WASTE STREAM 7V25 Resin from Decontamination Operations ILW

SITE Dounreay (Vulcan)

SITE OWNER Ministry of Defence

WASTE CUSTODIAN Ministry of Defence

WASTE TYPE ILW; SPD1

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	~2.6 m³
Future arisings -	1.4.2022 - 31.3.2025.....	0 m³
Total future arisings:		0 m³
Total waste volume:		2.6 m³

Comment on volumes: Ion Exchange (IX) resin was generated historically during decontamination trials and primary circuit operations. Quantities of IX resin discharged from containers of known volumes. Assumptions on zero future arisings based on current site operating procedures.

Uncertainty factors on volumes:

Stock (upper):	x 1.25	Arisings (upper)	x
Stock (lower):	x 0.75	Arisings (lower)	x

WASTE SOURCE IX resin generated from treatment systems designed to reduce soluble activity from process liquors.

PHYSICAL CHARACTERISTICS

General description: The organic resins are in the form of loose spherical beads of 0.5-0.75mm diameter and consists of mixed anion/cation resin, Purolite NRW37. Due to the chemical process used the resin will also contain the organic chelating agent, EDTA. There has been no physical/chemical changes to the waste.

Physical components (%vol): Organic ion exchange resin.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~0.7

Comment on density: Based on the ion exchange resin from the sampling datasheets.

CHEMICAL COMPOSITION

General description and components (%wt): 100% IX resin with trace organic chelating agent, EDTA.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: In liquid form
C-14: As a carbonate.
Cl-36: NE
Se-79: NE
Tc-99: NE
I-129: NE
Ra: Not detected
Th: Not detected
U: Ionic solution
Np: Not detected
Pu: Ionic solution

Metals and alloys (%wt): There are no metals in this waste stream.

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	0		
Other ferrous metals.....	0		
Iron.....	0		
Aluminium.....	0		
Beryllium.....	0		

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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): Organic materials are present as anionic and cationic ion exchange resins and include small quantities of EDTA.

	(%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	100.0	Purolite NRW37	100.0
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			

Other materials (%wt): Other materials are not present

	(%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	0		
Sand	0		
Glass/Ceramics	0		
Graphite	0		

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Desiccants/Catalysts	0
Asbestos	0
Non/low friable	0
Moderately friable	0
Highly friable	0
Free aqueous liquids	0
Free non-aqueous liquids	0
Powder/Ash	0

Inorganic anions (%wt): Not estimated

	(%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: EDTA . May also contain higher activity particles

	(%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	NE	
Soluble solids as bulk chemical compounds	NE	

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Hazardous substances / non hazardous pollutants: The resins may contain some chemical elements from the decontamination process.

	(%wt)	Type(s) and comment
Acrylamide	0	
Benzene	0	
Chlorinated solvents	0	
Formaldehyde	0	
Organometallics	0	
Phenol	0	
Styrene	0	
Tri-butyl phosphate	0	
Other organophosphates	0	
Vinyl chloride	0	
Arsenic	0	
Barium	0	
Boron	NE	
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	
Electronic Electrical Equipment (EEE)		
EEE Type 1	0	
EEE Type 2	0	
EEE Type 3	0	
EEE Type 4	0	
EEE Type 5	0	

Complexing agents (%wt): Yes

	(%wt)	Type(s) and comment
EDTA	~~1.6	
DPTA	0	
NTA	0	
Polycarboxylic acids	0	
Other organic complexants	0	
Total complexing agents	~~1.6	

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Potential for the waste to contain discrete items: No.

PACKAGING AND CONDITIONING

Conditioning method: Not specified.

Plant Name: -

Location: -

Plant startup date: -

Total capacity (m^3/y incoming waste): -

Target start date for packaging this stream: -

Throughput for this stream (m^3/y incoming waste): -

Other information: -

Likely container type:

Container	Waste packaged (%vol)	Waste loading (m^3)	Payload (m^3)	Number of packages
Not specified	100.0	NE	NE	NE

Likely container type comment: To be determined.

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix: Not Specified

Other information: -

Conditioned density (t/m^3): -

Conditioned density comment: -

Other information on conditioning: Packaging/treatment/conditioning process yet to be confirmed.

Opportunities for alternative disposal routing: Not yet determined

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
-	-	-	-	-	-

RADIOACTIVITY

Source: The waste arisings are from decontamination trials and from the reactor primary circuit.

Uncertainty: Undertaken by theoretical modelling as for ALARP reasons these resins could not be sampled

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: Theoretical modelling

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Other information: -

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Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code	Nuclide	Mean radioactivity, TBq/m³ Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3	3.65E+00	DD 2			Gd 153				
Be 10					Ho 163				
C 14	4.71E-01	DD 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	1.4E-04	DD 2			Pb 210				
Co 60	1.78E-02	DD 2			Bi 208				
Ni 59					Bi 210m				
Ni 63	2.38E-03	DD 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	1.72E-01	DD 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					U 232	4.22E-09	DD 5		
Ru 106					U 233	6E-09	DD 5		
Pd 107					U 234	6E-09	DD 5		
Ag 108m	2.87E-06	DD 2			U 235	2.2E-09	DD 5		
Ag 110m					U 236	2.2E-09	DD 5		
Cd 109					U 238	3.16E-08	DD 5		
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	1E-05	DD 5		
Sn 123					Pu 239	1.6E-07	DD 5		
Sn 126					Pu 240	1.6E-07	DD 5		
Sb 125	1.04E-02	DD 2			Pu 241	1.14E-05	DD 5		
Sb 126					Pu 242	2.98E-09	DD 5		
Te 125m					Am 241	7.38E-09	DD 5		
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	3.26E-03	DD 2			Cm 242	9.18E-10	DD 5		
Cs 135					Cm 243	5E-10	DD 5		
Cs 137	4.47E-02	DD 2			Cm 244	5E-10	DD 5		
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					Other a				
Eu 152					Other b/g				
Eu 154					**Total a**	**1.04E-05**	**DD 2**	**0**	
Eu 155					**Total b/g**	**4.37E+00**	**DD 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