

WASTE STREAM	3L02	Pond Water Filtration Sludge
---------------------	-------------	-------------------------------------

SITE Heysham 1

SITE OWNER EDFE NGL

WASTE CUSTODIAN EDFE NGL

WASTE TYPE ILW; SPD1

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	3.4 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.....	0.3 m ³
Total future arisings:		2.1 m ³
Total waste volume:		5.5 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 Filtration of pond waters.

PHYSICAL CHARACTERISTICS

General description: Sludge, sand and any filter precoat material that may be used. There will be no large items that may require special handling.

Physical components (%vol): Sludge, sand including filter aid material, spent abrasive material (100% vol). No other items identified. The breakdown of the components constituting the sludge has not been assessed.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): A wide variety of materials including filter precoat material and sand.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Tritiated water
 C-14: Graphite
 Cl-36: Not assessed
 Se-79: Not assessed
 Tc-99: Not assessed
 I-129: Not assessed
 Ra: Not assessed
 Th: Not assessed
 U: Not assessed
 Np: Not assessed
 Pu: Not assessed

Metals and alloys (%wt): -

Stainless steel.....	TR
Other ferrous metals.....	TR
Iron.....	TR
Aluminium.....	TR
Beryllium.....	NE
Cobalt.....	NE
Copper.....	TR
Lead.....	TR

WASTE STREAM

3L02

Pond Water Filtration Sludge

	Magnox/Magnesium.....	0
	Nickel.....	NE
	Titanium.....	NE
	Uranium.....	NE
	Zinc.....	TR
	Zircaloy/Zirconium.....	0
	Other metals.....	NE
Organics (%wt):	Oil and grease may be present.	
	Total cellulosics.....	NE
	Paper, cotton.....	
	Wood.....	
	Halogenated plastics	TR
	Total non-halogenated plastics.....	TR
	Condensation polymers.....	TR
	Others.....	TR
	Organic ion exchange materials....	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.....	NE
Other materials (%wt):	-	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs.....	~100.0
	Soil.....	0
	Brick/Stone/Rubble.....	0
	Cementitious material.....	0
	Sand.....	NE
	Glass/Ceramics.....	0
	Graphite.....	0
	Desiccants/Catalysts.....	0
	Asbestos.....	0
	Non/low friable.....	
	Moderately friable.....	
	Highly friable.....	
	Free aqueous liquids.....	0
	Free non-aqueous liquids.....	0

WASTE STREAM

3L02

Pond Water Filtration Sludge

	Powder/Ash.....	0	
Inorganic anions (%wt):	Only trace quantities expected.		
	Fluoride.....	TR	
	Chloride.....	TR	
	Iodide.....	TR	
	Cyanide.....	NE	
	Carbonate.....	TR	
	Nitrate.....	TR	
	Nitrite.....	NE	
	Phosphate.....	TR	
	Sulphate.....	TR	
	Sulphide.....	TR	
Materials of interest for waste acceptance criteria:	Expect only trace quantities if any.		
	Combustible metals.....	0	
	Low flash point liquids.....	0	
	Explosive materials.....	0	
	Phosphorus.....	0	
	Hydrides.....	0	
	Biological etc. materials.....	0	
	Biodegradable materials.....	0	
	Putrescible wastes.....		
	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	

WASTE STREAM**3L02****Pond Water Filtration Sludge**

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

Expect only trace quantities, if any.

PACKAGING AND CONDITIONING

Conditioning method:	The waste will be encapsulated. Another approach being kept under review is (i) to dry the sludge (ii) to supercompact drums of dry sludge (iii) to grout the supercompact drums in an "enhanced" drum.
Plant Name:	None.
Location:	Heysham 1 Power Station.
Plant startup date:	Probably between 2029 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.

WASTE STREAM	3L02	Pond Water Filtration Sludge
---------------------	-------------	-------------------------------------

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	500 l drum	100.0	~0.33	0.47	17

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 is expected to be used.

Conditioned density (t/m³): ~1.7

Conditioned density comment: The density range varies from 1.68 to 1.84 t/m³.

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

Opportunities for alternative disposal routing: No

Treatment	Stream volume (%)	Comment
-	-	-

RADIOACTIVITY

Source: Contaminated sludge. Contamination by activation products will be the main source of activity.

Uncertainty: The values quoted were 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 assessment plus some limited measurements of waste.

Other information: Other beta/gamma arisings and stock nuclides include (in TBq/m³) Cr51 (1E+2, 2E-2); Co58 (5E+0, 2E-2); Sr89 (1E-7, 1E-10); Y91 (1E-6, 2E-9) Zr95 (4E-4, 1E-6); Nb95 (1E-3, 5E-7); Ru103 (4E-9, 3E-12); Ta182 (2E+0, 1E-2) Fe59 (2E-1, 2E-4) and Sb124 (6E-2, 1E-4).

WASTE STREAM 3L02 Pond Water Filtration Sludge

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	<8E-06	D 3	<2E-05	D 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	9E-03	CD 2	5E+00	CD 2	Pb 205				
Fe 55	9E-01	CD 2	1E+01	CD 2	Pb 210		8		8
Co 60	3E-01	CD 2	1E+00	CD 2	Bi 208				
Ni 59	1E-02	CD 2	1E-02	CD 2	Bi 210m				
Ni 63	1E+00	CD 2	1E+00	CD 2	Po 210		8		8
Zn 65	9E-05	CD 2	1E-01	CD 2	Ra 223				
Se 79	1.21E-08	CD 2	1.21E-08	CD 2	Ra 225				
Kr 81					Ra 226		8		8
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	2E-02	CD 2	2E-02	CD 2	Th 227				
Zr 93	6E-07	CD 2	6E-07	CD 2	Th 228				
Nb 91					Th 229		8		8
Nb 92					Th 230		8		8
Nb 93m	7E-08	6		6	Th 232		8		8
Nb 94	1E-05	CD 2	1E-05	CD 2	Th 234				
Mo 93		8		8	Pa 231		8		8
Tc 97					Pa 233				
Tc 99	3E-06	CD 2	3E-06	CD 2	U 232				
Ru 106	5E-05	CD 2	1E-02	CD 2	U 233		8		8
Pd 107		8		8	U 234	2E-06	CD 2	2E-06	CD 2
Ag 108m		8		8	U 235	5E-08	CD 2	5E-08	CD 2
Ag 110m	2E-05	CD 2	3E-02	CD 2	U 236	4E-07	CD 2	4E-07	CD 2
Cd 109					U 238	7E-07	CD 2	7E-07	CD 2
Cd 113m					Np 237	3E-07	CD 2	3E-07	CD 2
Sn 119m					Pu 236				
Sn 121m		8		8	Pu 238	1E-03	CD 2	1E-03	CD 2
Sn 123					Pu 239	4E-04	CD 2	4E-04	CD 2
Sn 126	4.35E-08	CD 2	4.35E-08	CD 2	Pu 240	8E-04	CD 2	8E-04	CD 2
Sb 125	9E-05	CD 2	4E-03	CD 2	Pu 241	6E-02	CD 2	1E-01	CD 2
Sb 126					Pu 242	2E-06	CD 2	2E-06	CD 2
Te 125m					Am 241	1E-03	CD 2	7E-04	CD 2
Te 127m					Am 242m	1E-05	CD 2	1E-05	CD 2
I 129	5E-09	CD 2	5E-09	CD 2	Am 243	7E-06	CD 2	7E-06	CD 2
Cs 134	1E-03	CD 2	2E-02	CD 2	Cm 242	8E-06	CD 2	6E-04	CD 2
Cs 135	9E-08	CD 2	9E-08	CD 2	Cm 243	7E-06	CD 2	1E-05	CD 2
Cs 137	2E-02	CD 2	2E-02	CD 2	Cm 244	3E-04	CD 2	4E-04	CD 2
Ba 133					Cm 245		8		8
La 137					Cm 246		8		8
La 138					Cm 248				
Ce 144	1E-05	CD 2	9E-03	CD 2	Cf 249				
Pm 145					Cf 250				
Pm 147	2E-03	CD 2	2E-02	CD 2	Cf 251				
Sm 147					Cf 252				
Sm 151	2E-05	CD 2	2E-05	CD 2	Other a		8		8
Eu 152		6		6	Other b/g	5E-02	CD 2	1E+02	CD 2
Eu 154	2E-03	CD 2	6E-03	CD 2	Total a	3.53E-03	CD 2	3.92E-03	CD 2
Eu 155	7E-04	CD 2	4E-03	CD 2	Total b/g	2.38E+00	CD 2	1.17E+02	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