

WASTE STREAM**3L15****Active Effluent Ion Exchange Material****SITE** Heysham 1**SITE OWNER** EDFE NGL**WASTE CUSTODIAN** EDFE NGL**WASTE TYPE** LLW**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	6.0 m ³
Future arisings -	1.4.2019 - 31.3.2024.....	1.0 m ³
	1.4.2024 - 31.3.2026.....	0.8 m ³
	1.4.2026 - 31.3.2027.....	0.4 m ³
Total future arisings:		2.2 m ³
Total waste volume:		8.2 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. 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/m³): 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

Stainless steel.....	TR
Other ferrous metals.....	TR
Iron.....	NE
Aluminium.....	
Beryllium.....	NE
Cobalt.....	NE
Copper.....	0
Lead.....	0
Magnox/Magnesium.....	0
Nickel.....	NE
Titanium.....	NE
Uranium.....	NE
Zinc.....	0

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	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.	
	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):	-	
	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.....	
	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.	

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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.

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
Active particles.....	0
Soluble solids as bulk chemical compounds.....	0

Not expected

Hazardous substances / non hazardous pollutants:

-	
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

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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
 EDTA..... NE
 DPTA..... NE
 NTA..... NE
 Polycarboxylic acids..... NE
 Other organic complexants..... NE
 Total complexing agents..... NE

Possibly in trace quantities.

TREATMENT, PACKAGING AND DISPOSAL

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	On-site	100.0

Comment on planned treatments:

Alternative treatments to encapsulation, such as incineration, will be considered if appropriate at the time of recovery.

WASTE STREAM**3L15****Active Effluent Ion Exchange Material****Disposal Routes:**

Disposal Route	Stream volume %
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

Upcoming (2019/20-2021/22) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2019/20	2020/21	2021/22
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			

Waste Packaging for Disposal:

Container	Stream volume %	Waste loading m ³	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	100.0	~6.28	2

Other information: CF of 2.35 assumed.

Waste Planned for Disposal at the LLW Repository:

Container voidage: -

Waste Characterisation Form (WCH): It is not yet determined if the waste meets LLWR's Waste Acceptance Criteria (WAC).

Waste consigned for disposal to LLWR in year of generation: No.

Potential for the waste to contain discrete items: No

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: -

WASTE STREAM**3L15****Active Effluent Ion Exchange Material****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 ³) 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 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					Gd 153				
Be 10					Ho 163				
C 14					Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36					Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40	8.96E-07	CC 2	8.96E-07	DD 2	Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54	9.74E-08	CC 2	9.74E-08	CC 2	Pb 205				
Fe 55					Pb 210				
Co 60	1.48E-06	CC 2	1.48E-06	CC 2	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				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	1.53E-07	CC 2	1.53E-07	CC 2	Cm 242				
Cs 135					Cm 243				
Cs 137	2.05E-06	CC 2	2.05E-06	CC 2	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		8		8
Eu 152					Other b/g	1.49E-06	CC 2	1.49E-06	CC 2
Eu 154					Total a	<1E-09	8	<1E-09	8
Eu 155					Total b/g	6.17E-06	CD 2	6.17E-06	CD 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