

WASTE STREAM	4B01	Ion Exchange Resin and Sand
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SITE Hunterston B

SITE OWNER EDFE NGL

WASTE CUSTODIAN EDFE NGL

WASTE TYPE ILW; SPD1

Is the waste subject to Scottish Policy: Yes

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	22.0 m ³
Future arisings -	1.4.2022 - 31.3.2023.....	0.7 m ³
	1.4.2023 - 31.3.2024.....	1.0 m ³
	1.4.2024 - 31.3.2025.....	3.4 m ³
Total future arisings:		5.1 m ³
Total waste volume:		27.1 m ³

Comment on volumes: Waste volumes will be variable depending on station operating conditions.

Uncertainty factors on volumes: Stock (upper): x 1.25 Arisings (upper) x 1.5
 Stock (lower): x 0.75 Arisings (lower) x 0.5

WASTE SOURCE Waste arises from spent (i.e. chemically exhausted) ion exchange resins and filter sand.

PHYSICAL CHARACTERISTICS

General description: The waste consists of spent ion exchange resins, sand and contaminants. The waste is stored under water but the water is not included as the waste will be dewatered prior to conditioning. There are no large items that require special handling.

Physical components (%vol): At the end of defuelling the physical constituents of this waste stream is expected to be: Ion exchange resins (~45%), filter backwash sand (~55%). It is expected that there will be no further discharges of sand until the end of defuelling.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1.9

Comment on density: The density is estimated based on stocks and anticipated future arisings.

CHEMICAL COMPOSITION

General description and components (%wt): This waste stream will be comprised of sand and contaminants mixed with organic polystyrene ion exchange resins.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Tritiated water
 C-14: Not expected to be significant
 Cl-36: Not expected to be significant
 Se-79: Not expected to be significant
 Tc-99: Not expected to be significant
 I-129: Not expected to be significant
 Ra: Not expected to be significant
 Th: Not expected to be significant
 U: Not expected to be significant
 Np: Not expected to be significant
 Pu: Not expected to be significant

Metals and alloys (%wt): -

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

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Beryllium.....	0
Cobalt.....	0
Copper.....	0
Lead.....	0
Magnox/Magnesium.....	0
Nickel.....	0
Titanium.....	0
Uranium.....	0
Zinc.....	0
Zircaloy/Zirconium.....	0
Other metals.....	0

Organics (%wt): This waste is not expected to contain any organics.

	(%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....	~45.0		
Total rubber.....	0		
Halogenated rubber	0		
Non-halogenated rubber.....	0		
Hydrocarbons.....	NE		
Oil or grease	NE		
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..	NE		
Inorganic sludges and flocs.....	~		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....	~55.0		
Glass/Ceramics.....	0		

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Graphite.....	0
Desiccants/Catalysts.....	0
Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): There may be trace quantities of the listed inorganic anions.

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

Materials of interest for waste acceptance criteria: There are no hazardous materials present.

	(%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.....	0	
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	0	
Reacting with water.....	0	
Higher activity particles.....	P	May be present
Soluble solids as bulk chemical compounds.....	0	

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Hazardous substances /
non hazardous pollutants:

This waste is not expected to contain any listed substances.

	(%wt)	Type(s) and comment
Acrylamide.....	NE	
Benzene.....	NE	
Chlorinated solvents.....	NE	
Formaldehyde.....	NE	
Organometallics.....	NE	
Phenol.....	NE	
Styrene.....	NE	
Tri-butyl phosphate.....	NE	
Other organophosphates.....	NE	
Vinyl chloride.....	NE	
Arsenic.....	NE	
Barium.....	NE	
Boron.....	NE	
Boron (in Boral).....	NE	
Boron (non-Boral).....	NE	
Cadmium.....	NE	
Caesium.....	NE	
Selenium.....	NE	
Chromium.....	NE	
Molybdenum.....	NE	
Thallium.....	NE	
Tin.....	NE	
Vanadium.....	NE	
Mercury compounds.....	NE	
Others.....	NE	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	0	
EEE Type 2.....	0	
EEE Type 3.....	0	
EEE Type 4.....	0	
EEE Type 5.....	0	

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....	NE	
DPTA.....	NE	
NTA.....	NE	
Polycarboxylic acids.....	NE	
Other organic complexants.....	NE	There are no known complexing agents present.
Total complexing agents.....	NE	

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Potential for the waste to contain discrete items: No.

PACKAGING AND CONDITIONING

Conditioning method: Resin and sand will be dewatered prior to encapsulation in cement. Supercompaction will not be used.

Plant Name: Radwaste Conditioning and Packaging Plant.

Location: Hunterston B Power Station.

Plant startup date: ~2023

Total capacity (m³/y incoming waste): NE

Target start date for packaging this stream: -

Throughput for this stream (m³/y incoming waste): NE

Other information: All waste in a tank will be retrieved when a conditioning campaign is undertaken. It is expected that there will be several campaigns.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	500 l drum	100.0	~0.2	0.47	136

Likely container type comment: -

Range in container waste volume: -

Other information on containers: Stainless Steel.

Likely conditioning matrix: BFS/OPC

Other information: A cement blend of BFS/OPC has been considered.

Conditioned density (t/m³): ~1.9

Conditioned density comment: -

Other information on conditioning: All wastes will be dewatered prior to encapsulation.

Opportunities for alternative disposal routing: No

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

RADIOACTIVITY

Source: The main sources of radioactivity are from Fe-55 and Co-60.

Uncertainty: The estimate of total activity is within a factor of 10.

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'.

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Measurement of radioactivities:

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Other information:

The specific activity at various times in the operating history of the plant will vary widely. The estimates are based upon theoretical assessments of values expected after several years of operation. Other beta/gamma nuclides of arisings and stocks (in TBq/m³) include; S35 (8E-2, 4E-4); Ca45 (3E-01, 4E-3); Cr51 (2E-2, 4E-6); Co58 (4E-2, 1E-4) Zr95 (2E-4, 5E-7); Nb95 (2E-4, 1E-7); Ru103 (5E-5, 4E-8) and Ta182 (8E-3, 6E-5).

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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	1.22E-03	CC 1	1.22E-03	CC 1	Gd 153				
Be 10					Ho 163				
C 14	1.09E-04	CC 1	1.09E-04	CC 1	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36	5.55E-04	CC 1	5.55E-04	CC 1	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54	4.95E-05	CC 1	4.95E-05	CC 1	Pb 205				
Fe 55	9.40E-03	CC 1	9.40E-03	CC 1	Pb 210				
Co 60	5.80E-03	CC 1	5.80E-03	CC 1	Bi 208				
Ni 59					Bi 210m				
Ni 63	5.5E-03	CC 1	5.5E-03	CC 1	Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	2.81E-04	CC 1	2.81E-04	CC 1	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94	7.28E-06	CC 1	7.28E-06	CC 1	Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233	9.35E-08	CC 1	9.35E-08	CC 1
Pd 107					U 234	9.35E-08	CC 1	9.35E-08	CC 1
Ag 108m	2.28E-05	CC 1	2.28E-05	CC 1	U 235	4.41E-08	CC 1	4.41E-08	CC 1
Ag 110m					U 236	9.11E-09	CC 1	9.11E-09	CC 1
Cd 109					U 238	2.03E-07	CC 1	2.03E-07	CC 1
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	1.82E-04	CC 1	1.82E-04	CC 1
Sn 123					Pu 239	3.49E-04	CC 1	3.49E-04	CC 1
Sn 126					Pu 240	3.49E-04	CC 1	3.49E-04	CC 1
Sb 125					Pu 241	9.22E-03	CC 1	9.22E-03	CC 1
Sb 126					Pu 242				
Te 125m					Am 241	5.96E-04	CC 1	5.96E-04	CC 1
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	1.27E-05	CC 1	1.27E-05	CC 1	Cm 242	2.92E-06	CC 1	2.92E-06	CC 1
Cs 135					Cm 243	2.12E-05	CC 1	2.12E-05	CC 1
Cs 137	4.88E-03	CC 1	4.88E-03	CC 1	Cm 244	2.12E-05	CC 1	2.12E-05	CC 1
Ba 133	1.13E-05	CC 1	1.13E-05	CC 1	Cm 245	1.03E-05	CC 1	1.03E-05	CC 1
La 137					Cm 246	1.03E-05	CC 1	1.03E-05	CC 1
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147	3.60E-04	CC 1	3.60E-04	CC 1	Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152	4.34E-06	CC 1	4.34E-06	CC 1	Other b/g	3.53E-05	CC 1	3.53E-05	CC 1
Eu 154	2.31E-04	CC 1	2.31E-04	CC 1	Total a	1.54E-03	CC 1	1.54E-03	CC 1
Eu 155	7.32E-05	CC 1	7.32E-05	CC 1	Total b/g	3.78E-02	CC 1	3.78E-02	CC 1

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