WASTE STREAM 3L01 Pond Water Ion Exchange Material

SITE Heysham 1

SITE OWNER EDFE NGL

WASTE CUSTODIAN EDFE NGL

WASTE TYPE ILW; SPD1

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	11.5 m³
Future arisings -	1.4.2019 - 31.3.2024.....	2.0 m³
	1.4.2024 - 31.3.2026.....	1.6 m³
	1.4.2026 - 31.3.2027.....	0.5 m³
Total future arisings:		4.1 m³
Total waste volume:		15.6 m³

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/m³): 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

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

WASTE STREAM 3L01 Pond Water Ion Exchange Material

	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.	
	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):	-	
	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	
	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.	

WASTE STREAM 3L01 Pond Water Ion Exchange Material

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	P	May be present
Soluble solids as bulk chemical compounds	0	

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

WASTE STREAM 3L01 Pond Water Ion Exchange Material

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	Possibly in trace quantities.
Total complexing agents	NE	

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.
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	78

WASTE STREAM 3L01 Pond Water Ion Exchange Material

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/m³):	~1.7
Conditioned density comment:	Density range may vary from 1.62 - 1.72 t/m³.
Other information on conditioning:	Appropriate plant to be provided at the Station in accordance with strategy.
Opportunities for alternative disposal routing:	No

Treatment	Stream volume (%)	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/m³) 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)."

WASTE STREAM 3L01 Pond Water Ion Exchange Material

Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	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	<1.69E-05	C 3	<2E-05	C 3	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	1.78E-03	C C 2	1E+00	C C 2	Pb 205				
Fe 55	9.37E-02	C C 2	2E+00	C C 2	Pb 210		8		8
Co 60	5.39E-01	C C 2	4E+00	C C 2	Bi 208				
Ni 59		6		6	Bi 210m				
Ni 63	3.92E-01	C C 2	4E-01	C C 2	Po 210		8		8
Zn 65	3.27E-05	C C 2	5E-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	6.55E-06	C C 2	2E-03	C C 2	U 233		8		8
Pd 107		8		8	U 234		8		8
Ag 108m		8		8	U 235		8		8
Ag 110m	9.40E-06	C C 2	1E-02	C C 2	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		8		8
Sn 123					Pu 239		8		8
Sn 126		8		8	Pu 240		8		8
Sb 125					Pu 241		8		8
Sb 126					Pu 242		8		8
Te 125m					Am 241		8		8
Te 127m					Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134		8		8	Cm 242		8		8
Cs 135		8		8	Cm 243		8		8
Cs 137		8		8	Cm 244		8		8
Ba 133	2.47E-03	C C 2	5E-03	C C 2	Cm 245		8		8
La 137					Cm 246		8		8
La 138					Cm 248				
Ce 144	2.78E-06	C C 2	2E-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		8		8
Eu 152		8		8	Other b/g	5E-03	C C 2	5E+00	C C 2
Eu 154	1.57E-03	C C 2	5E-03	C C 2	**Total a**	**<1E-09**	**8**	**<1E-09**	**8**
Eu 155	6.43E-04	C C 2	5E-03	C C 2	**Total b/g**	**1.04E+00**	**C C 2**	**1.25E+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