

WASTE STREAM	9C36/C	Ion Exchange Resin from Ponds
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SITE Bradwell

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Nuclear Restoration Services Ltd (NRS)

WASTE TYPE ILW

WASTE VOLUMES

	At 1.4.2025	Reported (m ³)	OR	Conditioned (m ³)	Packaged (m ³)
Stocks:				= 27.9	100.1
Future arisings:					0.0
					0.0
Total future arisings:				0.0	0.0
Total waste volume:				27.9	100.1

Number of waste packages in stock: At 1.4.2025..... 76 packages

Comment on arising rates: -

Additional information on quantities: -

Uncertainty factors on volumes:

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

WASTE SOURCE Pond water treatment plant caesium removal units.

PHYSICAL CHARACTERISTICS

General description: Spent caesium-selective ion exchange material arising from the treatment of pond waters in the Pond Water Filtration and Caesium Removal (PWFCR) plant. Conditioned, by drying, through the use of the advanced drying vacuum system (AVDS).

Changes since waste generated: -

Bulk density (t/m³): = 1.2

Comment on density: The density is the wasteform density.

CHEMICAL COMPOSITION

General description and components (%wt): Composition appropriate to proprietary ion exchange materials, some of which are organic in nature. Water in which the ion exchange material is immersed. Proprietary ion exchange materials, Duolite ARC 9359 (100 wt%).

Chemical state: -

Sheet metal proportion / thickness: There are no sheet or bulk metal items.

Metals and alloys (%wt):

	(%wt)	Type(s) / Grades(s) with proportions	% of total C14 activity
Stainless steel.....	NE	-	
Other ferrous metals.....	NE	-	
Iron.....	-	-	
Aluminium.....	NE	-	
Beryllium.....	TR	-	
Cobalt.....	-	-	
Copper.....	NE	-	
Lead.....	TR	Lead would be in trace quantities, if present.	
Magnox/Magnesium.....	NE	-	
Nickel.....	-	-	
Titanium.....	-	-	
Uranium.....	-	-	
Zinc.....	NE	-	
Zircaloy/Zirconium.....	NE	-	
Other metals.....	NE	"Other" metals have not been assessed.	

Organics (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	= 0	-	
Paper, cotton.....	= 0	-	
Wood.....	= 0	-	
Halogenated plastics.....	= 0	-	
Total non-halogenated plastics.....	= 0	-	
Condensation polymers.....	= 0	-	
Others.....	= 0	-	
Organic ion exchange materials.....	= 100.0	Duolite ARC 9359	
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.....	NE	-	

Other materials (%wt):

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials.....	= 0	-	
Inorganic sludges and flocs.....	NE	-	
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.....	0	-
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.....	TR	-
DPTA.....		-
NTA.....		-
Polycarboxylic acids.....		-
Other organic complexants.....		-
Total complexing agents.....		-

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:

The waste has been conditioned using the AVDS plant to conduct heated vacuum drying at 50 mbar.

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 (m³)	Payload (m³)	Number of packages	Estimated start date for packaging
	500 l RS drum (0mm Pb)	100.0	0.37	0.37	76	-

Range in container waste loading: -

Other information on packaging and conditioning: -

Conditioned density (t/m³): = 1.2
 Conditioned density comment: The density is the wasteform density

Management Routes:

Disposal Route	Stream volume %	Raw density t/m³	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: Spent ion exchange resins arising from the treatment of pond water. Resins are used to remove caesium from fuel pond water. There will be contamination by other fission products, actinides and activation products.

Uncertainty: -

Measurement of radioactivities: Specific activity is a function of Station operating history. The values are calculated using the ST4 RN inventory and the wastestream volume.

Chemical form of radionuclides:

H-3: The chemical form of tritium has not been determined.
 C-14: The chemical form of carbon 14 has not been determined but may be graphite.
 Cl-36: The chemical form of chlorine 36 has not been determined but may be chloride.
 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: -
 Th: -
 U: The chemical form of uranium isotopes is not determined but may be uranium oxides.
 Np: The chemical form of neptunium has not been determined.
 Pu: The chemical form of plutonium isotopes is not determined but may be plutonium oxides.

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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	2.26E-05	C C 2			Gd 153		8		
Be 10		8			Ho 163	1.78E-08	C C 2		
C 14	2.36E-06	C C 2			Ho 166m	5.47E-06	C C 2		
Na 22		8			Tm 170		8		
Al 26		8			Tm 171	1.05E-07	C C 2		
Cl 36	4.23E-09	C C 2			Lu 174	4.64E-09	C C 2		
Ar 39	7.29E-07	C C 2			Lu 176		8		
Ar 42		8			Hf 178n	1.07E-05	C C 2		
K 40		8			Hf 182		8		
Ca 41	1.86E-08	C C 2			Pt 193	8.51E-08	C C 2		
Mn 53		8			Ti 204	5.45E-06	C C 2		
Mn 54		8			Pb 205		8		
Fe 55	2.32E-06	C C 2			Pb 210		8		
Co 60	5.78E-05	C C 2			Bi 208		8		
Ni 59	6.36E-07	C C 2			Bi 210m		8		
Ni 63	9.65E-04	C C 2			Po 210		8		
Zn 65		8			Ra 223		8		
Se 79	1.84E-08	C C 2			Ra 225		8		
Kr 81	1.81E-09	C C 2			Ra 226		8		
Kr 85	1.10E-03	C C 2			Ra 228		8		
Rb 87		8			Ac 227		8		
Sr 90	6.93E-02	C C 2			Th 227		8		
Zr 93	9.04E-07	C C 2			Th 228	2.79E-09	C C 2		
Nb 91		8			Th 229		8		
Nb 92		8			Th 230		8		
Nb 93m	2.51E-06	C C 2			Th 232		8		
Nb 94	2.13E-07	C C 2			Th 234	1.33E-06	C C 2		
Mo 93	1.26E-08	C C 2			Pa 231		8		
Tc 97		8			Pa 233	5.37E-08	C C 2		
Tc 99	7.36E-06	C C 2			U 232	2.71E-09	C C 2		
Ru 106	1.27E-08	C C 2			U 233	5.30E-09	C C 2		
Pd 107	4.49E-08	C C 2			U 234	9.53E-07	C C 2		
Ag 108m	8.77E-08	C C 2			U 235	3.45E-08	C C 2		
Ag 110m		8			U 236	1.27E-07	C C 2		
Cd 109		8			U 238	1.33E-06	C C 2		
Cd 113m	3.28E-06	C C 2			Np 237	5.37E-08	C C 2		
Sn 119m		8			Pu 236		8		
Sn 121m	8.88E-06	C C 2			Pu 238	1.55E-04	C C 2		
Sn 123		8			Pu 239	1.31E-04	C C 2		
Sn 126	1.67E-07	C C 2			Pu 240	1.30E-04	C C 2		
Sb 125	1.34E-05	C C 2			Pu 241	5.31E-03	C C 2		
Sb 126	2.34E-08	C C 2			Pu 242	2.30E-07	C C 2		
Te 125m	3.36E-06	C C 2			Am 241	3.78E-04	C C 2		
Te 127m		8			Am 242m	1.47E-06	C C 2		
I 129	1.56E-08	C C 2			Am 243	4.32E-07	C C 2		
Cs 134	6.97E-04	C C 2			Cm 242	1.22E-06	C C 2		
Cs 135	1.96E-05	C C 2			Cm 243	2.45E-07	C C 2		
Cs 137	1.72E+00	C C 2			Cm 244	3.84E-06	C C 2		
Ba 133	3.04E-07	C C 2			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	5.84E-06	C C 2			Cf 251		8		
Sm 147		8			Cf 252		8		
Sm 151	2.04E-04	C C 2			Unsp a				
Eu 152	4.02E-07	C C 2			Unsp b/g				
Eu 154	1.59E-04	C C 2			Total a	8.02E-04	*	0	*
Eu 155	3.33E-05	C C 2			Total b/g	1.79E+00	*	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