WASTE STREAM	7F26/C	Conditioned Ion Exchange Resin from Nuclear Effluent Plants

SITE Clyde Submarine Base

SITE OWNER Ministry of Defence (MOD)

WASTE CUSTODIAN Ministry of Defence (MOD)

WASTE TYPE LLW

WASTE VOLUMES

		Reported (m^3)	OR	Conditioned (m^3)	Packaged (m^3)
Stocks:	At 1.4.2025			= 0	0.0
Future arisings:	1.4.2025 - 31.3.2026			= 0	0.0
	1.4.2026 - 31.3.2027			= 0.7	0.7
	1.4.2027 - 31.3.2028			= 0	0.0
	1.4.2029 - 31.3.2040			= 1.4	1.5
	1.4.2040 - 31.3.2050			= 1.4	1.5
	1.4.2050 - 31.3.2060			= 1.4	1.5
	1.4.2060 - 31.3.2070			= 1.4	1.5
	1.4.2070 - 31.3.2080			= 1.4	1.5
	1.4.2080 - 31.3.2090			= 1.4	1.5
	1.4.2090 - 31.3.2100			= 1.4	1.5
	1.4.2100 - 31.3.2110			= 1.4	1.5
Total future arisings:				**11.9**	**12.7**
Total waste volume:				**11.9**	**12.7**

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

Comment on arising rates: Ion Exchange Resin used in the effluent treatment process is periodically replaced to maintain efficiency and meet LLW criterion. Operational experience utilising current plant indicates that IXR needs to be replaced approximately every 10 years. Although it is expected that the frequency of change may increase as new facilities become operational, and old facilities are decommissioned.

Additional information on quantities: The IXR is replaced dependent on two key factors: continued efficiency and the LLW activity criterion. The activity retained by the IXR could increase/decrease the frequency of resin changes; however, operational experience and knowledge of the future programme of work substantiate the arisings that have been predicted.

Uncertainty factors on volumes:

Stock (upper):	x -	Arisings (upper):	x 2.00
Stock (lower):	x -	Arisings (lower):	x 0.75

WASTE SOURCE IXR used to remove radioactivity from low level aqueous radioactive waste from the Naval Programme.

PHYSICAL CHARACTERISTICS

General description: The IXR is polymer based spherical beads of 0.425 - 1.2 mm diameter.

Changes since waste generated: Previous disposals used a cement/fly ash mixture to immobilse 7F26(C) in 200 L drums. It is recognised that the Waste Management Framework as provided by NWS offers alternative solutions to divert from the LLWR, that do not require physical or chemical changes to the wastestream.

Bulk density (t/m^3): ~ 2.0

Comment on density: Approximate density of concrete and fly ash mixture combined with known density of the waste stream. Alternatively, 100% polymer resin bulk density is 0.128 t/m3.

CHEMICAL COMPOSITION

General description and components (%wt): Polymer bead resin (60%) in cement/fly ash mixture (40%) in 200 litre drums. Alternatively 100% polymer resin dependent on waste management option selected.

Chemical state: Neutral

Sheet metal proportion / thickness: -

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel	= 10.0	-	
Other ferrous metals	= 0	-	
Iron	= 0	-	
Aluminium	= 0	-	
Beryllium	= 0	-	
Cobalt	= 0	-	
Copper	= 0	-	
Lead	= 0	-	
Magnox/Magnesium	= 0	-	
Nickel	= 0	-	
Titanium	= 0	-	
Uranium	= 0	-	
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	= 0	-	
Condensation polymers	= 0	-	
Others	= 0	-	
Organic ion exchange materials	~ 54.0	-	
Total rubber	= 0	-	
Halogenated rubber	= 0	-	
Non-halogenated rubber	= 0	-	
Hydrocarbons	= 0	-	
Oil or grease	= 0	-	
Fuel	= 0	-	
Asphalt/Tarmac (cont.coal tar)	= 0	-	
Asphalt/Tarmac (no coal tar)	= 0	-	
Bitumen	= 0	-	
Others	= 0	-	
Other organics	= 0	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials	= 0	-	
Inorganic sludges and flocs	= 0	-	
Soil	= 0	-	
Brick/Stone/Rubble	= 0	-	
Cementitious material	~ 36.0	-	
Sand	= 0	-	
Glass/Ceramics	= 0	-	
Graphite	= 0	-	
Desiccants/Catalysts	= 0	-	
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	NE	-
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	= 0	-
Corrosive materials	= 0	-
Pyrophoric materials	= 0	-
Generating toxic gases	= 0	-
Reacting with water	= 0	-
Higher activity particles	= 0	-
Soluble solids as bulk chemical compounds	= 0	-

Hazardous substances / non hazardous pollutants: -

	(%wt)	Type(s) and comment
Acrylamide	= 0	-
Benzene	= 0	-
Chlorinated solvents	= 0	-
Formaldehyde	= 0	-
Organometallics	= 0	-
Phenol	= 0	-
Styrene	~ 36.0	MSDS used to estimate ethenylbenzene content
Tri-butyl phosphate	= 0	-
Other organophosphates	= 0	-
Vinyl chloride	= 0	-
Arsenic	= 0	-
Barium	= 0	-
Boron	= 0	-
Boron (in Boral)		-
Boron (non-Boral)		-
Cadmium	= 0	-
Caesium	= 0	-
Selenium	= 0	-
Chromium	= 0	-
Molybdenum	= 0	-
Thallium	= 0	-
Tin	= 0	-
Vanadium	= 0	-
Mercury compounds	= 0	-
Others	= 0	-

Complexing agents (%wt): Yes

	(%wt)	Type(s) and comment
EDTA		-
DPTA		-
NTA		-
Polycarboxylic acids		-
Other organic complexants		As a polystyrene-based polymer, the waste may contain traces of organic materials that act as complexing agents.
Total complexing agents	TR	-

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	On-site	= 100.0

Comments on planned treatments: Resins are currently solidified, but alternative methods of disposal are being actively explored, for example incineration. If this option is feasible, 100% incineration will be completed off-site in line with UK diversion policy from LLWR.

Conditioning method: -

Conditioning plants:

Plant Name	Location

Likely conditioning matrix: -

Further information on the conditioning 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
1/2 Height IP-2 Disposal/Re-usable ISO (TC01/TC02)	100.0	6.1	18.3	2	-

Range in container waste loading:

Other information on packaging and conditioning: 200 L drums will be consigned to the LLWR for packing into HHISOs which will subsequantly be grouted.

Conditioned density (t/m^3): ~ 2.0
Conditioned density comment: Based upon bulk density value in materials section of submission.

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 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	= 100.0		2025

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

Opportunities for alternative disposal routing: Yes

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Opportunity Confidence	Comment
LLWR	Incineration facility	= 100.0	GREEN	-

RADIOACTIVITY

Source: The radioactivity in the waste is predominantly activation and corrosion products from the Naval Reactor Plant.

Uncertainty: Specific activity data are assessed by measurement. The uncertainties on the specific activity values have been selected as 1.5 (upper) and 10 (lower) to reflect potential variation of radioactive effluent processed.

Measurement of radioactivities: Specific activities in future arisings are based on analysis of the previous dipsosal.

Chemical form of radionuclides:

H-3: HTO
C-14: Methane
Cl-36: Chloride
Se-79: None
Tc-99: None
I-129: None
Ra: None
Th: None
U: None
Np: None
Pu: None

WASTE STREAM **7F26/C** **Conditioned Ion Exchange Resin from Nuclear Effluent Plants**

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			= 7.79E-04	A C 1	Gd 153				
Be 10					Ho 163				
C 14			= 4.83E-05	A C 1	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36			= 2.30E-06	A C 1	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41					Pt 193				
Mn 53					Tl 204				
Mn 54			= 3.37E-05	A C 1	Pb 205				
Fe 55			= 1.01E-05	A C 1	Pb 210				
Co 60			= 5.62E-04	A C 1	Bi 208				
Ni 59					Bi 210m				
Ni 63			= 7.70E-06	A C 1	Po 210				
Zn 65					Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226				
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					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					U 233				
Pd 107					U 234				
Ag 108m					U 235				
Ag 110m			= 3.60E-06	A C 1	U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125			= 1.09E-05	A C 1	Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137					Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Unsp a				
Eu 152					Unsp b/g				
Eu 154					**Total a**	**0**	*	**0**	*
Eu 155					**Total b/g**	**0**	*	**1.46E-03**	*

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