1.37E-04</b>	<b>BB 2</b>	<b>0</b>	
Eu 155	5.39E-07	BB 2			<b>Total b/g</b>	<b>4.55E+00</b>	<b>BB 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