

WASTE STREAM	3T03	ILW Sludges
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SITE Hinkley Point C
SITE OWNER NNB GenCo (HPC) Ltd
WASTE CUSTODIAN NNB GenCo (HPC) Ltd
WASTE TYPE ILW
 Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	0 m ³
Future arisings -	1.4.2027 - 31.3.2028.....	~2.0 m ³
	1.4.2028 - 31.3.2029.....	~2.0 m ³
	1.4.2029 - 31.3.2030.....	~2.0 m ³
	1.4.2030 - 31.3.2031.....	~2.0 m ³
	1.4.2031 - 31.3.2032.....	~2.0 m ³
	1.4.2032 - 31.3.2033.....	~2.0 m ³
	1.4.2033 - 31.3.2034.....	~2.0 m ³
	1.4.2034 - 31.3.2035.....	~2.0 m ³
	1.4.2035 - 31.3.2036.....	~2.0 m ³
	1.4.2036 - 31.3.2037.....	~2.0 m ³
	1.4.2037 - 31.3.2038.....	~2.0 m ³
	1.4.2038 - 31.3.2039.....	~2.0 m ³
	1.4.2039 - 31.3.2040.....	~2.0 m ³
	1.4.2040 - 31.3.2041.....	~2.0 m ³
	1.4.2041 - 31.3.2042.....	~2.0 m ³
	1.4.2042 - 31.3.2043.....	~2.0 m ³
	1.4.2043 - 31.3.2044.....	~2.0 m ³
	1.4.2044 - 31.3.2045.....	~2.0 m ³
	1.4.2045 - 31.3.2046.....	~2.0 m ³
	1.4.2046 - 31.3.2047.....	~2.0 m ³
	1.4.2047 - 31.3.2048.....	~2.0 m ³
	1.4.2048 - 31.3.2049.....	~2.0 m ³
	1.4.2049 - 31.3.2050.....	~2.0 m ³
	1.4.2050 - 31.3.2051.....	~2.0 m ³
	1.4.2051 - 31.3.2052.....	~2.0 m ³
	1.4.2052 - 31.3.2053.....	~2.0 m ³
	1.4.2053 - 31.3.2054.....	~2.0 m ³
	1.4.2054 - 31.3.2055.....	~2.0 m ³
	1.4.2055 - 31.3.2056.....	~2.0 m ³
	1.4.2056 - 31.3.2057.....	~2.0 m ³
	1.4.2057 - 31.3.2058.....	~2.0 m ³
	1.4.2058 - 31.3.2059.....	~2.0 m ³
	1.4.2059 - 31.3.2060.....	~2.0 m ³
	1.4.2060 - 31.3.2061.....	~2.0 m ³
	1.4.2061 - 31.3.2062.....	~2.0 m ³
	1.4.2062 - 31.3.2063.....	~2.0 m ³
	1.4.2063 - 31.3.2064.....	~2.0 m ³
	1.4.2064 - 31.3.2065.....	~2.0 m ³
	1.4.2065 - 31.3.2066.....	~2.0 m ³
	1.4.2066 - 31.3.2067.....	~2.0 m ³
	1.4.2067 - 31.3.2068.....	~2.0 m ³
	1.4.2068 - 31.3.2069.....	~2.0 m ³
	1.4.2069 - 31.3.2070.....	~2.0 m ³
	1.4.2070 - 31.3.2071.....	~2.0 m ³
	1.4.2071 - 31.3.2072.....	~2.0 m ³
	1.4.2072 - 31.3.2073.....	~2.0 m ³
	1.4.2073 - 31.3.2074.....	~2.0 m ³
	1.4.2074 - 31.3.2075.....	~2.0 m ³

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1.4.2075 - 31.3.2076.....	~2.0 m ³
1.4.2076 - 31.3.2077.....	~2.0 m ³
1.4.2077 - 31.3.2078.....	~2.0 m ³
1.4.2078 - 31.3.2079.....	~2.0 m ³
1.4.2079 - 31.3.2080.....	~2.0 m ³
1.4.2080 - 31.3.2081.....	~2.0 m ³
1.4.2081 - 31.3.2082.....	~2.0 m ³
1.4.2082 - 31.3.2083.....	~2.0 m ³
1.4.2083 - 31.3.2084.....	~2.0 m ³
1.4.2084 - 31.3.2085.....	~2.0 m ³
1.4.2085 - 31.3.2086.....	~2.0 m ³
1.4.2086 - 31.3.2087.....	~2.0 m ³

Total future arisings: 120.0 m³
 Total waste volume: 120.0 m³

Comment on volumes: All future anticipated arisings. No uncertainty data currently available.

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 1.0
 Stock (lower): x Arisings (lower) x 1.0

WASTE SOURCE

During the operation of the Hinkley Point C UK EPR units, particulates will settle as sludges in various buffer and storage tanks associated with the auxiliary water circuits (e.g. Liquid Waste Processing System (TEU [LWPS]), Liquid Radwaste Monitoring and Discharge System (KER [LRMDS])). These are contaminated with a range of fission and activated corrosion products. This sludge is periodically cleaned out and removed for treatment prior to disposal.

PHYSICAL CHARACTERISTICS

General description: The physical form of this waste stream is described as a sludge consisting of settled metal oxide particulate.
 Physical components (%wt): Sludge 100%wt
 Sealed sources: The waste does not contain sealed sources.
 Bulk density (t/m³): ~1.92
 Comment on density: Waste form density

CHEMICAL COMPOSITION

General description and components (%wt): Sludges arise from the cleaning of tanks' bottoms (Liquid Waste Treatment System, Liquid Effluents Treatment System...) and sumps. Activity: Activation product and fission product β and β/γ emitters (60Co, 137Cs, 63Ni...) Chemicals: Fe, Co, Ni, Cr, Ca, Na, carbonates, borates...

Chemical state: Neutral

Chemical form of radionuclides: -

Metals and alloys (%wt): Metals that are also hazardous are captured in the hazardous material section

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....			
Other ferrous metals.....			
Iron.....			
Aluminium.....			
Beryllium.....			
Cobalt.....			
Copper.....			
Lead.....	~0.03		
Magnox/Magnesium.....			
Nickel.....	~0.02		

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Titanium.....

Uranium.....

Zinc.....

Zircaloy/Zirconium.....

Other metals..... <0.01 antimony

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	NE		
Paper, cotton.....	NE		
Wood.....	NE		
Halogenated plastics	NE		
Total non-halogenated plastics.....	NE		
Condensation polymers.....	NE		
Others.....	NE		
Organic ion exchange materials....	NE		
Total rubber.....	NE		
Halogenated rubber	NE		
Non-halogenated rubber.....	NE		
Hydrocarbons.....	NE		
Oil or grease	NE		
Fuel.....	NE		
Asphalt/Tarmac (cont.coal tar)...	NE		
Asphalt/Tarmac (no coal tar)....	NE		
Bitumen.....	NE		
Others.....	NE		
Other organics.....	NE		

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..			
Inorganic sludges and flocs.....	~100.0		
Soil.....			
Brick/Stone/Rubble.....			
Cementitious material.....			
Sand.....			
Glass/Ceramics.....			
Graphite.....			
Desiccants/Catalysts.....			
Asbestos.....			
Non/low friable.....			
Moderately friable.....			
Highly friable.....			

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Free aqueous liquids.....

Free non-aqueous liquids.....

Powder/Ash.....

Inorganic anions (%wt): -

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

Materials of interest for waste acceptance criteria: -

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

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		

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Phenol.....
 Styrene.....
 Tri-butyl phosphate.....
 Other organophosphates.....
 Vinyl chloride.....
 Arsenic.....
 Barium.....
 Boron..... ~0.10
 Boron (in Boral).....
 Boron (non-Boral).....
 Cadmium..... <0.01
 Caesium.....
 Selenium.....
 Chromium..... ~0.02
 Molybdenum.....
 Thallium.....
 Tin.....
 Vanadium.....
 Mercury compounds..... <0.01
 Others.....
 Electronic Electrical Equipment (EEE)
 EEE Type 1.....
 EEE Type 2.....
 EEE Type 3.....
 EEE Type 4.....
 EEE Type 5.....

Complexing agents (%wt): Not yet determined

(%wt) Type(s) and comment

EDTA.....
 DPTA.....
 NTA.....
 Polycarboxylic acids.....
 Other organic complexants.....
 Total complexing agents.....

Potential for the waste to contain discrete items: Yes. Grouted waste in 500l drum

PACKAGING AND CONDITIONING

Conditioning method: Encapsulation through mixing with mortar
 Plant Name: HPC
 Location: HPC
 Plant startup date: 2030
 Total capacity (m³/y incoming waste): -

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Target start date for packaging this stream: 2030

Throughput for this stream (m³/y incoming waste): ~2.0

Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	500 l drum	100.0	~0.14	0.47	858

Likely container type comment: See RWM specification WPS/705/01

Range in container waste volume: Average provided.

Other information on containers: Pumped into concrete container or metallic drum depending on radioactivity levels.

Likely conditioning matrix: Blast furnace slag/Ordinary Portland cement mixture

Other information: -

Conditioned density (t/m³): ~1.92
 Conditioned density comment: Encapsulation through mixing with mortar

Other information on conditioning: -

Opportunities for alternative disposal routing: Yes

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	2035	High	It is expected that sludges generated as ILW will decay to LLW in relatively short timescales.

RADIOACTIVITY

Source: Sludges arise from the cleaning of tanks' bottoms (Liquid Waste Treatment System, Liquid Effluents Treatment System...) and sumps.

Uncertainty: Sample is based on 144 reactor years of operation of PWRs in France so is a very reasonable estimate of anticipated waste arisings from HPC.

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: -

Other information: -

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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			~1.6E-03	BB 2	Gd 153				
Be 10			~8.6E-10	BB 2	Ho 163				
C 14			~4.72E-05	BB 2	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36			~4.28E-09	BB 2	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41			~2.15E-08	BB 2	Pt 193				
Mn 53					Tl 204				
Mn 54			~4.4E-04	BB 2	Pb 205				
Fe 55			~9.04E-03	BB 2	Pb 210				
Co 60			~4.28E-03	BB 2	Bi 208				
Ni 59			~2.28E-06	BB 2	Bi 210m				
Ni 63			~9.88E-04	BB 2	Po 210				
Zn 65			~1.1E-04	BB 4	Ra 223				
Se 79			~8.8E-10	BB 2	Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90			~1.12E-04	BB 2	Th 227				
Zr 93			~2.15E-07	BB 2	Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94			~5.6E-07	BB 2	Th 234				
Mo 93			~4.28E-09	BB 2	Pa 231				
Tc 97					Pa 233				
Tc 99			~9.24E-08	BB 2	U 232				
Ru 106					U 233				
Pd 107			~2.20E-09	BB 2	U 234				
Ag 108m			~4.28E-06	BB 2	U 235				
Ag 110m			~1.21E-03	BB 2	U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m			~4.4E-09	BB 2	Pu 238				
Sn 123					Pu 239				
Sn 126			~1.98E-09	BB 2	Pu 240				
Sb 125			~1.1E-04	BB 2	Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129			~2.20E-10	BB 2	Am 243				
Cs 134			~1.1E-04	BB 2	Cm 242				
Cs 135			~6.6E-10	BB 2	Cm 243				
Cs 137			~2.20E-04	BB 2	Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151			~8.8E-07	BB 2	Other a				
Eu 152					Other b/g				
Eu 154					Total a	0		NE	
Eu 155					Total b/g	0		~1.83E-02	BB 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