WASTE STREAM	9G18/C	Ion Exchange Material - Conditioned Waste

SITE Trawsfynydd

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m^3)	OR	Conditioned (m^3)	Packaged (m^3)
Stocks:	At 1.4.2025		= 198.9	365.4
Future arisings:				0.0
Total future arisings:				0.0
Total waste volume:			**0.0**	**0.0**
			198.9	**365.4**

Number of waste packages in stock: At 1.4.2025…… 861 packages

Comment on arising rates: No future arisings.

Additional information on quantities: The volume of conditioned waste packaged in type 1803C drums is 198.9 m3, drums have an external volume of 653.7 cubic metres. There are 861 drums. This includes 1 non-compliant drum.

Uncertainty factors on volumes:

Stock (upper):	x 1.00	Arisings (upper):	x -
Stock (lower):	x 1.00	Arisings (lower):	x -

WASTE SOURCE Ion exchange materials retrieved from storage tanks (resin vault 1) and solidified in the solidification plant at Trawsfynydd (campaigns 3 and 5).

PHYSICAL CHARACTERISTICS

General description: Conditioned ion exchange material in packages originally intended for sea dumping. The packages are type 1803C (861 off). Each is of gross weight about 2.5 t and contains approximately 0.3 m3 of conditioned ion exchange material. Drums are 0.9 m diameter x 1.2 m high. The packages each weigh about 2.5 t and so require suitable lifting equipment.

Changes since waste generated: -

Bulk density (t/m³): = 1.4

Comment on density: Density of waste is 1.38 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. This was performed in two distinct campaigns between 2001 and 2006. Packaging and conditioning was carried out with a neoprene rubber gasket being incorporated into each drum. Conditioned waste percentage weight: Ion exchange material (62.5% wt), polymer (29% wt), iron grit (5.2% wt), extender (2.3% wt), catalyst (0.86% wt), promotor (0.13% wt).. Ion exchange material types: Proprietory 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

Sheet metal proportion / thickness: Mild steel liners and reinforcing bars are present.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel……	= 0	-	
Other ferrous metals……	~ 5.2	iron grit in inactive feed material	
Iron……	= 0	-	
Aluminium……	= 0	-	
Beryllium……	0	-	
Cobalt……		-	
Copper……	= 0	-	
Lead……	= 0	-	
Magnox/Magnesium……	= 0	-	
Nickel……		-	
Titanium……		-	
Uranium……		-	
Zinc……	= 0	-	
Zircaloy/Zirconium……	= 0	-	
Other metals……	= 0	-	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulosics	= 0	-	
Paper, cotton	= 0	-	
Wood	= 0	-	
Halogenated plastics	= 0	-	
Total non-halogenated plastics	= 32.3	-	
Condensation polymers	= 32.3	Polymer, extender, catalyst and promotor.	
Others	= 0	-	
Organic ion exchange materials	~ 31.3	Inorganic Lewatit DN 42%, Organic AW500 32%, unspecified (IRN74, ARC359, IE95, IRN78L and cation resin.) represented at 50/50 split	
Total rubber	TR	-	
Halogenated rubber	TR	Neoprene.	
Non-halogenated rubber		-	
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	~ 31.3	Inorganic Lewatit DN 42%, Organic AW500 32%, unspecified (IRN74, ARC359, IE95, IRN78L and cation resin.) represented at 50/50 split	
Inorganic sludges and flocs		-	
Soil	= 0	-	
Brick/Stone/Rubble	= 0	-	
Cementitious material	= 0	-	
Sand		-	
Glass/Ceramics	= 0	-	
Graphite	= 0	-	
Desiccants/Catalysts		-	
Asbestos	= 0	-	
Non/low friable		-	
Moderately friable		-	
Highly friable		-	
Free aqueous liquids	= 0	-	
Free non-aqueous liquids	= 0	-	
Powder/Ash	= 0	-	

COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS

Inorganic anions (%wt):

	(%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:

	(%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: -

	(%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		-

Complexing agents (%wt): No

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

Physical components:

	Number	Type(s) and comment
Sources		-
Electronic & Electrical Equipment (EEE)		-
EEE Type 1		-
EEE Type 2		-
EEE Type 3		-
EEE Type 4		-
EEE Type 5		-

TREATMENT, PACKAGING AND DISPOSAL

Planned on-site / off-site treatment(s):

Treatment	On-site / Off-site	Stream volume %
Size reduction		
Decay storage		
Low force compaction		
Supercompaction (HFC)		
Incineration		
Drying/dewatering/liquid separation		
Tie down/fixatives/strippable coating/painting application		
Decontamination		
Metal treatment		
Recycling / reuse		
Thermal treatment, including vitrification		
Encapsulation		
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments: -

Conditioning method: Waste has been conditioned by encapsulating in type 1803C drums. Further packaging of this waste stream is required to meet transport compliance prior to transfer to the GDF.

Conditioning plants:

Plant Name	Location

Likely conditioning matrix: -

Further information on the conditioning matrix: Individual type 1803C drums have been conditioned by encapsulation with a polymer matrix. To create the final waste packages, current estimates suggest that 6 type 1803C drums will be overpacked into a 4m ILW box before disposal to a suitable repository. This is likely to involve infilling the space between the drums in the 4m ILW Box with a BFS/OPC matrix.

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m^3)	Payload (m^3)	Number of packages	Estimated start date for packaging
4 m box (200 mm concrete shielding)	100.0	1.4	10.9	144	-

Range in container waste loading: No significant variability is expected.

Other information on packaging and conditioning: The overall volume of Type 1803C drums is approximately 760 litres and they are made of mild steel. The 4m ILW Box is expected to be made of stainless steel.

Conditioned density (t/m^3): = 1.4

Conditioned density comment: The density of the conditioned waste (resin and polymer) is approximately 1.38t/m3. The expected density of the final waste packages (4m ILW Box containing 6 type 1803C drums) is approximately 2.5 t/m3.

Management Routes:

Disposal Route	Stream volume %	Raw density t/m^3	Start date
Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland)			
Expected to be Non-NSD HAW managed under Scottish Government's policy			
Expected to be disposed to LLW Vaults NRS Dounreay			
Expected to be consigned to the Geological Disposal Facility	100.0		
Expected to be consigned to a Near Surface Disposal Facility			
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be disposed On-Site			
Expected to be managed by In-Situ Disposal			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

Classification codes for waste expected to be consigned to a landfill facility:

Opportunities for alternative disposal routing: No

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
-	-	-	-	-

RADIOACTIVITY

Source: Conditioned used ion exchange resins arising from the treatment of pond and effluent water. Contamination by fission products is the main source of activity. Some actinides are also present.

Uncertainty: Specific activity is a function of Station operating history. Values were derived from available measurements. The values quoted are indicative of the activities that might be expected.

Measurement of radioactivities: The assigned radioactivity has been determined from plant operating records supported by sampling and analysis of the raw resin prior to conditioning. The quoted activities are based upon declared activities on package records that were recorded in 2001, 2002 or 2006. These were then decayed to the reference date of 1/4/25. Conditioned waste volume is taken into account for specific activity.

Chemical form of radionuclides:

H-3: Chemical form of tritium has not been determined but is likely to be water or as other inorganic or as organic compounds.
C-14: The carbon 14 content is insignificant.
Cl-36: The chlorine 36 content is insignificant.
Se-79: The chemical form of selenium has not been determined.
Tc-99: The chemical form of technetium has not been determined.
I-129: -
Ra: The radium isotope content is insignificant.
Th: The thorium isotope content is insignificant.
U: The uranium isotope content is insignificant.
Np: The chemical form of neptunium has not been determined.
Pu: Chemical form of plutonium isotopes may be plutonium oxides.

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3	6.69E-07	C C 2			Gd 153		8		
Be 10		8			Ho 163		8		
C 14	1.31E-06	C C 2			Ho 166m		8		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171		8		
Cl 36	1.73E-07	C C 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	4.28E-09	C C 2			Pb 210		8		
Co 60	9.44E-08	C C 2			Bi 208		8		
Ni 59		8			Bi 210m		8		
Ni 63	6.23E-06	C C 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	5.43E-02	C C 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	4.03E-07	C C 2		
Mo 93		8			Pa 231		8		
Tc 97		8			Pa 233	2.14E-09	C C 2		
Tc 99	8.08E-05	C C 2			U 232		8		
Ru 106		8			U 233		8		
Pd 107		8			U 234	2.35E-07	C C 2		
Ag 108m		8			U 235	4.09E-08	C C 2		
Ag 110m		8			U 236		8		
Cd 109		8			U 238	4.03E-07	C C 2		
Cd 113m		8			Np 237	2.16E-09	C C 2		
Sn 119m		8			Pu 236		8		
Sn 121m		8			Pu 238	3.83E-05	C C 2		
Sn 123		8			Pu 239	1.18E-04	C C 2		
Sn 126		8			Pu 240	1.47E-04	C C 2		
Sb 125	3.43E-09	C C 2			Pu 241	9.95E-04	C C 2		
Sb 126		8			Pu 242		8		
Te 125m		8			Am 241	4.84E-04	C C 2		
Te 127m		8			Am 242m		8		
I 129	5.40E-08	C C 2			Am 243		8		
Cs 134	9.90E-09	C C 2			Cm 242		8		
Cs 135		8			Cm 243	1.12E-07	C C 2		
Cs 137	4.91E-01	C C 2			Cm 244	1.44E-06	C C 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	2.29E-08	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151		8			Unsp a				
Eu 152		8			Unsp b/g				
Eu 154	3.12E-06	C C 2			**Total a**	**7.89E-04**	*	**0**	*
Eu 155	1.79E-07	C C 2			**Total b/g**	**5.46E-01**	*	**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 the 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
* Total calculated from the 114 declared radionuclides