

<b>WASTE STREAM</b>	<b>9E20</b>	<b>Ion Exchange Material</b>
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**SITE** Oldbury  
**SITE OWNER** Nuclear Decommissioning Authority

**WASTE CUSTODIAN** Magnox Limited

**WASTE TYPE** ILW

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2022.....	14.7 m <sup>3</sup>
Future arisings -	1.4.2022 - 31.3.2023.....	4.1 m <sup>3</sup>
	1.4.2024 - 31.3.2031.....	2.1 m <sup>3</sup>
Total future arisings:		6.2 m <sup>3</sup>
Total waste volume:		20.9 m <sup>3</sup>

Comment on volumes: -

Uncertainty factors on volumes: Stock (upper): x 1.2 Arisings (upper) x 1.2  
 Stock (lower): x 0.8 Arisings (lower) x 0.8

**WASTE SOURCE** Spent ion exchange materials arising from the treatment of pond waters.

**PHYSICAL CHARACTERISTICS**

General description: The ion exchange material is stored under water in a tank. It should be easily pumped and have rapid settling characteristics. It would be expected to have a density (flooded with water) of about 1.1 t/m<sup>3</sup> with a voidage of 0.2 to 0.35, i.e. 0.2 to 0.35 of the volume of a bed of settled flooded ion exchange material would be interstitial water. There are no large items which may require special handling.

Physical components (%vol): The following breakdown is approximate: ion exchange materials (70% vol), interstitial water (30% vol), other minor components are not assessed.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): ~1.1

Comment on density: The bulk density of the waste flooded with water is expected to be about 1.1 t/m<sup>3</sup>.

**CHEMICAL COMPOSITION**

General description and components (%wt): Composition appropriate to proprietary ion exchange materials, which are all organic in nature. A small quantity of sand is present with the ion exchange material. Water in which the ion exchange material is immersed. Proprietary ion exchange materials and sand (~70%wt) and water (~30%wt). The ion exchange materials include Granular Lewatit (phenol formaldehyde based), IRN77, IRN78, IRN163, IR120 and IRA402 (all polystyrene based).

Chemical state: Alkali

Chemical form of radionuclides: H-3: The chemical form of tritium will be present as tritiated water.  
 C-14: Carbon 14 will be present as graphite dust particles.  
 Cl-36: Chlorine 36 may be present in graphite dust particles.  
 Se-79: The selenium content is insignificant.  
 Tc-99: The technetium content is insignificant.  
 Ra: The radium isotope content is insignificant.  
 Th: Traces of Thorium may be present in metallic form, as oxide or as insoluble salts.  
 U: Uranium isotopes may be present as natural uranium metal or oxides.  
 Np: The neptunium content is insignificant.  
 Pu: Plutonium isotopes are expected to be present as trace amounts from minor fuel leakage, probably metallic or oxides.

Metals and alloys (%wt): There are no metallic items present.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	TR		
Other ferrous metals.....	TR		
Iron.....			
Aluminium.....	TR		
Beryllium.....	0		
Cobalt.....			
Copper.....	TR		
Lead.....	TR		
Magnox/Magnesium.....	TR	Magnox might be present in trace quantities.	
Nickel.....			
Titanium.....			
Uranium.....			
Zinc.....	TR		
Zircaloy/Zirconium.....	TR		
Other metals.....	TR	Only trace quantities of "other" metals are present.	

Organics (%wt):                      Proprietary ion exchange resins which are organic in nature are present. No oil expected. Halogenated plastics will not be present, traces of neoprene may be 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....	~70.0	The ion exchange materials include Granular Lewatit (phenol formaldehyde based), IRN77, IRN78, IRN163, IR120 and IRA402 (all polystyrene based).	
Total rubber.....	TR		
Halogenated rubber .....	TR	neoprene	
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):                      -

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	TR		
Sand.....			
Glass/Ceramics.....	0		
Graphite.....	TR		
Desiccants/Catalysts.....			
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	~30.0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt):      The concentrations given are based upon the concentrations assumed to be present in the water associated with the resin.

	(%wt)	Type(s) and comment
Fluoride.....	TR	
Chloride.....	TR	
Iodide.....	TR	
Cyanide.....	0	
Carbonate.....	0.05	
Nitrate.....	TR	
Nitrite.....	TR	
Phosphate.....	TR	
Sulphate.....	1.5	
Sulphide.....	TR	

Materials of interest for waste acceptance criteria:      No materials likely to pose a fire or other non-radiological hazard have been identified. Magnox might be present but only in trace quantities, if any. There may be trace quantities of biological material.

	(%wt)	Type(s) and comment
Combustible metals.....	TR	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	TR	
Biodegradable materials.....	0	
Putrescible wastes.....	0	

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Non-putrescible wastes.....  
 Corrosive materials..... 0  
 Pyrophoric materials..... 0  
 Generating toxic gases..... 0  
 Reacting with water..... TR  
 Higher activity particles.....  
 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.....		

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Complexing agents (%wt): Yes

(%wt) Type(s) and comment

EDTA.....  
DPTA.....  
NTA.....  
Polycarboxylic acids.....  
Other organic complexants.....  
Total complexing agents..... TR

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: -  
Plant Name: -  
Location: Oldbury Power Station  
Plant startup date: -  
Total capacity (m³/y incoming waste): ~100.0  
Target start date for packaging this stream: 2026  
Throughput for this stream (m³/y incoming waste): -  
Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m³)	Payload (m³)	Number of packages
	3m³ RS box	100.0	2.09	2.5	10

Likely container type comment: Waste will be transferred to Type VI yellow boxes and dried.

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: -

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
Disposal at a Geological Disposal	Disposal at LLWR	~12.0	2022	High	A proportion of 9E20 has been found to be LLW after recent

**WASTE STREAM**

**9E20**

**Ion Exchange Material**

Facility

characterisation. Two new waste stream IDs have been allocated (9E71 & 9E72) in order to commence discussions with LLWR over new WCH forms to split out 1.89m<sup>3</sup> of cation resin and 0.56m<sup>3</sup> of anion resin from the ILW stream.

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**RADIOACTIVITY**

Source:

Spent ion exchange resins arising from the treatment of Pond Water. Contamination by fission products, actinides and activation products.

Uncertainty:

Specific activity is a function of Station operating history and pond conditions. Values were derived from measurements.

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 activities quoted were derived from measurements.

Other information:

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**WASTE STREAM 9E20 Ion Exchange Material**

Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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	1.03E-04	CC 2	1.03E-04	CC 2	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	8.99E-06	CC 2	8.99E-06	CC 2	Ho 166m		8		8
Na 22		8		8	Tm 170		8		8
Al 26	8E-06	CC 2	8E-06	CC 2	Tm 171		8		8
Cl 36	2E-06	CC 2	2E-06	CC 2	Lu 174		8		8
Ar 39		8		8	Lu 176		8		8
Ar 42		8		8	Hf 178n		8		8
K 40		8		8	Hf 182		8		8
Ca 41		8		8	Pt 193		8		8
Mn 53		8		8	Tl 204		8		8
Mn 54		8		8	Pb 205		8		8
Fe 55	4.55E-08	CC 2	4.55E-08	CC 2	Pb 210		8		8
Co 60	<1.49E-06	C 3	<1.49E-06	C 3	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	6.45E-05	CC 2	6.45E-05	CC 2	Po 210		8		8
Zn 65		8		8	Ra 223		8		8
Se 79		8		8	Ra 225		8		8
Kr 81		8		8	Ra 226		8		8
Kr 85		8		8	Ra 228		8		8
Rb 87		8		8	Ac 227		8		8
Sr 90	1.51E-02	CC 2	1.51E-02	CC 2	Th 227		8		8
Zr 93		8		8	Th 228		8		8
Nb 91		8		8	Th 229		8		8
Nb 92		8		8	Th 230		8		8
Nb 93m		8		8	Th 232		8		8
Nb 94		8		8	Th 234	1E-08	CC 2	1E-08	CC 2
Mo 93		8		8	Pa 231		8		8
Tc 97		8		8	Pa 233		8		8
Tc 99		8		8	U 232		8		8
Ru 106		8		8	U 233		8		8
Pd 107		8		8	U 234	2.01E-08	CC 2	2.01E-08	CC 2
Ag 108m	<3.92E-05	C 3	<3.92E-05	C 3	U 235		8		8
Ag 110m		8		8	U 236	<1E-09	C 3	<1E-09	C 3
Cd 109		8		8	U 238	1E-08	CC 2	1E-08	CC 2
Cd 113m		8		8	Np 237		8		8
Sn 119m		8		8	Pu 236		8		8
Sn 121m		8		8	Pu 238	4.55E-06	CC 2	4.55E-06	CC 2
Sn 123		8		8	Pu 239	4E-06	CC 2	4E-06	CC 2
Sn 126		8		8	Pu 240	7E-06	CC 2	7E-06	CC 2
Sb 125		8		8	Pu 241	1.70E-04	CC 2	1.70E-04	CC 2
Sb 126		8		8	Pu 242		8		8
Te 125m		8		8	Am 241	3.37E-05	CC 2	3.37E-05	CC 2
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	1.38E-07	CC 2	1.38E-07	CC 2	Cm 242		8		8
Cs 135		8		8	Cm 243		8		8
Cs 137	3.82E-01	CC 2	3.82E-01	CC 2	Cm 244	1.27E-07	CC 2	1.27E-07	CC 2
Ba 133		8		8	Cm 245		8		8
La 137		8		8	Cm 246		8		8
La 138		8		8	Cm 248		8		8
Ce 144		8		8	Cf 249		8		8
Pm 145		8		8	Cf 250		8		8
Pm 147	2.25E-08	CC 2	2.25E-08	CC 2	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151	1.82E-06	CC 2	1.82E-06	CC 2	Other a				
Eu 152		8		8	Other b/g				
Eu 154	<7.7E-06	C 3	<7.7E-06	C 3	<b>Total a</b>	<b>4.94E-05</b>	<b>CC 2</b>	<b>4.94E-05</b>	<b>CC 2</b>
Eu 155		8		8	<b>Total b/g</b>	<b>3.97E-01</b>	<b>CC 2</b>	<b>3.97E-01</b>	<b>CC 2</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