

<b>WASTE STREAM</b>	<b>3S03</b>	<b>Spent Cartridge Filters (ILW)</b>
---------------------	-------------	--------------------------------------

**SITE** Sizewell B

**SITE OWNER** EDFE NGL

**WASTE CUSTODIAN** EDFE NGL

**WASTE TYPE** ILW; SPD1

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	~3.5 m <sup>3</sup>
Future arisings -	1.4.2019 - 31.3.2035.....	8.8 m <sup>3</sup>
	1.4.2035 - 31.3.2041.....	0 m <sup>3</sup>
	1.4.2041 - 31.3.2042.....	3.3 m <sup>3</sup>
Total future arisings:		12.1 m <sup>3</sup>
Total waste volume:		15.6 m <sup>3</sup>

Comment on volumes: Waste filters are contained in Ductile Cast Iron (DCI) Containers (~250) and Multipack Drums (12) pending decision on final disposal packaging. Arisings volume will be variable depending on station operating conditions. Following planned shutdown in 2035 and defuelling operations, the fuel storage ponds and associated plant will continue in operation for a number of years before removal of the last cartridge filters etc. The current plan shows this in 2040/1. Total volume of DCI and Multipack drums is ~131.5m<sup>3</sup>.

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 cartridge filters.

**PHYSICAL CHARACTERISTICS**

General description: Spent filter cartridges. The amount of particulate radioactive material trapped on each filter may be very variable. There may be some retained water.

Physical components (%vol): Filter cartridges (100 vol%). No other constituents identified.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): 0.85

Comment on density: -

**CHEMICAL COMPOSITION**

General description and components (%wt): The waste is spent filter cartridges, which are composed principally of stainless steel supports with glass fibre filter element and some organic materials. Fission products, actinides and other activation products will be present as contaminants. Stainless steel (~85% wt), glass fibre (~1% wt). Small quantities of epoxy resin (~5% wt), polyester (~1%wt), polyester / polypropylene (~1% wt) and ethylene propylene rubber (~0.15% wt) are used for fixing and sealing purposes. Remaining component is retained water.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Will be present in any retained water.  
 C-14: Trace (value unknown but not thought significant), probably as oxide.  
 Cl-36: Not expected to be significant.  
 Se-79: Not expected to be significant.  
 Tc-99: Not expected to be significant.  
 I-129: Not expected to be significant.  
 Ra: Not expected to be significant.  
 Th: Not expected to be significant.  
 U: Not expected to be significant.  
 Np: Not expected to be significant.  
 Pu: Not expected to be significant.

Metals and alloys (%wt): About 7 inch diameter by 18 inch high hollow cylinder. Has top and bottom disks that are connected by three rods and a metal gauze containing the filter matrix.

**WASTE STREAM**

**3S03**

**Spent Cartridge Filters (ILW)**

	Stainless steel.....	~85.0	304 - 100%.
	Other ferrous metals.....	0	
	Iron.....	0	
	Aluminium.....	NE	
	Beryllium.....	NE	
	Cobalt.....	NE	
	Copper.....	NE	
	Lead.....	NE	
	Magnox/Magnesium.....	0	
	Nickel.....	NE	
	Titanium.....	NE	
	Uranium.....	NE	
	Zinc.....	NE	
	Zircaloy/Zirconium.....	0	
	Other metals.....	TR	
Organics (%wt):	Organic materials as tabulated are expected.		
	Total cellulose.....	0	
	Paper, cotton.....	0	
	Wood.....	0	
	Halogenated plastics .....	0	
	Total non-halogenated plastics.....	~7.0	
	Condensation polymers.....	~5.0	
	Others.....	~2.0	
	Organic ion exchange materials....	0	
	Total rubber.....	~0.15	
	Halogenated rubber .....	0	
	Non-halogenated rubber.....	~0.15	
	Hydrocarbons.....	NE	
	Oil or grease .....	NE	
	Fuel.....	0	
	Asphalt/Tarmac (cont.coal tar)...	0	
	Asphalt/Tarmac (no coal tar)....	0	
	Bitumen.....	0	
	Others.....	0	
	Other organics.....	TR	
Other materials (%wt):	-		
	Inorganic ion exchange materials.	0	
	Inorganic sludges and flocs.....	0	
	Soil.....	0	
	Brick/Stone/Rubble.....	0	
	Cementitious material.....	0	
	Sand.....	0	
	Glass/Ceramics.....	~1.0	

**WASTE STREAM**

**3S03**

**Spent Cartridge Filters (ILW)**

	Graphite.....	0	
	Desiccants/Catalysts.....	0	
	Asbestos.....	0	
	Non/low friable.....		
	Moderately friable.....		
	Highly friable.....		
	Free aqueous liquids.....	~6.9	
	Free non-aqueous liquids.....	0	
	Powder/Ash.....	0	
Inorganic anions (%wt):	None of the listed inorganic anions are expected to be present at greater than the significant level (0.01% for halides, 0.1% for others).		
	Fluoride.....	TR	
	Chloride.....	TR	
	Iodide.....	TR	
	Cyanide.....	0	
	Carbonate.....	TR	
	Nitrate.....	TR	
	Nitrite.....	NE	
	Phosphate.....	0	
	Sulphate.....	0	
	Sulphide.....	0	
Materials of interest for waste acceptance criteria:	Some effluent is expected to be retained by the filters.		
	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	

**WASTE STREAM****3S03****Spent Cartridge Filters (ILW)**

Formaldehyde.....	NE
Organometallics.....	NE
Phenol.....	NE
Styrene.....	NE
Tri-butyl phosphate.....	NE
Other organophosphates.....	NE
Vinyl chloride.....	NE
Arsenic.....	NE
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

May be present in trace quantities.

**PACKAGING AND CONDITIONING**

Conditioning method:	The waste is to be encapsulated. It will not be supercompacted.
Plant Name:	-
Location:	-
Plant startup date:	-
Total capacity (m <sup>3</sup> /y incoming waste):	-
Target start date for packaging this stream:	-

**WASTE STREAM 3S03 Spent Cartridge Filters (ILW)**

Throughput for this stream (m<sup>3</sup>/y incoming waste): -

Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages
	Other(Shielded 500 litre drum. External displacement volume = 0.6m <sup>3</sup> , Internal Volume = 0.12m <sup>3</sup> .)	100.0	~0.05	0.12	312

Likely container type comment: It is assumed that due to activity limits there would be 1 filter present in each drum (the volume of a filter is ~0.05m<sup>3</sup>). It is possible that 2 filters may be placed into each drum however this is not currently expected.

Range in container waste volume: -

Other information on containers: The drums will be self-shielding made from Ductile Cast Iron (DCI) to give a shield wall thickness of 185 mm. The external profile is the same as the standard NDA 500 litre drum. It is possible that the waste will be required to be transferred to standard unshielded 500 litre drums, however this is not yet determined.

Likely conditioning matrix: PFA/OPC  
 Other information: The encapsulating matrix is expected to be 3:1 PFA/OPC.

Conditioned density (t/m<sup>3</sup>): ~1.8

Conditioned density comment: The density is expected to lie between 1.5 and 2.5t/m<sup>3</sup>.

Other information on conditioning: Appropriate plant to be provided at the Station in accordance with EDF Energy strategy. Conditioning is expected to take place after short term accumulation (about 1 year) for the most active filters. Some of the less active filters will be left in an unconditioned state for 10-15 years to allow decay to LLW levels.

Opportunities for alternative disposal routing:

Treatment	Stream volume (%)	Comment
-	-	-

**RADIOACTIVITY**

Source: Spent filter cartridges from various filters. Contamination is principally by fission products, actinides and activation products, with traces of soluble fission products.

Uncertainty: The activity values quoted are indicative of the activities expected. The activity estimates are thought to be accurate to within a factor of 10.

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.

Other information: Specific activity is a function of station operating history. The values quoted are indicative of the magnitude of the activities but individual filters may have significantly higher activities. Other beta/gamma nuclides of arisings and stocks (in TBq/m<sup>3</sup>) include Cr51 (4E-3, 3E-6); Co58 (1E-1, 1E-3); Sr89 (3E-4, 2E-6); Y91 (6E-5, 5E-7); Zr95 (9E-4, 9E-6); Nb95 (9E-4, 2E-6); Ru103 (1E-4, 3E-7) and I131 (3E-3, 3E-11).

**WASTE STREAM**

**3S03**

**Spent Cartridge Filters (ILW)**

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	2.53E-01	CC 2	1E-05	CC 2	Gd 153				
Be 10		8		8	Ho 163				
C 14	6.30E-02	CC 2	3E-09	C 3	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36		8	7E-08	CC 2	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	1.43E-04	CC 2	2E-02	CC 2	Pb 205				
Fe 55	2.01E-01	CC 2	2E-02	CC 2	Pb 210	8			8
Co 60	1.62E-01	CC 2	2E-02	CC 2	Bi 208				
Ni 59		8	2E-06	CC 2	Bi 210m				
Ni 63	3.13E-01	CC 2	2E-04	CC 2	Po 210	8			8
Zn 65	9.80E-07	CC 2	1E-03	CC 2	Ra 223				
Se 79		8	8.62E-10	CC 2	Ra 225				
Kr 81					Ra 226	8			8
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90		8	2E-04	CC 2	Th 227				
Zr 93		8	2E-08	CC 2	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	2E-07	CC 2	Th 234				
Mo 93		8	3E-07	CC 2	Pa 231	8			8
Tc 97					Pa 233				
Tc 99		8	2E-09	CC 2	U 232				
Ru 106		8	2E-03	CC 2	U 233	8			8
Pd 107		8	2E-09	CC 2	U 234	8			8
Ag 108m		8		8	U 235	8			8
Ag 110m					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	2E-03	CC 2	Cm 242	8			8
Cs 135		8	7E-09	CC 2	Cm 243	8			8
Cs 137	5.32E-02	CC 2	3E-03	CC 2	Cm 244	8			8
Ba 133					Cm 245	8			8
La 137					Cm 246	8			8
La 138					Cm 248				
Ce 144		8	2E-03	CC 2	Cf 249				
Pm 145					Cf 250				
Pm 147		8	2E-04	CC 2	Cf 251				
Sm 147					Cf 252				
Sm 151		8	4E-07	CC 2	Other a	8			8
Eu 152		8	6E-09	CC 2	Other b/g	1E-03	CC 2	1E-01	CC 2
Eu 154		8	2E-05	CC 2	<b>Total a</b>	<b>0</b>	<b>8</b>	<b>5.33E-06</b>	<b>CC 2</b>
Eu 155		8	1E-05	CC 2	<b>Total b/g</b>	<b>1.05E+00</b>	<b>CC 2</b>	<b>1.71E-01</b>	<b>CC 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