

<b>WASTE STREAM</b>	<b>2D96.4</b>	<b>Ion Exchange Material in Skips (AW500)</b>
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**SITE** Sellafield  
**SITE OWNER** Nuclear Decommissioning Authority

**WASTE CUSTODIAN** Sellafield Limited

**WASTE TYPE** ILW

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

		Reported
Stocks:	At 1.4.2022.....	302.6 m <sup>3</sup>
Total future arisings:		0 m <sup>3</sup>
Total waste volume:		302.6 m <sup>3</sup>

Comment on volumes: Ion exchange resins are no longer used to treat the pond water, however two skips of Ion exchange resin are still in place as part of the emergency pumping arrangements. There are 232 skips. Any future arisings will be generated from skip changes on the emergency pumping system.

Uncertainty factors on volumes: Stock (upper): x 1.3 Arisings (upper) x  
 Stock (lower): x 0.7 Arisings (lower) x

**WASTE SOURCE** Ion exchange material from pond water treatment.

**PHYSICAL CHARACTERISTICS**

General description: The waste arises as zeolite type AW500 from the treatment of pond water. It is in the form of elliptical pellets approximately 5mm in length. The zeolite is held in a mild steel mesh within a modified Magnox fuel skip. No items require special handling.

Physical components (%vol): Ion exchange material (94%), skips and mesh (6%).

Sealed sources: Not yet determined.

Bulk density (t/m<sup>3</sup>): ~1.5

Comment on density: The mean density of a skip containing zeolite is 1.28 t/m<sup>3</sup>.

**CHEMICAL COMPOSITION**

General description and components (%wt): Zeolite (AW500) (65%), aluminium (as Al<sub>2</sub>O<sub>3</sub>), silicon (as SiO<sub>2</sub>), caesium, mild steel (35%).

Chemical state: Neutral

Chemical form of radionuclides: -

Metals and alloys (%wt): The internal steel cage of the skip is 6 mm thick mild steel. There is also mild steel wire mesh within the skips.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	35.0		
Iron.....			
Aluminium.....	0		
Beryllium.....			
Cobalt.....	0		
Copper.....			
Lead.....	0		
Magnox/Magnesium.....	0		
Nickel.....	0		
Titanium.....			

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Uranium.....  
 Zinc..... 0  
 Zircaloy/Zirconium..... 0  
 Other metals..... 0

Organics (%wt): No organic materials are present (the waste consists of inorganic ion exchange material).

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0		
Paper, cotton.....			
Wood.....			
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.....			
Oil or grease .....			
Fuel.....			
Asphalt/Tarmac (cont.coal tar)...			
Asphalt/Tarmac (no coal tar)....			
Bitumen.....			
Others.....			
Other organics.....	0		

Other materials (%wt): -

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	57.0		
Inorganic sludges and flocs.....	TR		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....	TR		
Glass/Ceramics.....			
Graphite.....	0		
Desiccants/Catalysts.....			
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	~8.0		

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Free non-aqueous liquids..... 0

Powder/Ash.....

Inorganic anions (%wt): Silicates are present and probably other anions in trace quantities.

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

Materials of interest for waste acceptance criteria: Free liquid is held in zeolite skips but is not hazardous.

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

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....	NE	
Chlorinated solvents.....		
Formaldehyde.....		
Organometallics.....		
Phenol.....	NE	

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Styrene.....	
Tri-butyl phosphate.....	NE
Other organophosphates.....	
Vinyl chloride.....	NE
Arsenic.....	NE
Barium.....	
Boron.....	NE
Boron (in Boral).....	
Boron (non-Boral).....	
Cadmium.....	NE
Caesium.....	
Selenium.....	NE
Chromium.....	NE
Molybdenum.....	NE
Thallium.....	
Tin.....	NE
Vanadium.....	NE
Mercury compounds.....	
Others.....	NE
Electronic Electrical Equipment (EEE)	
EEE Type 1.....	
EEE Type 2.....	
EEE Type 3.....	
EEE Type 4.....	
EEE Type 5.....	

Complexing agents (%wt):      No

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids.....		
Other organic complexants.....	0	No organic complexing agents are present.
Total complexing agents.....	0	

Potential for the waste to contain discrete items:      No.

**PACKAGING AND CONDITIONING**

Conditioning method:      The skips will be loaded into Self-Shielded Boxes, prior to treatment through BEP (Flood Grout)

Plant Name:      (Storage in Self Shielded Boxes, prior to treatment in) Box Encapsulation Plant.

Location:      Sellafield.

Plant startup date:      BEP Flood Grout process available March 2022, Ref GEN 5601A

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

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Target start date for packaging this stream: -

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

Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m <sup>3</sup> )	Payload (m <sup>3</sup> )	Number of packages
	Sellafield 3m <sup>3</sup> box	100.0	~1.277	2.7	237

Likely container type comment: Packaging plans are being developed.

Range in container waste volume: -

Other information on containers: Stainless Steel

Likely conditioning matrix: BFS/OPC;PFA/OPC  
Other information: LoC not yet obtained.

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

Conditioned density comment: -

Other information on conditioning: -

Opportunities for alternative disposal routing: Not yet determined

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

**RADIOACTIVITY**

Source: The main source of the activity is from the fuel contamination of pond water giving mixed fission product and uranium contamination of AW500 resins. Caesium is the dominant radioactive element present.

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: -

Other information: Other alpha not specified.

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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					Gd 153				
Be 10					Ho 163				
C 14					Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36					Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54					Pb 205				
Fe 55					Pb 210				
Co 60	1.88E-04	BB 2			Bi 208				
Ni 59					Bi 210m				
Ni 63					Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	6.06E-01	BB 2			Th 227				
Zr 93					Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m					Th 232				
Nb 94					Th 234				
Mo 93					Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106	2.23E-11	BB 2			U 233				
Pd 107					U 234	4.68E-05	BB 2		
Ag 108m					U 235	1.74E-06	BB 2		
Ag 110m					U 236				
Cd 109					U 238	5.76E-05	BB 2		
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	3.91E-03	BB 2		
Sn 123					Pu 239	1.56E-02	BB 2		
Sn 126					Pu 240	1.10E-02	BB 2		
Sb 125					Pu 241	3.52E-02	BB 2		
Sb 126					Pu 242	2.42E-06	BB 2		
Te 125m					Am 241	2.07E-02	BB 2		
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	3.55E-05	BB 2			Cm 242				
Cs 135					Cm 243				
Cs 137	1.65E+02	BB 2			Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144	2.85E-14	BB 2			Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152					Other b/g				
Eu 154	2.75E-02	BB 2			<b>Total a</b>	<b>5.13E-02</b>	<b>BB 2</b>	<b>0</b>	
Eu 155	3.41E-03	BB 2			<b>Total b/g</b>	<b>1.65E+02</b>	<b>BB 2</b>	<b>0</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