WASTE STREAM 3M01 Pond Ion Exchange Material

SITE	Heysham 2
SITE OWNER	EDFE NGL
WASTE CUSTODIAN	EDFE NGL
WASTE TYPE	ILW; SPD1
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	2.5 m^3
Future arisings -	1.4.2022 - 31.3.2028.....	0.3 m^3
	1.4.2028 - 31.3.2030.....	0.2 m^3
	1.4.2030 - 31.3.2031.....	0.3 m^3
Total future arisings:		0.8 m^3
Total waste volume:		3.3 m^3

Comment on volumes: Arisings are dependent on station operations.

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 Spent Ion Exchange materials. There may be traces of sludge associated with the ion exchange material.

PHYSICAL CHARACTERISTICS

General description: The waste is expected to be polystyrene bead ion exchange material, particle size range 0.3 - 1.2 mm. Small amounts of caesium ion exchange material pellets 3/8" long and 1/16" diameter may also be present. There are no large items that may require special handling.

Physical components (%vol): Ion exchange material (drained water-saturated beads~70% vol), Water (interstitial ~30% vol) and possibly traces of sludge.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m^3): 1.1

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): Proprietary ion exchange materials (~35% bone-dry wt), water (absorbed plus intrestitial ~65% wt) and possibly traces of sludge. The proprietary ion exchange material normally used is expected to be an organic bead material (polystyrene cross linked with divinyl benzene). The caesium ion exchange material that would be used in the event of there being leaking fuel in the pond would be an inorganic mineral material. Boron and sodium will be present in the water and on the ion exchange material.

Chemical state: -

Chemical form of radionuclides: -

Metals and alloys (%wt): -

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

WASTE STREAM 3M01 Pond Ion Exchange Material

Lead	NE
Magnox/Magnesium	NE
Nickel	NE
Titanium	NE
Uranium	NE
Zinc	NE
Zircaloy/Zirconium	NE
Other metals	NE

Organics (%wt): Proprietary ion-exchange resins are expected (includes absorbed water).

	(%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	~65.0		
Total rubber	0		
Halogenated rubber	0		
Non-halogenated rubber	0		
Hydrocarbons	0		
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	NE		
Inorganic sludges and flocs	NE		
Soil	0		
Brick/Stone/Rubble	0		
Cementitious material	0		
Sand	0		
Glass/Ceramics			
Graphite	0		
Desiccants/Catalysts	0		
Asbestos	0		

WASTE STREAM 3M01 Pond Ion Exchange Material

Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	~35.0
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): -

	(%wt)	Type(s) and comment
Fluoride.....	NE	
Chloride.....	NE	
Iodide.....	NE	
Cyanide.....	NE	
Carbonate.....	~3.0	
Nitrate.....	NE	
Nitrite.....	NE	
Phosphate.....	NE	
Sulphate.....	<1.0	
Sulphide.....	NE	

Materials of interest for waste acceptance criteria: Ion exchange resins are combustible when dry.

	(%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	

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....	NE	
Benzene.....	NE	

WASTE STREAM 3M01 Pond Ion Exchange Material

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).....	
Boron (non-Boral).....	
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): Not yet determined

	(%wt)	Type(s) and comment
EDTA.....	NE	
DPTA.....	NE	
NTA.....	NE	
Polycarboxylic acids…….	NE	
Other organic complexants.....	NE	Possibly in trace quantities
Total complexing agents.....	NE	

Potential for the waste to contain discrete items: Yes.

PACKAGING AND CONDITIONING

Conditioning method: The waste is expected to be encapsulated in BFS/OPC matrix. The fallback option is wet oxidation followed by encapsulation of the residual sludge (or possibly drying and supercompaction). Drums of supercompacted waste would be grouted in an

'enhanced' drum. Other process options are being kept under review.

Plant Name: None.

Location: Heysham 2 Power Station.

Plant startup date: Between 2035 and 2038.

Total capacity (m^3/y incoming waste): ~175.0

Target start date for packaging this stream: -

Throughput for this stream (m^3/y incoming waste): ~

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	17

Likely container type comment: -

Range in container waste volume: -

Other information on containers: Stainless Steel

Likely conditioning matrix: BFS/OPC

Other information: A 9:1 BFS/OPC matrix is expected to be used.

Conditioned density (t/m^3): ~1.7

Conditioned density comment: Density may vary from 1.62 - 1.72 t/m^3.

Other information on conditioning: Appropriate plant to be provided at the Station in accordance with EDF Energy strategy.

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: Spent Ion Exchange Resins. Contamination by activation products will be a main source of activity.

Uncertainty: Resin accumulated during early years of operation is likely to be of low activity.

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: Radiochemical analysis of samples.

Other information: -

WASTE STREAM 3M01 Pond Ion Exchange Material

Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	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		6		6	Gd 153				
Be 10		8		8	Ho 163				
C 14		8		8	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36		6		6	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41		8		8	Pt 193				
Mn 53					Tl 204				
Mn 54	5.64E-04	C C 2	9.42E-03	C C 2	Pb 205				
Fe 55	6.44E-03	C C 2	5.28E-02	C C 2	Pb 210		8		8
Co 60	5.44E-02	C C 2	2.05E-01	C C 2	Bi 208				
Ni 59		8		8	Bi 210m				
Ni 63		6		6	Po 210		8		8
Zn 65	1.18E-03	C C 2	2.30E-02	C C 2	Ra 223				
Se 79		8		8	Ra 225				
Kr 81					Ra 226		8		8
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90		8		8	Th 227				
Zr 93		8		8	Th 228				
Nb 91					Th 229		8		8
Nb 92					Th 230		8		8
Nb 93m		8		8	Th 232		8		8
Nb 94		8		8	Th 234				
Mo 93		8		8	Pa 231		8		8
Tc 97					Pa 233				
Tc 99		8		8	U 232				
Ru 106	<4.29E-04	C 3	<6.34E-03	C 3	U 233		8		8
Pd 107		8		8	U 234		8		8
Ag 108m	<2.07E-04	C 3	<2.07E-04	C 3	U 235		8		8
Ag 110m	<1.64E-04	C 3	<3.12E-03	C 3	U 236		8		8
Cd 109					U 238		8		8
Cd 113m					Np 237		8		8
Sn 119m					Pu 236				
Sn 121m		8		8	Pu 238	6.71E-06	C C 2	7.52E-06	C C 2
Sn 123					Pu 239	1.39E-05	C C 2	1.39E-05	C C 2
Sn 126		8		8	Pu 240	5.57E-06	C C 2	5.57E-06	C C 2
Sb 125	<5.87E-05	C 3	<3.86E-04	C 3	Pu 241	5.59E-04	C C 2	1.03E-03	C C 2
Sb 126					Pu 242		8		8
Te 125m					Am 241	5.56E-04	C C 2	5.56E-04	C C 2
Te 127m					Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	3.84E-04	C C 2	3.29E-03	C C 2	Cm 242	4.04E-08	C C 2	9.52E-07	C C 2
Cs 135		8		8	Cm 243	1.88E-08	C C 2	2.59E-08	C C 2
Cs 137	1.84E-02	C C 2	2.52E-02	C C 2	Cm 244	5.85E-07	C C 2	9.65E-07	C C 2
Ba 133	3.36E-04	C C 2	7.45E-04	C C 2	Cm 245		8		8
La 137					Cm 246		8		8
La 138					Cm 248				
Ce 144	6.84E-05	C C 2	1.21E-03	C C 2	Cf 249				
Pm 145					Cf 250				
Pm 147		8		8	Cf 251				
Sm 147					Cf 252				
Sm 151		8		8	Other a	<1E-09	8	<1E-09	8
Eu 152	<1.1E-04	C 3	<2.10E-04	C 3	Other b/g	5.94E-07	C C 2	5.94E-07	C C 2
Eu 154	2.24E-04	C C 2	5.71E-04	C C 2	**Total a**	**5.82E-04**	**C C 2**	**5.85E-04**	**C C 2**
Eu 155	<1.7E-04	C 3	<6.95E-04	C 3	**Total b/g**	**8.37E-02**	**C C 2**	**3.33E-01**	**C C 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