

<b>WASTE STREAM</b>	<b>3M02</b>	<b>Pond Water Filter Sludge</b>
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**SITE** Heysham 2

**SITE OWNER** EDFE NGL

**WASTE CUSTODIAN** EDFE NGL

**WASTE TYPE** ILW; SPD1

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	8.4 m <sup>3</sup>
Future arisings -	1.4.2019 - 31.3.2030.....	0.6 m <sup>3</sup>
	1.4.2030 - 31.3.2032.....	0.2 m <sup>3</sup>
Total future arisings:		0.8 m <sup>3</sup>
Total waste volume:		9.2 m <sup>3</sup>

Comment on volumes: Arisings are dependent on station operations.

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** Sludge and filter pre-coat material.

**PHYSICAL CHARACTERISTICS**

General description: Sludge and any filter precoat material (Dicalite Speedplus). Precoat mean particle size is 8 - 9.5 micron. There are no large items that may require special handling.

Physical components (%wt): Filter Precoat (Dicalite Speedplus) (~80% wt) containing pond debris. No other constituents identified.

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): Predominantly Filter precoat (Dicalite Speedplus) which is essentially mineral silica (silicon dioxide). There will also be debris filtered from pond water. Other materials not assessed.

Chemical state: Neutral

Chemical form of radionuclides:

- H-3: Contamination by tritiated water
- C-14: Not expected to be significant
- Cl-36: Not determined
- Se-79: Not determined
- Tc-99: Not determined
- I-129: Not determined
- Ra: Not expected to be significant
- Th: Not expected to be significant
- U: Not determined
- Np: Not determined
- Pu: Not determined

Metals and alloys (%wt): -

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

**WASTE STREAM****3M02****Pond Water Filter Sludge**

	Titanium.....	NE
	Uranium.....	NE
	Zinc.....	NE
	Zircaloy/Zirconium.....	NE
	Other metals.....	NE
Organics (%wt):	To be further assessed following operational experience.	
	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....	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.....	0
	Glass/Ceramics.....	0
	Graphite.....	0
	Desiccants/Catalysts.....	0
	Asbestos.....	0
	Non/low friable.....	
	Moderately friable.....	
	Highly friable.....	
	Free aqueous liquids.....	P
	Free non-aqueous liquids.....	P
	Powder/Ash.....	0
Inorganic anions (%wt):	Further assessment required.	

**WASTE STREAM****3M02****Pond Water Filter Sludge**

Fluoride.....	NE
Chloride.....	TR
Iodide.....	NE
Cyanide.....	NE
Carbonate.....	~4.2
Nitrate.....	NE
Nitrite.....	NE
Phosphate.....	NE
Sulphate.....	~0.30
Sulphide.....	NE

Materials of interest for waste acceptance criteria:

No material likely to represent a fire or other non-radiological hazard is expected to be present.

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

May be present

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

<b>WASTE STREAM</b>	<b>3M02</b>	<b>Pond Water Filter Sludge</b>
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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

Expect only trace quantities, if any.

**PACKAGING AND CONDITIONING**

Conditioning method: The waste is expected to be encapsulated in a BFS/OPC matrix. Another approach being kept under review is (i) to dry the sludge (ii) to supercompact drums of dry sludge (iii) to grout the supercompacted drums in an "enhanced" drum.  
 Plant Name: None.  
 Location: Heysham 2 Power Station.  
 Plant startup date: Expected between 2035 and 2038.  
 Total capacity (m<sup>3</sup>/y incoming waste): ~175.0  
 Target start date for packaging this stream: -  
 Throughput for this stream (m<sup>3</sup>/y incoming waste): -  
 Other information: All waste will be retrieved when a conditioning campaign is undertaken. It is expected that there will be several campaigns.

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages
	500 l drum	100.0	~0.33	0.47	28

<b>WASTE STREAM</b>	<b>3M02</b>	<b>Pond Water Filter Sludge</b>
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Likely container type comment: -

Range in container waste volume: -

Other information on containers: Stainless Steel

Likely conditioning matrix: BFS/OPC  
 Other information: A 9:1 BFS/OPC matrix to formula FS044A is expected.

Conditioned density (t/m<sup>3</sup>): ~1.76  
 Conditioned density comment: Density in the range 1.68 - 1.84 t/m<sup>3</sup> is expected.

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 filter precoat. Contamination by activation products will be the main source of activity.

Uncertainty: The values quoted were based on tank sampling and some theoretical assessments. Factor applied to tank measured activity levels to estimate arisings activity based on steady state input for 30 years.

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: Predominantly radiochemical analysis of samples.

Other information: -

**WASTE STREAM 3M02 Pond Water Filter Sludge**

Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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		6		6	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	6.33E-03	CC 2	1.06E-01	DD 2	Pb 205				
Fe 55	2E+00	CC 2	1.64E+01	DD 2	Pb 210		8		8
Co 60	2.52E-02	CC 2	9.5E-02	DD 2	Bi 208				
Ni 59		6		6	Bi 210m				
Ni 63		6		6	Po 210		8		8
Zn 65	1E-02	CC 2	1.95E-01	DD 2	Ra 223				
Se 79		6		6	Ra 225				
Kr 81					Ra 226		8		8
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90		6		6	Th 227				
Zr 93		6		6	Th 228				
Nb 91					Th 229		8		8
Nb 92					Th 230		8		8
Nb 93m		8		8	Th 232		8		8
Nb 94		6		6	Th 234				
Mo 93		8		8	Pa 231		8		8
Tc 97					Pa 233				
Tc 99		6		6	U 232				
Ru 106	<1E-02	C 3	<1.48E-01	D 3	U 233		8		8
Pd 107		8		8	U 234		6		6
Ag 108m	<2E-05	C 3	<2E-05	D 3	U 235		6		6
Ag 110m	2.08E-04	CC 2	3.95E-03	DD 2	U 236		6		6
Cd 109					U 238		6		6
Cd 113m					Np 237		6		6
Sn 119m					Pu 236				
Sn 121m		8		8	Pu 238	2E-04	CC 2	2.24E-04	DD 2
Sn 123					Pu 239	2E-04	CC 2	2E-04	DD 2
Sn 126		6		6	Pu 240	4E-04	CC 2	4E-04	DD 2
Sb 125	<9E-06	C 3	5.92E-05	D 3	Pu 241	4E-02	CC 2	7.4E-02	DD 2
Sb 126					Pu 242		6		6
Te 125m					Am 241	1.64E-03	CC 2	1.64E-03	DD 2
Te 127m					Am 242m		6		6
I 129		6		6	Am 243		6		6
Cs 134	2.2E-04	CC 2	1.89E-03	DD 2	Cm 242	1E-05	CC 2	2.36E-04	DD 2
Cs 135		6		6	Cm 243	1E-06	CC 2	1.38E-06	DD 2
Cs 137	4.79E-03	CC 2	6.56E-03	DD 2	Cm 244	4E-05	CC 2	6.6E-05	DD 2
Ba 133					Cm 245		8		8
La 137					Cm 246		8		8
La 138					Cm 248				
Ce 144	<3E-03	C 3	<5.30E-02	D 3	Cf 249				
Pm 145					Cf 250				
Pm 147		6		6	Cf 251				
Sm 147					Cf 252				
Sm 151		6		6	Other a	<1E-09	8	<1E-09	8
Eu 152	<3E-05	C 3	<5.73E-05	DD 2	Other b/g	1E-03	CC 2	1E-03	DD 2
Eu 154	5.43E-04	CC 2	1.39E-03	DD 2	<b>Total a</b>	<b>1.30E-03</b>	<b>CC 2</b>	<b>2.77E-03</b>	<b>DD 2</b>
Eu 155	3.18E-04	CC 2	1.30E-03	DD 2	<b>Total b/g</b>	<b>2.07E+00</b>	<b>CC 2</b>	<b>1.71E+01</b>	<b>DD 2</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