

<b>WASTE STREAM</b>	<b>3L15</b>	<b>Active Effluent Ion Exchange Material</b>
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**SITE** Heysham 1

**SITE OWNER** EDFE NGL

**WASTE CUSTODIAN** EDFE NGL

**WASTE TYPE** LLW

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

	Reported
Stocks: At 1.4.2022.....	6.0 m <sup>3</sup>
Future arisings - 1.4.2022 - 31.3.2024.....	0.4 m <sup>3</sup>
1.4.2024 - 31.3.2026.....	0.8 m <sup>3</sup>
1.4.2026 - 31.3.2027.....	0.4 m <sup>3</sup>
Total future arisings:	1.6 m <sup>3</sup>
Total waste volume:	7.6 m <sup>3</sup>

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. 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, some sludge. Volume breakdown not assessed.

Sealed sources: The waste does not contain sealed sources.

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

Comment on density: -

**CHEMICAL COMPOSITION**

General description and components (%wt): Materials accumulated include IRN 154L (a combination of IRN163 and IRN168) and IRN 150L (a combination of IRN77 and IRN78L). Proprietary Ion Exchange materials, water. Minor components not assessed. Composition appropriate to proprietary ion exchange materials, some of which will be organic in nature.

Chemical state: -

Chemical form of radionuclides: -

Metals and alloys (%wt): Traces of steel particulate may be present

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

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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 cellulose.....	0		
Paper, cotton.....	0		
Wood.....	0		
Halogenated plastics .....	0		
Total non-halogenated plastics.....	0		
Condensation polymers.....	0		
Others.....	0		
Organic ion exchange materials....	~100.0		
Total rubber.....	0		
Halogenated rubber .....	0		
Non-halogenated rubber.....	0		
Hydrocarbons.....	TR		
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.....	0		
Glass/Ceramics.....			
Graphite.....	0		
Desiccants/Catalysts.....	0		
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			

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

Inorganic anions (%wt): Further assessment will be necessary. Only trace amounts are expected.

	(%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.....	0	Not expected
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	
Organometallics.....	NE	

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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      No. No  
contain discrete items:

**TREATMENT, PACKAGING AND DISPOSAL**

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Planned on-site / off-site treatment(s):

Treatment	On-site / Off site	Stream volume %
Low force compaction Supercompaction (HFC) Incineration Solidification Decontamination Metal treatment Size reduction Decay storage Recycling / reuse Other / various None	Off-site	100.0

Comment on planned treatments:

Based on preliminary characterisation campaign 2021

**Disposal Routes:**

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository Expected to be consigned to a Landfill Facility Expected to be consigned to an On-Site Disposal Facility Expected to be consigned to an Incineration Facility Expected to be consigned to a Metal Treatment Facility Expected to be consigned as Out of Scope Expected to be recycled / reused Disposal route not known	100.0	

Classification codes for waste expected to be consigned to a landfill facility: -

**Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):**

Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
Expected to be consigned to the LLW Repository Expected to be consigned to a Landfill Facility Expected to be consigned to an On-Site Disposal Facility Expected to be consigned to an Incineration Facility Expected to be consigned to a Metal Treatment Facility Expected to be consigned as Out of Scope Expected to be recycled / reused Disposal route not known			

**Opportunities for alternative disposal routing:** -

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

**Waste Packaging for Disposal:** (Not applicable to this waste stream)

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Container	Stream volume %	Waste loading m <sup>3</sup>	Number of packages
1/3 Height IP-1 ISO			
2/3 Height IP-2 ISO			
1/2 Height WAMAC IP-2 ISO			
1/2 Height IP-2 Disposal/Re-usable ISO			
2m box (no shielding)			
4m box (no shielding)			
Other			

Other information: -

**Waste Planned for Disposal at the LLW Repository:** (Not applicable to this waste stream)

Container voidage: -

Waste Characterisation Form (WCH): -

Waste consigned for disposal to LLWR in year of generation: -

**Non-Containerised Waste for In-Vault Grouting:** (Not applicable to this waste stream)

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

**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 tank sampling.

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 assessments and limited tank sampling.

Other information: Other beta/gamma nuclides included (in TBq/m<sup>3</sup>) in arisings and stocks are: - S35 (2E-3, 1E-6) Ca45 (5E-3, 3E-5); Cr51 (2E-3, 9E-11); Co58 (3E-2, 6E-6); Zr95 (7E-6, 8E-10); Nb95 (7E-6, 6E-12); Ru103 (3E-6, 8E-12); Ta182 (5E-2, 9E-5); P32 (8E-5, 9E-18); Fe59 (3E-4, 3E-9); Ce141 (4E-6, 1E-12); Tb160 (5E-6, 1E-9) and Hf181 (5E-6, 3E-11).

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**Active Effluent 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	2.15E-06	cc 1	2.15E-06	cc 1	Gd 153				
Be 10					Ho 163				
C 14	2.51E-06	cc 1	2.51E-06	cc 1	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36	2.86E-07	cc 1	2.86E-07	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					Pb 205				
Fe 55	2.39E-06	cc 1	2.39E-06	cc 1	Pb 210				
Co 60	9.66E-08	cc 1	9.66E-08	cc 1	Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					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	4.06E-08	cc 1	4.06E-08	cc 1
Sn 123					Pu 239	5.97E-08	cc 1	5.97E-08	cc 1
Sn 126					Pu 240	5.97E-08	cc 1	5.97E-08	cc 1
Sb 125					Pu 241	7.40E-06	cc 1	7.40E-06	cc 1
Sb 126					Pu 242				
Te 125m					Am 241	4.65E-08	cc 1	4.65E-08	cc 1
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137	1.29E-05	cc 1	1.29E-05	cc 1	Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152					Other b/g				
Eu 154					<b>Total a</b>	<b>2.06E-07</b>	<b>cc 1</b>	<b>2.06E-07</b>	<b>CC 1</b>
Eu 155					<b>Total b/g</b>	<b>2.77E-05</b>	<b>cc 1</b>	<b>2.77E-05</b>	<b>cc 1</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