

<b>WASTE STREAM</b>	<b>3J02</b>	<b>Sludge</b>
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**SITE** Dungeness B

**SITE OWNER** EDFE NGL

**WASTE CUSTODIAN** EDFE NGL

**WASTE TYPE** ILW; SPD1

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2022.....	7.4 m <sup>3</sup>
Future arisings -	1.4.2022 - 31.3.2028.....	0.8 m <sup>3</sup>
Total future arisings:		0.8 m <sup>3</sup>
Total waste volume:		8.2 m <sup>3</sup>

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** Sludge and filter pre-coat material.

**PHYSICAL CHARACTERISTICS**

General description: Sludge and filter aid materials, e.g. Celite 545. Graphite particulate, corrosion particulate and miscellaneous particulate. Also abrasive materials may be present. There are no large items that may require special handling.

Physical components (%vol): Sludge including filter aid material and 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/m<sup>3</sup>): 2

Comment on density: -

**CHEMICAL COMPOSITION**

General description and components (%wt): A wide variety of materials including Celite 545 filter aid.

Chemical state: Neutral

Chemical form of radionuclides: H-3: As Tritiated Water  
 C-14: Some contaminated by activated graphite may be expected  
 Cl-36: Not expected to be significant  
 Se-79: Not Assessed  
 Tc-99: Not Assessed  
 I-129: Not expected to be significant  
 Ra: Not expected to be significant  
 Th: Not expected to be significant  
 U: Not Assessed  
 Np: Not expected to be significant  
 Pu: Not Assessed

Metals and alloys (%wt): -

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	NE		
Other ferrous metals.....	NE		
Iron.....	NE		
Aluminium.....	NE		
Beryllium.....	NE		
Cobalt.....	NE		

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Copper.....	NE
Lead.....	NE
Magnox/Magnesium.....	NE
Nickel.....	NE
Titanium.....	NE
Uranium.....	NE
Zinc.....	NE
Zircaloy/Zirconium.....	NE
Other metals.....	NE

Organics (%wt):                      Oil and grease may be present.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	NE		
Paper, cotton.....	NE		
Wood.....	NE		
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.....	TR		
Oil or grease .....			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	NE		

Other materials (%wt):                      -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	100.0		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....	NE		
Glass/Ceramics.....			
Graphite.....	NE		
Desiccants/Catalysts.....	0		

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Asbestos.....	0
Non/low friable.....	
Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	P
Free non-aqueous liquids.....	P
Powder/Ash.....	0

Inorganic anions (%wt): -

	(%wt)	Type(s) and comment
Fluoride.....	NE	
Chloride.....	~0.02	
Iodide.....	NE	
Cyanide.....	NE	
Carbonate.....	~2.8	
Nitrate.....	NE	
Nitrite.....	NE	
Phosphate.....	NE	
Sulphate.....	~0.55	
Sulphide.....	NE	

Materials of interest for waste acceptance criteria: Expect only trace quantities if any.

	(%wt)	Type(s) and comment
Combustible metals.....	0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	TR	
Biodegradable materials.....	TR	
Putrescible wastes.....		
Non-putrescible wastes.....	0	
Corrosive materials.....	0	
Pyrophoric materials.....	0	
Generating toxic gases.....	NE	
Reacting with water.....	0	
Higher activity particles.....	P	May be present
Soluble solids as bulk chemical compounds.....	0	

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....	NE	

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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
Boron (in Boral).....	
Boron (non-Boral).....	
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
	(%wt)
EDTA.....	NE
DPTA.....	NE
NTA.....	NE
Polycarboxylic acids.....	NE
Other organic complexants.....	NE
Total complexing agents.....	TR

Type(s) and comment

Expect only trace quantities, if any.

Potential for the waste to contain discrete items: Yes.

**WASTE STREAM****3J02****Sludge****PACKAGING AND CONDITIONING**

Conditioning method: The waste is expected to be encapsulated probably 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: Dungeness B Power Station.

Plant startup date: Between 2028 and 2033.

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. There may be more than one campaign.

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	25

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: The matrix is expected to be 9:1 BFS/OPC.

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

Conditioned density comment: Density range of 1.68 - 1.84 t/m<sup>3</sup>.

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

Opportunities for alternative disposal routing: No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	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 which assume higher activity than is anticipated during early operation. The activities indicate a maximum based upon limited operating experience and assume oxide spalling.

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'.

**WASTE STREAM****3J02****Sludge**

Measurement of  
radioactivities:

Theoretical assessments.

Other information:

Other beta/gamma nuclides include (in TBq/m<sup>3</sup>) S35 (2E-4, 3E-6); Ca45 (6E-4, 2E-5); Cr51 (1E+1, 7E-3); Co58 (5E-1, 5E-3); Sr89 (1E-8, 5E-11); Y91 (1E-7, 7E-10) Zr95 (4E-5, 4E-7); Nb95 (1E-6, 2E-9); Ru103 (1E-7, 3E-10); Ta182 (2E-1, 5E-3); Fe59 (2E-2, 8E-5) and Sb124 (6E-3, 5E-5).

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	<2E-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	4E-02	CC 2	5E-01	CC 2	Pb 205				
Fe 55	2E-01	CC 2	1E+00	CC 2	Pb 210	8			8
Co 60	4E-02	CC 2	1E-01	CC 2	Bi 208				
Ni 59	1E-03	CC 2	1E-03	CC 2	Bi 210m				
Ni 63	1E-01	CC 2	1E-01	CC 2	Po 210	8			8
Zn 65	6E-04	CC 2	1E-02	CC 2	Ra 223				
Se 79	1.21E-09	CC 2	1.21E-09	CC 2	Ra 225				
Kr 81					Ra 226	8			8
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	2E-03	CC 2	2E-03	CC 2	Th 227				
Zr 93	6E-08	CC 2	6E-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	1E-06	CC 2	1E-06	CC 2	Th 234				
Mo 93		8		8	Pa 231	8			8
Tc 97					Pa 233				
Tc 99	3E-07	CC 2	3E-07	CC 2	U 232				
Ru 106	8E-05	CC 2	1E-03	CC 2	U 233				8
Pd 107		8		8	U 234	2E-07	CC 2	2E-07	CC 2
Ag 108m		8		8	U 235	5E-09	CC 2	5E-09	CC 2
Ag 110m	2E-04	CC 2	3E-03	CC 2	U 236	4E-08	CC 2	4E-08	CC 2
Cd 109					U 238	7E-08	CC 2	7E-08	CC 2
Cd 113m					Np 237	3E-08	CC 2	3E-08	CC 2
Sn 119m					Pu 236				
Sn 121m		8		8	Pu 238	1E-04	CC 2	1E-04	CC 2
Sn 123					Pu 239	4E-05	CC 2	4E-05	CC 2
Sn 126	4.35E-09	CC 2	4.35E-09	CC 2	Pu 240	8E-05	CC 2	8E-05	CC 2
Sb 125	9E-05	CC 2	4E-04	CC 2	Pu 241	7E-03	CC 2	1E-02	CC 2
Sb 126					Pu 242	2E-07	CC 2	2E-07	CC 2
Te 125m					Am 241	1E-04	CC 2	7E-05	CC 2
Te 127m					Am 242m	1E-06	CC 2	1E-06	CC 2
I 129		8		8	Am 243	7E-07	CC 2	7E-07	CC 2
Cs 134	3E-04	CC 2	2E-03	CC 2	Cm 242	3E-06	CC 2	6E-05	CC 2
Cs 135	9E-09	CC 2	9E-09	CC 2	Cm 243	8E-07	CC 2	1E-06	CC 2
Cs 137	2E-03	CC 2	2E-03	CC 2	Cm 244	3E-05	CC 2	4E-05	CC 2
Ba 133					Cm 245		8		8
La 137					Cm 246		8		8
La 138					Cm 248				
Ce 144	7E-05	CC 2	9E-04	CC 2	Cf 249				
Pm 145					Cf 250				
Pm 147	4E-04	CC 2	2E-03	CC 2	Cf 251				
Sm 147					Cf 252				
Sm 151	3E-06	CC 2	3E-06	CC 2	Other a		8		8
Eu 152		8		8	Other b/g	2E-02	CC 2	1E+01	CC 2
Eu 154	3E-04	CC 2	6E-04	CC 2	<b>Total a</b>	<b>3.55E-04</b>	<b>CC 2</b>	<b>3.92E-04</b>	<b>CC 2</b>
Eu 155	1E-04	CC 2	4E-04	CC 2	<b>Total b/g</b>	<b>4.14E-01</b>	<b>CC 2</b>	<b>1.17E+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