

WASTE STREAM	9F45	Fuel Bottle
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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.....	< 0.1 m ³								
Total future arisings:	0 m ³								
Total waste volume:	< 0.1 m ³								
Comment on volumes:	-								
Uncertainty factors on volumes:	<table> <tr> <td>Stock (upper):</td> <td>x 1.5</td> <td>Arisings (upper)</td> <td>x</td> </tr> <tr> <td>Stock (lower):</td> <td>x 0.5</td> <td>Arisings (lower)</td> <td>x</td> </tr> </table>	Stock (upper):	x 1.5	Arisings (upper)	x	Stock (lower):	x 0.5	Arisings (lower)	x
Stock (upper):	x 1.5	Arisings (upper)	x						
Stock (lower):	x 0.5	Arisings (lower)	x						

WASTE SOURCE A leaking fuel element was removed from the reactor in November 2007 and placed inside a capped bottle to prevent excessive Cs-137/134 leaching into the ponds. The element was left in the bottle until June 2008 causing damage to the magnesium fuel can. Ion exchange resin cartridges were used to remove Cs-137/134 from the bottle prior to removing the element. The fuel element was intact when removed from the bottle and dispatched to Sellafield for reprocessing. High dose rates (>1Sv/hr) were observed on the bottle after the element was removed. The waste consists of the Fuel debris bottle, its cap containing ion exchange resin and an associated ion exchange resin column.

PHYSICAL CHARACTERISTICS

General description: Fuel Element Debris Bottle containing Fuel/Magnox residue, Fuel Element Debris Bottle cap containing Ion exchange resin and spent Ion exchange resin column.

Physical components (%wt): Fuel Element/Magnox can corrosion debris (1.62%), Ion Exchange Resin (0.58%), ABS (81.38%), Stainless Steel (16.09%), Polypropylene (0.03%), Polyethylene (0.04%), Retained Fluid (0.26%)

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 1.24

Comment on density: Based on volume and mass assumptions made for waste constituents.

CHEMICAL COMPOSITION

General description and components (%wt): Fuel Element/Magnox can corrosion debris (1.62%), Ion Exchange Resin (0.58%), ABS (81.38%), Stainless Steel (16.09%), Polypropylene (0.03%), Polyethylene (0.04%), Retained Fluid (0.26%)

Chemical state: Neutral

Chemical form of radionuclides:

- H-3: Not present
- C-14: Not present
- Cl-36: Not present
- Se-79: Not present
- Tc-99: Not present
- I-129: Not present
- Ra: Not determined
- Th: Not present
- U: Not determined
- Np: Not present
- Pu: Not determined

Metals and alloys (%wt): -

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	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	16.1		
Other ferrous metals.....	NE		
Iron.....			
Aluminium.....			
Beryllium.....			
Cobalt.....			
Copper.....			
Lead.....			
Magnox/Magnesium.....	NE		
Nickel.....			
Titanium.....			
Uranium.....			
Zinc.....			
Zircaloy/Zirconium.....	NE		
Other metals.....			

Organics (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0		
Paper, cotton.....	0		
Wood.....	0		
Halogenated plastics	0		
Total non-halogenated plastics.....	81.5		
Condensation polymers.....	81.5	ABS (81.38%), Polypropylene (0.03%), Polyethylene (0.04%)	
Others.....	0		
Organic ion exchange materials....	0		
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.....	0		

Other materials (%wt): -

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	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0.58		
Inorganic sludges and flocs.....	1.6	Fuel Element/Magnox can corrosion debris	
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....			
Glass/Ceramics.....	0		
Graphite.....	0		
Desiccants/Catalysts.....			
Asbestos.....	0	Not applicable	
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	~0.26	Retained Fluid (0.26%)	
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

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: Not applicable

	(%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.....		

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

Hazardous substances / non hazardous pollutants: none expected

	(%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: Yes. Resin - In & of itself not a DI; assumed not likely to contain any "rogue" items that could be. Bottle - All Stainless items assumed DIs.

PACKAGING AND CONDITIONING

Conditioning method: The bottle and associated ion exchange resin column are expected to be size reduced and containerised into a single MOSAIK

Plant Name: AVDS

Location: Sizewell A Site

Plant startup date: -

Total capacity (m³/y incoming waste): -

Target start date for packaging this stream: -

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

Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	500 l RS drum (0mm Pb)	100.0	0.029	0.49	1

Likely container type comment: -

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix: None

Other information: -

Conditioned density (t/m³): -

Conditioned density comment: -

Other information on conditioning: -

Opportunities for alternative disposal routing: -

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

RADIOACTIVITY

Source:	Activity associated with leaking Fuel Element and associated clean-up/containment techniques. (i.e. resin media)
Uncertainty:	-
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:	Inferred through gamma dose rate modelling and ratio to a reference radionuclide. Activity associated with this waste has been determined through dose-rate measurement and physical sampling
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		8			Gd 153		8		
Be 10		8			Ho 163		8		
C 14		8			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36		8			Lu 174		8		
Ar 39		8			Lu 176		8		
Ar 42		8			Hf 178n		8		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		8			Pb 210		8		
Co 60		8			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63		8			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79		8			Ra 225		8		
Kr 81		8			Ra 226		8		
Kr 85	3.79E-01	CC 2			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	5.30E+00	CC 2			Th 227		8		
Zr 93		8			Th 228		8		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230	1.22E-08	CC 2		
Nb 93m		8			Th 232		8		
Nb 94		8			Th 234		8		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233	2.66E-07	CC 2		
Tc 99		8			U 232		8		
Ru 106	1.21E-03	CC 2			U 233		8		
Pd 107		8			U 234	2.22E-04	CC 2		
Ag 108m		8			U 235		8		
Ag 110m	1.45E-08	CC 2			U 236	1.9E-08	CC 2		
Cd 109		8			U 238		8		
Cd 113m		8			Np 237	2.71E-07	CC 2		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	1.09E-01	CC 2		
Sn 123		8			Pu 239	9.51E-02	CC 2		
Sn 126		8			Pu 240	1.07E-01	CC 2		
Sb 125	2.77E-02	CC 2			Pu 241	4.78E+00	CC 2		
Sb 126		8			Pu 242	5.98E-05	CC 2		
Te 125m	6.93E-03	CC 2			Am 241	1.64E-01	CC 2		
Te 127m		8			Am 242m	2.54E-03	CC 2		
I 129		8			Am 243	1.41E-04	CC 2		
Cs 134	2.12E-02	CC 2			Cm 242	2.10E-03	CC 2		
Cs 135		8			Cm 243	1.13E-04	CC 2		
Cs 137	2.04E+01	CC 2			Cm 244	1.88E-03	CC 2		
Ba 133		8			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144	1.30E-04	CC 2			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147	4.71E-01	CC 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	4.60E-02	CC 2			Other a				
Eu 152	3.03E-03	CC 2			Other b/g				
Eu 154	7.76E-02	CC 2			Total a	4.8E-01	CC 2	0	
Eu 155	2.39E-02	CC 2			Total b/g	3.16E+01	CC 2	0	

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