WASTE STREAM 3N01 Ion Exchange Material

SITE	Hinkley Point B
SITE OWNER	EDFE NGL
WASTE CUSTODIAN	EDFE NGL
WASTE TYPE	ILW; SPD1

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2019.....	7.7 m³
Future arisings -	1.4.2019 - 31.3.2023.....	0.8 m³
	1.4.2023 - 31.3.2025.....	0.8 m³
	1.4.2025 - 31.3.2026.....	4.4 m³
Total future arisings:		6.0 m³
Total waste volume:		13.7 m³

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.

PHYSICAL CHARACTERISTICS

General description: Ion exchange material, water, sludge and sand. There are no large items that may require special handling.

Physical components (%vol): Ion exchange material, Water, Sludge, Sand (~15% vol and including some gravel). Volume breakdown not fully 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): Composition appropriate to proprietary ion exchange materials, some of which are organic in nature. Proprietary ion exchange materials (including IRN77, IRN 78 and a very small quantity of AW500), water, sludge, sand.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Diffused into materials
C-14: Not Expected to be significant
Cl-36: Not Assessed
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 Assessed
Np: Not Expected to be significant
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

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	Magnox/Magnesium	0
	Nickel	NE
	Titanium	NE
	Uranium	NE
	Zinc	TR
	Zircaloy/Zirconium	0
	Other metals	TR
Organics (%wt):	Proprietary organic ion exchange resins will be present. There may be some oil associated with the waste sand.	
	Total cellulosics	0
	Paper, cotton	0
	Wood	0
	Halogenated plastics	0
	Total non-halogenated plastics	0
	Condensation polymers	0
	Others	0
	Organic ion exchange materials	~65.0
	Total rubber	0
	Halogenated rubber	0
	Non-halogenated rubber	0
	Hydrocarbons	NE
	Oil or grease	NE
	Fuel	
	Asphalt/Tarmac (cont.coal tar)	
	Asphalt/Tarmac (no coal tar)	
	Bitumen	
	Others	
	Other organics	NE
Other materials (%wt):	Sand & gravel (~15%)	
	Inorganic ion exchange materials.	NE
	Inorganic sludges and flocs	P
	Soil	0
	Brick/Stone/Rubble	0
	Cementitious material	0
	Sand	~15.0
	Glass/Ceramics	NE
	Graphite	0
	Desiccants/Catalysts	0
	Asbestos	0
	Non/low friable	
	Moderately friable	
	Highly friable	
	Free aqueous liquids	~20.0

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	Free non-aqueous liquids	P	
	Powder/Ash	0	
Inorganic anions (%wt):	Only trace levels of the listed anions 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:	Ion exchange resins may be combustible when dry.		
	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	
	Formaldehyde	NE	
	Organometallics	NE	
	Phenol	NE	
	Styrene	NE	
	Tri-butyl phosphate	NE	
	Other organophosphates	NE	
	Vinyl chloride	NE	

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	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	May be present in trace quantities.
	Total complexing agents	NE	

PACKAGING AND CONDITIONING

Conditioning method:	The waste is expected to be encapsulated in a BFS/OPC matrix. Other approaches under review are (i) wet oxidation followed by drying and supercompaction of the resulting sludge. (ii) drying and supercompaction. Drums of supercompacted waste would be grouted in an "enhanced" drum.
Plant Name:	None
Location:	Hinkley Point B Power Station
Plant startup date:	Probably between 2023 & 2028.
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. It is expected that there will be several campaigns.

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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	69

Likely container type comment:	-
Range in container waste volume:	-
Other information on containers:	Stainless Steel
Likely conditioning matrix:	Cement
Other information:	9:1 BFS/OPC may be the encapsulating matrix to formula FS 032B.
Conditioned density (t/m^3):	~1.7
Conditioned density comment:	Density range is expected to be 1.62 - 1.72 t/m^3.
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 productes will be a main source of activity.
Uncertainty:	The activity values quoted are indicative of the activities that might be expected. Specific activity is a function of station operating history. The estimates are based upon theoretical estimates after several years of operation.
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.
Other information:	Other beta/gamma nuclides of arisings and stocks (in TBq/m^3) include; S35 (1E-1, 7E-4); Ca45 (4E-1, 9E-3); Cr51 (3E-2, 9E-6); Co58 (5E-2, 3E-4) Zr95 (3E-4, 1E-6); Nb95 (3E-4, 2E-7); Ru103 (7E-5, 8E-8), Ta182 (3E-2, 4E-4); P32 (7E-4, 3E-9); Fe59 (1E-3, 2E-6); Ce141 (7E-5, 4E-8); Tb160 (2E-4, 1E-6) and Hf181 (1E-4, 1E-7).

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Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	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	<1E-05	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	2E-02	C D 2	2E-01	C D 2	Pb 205				
Fe 55	3E-01	C D 2	1E+00	C D 2	Pb 210		8		8
Co 60	2E-01	C D 2	5E-01	C D 2	Bi 208				
Ni 59		8		8	Bi 210m				
Ni 63	7E-02	C D 2	7E-02	C D 2	Po 210		8		8
Zn 65	5E-04	C D 2	6E-03	C D 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	2E-05	C D 2	2E-04	C D 2	U 233		8		8
Pd 107		8		8	U 234	8E-08	C D 2		8
Ag 108m		8		8	U 235		8		8
Ag 110m	8E-05	C D 2	1E-03	C D 2	U 236	1E-09	C D 2		8
Cd 109					U 238		8		8
Cd 113m					Np 237		8		8
Sn 119m					Pu 236				
Sn 121m		8		8	Pu 238	3E-03	C D 2	3E-03	C D 2
Sn 123					Pu 239	3E-03	C D 2	3E-03	C D 2
Sn 126		8		8	Pu 240	5E-03	C D 2	5E-03	C D 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	2E-02	C D 2	1E-01	C D 2	Cm 242	5E-05	C D 2	9E-04	C D 2
Cs 135		8		8	Cm 243	3E-05	C D 2	3E-05	C D 2
Cs 137	2E-01	C D 2	2E-01	C D 2	Cm 244	4E-04	C D 2	6E-04	C D 2
Ba 133	4E-04	C D 2	6E-04	C D 2	Cm 245		8		8
La 137					Cm 246		8		8
La 138					Cm 248				
Ce 144	2E-05	C D 2	2E-04	C D 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	1E-02	C D 2	6E-01	C D 2
Eu 154	3E-04	C D 2	6E-04	C D 2	**Total a**	**1.15E-02**	**C D 2**	**1.25E-02**	**C D 2**
Eu 155		8		8	**Total b/g**	**8.21E-01**	**C D 2**	**2.68E+00**	**C D 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