

WASTE STREAM	3N02	Sludge
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SITE Hinkley Point 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.....	23.0 m ³
Future arisings -	1.4.2022 - 31.3.2023.....	0.6 m ³
	1.4.2023 - 31.3.2024.....	0.6 m ³
	1.4.2024 - 31.3.2025.....	0.6 m ³
Total future arisings:		1.8 m ³
Total waste volume:		24.8 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 Sludge and filter pre-coat material.

PHYSICAL CHARACTERISTICS

General description: Sludge, filter pre-coat (Dicalite Speedplus) There are no large items that may require special handling.

Physical components (%vol): Sludge, including filter precoat (100% vol), no other constituents identified. The breakdown of components constituting the sludge has not been assessed.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 2

Comment on density: -

CHEMICAL COMPOSITION

General description and components (%wt): A wide variety of materials. Filter precoat, silica and iron oxides are expected to predominate. The filter precoat is Dicalite Speedplus which is essentially silica (silicon dioxide). Organic material may be present.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Tritiated water
 C-14: Not Expected to be significant
 Cl-36: Not Assessed
 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 Assessed
 Pu: Not Assessed

Metals and alloys (%wt): -

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

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

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

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	TR		
Paper, cotton.....	NE		
Wood.....	NE		
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.....	NE		
Oil or grease	NE		
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.....	0		

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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): Only expected in trace quantities if any.

	(%wt)	Type(s) and comment
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: None expected, but there could be traces of non-pathogenic biological material.

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

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Hazardous substances /
non hazardous pollutants: -

	(%wt)	Type(s) and comment
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	
Boron (in Boral).....	NE	
Boron (non-Boral).....	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

	(%wt)	Type(s) and comment
EDTA.....	NE	
DPTA.....	NE	
NTA.....	NE	
Polycarboxylic acids.....	NE	
Other organic complexants.....	NE	Expect only trace quantities, if any.
Total complexing agents.....	TR	

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Potential for the waste to contain discrete items: No.

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: Hinkley Point B Power Station.

Plant startup date: Probably between 2023 and 2028.

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 in a tank 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	~0.33	0.47	76

Likely container type comment: -

Range in container waste volume: -

Other information on containers: Stainless Steel

Likely conditioning matrix: BFS/OPC

Other information: The matrix is expected to be 9:1 BFS/OPC to formula FS044A.

Conditioned density (t/m³): ~1.7

Conditioned density comment: Density range of 1.68 - 1.84 t/m³ is expected.

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
Disposal at a Geological Disposal Facility	Disposal at LLWR	100.0	2026	Medium	Based on preliminary characterisation data, however future arisings from defuelling and decommissioning will be added to tanks.

RADIOACTIVITY

Source: Contaminated sludge. Contamination by activation products will be the main source of activity.

Uncertainty: The values quoted are indicative of the activities that may be expected. The values quoted

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Definition of total alpha and total beta/gamma:	were based on theoretical assessments. The activities indicate a maximum total specific activity based upon operating experience and assume significant oxide spalling. 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, Eu154, Eu155, Am241 are derived from tank sampling.
Other information:	Other beta/gamma nuclides of arisings and stocks (in TBq/m ³) include; S35 (2E-4, 7E-10); Ca45 (6E-4, 2E-7); Cr51 (1E+1, 8E-14); Co58 (5E-1, 2E-7) Sr89 (1E-8, 0E+0); Y91 (1E-7, 2E-15); Zr95 (4E-5, 4E-12); Nb95 (1E-4, 4E-16); Ru103 (1E-7, 0E+0), Ta182 (2E-1, 8E-6); Fe59 (2E-2, 1E-11) and Sb124 (6E-3, 3E-10).

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	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	5.52E-04	cc 1	5.52E-04	cc 1	Gd 153				
Be 10					Ho 163				
C 14	3.34E-05	cc 1	3.34E-05	cc 1	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36	1.90E-05	cc 1	1.90E-05	cc 1	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54	3.95E-04	cc 1	3.95E-04	cc 1	Pb 205				
Fe 55	6.47E-03	cc 1	6.47E-03	cc 1	Pb 210				
Co 60	1.6E-03	cc 1	1.6E-03	cc 1	Bi 208				
Ni 59					Bi 210m				
Ni 63	5.20E-04	cc 1	5.20E-04	cc 1	Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	1.44E-05	cc 1	1.44E-05	cc 1	Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m	7.02E-07	cc 1	7.02E-07	cc 1	U 235				
Ag 110m	5.29E-06	cc 1	5.29E-06	cc 1	U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	5.87E-05	cc 1	5.87E-05	cc 1
Sn 123					Pu 239	1.07E-04	cc 1	1.07E-04	cc 1
Sn 126					Pu 240	1.07E-04	cc 1	1.07E-04	cc 1
Sb 125					Pu 241	2.23E-03	cc 1	2.23E-03	cc 1
Sb 126					Pu 242				
Te 125m					Am 241	2.15E-04	cc 1	2.15E-04	cc 1
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	8.63E-06	cc 1	8.63E-06	cc 1	Cm 242	2.99E-07	cc 1	2.99E-07	cc 1
Cs 135					Cm 243	5.87E-06	cc 1	5.87E-06	cc 1
Cs 137	1.55E-03	cc 1	1.55E-03	cc 1	Cm 244	5.87E-06	cc 1	5.87E-06	cc 1
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147	1.44E-05	cc 1	1.44E-05	cc 1	Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152					Other b/g	1.00E-05	cc 1	1.00E-05	cc 1
Eu 154	1.6E-05	cc 1	1.6E-05	cc 1	Total a	5E-04	cc 1	5E-04	CC 1
Eu 155	3.22E-06	cc 1	3.22E-06	cc 1	Total b/g	1.34E-02	cc 1	1.34E-02	cc 1

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