

WASTE STREAM	9J03	Ion Exchange Resins
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SITE Hunterston A
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Magnox Limited
WASTE TYPE ILW
 Is the waste subject to Scottish Policy: Yes

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0.1 m ³
Total future arisings:		0 m ³
Total waste volume:		0.1 m ³
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: The waste does not contain sealed sources.
 Bulk density (t/m³): ~1.06
 Comment on density: The density of the waste is approximately 1.06 t/m³. 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.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	TR		
Iron.....			
Aluminium.....	TR		
Beryllium.....	0		
Cobalt.....			

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Copper.....	TR	
Lead.....	0	
Magnox/Magnesium.....	TR	
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.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	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): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	NE		
Soil.....	0		
Brick/Stone/Rubble.....	0		

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Cementitious material.....	0
Sand.....	
Glass/Ceramics.....	0
Graphite.....	0
Desiccants/Catalysts.....	
Asbestos.....	0
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).

	(%wt)	Type(s) and comment
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.

	(%wt)	Type(s) and comment
Combustible metals.....	0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	0	
Putrescible wastes.....	0	
Non-putrescible wastes.....		
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....		

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Soluble solids as bulk chemical compounds.....

Hazardous substances / None expected
non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....		
Styrene.....		
Tri-butyl phosphate.....		
Other organophosphates.....		
Vinyl chloride.....		
Arsenic.....		
Barium.....		
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
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

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....		

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Total complexing agents..... 0

Potential for the waste to contain discrete items: No. In & of itself not a DI; assumed not likely to contain any "rogue" items that could be.

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 (m³/y incoming waste): -

Target start date for packaging this stream: -

Throughput for this stream (m³/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.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	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/m³): ~1.8

Conditioned density comment: The conditioned density range is expected to be approximately 1.6 to 1.9 t/m³.

Other information on conditioning: Wet ILW recovery and encapsulation plant used to condition Waste.

Opportunities for alternative disposal routing: -

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	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.

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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 ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	1.64E-06	CC 1			Gd 153		8		
Be 10		8			Ho 163	1.65E-09	CC 2		
C 14	2.06E-06	CC 1			Ho 166m	5.05E-07	CC 2		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	1.13E-07	CC 1			Lu 174		8		
Ar 39	5.48E-08	CC 2			Lu 176		8		
Ar 42		8			Hf 178n	4.33E-07	CC 2		
K 40		8			Hf 182		8		
Ca 41	6.07E-07	CC 1			Pt 193	5.07E-09	CC 2		
Mn 53		8			Tl 204	1.20E-08	CC 2		
Mn 54		8			Pb 205		8		
Fe 55	2.52E-06	CC 1			Pb 210		8		
Co 60	2.05E-06	CC 1			Bi 208		8		
Ni 59	2.69E-08	CC 1			Bi 210m		8		
Ni 63	7.24E-06	CC 1			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79	1.9E-09	CC 2			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85	2.76E-05	CC 2			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	5.15E-02	CC 1			Th 227		8		
Zr 93	9.11E-08	CC 2			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	1.62E-07	CC 2			Th 232		8		
Nb 94	2.23E-08	CC 2			Th 234	7.53E-08	CC 2		
Mo 93	1.31E-09	CC 2			Pa 231		8		
Tc 97		8			Pa 233	1.05E-08	CC 2		
Tc 99	1.02E-04	CC 1			U 232		8		
Ru 106		8			U 233		8		
Pd 107	6.4E-09	CC 2			U 234	2.30E-07	CC 1		
Ag 108m	7.85E-09	CC 2			U 235	2.41E-08	CC 1		
Ag 110m		8			U 236	8.91E-08	CC 2		
Cd 109		8			U 238	7.53E-08	CC 1		
Cd 113m	1.60E-07	CC 2			Np 237	1.06E-08	CC 2		
Sn 119m		8			Pu 236		8		
Sn 121m	8.69E-07	CC 2			Pu 238	9.34E-05	CC 1		
Sn 123		8			Pu 239	4.55E-05	CC 1		
Sn 126	2.18E-08	CC 2			Pu 240	4.54E-05	CC 1		
Sb 125	9.23E-09	CC 2			Pu 241	2.42E-02	CC 1		
Sb 126	3.05E-09	CC 2			Pu 242	6.85E-08	CC 2		
Te 125m	2.31E-09	CC 2			Am 241	1.07E-03	CC 1		
Te 127m		8			Am 242m	2.06E-07	CC 2		
I 129	1.76E-08	CC 1			Am 243	2.55E-07	CC 2		
Cs 134	9.32E-07	CC 1			Cm 242	1.70E-07	CC 1		
Cs 135	1.29E-05	CC 2			Cm 243	1.58E-05	CC 1		
Cs 137	9.99E-01	CC 1			Cm 244	1.80E-04	CC 1		
Ba 133	7.66E-09	CC 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	2.20E-07	CC 1			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	5.32E-05	CC 1			Other a				
Eu 152	5.46E-09	CC 2			Other b/g				
Eu 154	1.19E-05	CC 1			Total a	1.45E-03	CC 2	0	
Eu 155	1.76E-05	CC 1			Total b/g	1.07E+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