

**WASTE STREAM****3S09****Miscellaneous Activated Components****SITE** Sizewell B**SITE OWNER** EDFE NGL**WASTE CUSTODIAN** EDFE NGL**WASTE TYPE** ILW; SPD3

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2022.....	10.3 m <sup>3</sup>
Future arisings -	1.4.2022 - 31.3.2035.....	6.5 m <sup>3</sup>
	1.4.2035 - 31.3.2042.....	23.1 m <sup>3</sup>
Total future arisings:		29.6 m <sup>3</sup>
Total waste volume:		39.9 m <sup>3</sup>

Comment on volumes: Waste volumes will be variable depending on station operating conditions.

Uncertainty factors on volumes: Stock (upper): x 1.5 Arisings (upper) x 1.75  
 Stock (lower): x 0.5 Arisings (lower) x 0.25

**WASTE SOURCE** Metallic waste components removed from the reactor during refuelling.**PHYSICAL CHARACTERISTICS**

General description: Redundant reactor components. The presence of large items which may require special handling is to be assessed.

Physical components (%vol): Rod cluster control assemblies; Burnable poison assemblies; Neutron source assemblies; Flux mapping detectors; Core thermocouples. No other constituents have been identified.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): ~1

Comment on density: Density expected to be fairly low.

**CHEMICAL COMPOSITION**

General description and components (%wt): Steel (>50wt%). A detailed assessment of percentage constituents has not been made. There will be high concentrations of activation products. Fission products and actinides may be present as contaminants. Rod cluster control assembly materials are Ag (80 w/o) - In (15 w/o) - Cd (5 w/o) absorber, stainless steel cladding, spider and spring retainer, Inconel spring. Burnable poison rod assembly materials are borosilicate glass absorber and Inconel spring, with stainless steel for all other components. Primary neutron source assembly materials include those of burnable poison rod assemblies and there is additionally Cf252 and aluminium oxide.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Diffused into materials.  
 C-14: Incorporated into steel components.  
 Cl-36: Not assessed.  
 Se-79: Not assessed.  
 Tc-99: Not assessed.  
 I-129: Not assessed.  
 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): -

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	>50.0		
Other ferrous metals.....	NE		
Iron.....	NE		
Aluminium.....	NE		
Beryllium.....	NE		
Cobalt.....	NE		
Copper.....	NE		
Lead.....	NE		
Magnox/Magnesium.....	NE		
Nickel.....	NE	Present as constituent of stainless steel.	
Titanium.....	NE		
Uranium.....	NE		
Zinc.....	NE		
Zircaloy/Zirconium.....	NE		
Other metals.....	NE	Cr present as constituent of stainless steel.	

Organics (%wt):                      None anticipated.

	(%wt)	Type(s) and comment	% of total C14 activity
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....	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.....	0		

Other materials (%wt):                      -

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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.....	0		
Graphite.....	0		
Desiccants/Catalysts.....	0		
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt):           None of the listed inorganic anions are expected to be present at greater than 10% and concentrations are likely to be very much lower than this.

	(%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:           No material likely to represent a fire or other non-radiological hazard has been identified.

	(%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	

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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	

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	

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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	None anticipated.
Total complexing agents.....	NE	

Potential for the waste to contain discrete items: Yes.

**PACKAGING AND CONDITIONING**

Conditioning method: The waste is expected to be encapsulated.  
 Plant Name: Plant for all Final Site Clearance structural waste.  
 Location: Sizewell B Power Station.  
 Plant startup date: ~2043  
 Total capacity (m<sup>3</sup>/y incoming waste): NE  
 Target start date for packaging this stream: -  
 Throughput for this stream (m<sup>3</sup>/y incoming waste): NE  
 Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages
	4m box (100mm concrete shielding)	100.0	~12.2	~14.3	4

Likely container type comment: -

Range in container waste volume: -

Other information on containers: Stainless steel.

Likely conditioning matrix: BFS/OPC

Other information: Matrix could also be PFA/OPC based upon the assumption that items will require a free flowing grout.

Conditioned density (t/m<sup>3</sup>): ~3.0Conditioned density comment: The density of the encapsulated waste is expected to be approximately 3 t/m<sup>3</sup>.

Other information on conditioning: Waste may be retained at the Station pending Final Site Clearance.

Opportunities for alternative disposal routing: No

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

**RADIOACTIVITY**

Source:	Metallic components removed from the reactor during refuelling. The components will generally have high concentrations of activation products of which Co-60 is likely to be the most dominant in the medium term.
Uncertainty:	The activity values quoted are indicative of the activities expected. Indicative of the order of magnitude.
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:	Specific activity is a function of station operating history. The values quoted are indicative of the activities that might be expected. "Other" beta/gamma nuclides expected to be present in arisings and stocks (in TBq/m <sup>3</sup> ): - Cr51 (8E+1, 1E-1), Co58 (2E+3, 5E+1), Sr89 (7E+0, 9E-2), Y91 (1E+0, 2E-2), Zr95 (2E+1, 4E-1), Nb95 (2E+1, 8E-2), Ru103 (3E+0, 2E-2), I131 (6E+1, 1E-6), Fe59 (3E+1, 3E-1), Co57 (1E+1, 2E+0), Sb122 (3E+2, 0), Sb124 (2E+1, 4E-1), Sb127 (4E+2, 1E-13) and Ce141 (3E+0, 9E-3).

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	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	2E-01	CC 2	2E-01	CC 2	Gd 153				
Be 10		8		8	Ho 163				
C 14	<6E-05	C 3	<6E-05	C 3	Ho 166m				
Na 22		4		4	Tm 170				
Al 26		4		4	Tm 171				
Cl 36		8		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+01	CC 2	3E+02	CC 2	Pb 205				
Fe 55	2E+02	CC 2	5E+02	CC 2	Pb 210	8		8	
Co 60	3E+02	CC 2	5E+02	CC 2	Bi 208				
Ni 59	4E-02	CC 2	4E-02	CC 2	Bi 210m				
Ni 63	5E+00	CC 2	5E+00	CC 2	Po 210	8		8	
Zn 65	1E+00	CC 2	3E+01	CC 2	Ra 223				
Se 79	1.72E-05	CC 2	1.72E-05	CC 2	Ra 225				
Kr 81					Ra 226	8		8	
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	4E+00	CC 2	4E+00	CC 2	Th 227				
Zr 93	3E-04	CC 2	3E-04	CC 2	Th 228				
Nb 91					Th 229	8		8	
Nb 92					Th 230	8		8	
Nb 93m	6E-05	CC 2	5E-06	CC 2	Th 232	8		8	
Nb 94	4E-03	CC 2	4E-03	CC 2	Th 234				
Mo 93	5E-03	CC 2	5E-03	CC 2	Pa 231	8		8	
Tc 97					Pa 233				
Tc 99	5E-05	CC 2	5E-05	CC 2	U 232				
Ru 106	3E+00	CC 2	5E+01	CC 2	U 233	8		8	
Pd 107	5E-05	CC 2	5E-05	CC 2	U 234	1E-05	CC 2	1E-05	CC 2
Ag 108m	1E-08	CC 2	1E-08	CC 2	U 235	2E-07	CC 2	2E-07	CC 2
Ag 110m	4E-01	CC 2	1E+01	CC 2	U 236	3E-06	CC 2	3E-06	CC 2
Cd 109					U 238	4E-06	CC 2	4E-06	CC 2
Cd 113m					Np 237	3E-06	CC 2	3E-06	CC 2
Sn 119m					Pu 236				
Sn 121m		8		8	Pu 238	2E-02	CC 2	2E-02	CC 2
Sn 123					Pu 239	9E-03	CC 2	9E-03	CC 2
Sn 126		8		8	Pu 240	9E-03	CC 2	9E-03	CC 2
Sb 125	2E+01	CC 2	6E+01	CC 2	Pu 241	3E+00	CC 2	3E+00	CC 2
Sb 126	3E-01	CC 2	2E+02	CC 2	Pu 242	3E-05	CC 2	3E-05	CC 2
Te 125m	2E+01	CC 2	6E+00	CC 2	Am 241	3E-02	CC 2	4E-03	CC 2
Te 127m					Am 242m	2E-04	CC 2	2E-04	CC 2
I 129	2E-06	CC 2	2E-06	CC 2	Am 243	6E-04	CC 2	6E-04	CC 2
Cs 134	9E+00	CC 2	4E+01	CC 2	Cm 242	1E-03	CC 2	6E-02	CC 2
Cs 135	2E-04	CC 2	2E-04	CC 2	Cm 243	4E-05	CC 2	4E-05	CC 2
Cs 137	6E+01	CC 2	6E+01	CC 2	Cm 244	5E-03	CC 2	6E-03	CC 2
Ba 133					Cm 245	3E-06	CC 2	3E-06	CC 2
La 137					Cm 246	6E-07	CC 2	6E-07	CC 2
La 138					Cm 248				
Ce 144	2E+00	CC 2	4E+01	CC 2	Cf 249				
Pm 145					Cf 250				
Pm 147	2E+00	CC 2	5E+00	CC 2	Cf 251				
Sm 147					Cf 252				
Sm 151	8E-03	CC 2	8E-03	CC 2	Other a	8		8	
Eu 152	8E-05	CC 2	1E-04	CC 2	Other b/g	5E+01	CC 2	3E+03	CC 2
Eu 154	2E-01	CC 2	4E-01	CC 2	<b>Total a</b>	<b>7.47E-02</b>	<b>CC 2</b>	<b>1.09E-01</b>	<b>CC 2</b>
Eu 155	1E-01	CC 2	3E-01	CC 2	<b>Total b/g</b>	<b>7.00E+02</b>	<b>CC 2</b>	<b>4.81E+03</b>	<b>CC 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