WASTE STREAM 2C01 Ion Exchange Resins AW500 (Zeolite)

SITE Chapelcross

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: Yes

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	39.4 m³
Total future arisings:		0 m³
Total waste volume:		39.4 m³

Comment on volumes: The four reactors at Chapelcross ceased generating in the period from August 2001 (R1) to February 2004 (R2). There are 45 depleted skips, 2 live skips and 7 new skips.

Uncertainty factors on volumes:

Stock (upper):	x 1.2	Arisings (upper)	x
Stock (lower):	x 0.8	Arisings (lower)	x

WASTE SOURCE In situ treatment of fuel storage pond water.

PHYSICAL CHARACTERISTICS

General description: The waste consists of zeolite ion exchange material. No large items require special handling.

Physical components (%vol): Zeolite AW500 (100%).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 1

Comment on density: The average density refers to the mass of the components divided by the volume as stored.

CHEMICAL COMPOSITION

General description and components (%wt): Zeolite; aluminium (as Al2O3); silicon (as SiO2); caesium contamination.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Most tritium is expected to be present as water but some may be in the form of other inorganic compounds.
C-14: Traces of carbon 14 may be present as graphite.
Cl-36: Chlorine-36 content is insignificant.
Se-79: The selenium content is insignificant.
Tc-99: The chemical form of technetium has not been assessed.
Ra: Radium isotope content is insignificant.
Th: Thorium isotope content is insignificant.
U: The chemical form of uranium isotopes has not been assessed.
Np: The neptunium content is insignificant.
Pu: The chemical form of plutonium isotopes has not been assessed.

Metals and alloys (%wt): -

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

WASTE STREAM 2C01 Ion Exchange Resins AW500 (Zeolite)

Magnox/Magnesium	0
Nickel	
Titanium	
Uranium	0
Zinc	0
Zircaloy/Zirconium	0
Other metals	0

Organics (%wt): No organic materials are present. The waste is unlikely to contain metals.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	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			
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	100.0	Zeolite AW500	
Inorganic sludges and flocs	TR		
Soil	0		
Brick/Stone/Rubble	0		
Cementitious material	0		
Sand			
Glass/Ceramics	0		
Graphite	0		
Desiccants/Catalysts			
Asbestos	0		
Non/low friable			

WASTE STREAM 2C01 Ion Exchange Resins AW500 (Zeolite)

Moderately friable.....	
Highly friable.....	
Free aqueous liquids.....	P
Free non-aqueous liquids.....	0
Powder/Ash.....	0

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

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

Materials of interest for waste acceptance criteria: -

	(%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.....		
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: Toxic metals are not expected.

	(%wt)	Type(s) and comment
Acrylamide.....		
Benzene.....		
Chlorinated solvents.....		

WASTE STREAM 2C01 Ion Exchange Resins AW500 (Zeolite)

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.....	

Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....		
DPTA.....		
NTA.....		
Polycarboxylic acids…….		
Other organic complexants.....		
Total complexing agents.....	0	

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: Zeolite skips to be retrieved underwater into 120mm thick steel overpack, removed from ponds, drained and placed in Normal Density RCB.

Plant Name: -

Location: -

WASTE STREAM 2C01 Ion Exchange Resins AW500 (Zeolite)

Plant startup date: -

Total capacity (m^3/y incoming waste): ~500.0

Target start date for packaging this stream: -

Throughput for this stream (m^3/y incoming waste): ~16.5

Other information: -

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
6m^3 concrete box (SD)	100.0	0.788	5.8	50

Likely container type comment: -

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix:

Other information: -

Conditioned density (t/m^3): 1.0

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: Ion Exchange material used for cleaning fuel pond water. The waste is contaminated mainly with Cs-134 and Cs-137.

Uncertainty: The waste stream has not yet been characterised. Activities are indicative only.

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: -

WASTE STREAM 2C01 Ion Exchange Resins AW500 (Zeolite)

Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	2.18E-05	C C 2			Gd 153		8		
Be 10		4			Ho 163		8		
C 14		5			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		
K 40		8			Hf 182		8		
Ca 41		5			Pt 193		8		
Mn 53		8			Tl 204		8		
Mn 54		5			Pb 205		8		
Fe 55		5			Pb 210		4		
Co 60	2.81E-05	C C 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63		8			Po 210		4		
Zn 65		5			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	5.20E-01	A C 2			Th 227		8		
Zr 93		8			Th 228		8		
Nb 91		8			Th 229		4		
Nb 92		8			Th 230		4		
Nb 93m		8			Th 232		4		
Nb 94		8			Th 234		8		
Mo 93		8			Pa 231		4		
Tc 97		8			Pa 233		8		
Tc 99	2E-04	A C 2			U 232		8		
Ru 106		5			U 233		4		
Pd 107		8			U 234		8		
Ag 108m		8			U 235		8		
Ag 110m		8			U 236		8		
Cd 109		8			U 238		8		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238		5		
Sn 123		8			Pu 239		5		
Sn 126		4			Pu 240		5		
Sb 125		8			Pu 241		5		
Sb 126		8			Pu 242		8		
Te 125m		8			Am 241		5		
Te 127m		8			Am 242m		8		
I 129		8			Am 243		8		
Cs 134	2.37E-04	A C 2			Cm 242		8		
Cs 135	1E-04	A C 2			Cm 243		8		
Cs 137	5.28E+00	A C 2			Cm 244		8		
Ba 133		8			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		5			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147		5			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151		8			Other a				
Eu 152		8			Other b/g				
Eu 154		5			**Total a**	**0**		**0**	
Eu 155		5			**Total b/g**	**5.80E+00**	**A C 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