WASTE STREAM 3L01 Pond Water Ion Exchange Material

SITE	Heysham 1
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.....	11.9 m^3
Future arisings -	1.4.2022 - 31.3.2024.....	1.0 m^3
	1.4.2024 - 31.3.2026.....	1.6 m^3
	1.4.2026 - 31.3.2027.....	0.5 m^3
Total future arisings:		3.1 m^3
Total waste volume:		15.0 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 Spent ion exchange materials.

PHYSICAL CHARACTERISTICS

General description: The Ion Exchange material is stored under water in tanks. It should be easily pumped and have rapid settling characteristics. The waste is expected to be predominantly Rohm and Haas ion exchange material IRN 150 L (mixed bed resin). There are no large items which may require special handling. Particle size range of resin is 0.4 to 0.6 mm.

Physical components (%vol): Ion exchange material, water, sludge. Volume breakdown not assessed.

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, water. Minor components not assessed. Composition appropriate to proprietary ion exchange materials, some of which will be organic in nature. Materials accumulated include IRN 150L (a combination of IRN77 and IRN78L). Pond water ion exchange material will be in the borate form following use in treatment of boric acid dosed pond water.

Chemical state: -

Chemical form of radionuclides: -

Metals and alloys (%wt): Steel particulate may be present

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

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Nickel	NE
Titanium	NE
Uranium	NE
Zinc	0
Zircaloy/Zirconium	0
Other metals	NE

Organics (%wt): Proprietary organic ion-exchange resins will be present and expected to constitute nearly all of the waste apart from interstitial 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	NE		
Total rubber	0		
Halogenated rubber	0		
Non-halogenated rubber	0		
Hydrocarbons	NE		
Oil or grease			
Fuel			
Asphalt/Tarmac (cont.coal tar)			
Asphalt/Tarmac (no coal tar)			
Bitumen			
Others			
Other organics	NE		

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	NE		
Glass/Ceramics	0		
Graphite	0		
Desiccants/Catalysts	NE		
Asbestos	0		
Non/low friable			
Moderately friable			

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Highly friable.....	
Free aqueous liquids.....	P
Free non-aqueous liquids.....	0
Powder/Ash.....	0

Inorganic anions (%wt): Used pond water filtration resins will contain borate ions.

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

Materials of interest for waste acceptance criteria: Ion exchange resins may be 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	
Chlorinated solvents.....	NE	
Formaldehyde.....	NE	

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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): 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: No.

PACKAGING AND CONDITIONING

Conditioning method: It is expected that the waste will be encapsulated. Other approaches being kept under review are (1) to dry the resin, supercompact drums of dry resin and grout the supercompacted drums in an "enhanced" drum (2) wet oxidation of the resin, drying of the resulting sludge, supercompaction of the dry sludge and grouting of the supercompacted drums in an "enhanced" drum.

Plant Name: None.

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Location:	Heysham 1 Power Station.
Plant startup date:	Probably between 2024 and 2034.
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. There may be more than one campaign.

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	75

Likely container type comment:	-
Range in container waste volume:	-
Other information on containers:	The container material is expected to be stainless steel.
Likely conditioning matrix:	BFS/OPC
Other information:	A 9:1 BFS/OPC matrix imay be the encapsulating matrix but investigation of appropriate matrix materials is continuing and another material may consequently be selected.
Conditioned density (t/m^3):	~1.7
Conditioned density comment:	Density range 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 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:	Contamination by activation products will be the main source of activity.
Uncertainty:	Specific activity is a function of station operating history. The estimates are based upon theoretical assessments and limited operational data. The values quoted are indicative of those that might be expected.
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:	Theoretical assessment and limited measurement of samples.
Other information:	"Other beta/gamma arisings and stocks (in TBq/m^3) include S35 (1E+0, 4E-5); Ca45 (3E+0, 5E-3); Cr51 (3E-1, 2E-12); Co58 (3E-1, 2E-6); Zr95 (2E-3, 5E-9); Nb95 (2E-3, 1E-12); Ru103 (5E-3, 2E-11); Ta182 (1E-1, 2E-5); P32 (5E-3, 1E-23); Fe59 (1E-2, 4E-10); Tb160 (2E-3, 2E-8) and Hf181 (1E-3, 2E-11)."

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	5.48E-05	c c 1	5.48E-05	c c 1	Gd 153				
Be 10					Ho 163				
C 14	4.19E-05	c c 1	4.19E-05	c c 1	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36	9.56E-05	c c 1	9.56E-05	c c 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	2.50E-04	c c 1	2.50E-04	c c 1	Pb 205				
Fe 55	4.48E-04	c c 1	4.48E-04	c c 1	Pb 210				
Co 60	2.31E-03	c c 1	2.31E-03	c c 1	Bi 208				
Ni 59					Bi 210m				
Ni 63	2.02E-02	c c 1	2.02E-02	c c 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	8.91E-04	c c 1	8.91E-04	c c 1	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94	2.90E-05	c c 1	2.90E-05	c c 1	Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m					U 235				
Ag 110m					U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	1.13E-04	c c 1	1.13E-04	c c 1
Sn 123					Pu 239	2.19E-04	c c 1	2.19E-04	c c 1
Sn 126					Pu 240	2.19E-04	c c 1	2.19E-04	c c 1
Sb 125					Pu 241	7.02E-03	c c 1	7.02E-03	c c 1
Sb 126					Pu 242				
Te 125m					Am 241	9.34E-04	c c 1	9.34E-04	c c 1
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	1.01E-05	c c 1	1.01E-05	c c 1	Cm 242				
Cs 135					Cm 243	2.04E-05	c c 1	2.04E-05	c c 1
Cs 137	3.49E-03	c c 1	3.49E-03	c c 1	Cm 244	2.04E-05	c c 1	2.04E-05	c c 1
Ba 133	2.72E-05	c c 1	2.72E-05	c c 1	Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147	9.56E-05	c c 1	9.56E-05	c c 1	Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152					Other b/g	3.02E-05	c c 1	3.02E-05	C C 1
Eu 154	1.51E-04	c c 1	1.51E-04	c c 1	**Total a**	**1.53E-03**	**c 1**	**1.53E-03**	**c 1**
Eu 155	3.74E-05	c c 1	3.74E-05	c c 1	**Total b/g**	**3.51E-02**	**C c 1**	**3.51E-02**	**C c 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