

<b>WASTE STREAM</b>	<b>9F37</b>	<b>Sludge</b>
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**SITE** Sizewell A  
**SITE OWNER** Nuclear Decommissioning Authority

**WASTE CUSTODIAN** Magnox Limited

**WASTE TYPE** ILW

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2022.....	0 m <sup>3</sup>
Future arisings -	1.4.2024 - 31.3.2030.....	15.1 m <sup>3</sup>
Total future arisings:		15.1 m <sup>3</sup>
Total waste volume:		15.1 m <sup>3</sup>

Comment on volumes: -

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 1.5  
Stock (lower): x Arisings (lower) x 0.8

**WASTE SOURCE**

The sludge originates from routine filtration of liquid effluents and cooling pond water treatment and from clean-up operations of the cooling ponds and Effluent Treatment Plant / associated storage tanks. Sludge particles may be up to 5 millimetres in size by definition. This sludge is held in Wash Collection Tank/ Active Effluent Tank.

**PHYSICAL CHARACTERISTICS**

General description: The waste consists of debris washed from persons, corrosion products such as magnesium hydroxide and carbonate detached from fuel elements and extraneous materials such as flakes of paint. Sludge particles may be up to millimetre size, and there will probably be 50-450 kg/m<sup>3</sup> of solid material. Once fluidised the sludges should be readily transferred by pumping but reconcentration may be time consuming. There are no large items that may require special handling.

Physical components (%vol): Sludge (100%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m<sup>3</sup>): ~1.3

Comment on density: The bulk density is approximately 1.3 tonnes / cubic metre.

**CHEMICAL COMPOSITION**

General description and components (%wt): Magnesium hydroxide, magnesium carbonate, graphite dust, sand, and water.

Chemical state: Alkali

Chemical form of radionuclides: H-3: Chemical form of tritium has not been assessed but may be present as water or as other inorganic compounds or as organic compounds.  
C-14: The chemical form of carbon 14 has not been determined.  
Cl-36: The chemical form of chlorine 36 has not been determined.  
Se-79: The chemical form of selenium has not been determined.  
Tc-99: The chemical form of technetium has not been determined.  
Ra: The chemical form of radium isotopes has not been determined.  
Th: The thorium isotope content is insignificant.  
U: The chemical form of uranium isotopes has not been determined.  
Np: The chemical form of neptunium has not been determined.  
Pu: The chemical form of plutonium isotopes has not been determined.

Metals and alloys (%wt): No bulk metal items present.

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....		Components removed during sludge transfer	
Iron.....			
Aluminium.....	NE		
Beryllium.....	NE		
Cobalt.....			
Copper.....	NE		
Lead.....	NE		
Magnox/Magnesium.....		Components removed during sludge transfer	
Nickel.....			
Titanium.....			
Uranium.....			
Zinc.....	NE		
Zircaloy/Zirconium.....	NE		
Other metals.....	NE	The presence of "other" metals has not been fully assessed.	

Organics (%wt):                      There may be some oil and grease. Organic ion exchange resins would be expected in only trace quantities, if any.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0		
Paper, cotton.....	0		
Wood.....	0		
Halogenated plastics .....			
Total non-halogenated plastics.....	0		
Condensation polymers.....	0		
Others.....	0		
Organic ion exchange materials....	TR		
Total rubber.....	0		
Halogenated rubber .....	0		
Non-halogenated rubber.....	0		
Hydrocarbons.....			
Oil or grease .....			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	NE		

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.....	~100.0		
Soil.....	0		
Brick/Stone/Rubble.....	TR		
Cementitious material.....	TR		
Sand.....			
Glass/Ceramics.....	0		
Graphite.....	TR		
Desiccants/Catalysts.....			
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	P		
Free non-aqueous liquids.....	NE		
Powder/Ash.....	0		

Inorganic anions (%wt):      Not fully assessed. Likely to be a mixture of sulphates, silicates, carbonates and hydroxides present.

	(%wt)	Type(s) and comment
Fluoride.....	NE	
Chloride.....	NE	
Iodide.....	NE	
Cyanide.....	0	
Carbonate.....	NE	
Nitrate.....	NE	
Nitrite.....	NE	
Phosphate.....	NE	
Sulphate.....	NE	
Sulphide.....	NE	

Materials of interest for waste acceptance criteria:      The waste is unlikely to present a fire hazard but this requires confirmation since Magnox may be present and can ignite under appropriate conditions. There might be trace quantities of biological material.

	(%wt)	Type(s) and comment
Combustible metals.....		
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	TR	
Biodegradable materials.....	0	
Putrescible wastes.....	0	

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Non-putrescible wastes.....  
 Corrosive materials..... 0  
 Pyrophoric materials..... 0  
 Generating toxic gases..... NE  
 Reacting with water.....  
 Higher activity particles.....  
 Soluble solids as bulk chemical  
 compounds.....

Hazardous substances / To be determined.  
 non hazardous pollutants:

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....		
Styrene.....		
Tri-butyl phosphate.....		
Other organophosphates.....		
Vinyl chloride.....		
Arsenic.....		
Barium.....		
Boron.....	0	
Boron (in Boral).....		
Boron (non-Boral).....		
Cadmium.....		
Caesium.....		
Selenium.....		
Chromium.....		
Molybdenum.....		
Thallium.....		
Tin.....		
Vanadium.....		
Mercury compounds.....		
Others.....		
Electronic Electrical Equipment (EEE)		
EEE Type 1.....		
EEE Type 2.....		
EEE Type 3.....		
EEE Type 4.....		
EEE Type 5.....		

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Complexing agents (%wt):

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....		
Total complexing agents.....	NE	

Potential for the waste to contain discrete items:      No. In & of itself not a DI; assumed not likely to contain any "rogue" items that could be.

**PACKAGING AND CONDITIONING**

Conditioning method:      The waste will be loaded into a Ductile Cast Iron Container (DCIC) and dried in the container.

Plant Name:      AVDS

Location:      Sizewell A Site

Plant startup date:      -

Total capacity (m<sup>3</sup>/y incoming waste):      -

Target start date for packaging this stream:      -

Throughput for this stream (m<sup>3</sup>/y incoming waste):      -

Other information:      Sludges and sands will be loaded into the DCICs on a fill/dry cycle to maximise waste volume per container

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages
	3m <sup>3</sup> RS box	100.0	5.04	2.5	3

Likely container type comment:      -

Range in container waste volume:      -

Other information on containers:      The container is expected to be made from Ductile Caste Iron (DCI).

Likely conditioning matrix:      -

Other information:      -

Conditioned density (t/m<sup>3</sup>):      ~1.05

Conditioned density comment:      -

Other information on conditioning:      -

Opportunities for alternative disposal routing:      -

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

Source:

Sludge contaminated by Cs and Sr leached from irradiated fuel elements and contaminated skips and fission products and actinides.

Uncertainty:

Specific activity is a function of Station operating history.

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:

The values quoted were derived by extrapolation from available measurements and are indicative of the activities that might be expected.

Other information:

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Nuclide	Mean radioactivity, TBq/m <sup>3</sup>				Nuclide	Mean radioactivity, TBq/m <sup>3</sup>			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3			2.61E-03	CC 2	Gd 153				8
Be 10				8	Ho 163				8
C 14			1.89E-03	CC 2	Ho 166m				8
Na 22				8	Tm 170				8
Al 26				8	Tm 171				8
Cl 36			1.75E-06	CC 2	Lu 174				8
Ar 39				8	Lu 176				8
Ar 42				8	Hf 178n				8
K 40				8	Hf 182				8
Ca 41				8	Pt 193				8
Mn 53				8	Tl 204				8
Mn 54				8	Pb 205				8
Fe 55			3.00E-04	CC 2	Pb 210				8
Co 60			4.22E-04	CC 2	Bi 208				8
Ni 59				8	Bi 210m				8
Ni 63			9.15E-04	CC 2	Po 210				8
Zn 65				8	Ra 223				8
Se 79				8	Ra 225				8
Kr 81				8	Ra 226				8
Kr 85				8	Ra 228				8
Rb 87				8	Ac 227				8
Sr 90			1.12E-02	CC 2	Th 227				8
Zr 93				8	Th 228				8
Nb 91				8	Th 229				8
Nb 92				8	Th 230				8
Nb 93m				8	Th 232				8
Nb 94				8	Th 234		3.04E-07	CC 2	
Mo 93				8	Pa 231				8
Tc 97				8	Pa 233		7.73E-09	CC 2	
Tc 99				8	U 232				8
Ru 106			2.28E-06	CC 2	U 233		1.54E-09	CC 2	
Pd 107				8	U 234		3.1E-07	CC 2	
Ag 108m				8	U 235		7.28E-09	CC 2	
Ag 110m				8	U 236		3.51E-08	CC 2	
Cd 109				8	U 238		3.04E-07	CC 2	
Cd 113m				8	Np 237		7.85E-09	CC 2	
Sn 119m				8	Pu 236				8
Sn 121m				8	Pu 238		9.42E-04	CC 2	
Sn 123				8	Pu 239		1.04E-03	CC 2	
Sn 126				8	Pu 240		1.04E-03	CC 2	
Sb 125			1.53E-06	CC 2	Pu 241		2.17E-02	CC 2	
Sb 126				8	Pu 242				8
Te 125m			3.84E-07	CC 2	Am 241		3.54E-03	CC 2	
Te 127m				8	Am 242m				8
I 129			1.62E-08	CC 2	Am 243				8
Cs 134			2.1E-05	CC 2	Cm 242				8
Cs 135				8	Cm 243		1.05E-05	CC 2	
Cs 137			5.69E-02	CC 2	Cm 244		9.45E-06	CC 2	
Ba 133				8	Cm 245				8
La 137				8	Cm 246				8
La 138				8	Cm 248				8
Ce 144			1.36E-07	CC 2	Cf 249				8
Pm 145				8	Cf 250				8
Pm 147			3.4E-05	CC 2	Cf 251				8
Sm 147				8	Cf 252				8
Sm 151			1.26E-04	CC 2	Other a				
Eu 152			7.52E-07	CC 2	Other b/g				
Eu 154			1.41E-04	CC 2	<b>Total a</b>	<b>0</b>	<b>6.58E-03</b>	<b>CC 2</b>	
Eu 155			3.48E-05	CC 2	<b>Total b/g</b>	<b>0</b>	<b>9.62E-02</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