WASTE STREAM 3S12 CVCS Resins and Spent Resins (ILW)

SITE Sizewell B

SITE OWNER EDFE NGL

WASTE CUSTODIAN EDFE NGL

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	13.8 m³
Future arisings -	1.4.2022 - 31.3.2025.....	~5.0 m³
	1.4.2025 - 31.3.2026.....	~-9.5 m³
	1.4.2026 - 31.3.2035.....	~15.0 m³
	1.4.2035 - 31.3.2041.....	~30.0 m³
	1.4.2041 - 31.3.2042.....	~-54.3 m³
Total future arisings:		-13.8 m³
Total waste volume:		0 m³

Comment on volumes: Annual arisings are estimated at 1.66m3 during generation. Decomissioning arisings increase due to primary circuit decontamination(additional 30m3). Conditioning campaigns planned for ~2025 for 24 drums and the remainder processed at end of station life ~2041 see 3S12/C.

Uncertainty factors on volumes:

Stock (upper):	x 1.25	Arisings (upper)	x 1.25
Stock (lower):	x 0.75	Arisings (lower)	x 0.75

WASTE SOURCE The spent resins arise from operational de-mineralisers, whose primary function is reactor coolant purification and chemistry control.

PHYSICAL CHARACTERISTICS

General description: Spent resin waste is an aqueous slurry of spent organic ion exchange resin comprising mixed anion and cation bead resin based on a styrene divinylbenzene co-polymer (DVB-styrene), in approximately a 50:50 (anion:cation) mix.

Physical components (%vol): Flooded ion-exchange resin. ~70% Resin, ~30% interstitial water.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1.05

Comment on density: Flooded density of waste as stored on site.

CHEMICAL COMPOSITION

General description and components (%wt): Proprietary ion exchange resins, water. Some fine particulate corrosion products (activated) and insoluble particulate fission products. No other constituent is anticipated. Mixture of resins (including polystyrene bead resin) with both acidic functional groups in the lithium form and basic functional groups in the borate form. Exhausted sites rendered neutral.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: In interstitial water between the resin beads.
C-14: Not determined.
Cl-36: Not expected to be present in any measurable quantity.
Se-79: Not expected to be present in any measurable quantity.
Tc-99: Not expected to be present in any measurable quantity.
I-129: Not determined.
Ra: Not expected to be present in any measurable quantity.
Th: Not determined.
U: Trace quantities may exist adsorbed on the resin beads - detailed analysis still awaited.
Np: Not expected to be present in any measurable quantity.
Pu: Trace quantities may exist adsorbed on the resin beads - detailed analysis still awaited.

Metals and alloys (%wt): -

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel	TR		
Other ferrous metals	TR		
Iron	TR		
Aluminium			
Beryllium	0		
Cobalt	TR		
Copper			
Lead	0		
Magnox/Magnesium	0		
Nickel			
Titanium	NE		
Uranium	0		
Zinc	0		
Zircaloy/Zirconium	0		
Other metals	TR		

Organics (%wt): Organic proprietary polystyrene/divinyl benzene copolymer ion exchange resins will be present. %ages based on resins in storage tanks.

	(%wt)	Type(s) and comment	% of total C14 activity
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	~70.0		
Total rubber	0		
Halogenated rubber	0		
Non-halogenated rubber	0		
Hydrocarbons	NE		
Oil or grease			
Fuel			
Asphalt/Tarmac (cont.coal tar)			
Asphalt/Tarmac (no coal tar)			
Bitumen			
Others			
Other organics	TR		

Other materials (%wt): Based on resins in storage tanks

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0		
Inorganic sludges and flocs.....	0		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....	0		
Glass/Ceramics.....			
Graphite.....	0		
Desiccants/Catalysts.....	0		
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	~30.0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): Other significant anions include Borate (~3%wt).

	(%wt)	Type(s) and comment
Fluoride.....	~0.02	
Chloride.....	~0.10	
Iodide.....	NE	
Cyanide.....	NE	
Carbonate.....	NE	
Nitrate.....	NE	
Nitrite.....	NE	
Phosphate.....	NE	
Sulphate.....	~0.70	
Sulphide.....	NE	

Materials of interest for waste acceptance criteria: There are no materials identified which are likely to pose a fire or other non-radiological hazard.

	(%wt)	Type(s) and comment
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	

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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	

Hazardous substances / non hazardous pollutants: Contains spent ion exchange resin - listed substance code 190806.

	(%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	

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Complexing agents (%wt): Not yet determined

	(%wt)	Type(s) and comment
EDTA.....	NE	
DPTA.....	NE	
NTA.....	NE	
Polycarboxylic acids…….	NE	
Other organic complexants.....	NE	Complexing agents may be present in trace quantities.
Total complexing agents.....	TR	

Potential for the waste to contain discrete items: No.

PACKAGING AND CONDITIONING

Conditioning method: A percentage of this waste is currently dry drained and stored in MOSAIK casks. (Waste stream 3S12/C).

Plant Name: FAFNIR V & NEWA Processing plants.

Location: Sizewell B Power Station.

Plant startup date: 2014

Total capacity (m^3/y incoming waste): NE

Target start date for packaging this stream: 2014

Throughput for this stream (m^3/y incoming waste): NE

Other information: Waste that is processed in 2041 will be of higher activity than previous campaigns.

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
500 l RS drum (0mm Pb)	72.0	~0.465	~0.465	0
500 l RS drum (20mm Pb)	28.0	~0.41	~0.41	0

Likely container type comment: Campaign 1 used regular unshielded MOSAIK casks (Cast Iron) as will Campaign 2. Campaign 3 may use MOSAIK casks with either 20mm or 40mm lead lining.

Range in container waste volume: Payload & waste loading will vary between campaign 1/2 and campaign 3 .Use of 40mm lead lined casks for Campaign 3 will reduce payload to 0.382m^3.

Other information on containers: A total of approximately 160 casks are estimated throughout the entire disposal campaign.

Likely conditioning matrix: None

Other information: -

Conditioned density (t/m^3): -

Conditioned density comment: -

Other information on conditioning: -

Opportunities for alternative disposal routing: No

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Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

RADIOACTIVITY

Source:	Spent ion exchange resin arising from the treatment of liquids. Contamination will be by fission and activation products, and trace quantities of actinides.
Uncertainty:	The activity values quoted for existing waste is based on characterisation results. Activity of future arisings based on possible future contamination of resins with fission products. The activity estimates are thought to be accurate to within a factor of 10.
Definition of total alpha and total beta/gamma:	The majority listed stock alpha specific activities are all upper limits, therefore the total alpha activity will be less than the sum of the listed activities.
Measurement of radioactivities:	Theoretical assessment. Some activity data comes from limited tank sampling activities.
Other information:	-

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Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	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	2.41E-03	C C 2	1.64E-02	C C 2	Gd 153			2.29E-06	C C 2
Be 10			3.13E-09	C C 2	Ho 163			1.11E-07	C C 2
C 14	4.41E-02	C C 2	3.84E-02	C C 2	Ho 166m			1.63E-05	C C 2
Na 22		4		4	Tm 170			6.01E-06	C C 2
Al 26		4		4	Tm 171			5.26E-04	C C 2
Cl 36			8.24E-08	C C 2	Lu 174			8.51E-07	C C 2
Ar 39			3.41E-05	C C 2	Lu 176			1.06E-13	C C 2
Ar 42			1.96E-10	C C 2	Hf 178n			1.89E-05	C C 2
K 40			5E-11	C C 2	Hf 182			2.07E-10	C C 2
Ca 41			9.4E-08	C C 2	Pt 193			3.71E-07	C C 2
Mn 53			1.05E-12	C C 2	Tl 204			1.2E-04	C C 2
Mn 54	8.83E-04	C C 2	3.63E-02	C C 2	Pb 205			2.49E-12	C C 2
Fe 55	5.21E-02	C C 2	2.41E-01	C C 2	Pb 210			5.51E-10	C C 2
Co 60	6.58E-02	C C 2	4.46E-01	C C 2	Bi 208			1.26E-11	C C 2
Ni 59			6.41E-07	C C 2	Bi 210m			1.73E-12	C C 2
Ni 63	3.29E-01	C C 2	2.63E-01	C C 2	Po 210			1.6E-09	C C 2
Zn 65	<2.19E-08	C 3	1.53E-03	C C 2	Ra 223			1.63E-10	C C 2
Se 79			3.4E-08	C C 2	Ra 225			2.5E-07	C C 2
Kr 81			1.06E-07	C C 2	Ra 226			1.9E-09	C C 2
Kr 85	<1.90E-06	C 3	9.91E-03	C C 2	Ra 228			2.4E-07	C C 2
Rb 87			1.19E-10	C C 2	Ac 227			1.63E-10	C C 2
Sr 90	1.17E-03	C C 2	9.27E-03	C C 2	Th 227			1.6E-10	C C 2
Zr 93			9.46E-06	C C 2	Th 228	<5.84E-07	C 3	4.56E-07	C C 2
Nb 91			6.16E-09	C C 2	Th 229	<2.92E-07	C 3	2.5E-07	C C 2
Nb 92			6.5E-12	C C 2	Th 230	<2.92E-07	C 3	2.5E-07	C C 2
Nb 93m			4.19E-04	C C 2	Th 232	<3.65E-07	C 3	3.13E-07	C C 2
Nb 94			7.36E-06	C C 2	Th 234			7.19E-07	C C 2
Mo 93			1.63E-07	C C 2	Pa 231			4.03E-10	C C 2
Tc 97			6.11E-13	C C 2	Pa 233			1.79E-06	C C 2
Tc 99			6.96E-05	C C 2	U 232	<2.92E-07	C 3	2.17E-07	C C 2
Ru 106	<5.33E-05	C 3	7.64E-03	C C 2	U 233	9.49E-07	C C 2	5.97E-10	C C 2
Pd 107			7.43E-07	C C 2	U 234			1.18E-06	C C 2
Ag 108m			4.46E-07	C C 2	U 235			3.74E-08	C C 2
Ag 110m			7.36E-04	C C 2	U 236	<5.84E-07	C 3	4.93E-07	C C 2
Cd 109	<8.03E-08	C 3	1.36E-05	C C 2	U 238	<8.03E-07	C 3	7.19E-07	C C 2
Cd 113m	<3.65E-05	C 3	7.61E-05	C C 2	Np 237			1.79E-06	C C 2
Sn 119m			1.3E-06	C C 2	Pu 236			1.23E-08	C C 2
Sn 121m			1.25E-04	C C 2	Pu 238	9.56E-06	C C 2	9.66E-05	C C 2
Sn 123			3.63E-06	C C 2	Pu 239		6	3.79E-05	C C 2
Sn 126			1.1E-06	C C 2	Pu 240	<6.57E-07	C 3	3.8E-05	C C 2
Sb 125	<4.38E-08	C 3	3.26E-02	C C 2	Pu 241	<5.48E-05	C 3	5.74E-03	C C 2
Sb 126			3.54E-07	C C 2	Pu 242	<3.29E-07	C 3	3.99E-07	C C 2
Te 125m			8.16E-03	C C 2	Am 241	<5.11E-07	C 3	1.83E-04	C C 2
Te 127m			2.14E-05	C C 2	Am 242m	<6.57E-08	C 3	6.63E-07	C C 2
I 129	<1.83E-07	C 3	2.41E-07	C C 2	Am 243	<5.11E-08	C 3	2.37E-06	C C 2
Cs 134	4.20E-02	C C 2	3.07E-02	C C 2	Cm 242	<5.11E-08	C 3	2E-06	C C 2
Cs 135			2.66E-06	C C 2	Cm 243			1.11E-07	C C 2
Cs 137	3.62E-01	C C 2	4.03E-01	C C 2	Cm 244	<1.46E-08	C 3	1.46E-05	C C 2
Ba 133			1.41E-05	C C 2	Cm 245			3.77E-06	C C 2
La 137			1.6E-08	C C 2	Cm 246	<7.3E-09	C 3	1.06E-06	C C 2
La 138			2.34E-14	C C 2	Cm 248			4.93E-11	C C 2
Ce 144	<2.92E-08	C 3	3.76E-03	C C 2	Cf 249			5.17E-10	C C 2
Pm 145			5.36E-08	C C 2	Cf 250			3.17E-09	C C 2
Pm 147	<1.10E-05	C 2	3.14E-02	C C 2	Cf 251			4.9E-11	C C 2
Sm 147			1.66E-11	C C 2	Cf 252			1.33E-09	C C 2
Sm 151			1.51E-03	C C 2	Other a		8		8
Eu 152			1.57E-06	C C 2	Other b/g	<7.3E-04	C 3		6
Eu 154	<3.65E-08	C 3	1.31E-02	C C 2	**Total a**	**<1.53E-05**	**C 3**	**3.85E-04**	**C C 2**
Eu 155	<1.46E-08	C 3	3.23E-03	C C 2	**Total b/g**	**9.01E-01**	**C C 2**	**1.60E+00**	**C C 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