

WASTE STREAM	9E20	Ion Exchange Material
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SITE Oldbury
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Magnox Limited
WASTE TYPE ILW

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	14.7 m ³
Future arisings -	1.4.2021 - 31.3.2027.....	6.2 m ³
Total future arisings:		6.2 m ³
Total waste volume:		20.9 m ³
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/m³ 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: -

Bulk density (t/m³): ~1.1

Comment on density: The bulk density of the waste flooded with water is expected to be about 1.1 t/m³.

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.

Stainless steel.....	TR
Other ferrous metals.....	TR
Iron.....	
Aluminium.....	TR
Beryllium.....	0
Cobalt.....	

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	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.		
	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....	~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):	-		
	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.....		

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	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.	
	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.	
	Combustible metals.....	TR
	Low flash point liquids.....	0
	Explosive materials.....	0
	Phosphorus.....	0
	Hydrides.....	0
	Biological etc. materials.....	TR
	Biodegradable materials.....	
	Putrescible wastes.....	0
	Non-putrescible wastes.....	
	Corrosive materials.....	0
	Pyrophoric materials.....	0
	Generating toxic gases.....	0
	Reacting with water.....	TR
	Active particles.....	
	Soluble solids as bulk chemical compounds.....	
Hazardous substances / non hazardous pollutants:	None expected.	
	Acrylamide.....	
	Benzene.....	
	Chlorinated solvents.....	
	Formaldehyde.....	

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Organometallics.....
 Phenol.....
 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): Yes
 EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants.....
 Total complexing agents..... TR

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: 2021
 Throughput for this stream (m³/y incoming waste): -
 Other information: -

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

Likely container type comment: Waste will be transferred to a Type VI yellow box 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:

Treatment	Stream volume (%)	Comment
-	-	-

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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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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	1.22E-04	CC 2	1.44E-04	CC 2	Gd 153		8		8
Be 10		8		8	Ho 163		8		8
C 14	9.00E-06	CC 2	9E-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	9.72E-08	CC 2	2.08E-07	CC 2	Pb 210		8		8
Co 60	<2.21E-06	C 3	<3.28E-06	C 3	Bi 208		8		8
Ni 59		8		8	Bi 210m		8		8
Ni 63	6.59E-05	CC 2	6.73E-05	CC 2	Po 210		8		8
Zn 65		8	1.6E-09	CC 3	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	1.62E-02	CC 2	1.74E-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	2.00E-08	CC 2	2E-08	CC 2
Ag 108m	<3.94E-05	C 3	<3.96E-05	C 3	U 235		8		8
Ag 110m		8		8	U 236	<1.00E-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	4.66E-06	CC 2	4.77E-06	CC 2
Sn 123		8		8	Pu 239	4E-06	CC 2	4E-06	CC 2
Sn 126		8		8	Pu 240	7.00E-06	CC 2	7E-06	CC 2
Sb 125		8		8	Pu 241	1.97E-04	CC 2	2.27E-04	CC 2
Sb 126		8		8	Pu 242		8		8
Te 125m		8		8	Am 241	3.30E-05	CC 2	3.21E-05	CC 2
Te 127m		8		8	Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	3.76E-07	CC 2	1.03E-06	CC 2	Cm 242		8		8
Cs 135		8		8	Cm 243		8		8
Cs 137	4.09E-01	CC 2	4.38E-01	CC 2	Cm 244	1.43E-07	CC 2	1.6E-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	4.98E-08	CC 2	1.1E-07	CC 2	Cf 251		8		8
Sm 147		8		8	Cf 252		8		8
Sm 151	1.87E-06	CC 2	1.91E-06	CC 2	Other a				
Eu 152		8		8	Other b/g				
Eu 154	<9.81E-06	C 3	<1.25E-05	C 3	Total a	4.88E-05	CC 2	4.81E-05	CC 2
Eu 155		8		8	Total b/g	4.25E-01	CC 2	4.56E-01	CC 2

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