

<b>WASTE STREAM</b>	<b>9J03</b>	<b>Ion Exchange Resins</b>
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**SITE** Hunterston A  
**SITE OWNER** Nuclear Decommissioning Authority  
**WASTE CUSTODIAN** Magnox Limited  
**WASTE TYPE** ILW

**WASTE VOLUMES**

		Reported	
Stocks:	At 1.4.2019.....	0.5 m <sup>3</sup>	
Total future arisings:		0 m <sup>3</sup>	
Total waste volume:		0.5 m <sup>3</sup>	
Comment on volumes:	No future arisings are expected.		
Uncertainty factors on volumes:	Stock (upper):	x 1.2	Arisings (upper) x
	Stock (lower):	x 0.8	Arisings (lower) x

**WASTE SOURCE** Pond water treatment plant.

**PHYSICAL CHARACTERISTICS**

**General description:** The waste consists of ion exchange resin types Lewatit DN (in a granular form) and IRN-74. The resin is stored under water. There are no large items that require special handling.

**Physical components (%wt):** Resin (100%). The resin is stored under water. Further water will be added for fluidisation and retrieval purposes.

**Sealed sources:** -

**Bulk density (t/m<sup>3</sup>):** ~1.06

**Comment on density:** The density of the waste is approximately 1.06 t/m<sup>3</sup>. This assumes some mixing of resin and water.

**CHEMICAL COMPOSITION**

**General description and components (%wt):** Lewatit DN - phenolsulphonic acid - formaldehyde condensate, strong cation resin (82%) and IRN-74 - methylene sulphonic acid (18%). There is interstitial and supernatant water.

**Chemical state:** Alkali

**Chemical form of radionuclides:**  
H-3: The chemical form of tritium has not been determined but may be present as water or as other inorganic or organic compounds.  
C-14: The chemical form of carbon 14 has not been determined.  
Cl-36: The chemical form of chlorine 36 has not been determined.  
Se-79: The chemical form of selenium has not been determined.  
Tc-99: The chemical form of technetium has not been determined.  
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 may be present as uranium oxides.  
Np: The chemical form of neptunium has not been determined.  
Pu: The chemical form of plutonium isotopes has not been determined but may be present as plutonium oxides.

**Metals and alloys (%wt):** There is no sheet metal.

Stainless steel.....	0
Other ferrous metals.....	TR
Iron.....	
Aluminium.....	TR
Beryllium.....	0
Cobalt.....	
Copper.....	TR
Lead.....	0
Magnox/Magnesium.....	TR

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Nickel.....  
 Titanium.....  
 Uranium.....  
 Zinc..... TR  
 Zircaloy/Zirconium..... 0  
 Other metals..... TR

Possibly trace amounts of nickel, molybdenum, sodium, calcium and potassium.

**Organics (%wt):**

The only organic materials in the waste are ion exchange resins, Lewatit DN - phenolsulphonic acid - formaldehyde condensate, strong cation resin (82% wt) and IRN-74 - methylene sulphonic acid (18% wt). Some water might be bound with the resins. 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.... 100.0

Lewatit DN - phenolsulphonic acid - formaldehyde condensate, strong cation resin (82% wt) and IRN-74 - methylene sulphonic acid (18% wt).

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

**Other materials (%wt):**

-  
 Inorganic ion exchange materials. 0  
 Inorganic sludges and flocs..... NE  
 Soil..... 0  
 Brick/Stone/Rubble..... 0  
 Cementitious material..... 0  
 Sand.....  
 Glass/Ceramics..... 0  
 Graphite..... 0  
 Desiccants/Catalysts.....  
 Asbestos..... 0

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	Non/low friable.....	
	Moderately friable.....	
	Highly friable.....	
	Free aqueous liquids.....	P
	Free non-aqueous liquids.....	0
	Powder/Ash.....	0
Inorganic anions (%wt):	The waste is expected to contain only trace quantities of inorganic ions (<100 ppm).	
	Fluoride.....	TR
	Chloride.....	~0.01
	Iodide.....	0
	Cyanide.....	0
	Carbonate.....	0
	Nitrate.....	TR
	Nitrite.....	TR
	Phosphate.....	0
	Sulphate.....	TR
	Sulphide.....	0
Materials of interest for waste acceptance criteria:	The waste contains no hazardous materials.	
	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.....	

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Styrene.....  
 Tri-butyl phosphate.....  
 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: Resins will be encapsulated in a cement grout. Supercompaction will not be used.  
 Plant Name: Transportable ILW Solidification Plant  
 Location: Hunterston A Decommissioning Site  
 Plant startup date: -  
 Total capacity (m<sup>3</sup>/y incoming waste): -  
 Target start date for packaging this stream: -  
 Throughput for this stream (m<sup>3</sup>/y incoming waste): -  
 Other information: The tank will be fluidised and waste recovered in one campaign. Resins will be mixed with the sludge stream 9J33, remaining containers are accounted for under 9J33.

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Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages

Likely container type comment:

-

Range in container waste volume:

No significant variability is expected.

Other information on containers:

The container material is expected to be stainless steel.

Likely conditioning matrix:

Cement

Other information:

The waste is expected to be encapsulated in a modified Portland cement.

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

~1.8

Conditioned density comment:

The conditioned density range is expected to be approximately 1.6 to 1.9 t/m<sup>3</sup>.

Other information on conditioning:

Wet ILW recovery and encapsulation plant used to condition Waste.

Opportunities for alternative disposal routing:

Treatment	Stream volume (%)	Comment
-	-	-

**RADIOACTIVITY**

Source:

The waste arises from 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:

Activities have been estimated.

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	2.03E-05	CC 1			Gd 153		8		
Be 10		8			Ho 163	1.73E-08	CC 2		
C 14	2.15E-05	CC 1			Ho 166m	5.29E-06	CC 2		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	1.18E-06	CC 1			Lu 174		8		
Ar 39	5.78E-07	CC 2			Lu 176		8		
Ar 42		8			Hf 178n	4.84E-06	CC 2		
K 40		8			Hf 182		8		
Ca 41	6.35E-06	CC 1			Pt 193	5.52E-08	CC 2		
Mn 53		8			Tl 204	2.18E-07	CC 2		
Mn 54		8			Pb 205		8		
Fe 55	5.64E-05	CC 1			Pb 210		8		
Co 60	3.18E-05	CC 1			Bi 208		8		
Ni 59	2.81E-07	CC 1			Bi 210m		8		
Ni 63	7.73E-05	CC 1			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79	1.99E-08	CC 2			Ra 225		8		
Kr 81	3.03E-09	CC 2			Ra 226		8		
Kr 85	3.50E-04	CC 2			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	5.78E-01	CC 1			Th 227		8		
Zr 93	9.53E-07	CC 2			Th 228	4.16E-09	CC 2		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	1.80E-06	CC 2			Th 232		8		
Nb 94	2.33E-07	CC 2			Th 234	7.88E-07	CC 2		
Mo 93	1.37E-08	CC 2			Pa 231		8		
Tc 97		8			Pa 233	9.99E-08	CC 2		
Tc 99	1.06E-03	CC 1			U 232	4.04E-09	CC 2		
Ru 106		8			U 233	4.44E-09	CC 2		
Pd 107	6.69E-08	CC 2			U 234	2.40E-06	CC 1		
Ag 108m	8.25E-08	CC 2			U 235	2.52E-07	CC 1		
Ag 110m		8			U 236	9.32E-07	CC 2		
Cd 109		8			U 238	7.88E-07	CC 1		
Cd 113m	1.95E-06	CC 2			Np 237	1.00E-07	CC 2		
Sn 119m		8			Pu 236		8		
Sn 121m	9.44E-06	CC 2			Pu 238	1.00E-03	CC 1		
Sn 123		8			Pu 239	4.76E-04	CC 1		
Sn 126	2.28E-07	CC 2			Pu 240	4.74E-04	CC 1		
Sb 125	2.05E-07	CC 2			Pu 241	2.93E-01	CC 1		
Sb 126	3.20E-08	CC 2			Pu 242	7.17E-07	CC 2		
Te 125m	5.14E-08	CC 2			Am 241	9.93E-03	CC 1		
Te 127m		8			Am 242m	2.19E-06	CC 2		
I 129	1.84E-07	CC 1			Am 243	2.67E-06	CC 2		
Cs 134	2.67E-05	CC 1			Cm 242	1.81E-06	CC 1		
Cs 135	1.35E-04	CC 2			Cm 243	1.76E-04	CC 1		
Cs 137	1.12E+01	CC 1			Cm 244	2.11E-03	CC 1		
Ba 133	9.75E-08	CC 2			Cm 245	3.91E-09	CC 2		
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	5.08E-06	CC 1			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	5.69E-04	CC 1			Other a				
Eu 152	6.67E-08	CC 2			Other b/g				
Eu 154	1.59E-04	CC 1			<b>Total a</b>	<b>1.42E-02</b>	<b>CC 2</b>	<b>0</b>	
Eu 155	2.83E-04	CC 1			<b>Total b/g</b>	<b>1.21E+01</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