

WASTE STREAM	3J01	Ion Exchange Material
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SITE Dungeness B

SITE OWNER EDFE NGL

WASTE CUSTODIAN EDFE NGL

WASTE TYPE ILW; SPD1

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	32.2 m ³
Future arisings -	1.4.2019 - 31.3.2028.....	9.0 m ³
	1.4.2028 - 31.3.2030.....	4.0 m ³
	1.4.2030 - 31.3.2031.....	3.3 m ³
Total future arisings:		16.3 m ³
Total waste volume:		48.5 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 Spent ion exchange materials. Also some sludge.

PHYSICAL CHARACTERISTICS

General description: The waste is expected to be Rohm and Haas ion exchange material types IRN 154 (H+) and IRN 150L (mixed bed resin). Also some arisings of sludge. There are no large items that may require special handling.

Physical components (%vol): Ion exchange material, water, sludge, sand. 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, Sludge, sand and water. Composition appropriate to proprietary ion exchange materials, some of which will be organic in nature. There will be some sludge and sand.

Chemical state: -

Chemical form of radionuclides: -

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
- Titanium..... NE
- Uranium..... NE
- Zinc..... NE
- Zircaloy/Zirconium..... NE

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	Other metals.....	NE
Organics (%wt):	Proprietary organic ion-exchange resins and oil will be present.	
	Total cellulose.....	NE
	Paper, cotton.....	NE
	Wood.....	NE
	Halogenated plastics	0
	Total non-halogenated plastics.....	NE
	Condensation polymers.....	NE
	Others.....	NE
	Organic ion exchange materials....	P
	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.	NE
	Inorganic sludges and flocs.....	P
	Soil.....	0
	Brick/Stone/Rubble.....	0
	Cementitious material.....	P
	Sand.....	P
	Glass/Ceramics.....	
	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):	To be further assessed.	

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Fluoride.....	NE
Chloride.....	<<0.10
Iodide.....	NE
Cyanide.....	NE
Carbonate.....	~1.3
Nitrate.....	NE
Nitrite.....	NE
Phosphate.....	NE
Sulphate.....	~0.30
Sulphide.....	NE

Materials of interest for waste acceptance criteria:

Ion exchange resins may be combustible when dry. There is some oil associated with the waste stocks.

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

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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

Possibly in trace quantities.

PACKAGING AND CONDITIONING

Conditioning method: The waste is expected to be encapsulated in a BFS/OPC matrix. Other process options are being kept under review. Currently the waste is not expected to be supercompacted.

Plant Name: None.

Location: Dungeness B Power Station.

Plant startup date: Between 2028 and 2033.

Total capacity (m³/y incoming waste): ~175.0

Target start date for packaging this stream: -

Throughput for this stream (m³/y incoming waste): ~

Other information: All the 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 ³)	Payload (m ³)	Number of packages
	500 l drum	100.0	~0.2	0.47	243

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

Conditioned density (t/m³): 1.7
 Conditioned density comment: Density range is expected to be 1.62 - 1.73 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 and fission products.

Uncertainty: Specific activity is a function of station operating history. Much of the resin accumulated during the early operation of a station is likely to be of low activity. The stocks are known to be of low activity. Arisings may be of higher activity.

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 Estimates. Stock activities of Mn54, Co60, Cs134, Cs137 are derived from tank sampling.

Other information: Other beta/gamma nuclides of arisings and stocks (in TBq/m³) include S35 (1E-1, 3E-3); Ca45 (4E-1, 3E-2); Cr51 (3E-2, 4E-5); Co58 (5E-2, 1E-3); Zr95 (3E-4, 5E-6); Nb95 (3E-4, 1E-6); Ru103 (7E-5, 3E-7); Ta182 (3E-2, 1E-3); Ce141 (7E-5, 2E-7), P32 (7E-4, 1E-8), Fe59 (1E-3, 7E-6), Tb160 (2E-4, 4E-6) and Hf181 (1E-4, 6E-7).

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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	<7E-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	1.42E-02	CC 2	1.42E-02	DD 2	Pb 205				
Fe 55	3E-01	CD 2	1E+00	CD 2	Pb 210		8		8
Co 60	9.43E-02	CC 2	9.43E-02	DD 2	Bi 208				
Ni 59		6		6	Bi 210m				
Ni 63	3E-02	CD 2	7E-02	CD 2	Po 210		8		8
Zn 65	7E-04	CD 2	6E-03	CD 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	3E-05	CD 2	2E-04	CD 2	U 233		8		8
Pd 107		8		8	U 234		8		8
Ag 108m		8		8	U 235		8		8
Ag 110m	1E-04	CD 2	1E-03	CD 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	1E-03	CD 2	3E-03	CD 2
Sn 123					Pu 239	1E-03	CD 2	3E-03	CD 2
Sn 126		8		8	Pu 240	2E-03	CD 2	5E-03	CD 2
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	1.05E-03	CC 2	1.05E-03	DD 2	Cm 242	7E-05	CD 2	9E-04	CD 2
Cs 135		8		8	Cm 243	1E-05	CD 2	3E-05	CD 2
Cs 137	1.83E-02	CC 2	1.83E-02	DD 2	Cm 244	2E-04	CD 2	6E-04	CD 2
Ba 133	2E-04	CD 2	6E-04	CD 2	Cm 245		8		8
La 137					Cm 246		8		8
La 138					Cm 248				
Ce 144	3E-05	CD 2	2E-04	CD 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	3E-02	CD 2	6E-01	CD 2
Eu 154	2E-04	CD 2	6E-04	CD 2	Total a	4.28E-03	CD 2	1.25E-02	CD 2
Eu 155	2E-04	CD 2	6E-04	CD 2	Total b/g	4.89E-01	CD 2	1.81E+00	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