

WASTE STREAM	7E29	Intermediate Level Ion Exchange Resin (Decontamination)
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SITE Rosyth Royal Dockyard

SITE OWNER Ministry of Defence (MOD)

WASTE CUSTODIAN Ministry of Defence (MOD)

WASTE TYPE ILW

WASTE VOLUMES

	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:	At 1.4.2025	~ 23.0		
Future arisings:	1.4.2025 - 31.3.2026	= 0		
Total future arisings:		0.0		
Total waste volume:		23.0		

Number of waste packages in stock: At 1.4.2025..... - packages

Comment on arising rates: There are no predicted future arisings for this waste stream. Estimated arisings had been forecast in previous RWI submissions, however, none of those arisings have been realised. The project is now better defined and previously identified arisings from the use of the portable effluent treatment plant did not occur, and are not expected going forwards either.

Additional information on quantities: Estimate of current stocks is based on store records and recent project information reviews.

Uncertainty factors on volumes: Stock (upper): x 1.00 Arisings (upper): x -
Stock (lower): x 1.00 Arisings (lower): x -

WASTE SOURCE Current stocks have come from submarine refitting.

PHYSICAL CHARACTERISTICS

General description: The waste consists of ion exchange resin. The resin is polystyrene bead based, consisting of uniform spheroids of approximately 1 mm diameter. The resin is all solid and currently stored in water. The average composition of the waste is 63% resin and 37% water. The waste is non-compactable. Is it planned that the waste will undergo thermal treatment and is likely to be encapsulated prior to its disposal.

Changes since waste generated: Since generation the wastes have been transferred from older resin catch tanks into new waste resin handling containers for storage whilst awaiting consignment for treatment and subsequent disposal. Other than that the wastes have not undergone any physical or chemical processes or changes.

Bulk density (t/m³): = 1.1

Comment on density: The bulk density of the raw waste is 1.1 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): Polystyrene bead resin contaminated with absorbed species (100%). The beads are surface coated with complexing agent.

Chemical state: Neutral

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

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

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulotics.....	-	-	-
Paper, cotton.....	-	-	-
Wood.....	-	-	-
Halogenated plastics.....	-	-	-
Total non-halogenated plastics.....	-	-	-
Condensation polymers.....	-	-	-
Others.....	-	-	-
Organic ion exchange materials.....	~ 63.0	Polystyrene bead resin.	100.0
Total rubber.....	-	-	-
Halogenated rubber.....	-	-	-
Non-halogenated rubber.....	-	-	-
Hydrocarbons.....	-	-	-
Oil or grease.....	-	-	-
Fuel.....	-	-	-
Asphalt/Tarmac (cont.coal tar).....	-	-	-
Asphalt/Tarmac (no coal tar).....	-	-	-
Bitumen.....	-	-	-
Others.....	-	-	-
Other organics.....	-	-	-

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	-	-	-
Inorganic sludges and flocs.....	-	-	-
Soil.....	-	-	-
Brick/Stone/Rubble.....	-	-	-
Cementitious material.....	-	-	-
Sand.....	-	-	-
Glass/Ceramics.....	-	-	-
Graphite.....	-	-	-
Desiccants/Catalysts.....	-	-	-
Asbestos.....	-	-	-
Non/low friable.....	-	-	-
Moderately friable.....	-	-	-
Highly friable.....	-	-	-
Free aqueous liquids.....	~ 37.0	-	-
Free non-aqueous liquids.....	-	-	-
Powder/Ash.....	-	-	-

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

Inorganic anions (%wt):

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

Materials of interest for waste acceptance criteria:

	(%wt)	Type(s) and comment
Combustible metals.....	-	-
Low flash point liquids.....	-	-
Explosive materials.....	-	-
Phosphorus.....	-	-
Hydrides.....	-	-
Biological etc. materials.....	-	-
Biodegradable materials.....	-	-
Putrescible wastes.....	-	-
Non-putrescible wastes.....	-	-
Corrosive materials.....	-	-
Pyrophoric materials.....	-	-
Generating toxic gases.....	-	-
Reacting with water.....	-	-
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.....	-	-
Boron (in Boral).....	-	-
Boron (non-Boral).....	-	-
Cadmium.....	-	-
Caesium.....	-	-
Selenium.....	-	-
Chromium.....	-	-
Molybdenum.....	-	-
Thallium.....	-	-
Tin.....	-	-
Vanadium.....	-	-
Mercury compounds.....	-	-
Others.....	-	-

Complexing agents (%wt):

Yes		
	(%wt)	Type(s) and comment
EDTA.....	~ 0.81	The beads are surface coated with organic complexing agents. These are EDTA, citric acid and triammonium citrate (average concentration is 0.81% by weight). The complexing agents will be destroyed by a thermal treatment process prior to disposal .
DPTA.....	-	
NTA.....	-	
Polycarboxylic acids.....	-	
Other organic complexants.....	-	
Total complexing agents.....	~ 0.81	-

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	Off-site	= 100.0
Encapsulation	Off-site	= 100.0
Polymer encapsulation		
Other physical treatment		
Other chemical treatment		
Containerisation		
Treatment not yet determined		
None		

Comments on planned treatments:

The resins in stock cannot be directly disposed of to LLWR due to the use of EDTA during the decontamination process employed during previous activities. It is planned that these resins will be treated by a suitable thermal treatment process to destroy the chemical complexing agent present. Resins will be transported off-site to a waste contractor for this treatment in their IX resin conditioning facility. The resin contains significant quantities of cobalt-60 which will undergo radioactive decay. The average specific activity information for resins holdings indicates that they have now decayed from ILW to LLW. However, the resins are stored in a number of containers and when looked at on an individual container basis there are a number which still remain ILW. Further sampling is currently underway to provide updated information regarding the radioactive inventory of the resins. Treatment will be done in large batches and it is expected that on average in these large batches they will be LLW.

Conditioning method:

Following treatment it is planned that the waste contractor will encapsulate the resins in a suitable matrix and prepare appropriate waste packages for disposal to the LLWR. Resins following treatment are expected to be LLW - any remaining at ILW will be decay stored until suitable for disposal to the LLWR. Encapsulation method and waste packaging to be determined and managed by the waste contractor.

Conditioning plants:

Plant Name	Location

Likely conditioning matrix:

Unknown

Further information on the conditioning matrix:

Unknown

Waste Packaging:

Likely container type:

Container	Waste packaged (vol%)	Waste loading (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
210 l steel drum (TC14)	100.0	-	-	-	-

Range in container waste loading: Unknown

Other information on packaging and conditioning:

Waste to be prepared and consigned by the waste contractor following treatment.

Conditioned density (t/m³):

-

Conditioned density comment:

-

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)	= 100.0		
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			
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: Activation products from liquid effluents treated through ion exchange.

Uncertainty: Previous data based on much earlier samples and analysis. Data has been reviewed as part of the Resin Disposal Project and revised estimates have been produced. These have been calculated based on existing sampling data as well as considering factors from other similar resins. A further sampling campaign is currently underway to help improve certainty in inventory data.

Measurement of radioactivities: The specific activities were calculated using the data collated as described in Q24 and estimating an average holding per container of 708 L. This volume is based on the internal volume of the Waste Resin Holding Containers and Resin Catch Tanks. Actual volumes of certain tanks were recorded as part of retrieval operations, and further volumes will be recorded during treatment.

Chemical form of radionuclides: H-3: Mainly present as tritiated water.
C-14: Present in metal salts e.g. carbonates.
Cl-36: -
Se-79: -
Tc-99: Chemical form has not been determined.
I-129: -
Ra: -
Th: -
U: -
Np: -
Pu: Chemical form has not been determined.

WASTE STREAM		7E29		Intermediate Level Ion Exchange Resin (Decontamination)					
Nuclide	Mean radioactivity, TBq/m³				Nuclide	Mean radioactivity, TBq/m³			
	Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code		Waste at 1.4.2025	Bands and Code	Future Arisings	Bands and Code
H 3	~ 1.66E-06	B B 2			Gd 153				
Be 10					Ho 163				
C 14	~ 2.21E-03	B B 2			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	~ 3.22E-05	B B 2			Pb 210				
Co 60	~ 3.35E-03	B B 2			Bi 208				
Ni 59					Bi 210m				
Ni 63	~ 3.69E-03	B B 2			Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90	~ 7.22E-05	B B 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	~ 2.30E-08	B B 2			U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m					U 235				
Ag 110m					U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	~ 1.67E-06	B B 2		
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125	~ 9.33E-09	B B 2		Pu 241	~ 1.19E-06	B B 2			
Sb 126				Pu 242					
Te 125m				Am 241	~ 1.47E-07	B B 2			
Te 127m				Am 242m					
I 129				Am 243					
Cs 134				Cm 242					
Cs 135				Cm 243					
Cs 137	~ 7.70E-05	B B 2		Cm 244					
Ba 133				Cm 245					
La 137				Cm 246					
La 138				Cm 248					
Ce 144				Cf 249					
Pm 145				Cf 250					
Pm 147	~ 5.13E-08	B B 2		Cf 251					
Sm 147				Cf 252					
Sm 151	~ 2.67E-07	B B 2		Unsp a					
Eu 152				Unsp b/g					
Eu 154	~ 5.98E-07	B B 2		Total a	1.82E-06	*	0	*	
Eu 155	~ 2.33E-08	B B 2		Total b/g	9.44E-03	*	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