

<b>WASTE STREAM</b>	<b>3S06</b>	<b>Spent Resins (LLW)</b>
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**SITE** Sizewell B

**SITE OWNER** EDFE NGL

**WASTE CUSTODIAN** EDFE NGL

**WASTE TYPE** LLW

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2019.....	25.4 m <sup>3</sup>
Future arisings -	1.4.2019 - 31.3.2035.....	69.7 m <sup>3</sup>
	1.4.2035 - 31.3.2039.....	26.1 m <sup>3</sup>
Total future arisings:		95.8 m <sup>3</sup>
Total waste volume:		121.2 m <sup>3</sup>

Comment on volumes: Future arisings are based on the waste being conditioned into 400L drums. Unconditioned arisings are approximately 2.6m<sup>3</sup>/yr during operation and ~5.2m<sup>3</sup>/yr during 2039-2040. Station operation is assumed to end in 2035.

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** Proprietary resins from the treatment of liquids.

**PHYSICAL CHARACTERISTICS**

General description: Spent ion exchange resins. Activity levels are expected to vary considerably depending upon the ratio of resins from the various sources. The ion exchange resin is accumulated under water in tanks. It is easily pumped and has good settling characteristics. The ion exchange resin flooded with water would be expected to have a voidage of about 0.3, i.e. 0.3 of the volume of a bed of settled flooded ion exchange resin would be interstitial water. There are no large items that may require special handling.

Physical components (%wt): Metal (Mild Steel drum and sacrificial paddle) ~10%, Cement ~70%, spent ion exchange resin ~20%.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): ~1.89

Comment on density: Density from waste stream characterisation document.

**CHEMICAL COMPOSITION**

General description and components (%wt): Composition appropriate to proprietary resins, which will be organic polystyrene resins.

Chemical state: Neutral

Chemical form of radionuclides: H-3: In interstitial water.  
 C-14: Trace quantities may exist adsorbed onto the resin beads. Detailed analysis still awaited.  
 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 expected to be present in any measurable quantity.  
 Ra: Not expected to be present in any measurable quantity.  
 Th: Not expected to be present in any measurable quantity.  
 U: Trace quantities may exist adsorbed onto the resin beads, probably as salts. Detailed analysis still awaited.  
 Np: Not expected to be present in any measurable quantity.  
 Pu: Trace quantities may exist adsorbed onto the resin beads, probably as salts. Detailed analysis still awaited.

Metals and alloys (%wt): -

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	Stainless steel.....	TR
	Other ferrous metals.....	~10.0
	Iron.....	NE
	Aluminium.....	
	Beryllium.....	0
	Cobalt.....	0
	Copper.....	
	Lead.....	0
	Magnox/Magnesium.....	0
	Nickel.....	
	Titanium.....	0
	Uranium.....	0
	Zinc.....	0
	Zircaloy/Zirconium.....	TR
	Other metals.....	TR
Organics (%wt):	Organic proprietary ion exchange resins polystyrene/divinyl benzene copolymer will be present.	
	Total cellulose.....	0
	Paper, cotton.....	0
	Wood.....	0
	Halogenated plastics .....	0
	Total non-halogenated plastics.....	0
	Condensation polymers.....	0
	Others.....	0
	Organic ion exchange materials....	~20.0
	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.....	TR
Other materials (%wt):	-	
	Inorganic ion exchange materials.	0
	Inorganic sludges and flocs.....	0
	Soil.....	0
	Brick/Stone/Rubble.....	0
	Cementitious material.....	~70.0
	Sand.....	0

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	Glass/Ceramics.....	
	Graphite.....	0
	Desiccants/Catalysts.....	0
	Asbestos.....	0
	Non/low friable.....	
	Moderately friable.....	
	Highly friable.....	
	Free aqueous liquids.....	P
	Free non-aqueous liquids.....	0
	Powder/Ash.....	0
Inorganic anions (%wt):	Not assessed, but expected to be very low.	
	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:	There are no materials identified in the waste likely to represent a fire or other non-radiological hazard.	
	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.....	0
		Not expected.
	Soluble solids as bulk chemical compounds.....	0
Hazardous substances / non hazardous pollutants:	Contains spent ion exchange resins - listed substance code 190806.	
	Acrylamide.....	NE
	Benzene.....	NE

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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
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.....	TR

Complexing agents may be present in trace quantities.

**TREATMENT, PACKAGING AND DISPOSAL**

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Planned on-site / off-site treatment(s):

Treatment	On-site / Off site	Stream volume %
Low force compaction Supercompaction (HFC) Incineration Solidification Decontamination Metal treatment Size reduction Decay storage Recycling / reuse Other / various None	On-site	100.0

Comment on planned treatments:

Prior to disposal the 400L drums of conditioned resin will be encapsulated into half height ISO containers at LLWR.

**Disposal Routes:**

Disposal Route	Stream volume %
Expected to be consigned to the LLW Repository Expected to be consigned to a Landfill Facility Expected to be consigned to an On-Site Disposal Facility Expected to be consigned to an Incineration Facility Expected to be consigned to a Metal Treatment Facility Expected to be consigned as Out of Scope Expected to be recycled / reused Disposal route not known	100.0

**Upcoming (2019/20-2021/22) Waste Routing (if expected to change from above):**

Disposal Route	Stream volume %		
	2019/20	2020/21	2021/22
Expected to be consigned to the LLW Repository Expected to be consigned to a Landfill Facility Expected to be consigned to an On-Site Disposal Facility Expected to be consigned to an Incineration Facility Expected to be consigned to a Metal Treatment Facility Expected to be consigned as Out of Scope Expected to be recycled / reused Disposal route not known			

**Waste Packaging for Disposal:**

Container	Stream volume %	Waste loading m <sup>3</sup>	Number of packages
1/3 Height IP-1 ISO 2/3 Height IP-2 ISO 1/2 Height WAMAC IP-2 ISO 1/2 Height IP-2 Disposal/Re-usable ISO 2m box (no shielding) 4m box (no shielding) Other	100.0	~7.56	17

Other information:

The resins will be conditioned into uncompactable 400L drums, which will then be loaded into half height ISO containers. Waste loading is based on approximately 20 x 400L drums loaded into each half-height ISO container.

**Waste Planned for Disposal at the LLW Repository:**

Container voidage:

-

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Waste Characterisation Form (WCH):

The waste meets the LLWR's Waste Acceptance Criteria (WAC).  
The waste does not have a current WCH.

The WSCD is still valid.

Waste consigned for disposal to LLWR in year of generation:

No. Disposals include backlog of waste stored on site.

Potential for the waste to contain discrete items:

No

**Non-Containerised Waste for In-Vault Grouting:** (Not applicable to this waste stream)

Stream volume (%):

-

Waste stream variation:

-

Bounding cuboidal volume:

Inaccessible voidage:

-

Other information:

-

**RADIOACTIVITY**

Source:

Spent ion exchange resin. Contamination by fission products, actinides and activation products.

Uncertainty:

The activity values quoted are indicative of the activities that may be expected and are obtained from the waste stream characterisation document. There is a higher level of uncertainty for activity in future arisings.

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:

Activity estimates are based on fingerprint of waste stream and on dose rate measurements of drummed waste.

Other information:

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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	3.33E-04	CC 2	3.33E-04	DD 2	Gd 153				
Be 10		8		8	Ho 163				
C 14	3.5E-04	CC 2	3.5E-04	DD 2	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36		8		8	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	2.67E-04	CC 2	2.67E-04	DD 2	Pb 205				
Fe 55	2.83E-04	CC 2	2.83E-04	DD 2	Pb 210	8			8
Co 60	1E-03	CC 2	1E-03	DD 2	Bi 208				
Ni 59		8		8	Bi 210m				
Ni 63	1.75E-03	CC 2	1.75E-03	DD 2	Po 210	8			8
Zn 65	3E-06	CC 2	3E-06	DD 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	8.33E-06	CC 2	8.33E-06	DD 2	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	2.5E-06	CC 2	2.5E-06	DD 2	U 233	8			8
Pd 107		8		8	U 234	8			8
Ag 108m	8.33E-07	CC 2	8.33E-07	DD 2	U 235	8			8
Ag 110m	8.33E-07	CC 2	8.33E-07	DD 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	5E-07	CC 2	5E-07	DD 2
Sn 123					Pu 239	5E-07	CC 2	5E-07	DD 2
Sn 126		8		8	Pu 240	5E-07	CC 2	5E-07	DD 2
Sb 125	1.25E-04	CC 2	1.25E-04	DD 2	Pu 241	1.33E-05	CC 2	1.33E-05	DD 2
Sb 126					Pu 242		8		8
Te 125m					Am 241	5E-07	CC 2	5E-07	DD 2
Te 127m					Am 242m		8		8
I 129		8		8	Am 243		8		8
Cs 134	6.67E-05	CC 2	6.67E-05	DD 2	Cm 242	1.67E-07	CC 2	1.67E-07	DD 2
Cs 135		8		8	Cm 243	5E-07	CC 2	5E-07	DD 2
Cs 137	1.08E-03	CC 2	1.08E-03	DD 2	Cm 244	5E-07	CC 2	5E-07	DD 2
Ba 133					Cm 245		8		8
La 137					Cm 246		8		8
La 138					Cm 248				
Ce 144	8.33E-07	CC 2	8.33E-07	DD 2	Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Other a		8		8
Eu 152		8		8	Other b/g	2.17E-06	CC 2	2.17E-06	DD 2
Eu 154		8		8	<b>Total a</b>	<b>3.17E-06</b>	<b>CC 2</b>	<b>3.17E-06</b>	<b>DD 2</b>
Eu 155		8		8	<b>Total b/g</b>	<b>5.29E-03</b>	<b>CC 2</b>	<b>5.29E-03</b>	<b>DD 2</b>

**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