

WASTE STREAM	9G107/C	Ion Exchange Material
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SITE Trawsfynydd

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Conditioned	Packaged
Stocks:	At 1.4.2022.....	103.8 m ³	453.9 m ³
Total future arisings:		0 m ³	0 m ³
Total waste volume:		103.8 m ³	453.9 m ³
Number of waste packages in stock:	At 1.4.2022.....	136 package(s)	

Comment on volumes: No future arisings. 136 x 1803 type drums are currently in stock. It is assumed 6 drums will be packaged into a 4m³ box at the time of disposal.

Uncertainty factors on volumes:
 Stock (upper): x 1.0 Arisings (upper) x
 Stock (lower): x 1.0 Arisings (lower) x

WASTE SOURCE Ion exchange materials retrieved from storage tanks (resin vault 3) and solidified in the solidification plant at Trawsfynydd (campaign 8).

PHYSICAL CHARACTERISTICS

General description: Conditioned ion exchange material in packages originally intended for sea dumping. The packages (136) are type 1803C. Drums are 0.9 m diameter x 1.2 m high and contain approximately 0.3 m³ of conditioned ion exchange material. The packages each weigh about 2.5 t and so require suitable lifting equipment.

Physical components (%vol): Ion exchange material (5.7% wt), polymer and iron grit (6.6% wt), water (2.4 % wt), mild steel (1.7% wt), iron shot (74.8% wt), cement paste/grout (8.8% wt).

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~3.2

Comment on density: Density of waste is 1.2 t/m³. Density of packaged waste is 3.2 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): The ion exchange material which is contaminated with both fission products and actinides, has been conditioned by mixing with DOW WSB 101 polymer. Packaging and conditioning was carried out with a neoprene rubber gasket being incorporated into each drum. On average each package contains proprietary ion exchange materials (including a little sand) (5.7% wt), iron grit and DOW polymer (6.6% wt), water (2.4% wt), mild steel (1.7% wt), iron shot (74.8% wt), cement paste/grout (8.8% wt). Ion exchange material types: Proprietary ion exchange material including mainly Lewatit DN and AW500, the remainder consists of IRA 74, ARC 359, IE95, IRN78L and cation resin. At least 32% of the ion exchange resins are organic in nature (principally phenol formaldehyde based). The remainder are inorganic materials.

Chemical state: Neutral

Chemical form of radionuclides: H-3: The chemical form of tritium is likely to be water but may be inorganic compounds or organic compounds.
 C-14: The chemical form of carbon 14 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 radium isotope content is insignificant.
 Th: The thorium isotope content is insignificant.
 U: The chemical form of uranium isotopes has not been determined but may be uranium oxides.
 Np: The chemical form of neptunium has not been determined.
 Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.

Metals and alloys (%wt): Mild steel liners and reinforcing bars are present.

WASTE STREAM	9G107/C	Ion Exchange Material
---------------------	----------------	------------------------------

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	1.7		
Iron.....	75.3	Consists of iron shot (74.8 wt%) and iron grit (0.5wt%).	
Aluminium.....	0		
Beryllium.....			
Cobalt.....			
Copper.....			
Lead.....			
Magnox/Magnesium.....			
Nickel.....			
Titanium.....			
Uranium.....			
Zinc.....			
Zircaloy/Zirconium.....			
Other metals.....			

Organics (%wt): Proprietary ion exchange resins which are organic in nature.

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics.....	0		
Paper, cotton.....	0		
Wood.....	0		
Halogenated plastics	0		
Total non-halogenated plastics.....	6.1		
Condensation polymers.....	~6.1		
Others.....	0		
Organic ion exchange materials....	~1.9		
Total rubber.....	TR		
Halogenated rubber	TR	Neoprene	
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): -

WASTE STREAM	9G107/C	Ion Exchange Material
---------------------	----------------	------------------------------

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	~3.8		
Inorganic sludges and flocs.....	NE		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	~8.8		
Sand.....			
Glass/Ceramics.....	0		
Graphite.....	0		
Desiccants/Catalysts.....			
Asbestos.....	0		
Non/low friable.....			
Moderately friable.....			
Highly friable.....			
Free aqueous liquids.....	~2.4		
Free non-aqueous liquids.....	TR		
Powder/Ash.....	0		

Inorganic anions (%wt): -

	(%wt)	Type(s) and comment
Fluoride.....	0	
Chloride.....		
Iodide.....	0	
Cyanide.....	0	
Carbonate.....		
Nitrate.....	0	
Nitrite.....	0	
Phosphate.....	0	
Sulphate.....	~0.10	
Sulphide.....	0	

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.....		

WASTE STREAM	9G107/C	Ion Exchange Material
---------------------	----------------	------------------------------

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 / None expected
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.....		

WASTE STREAM	9G107/C	Ion Exchange Material
---------------------	----------------	------------------------------

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

Container type:	Container	Waste packaged (%vol)	Waste loading (m ³)	Payload (m ³)	Number of packages
	4m box (200mm concrete shielding)	100.0	4.58	10.9	23

Container type comment: The loading volume assumes 6 type 1803 drums can be placed in a 4m ILW box.

Range in container waste volume: Variability in waste loading is not expected to vary significantly.

Other information on containers: The 1803 drum will be made of mild steel. A 4m ILW box would be made of stainless steel. If the waste is LLW, 200 litre drums will be used to package the waste; these are made from mild steel.

Conditioned density (t/m³): ~2.5

Conditioned density comment: The density of the wasteform is estimated to be approximately 2.5 t/m³. The wasteform is taken as being 6 type 1803 drums conditioned in the available volume in a 4m box.

Other information on conditioning: Packaging of the drums in 4m boxes is not expected to take place until the waste is to be sent to a repository.

RADIOACTIVITY

Source: Spent ion exchange resins arising from the treatment of pond and effluent water. Some filter materials. Contamination by fission products, actinides and activation products.

Uncertainty: Specific activity is a function of Station operating history. The values quoted are indicative of the activities that might be expected.

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: Values were derived by extrapolation from available measurements.

Other information: -

WASTE STREAM 9G107/C Ion Exchange Material

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	3.73E-07	CC 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	3.93E-07	CC 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	5.18E-08	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	2.09E-08	CC 2			Pb 210		8		
Co 60	1.21E-07	CC 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63	2.02E-06	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	2.12E-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	1.21E-07	CC 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233		8		
Tc 99	2.42E-05	CC 2			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234	7.03E-08	CC 2		
Ag 108m		8			U 235	1.23E-08	CC 2		
Ag 110m		8			U 236		8		
Cd 109		8			U 238	1.21E-07	CC 2		
Cd 113m		8			Np 237		8		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	1.25E-05	CC 2		
Sn 123		8			Pu 239	3.54E-05	CC 2		
Sn 126		8			Pu 240	4.42E-05	CC 2		
Sb 125	1.63E-08	CC 2			Pu 241	5.07E-04	CC 2		
Sb 126		8			Pu 242		8		
Te 125m	4.08E-09	8			Am 241	1.41E-04	CC 2		
Te 127m		8			Am 242m		8		
I 129	1.62E-08	CC 2			Am 243		8		
Cs 134	1.19E-07	CC 2			Cm 242		8		
Cs 135		8			Cm 243	4.31E-08	CC 2		
Cs 137	1.89E-01	CC 2			Cm 244	6.56E-07	CC 2		
Ba 133		8			Cm 245		8		
La 137		8			Cm 246		8		
La 138		8			Cm 248		8		
Ce 144		8			Cf 249		8		
Pm 145		8			Cf 250		8		
Pm 147	1.26E-07	CC 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151		8			Other a				
Eu 152		8			Other b/g				
Eu 154	2.27E-06	CC 2			Total a	2.34E-04	CC 2	0	
Eu 155	2.59E-07	CC 2			Total b/g	2.11E-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