WASTE STREAM 7V28 Resin from Decontamination Operations LLW

SITE	Dounreay (Vulcan)
SITE OWNER	Ministry of Defence
WASTE CUSTODIAN	Ministry of Defence
WASTE TYPE	LLW; SPD1
Is the waste subject to Scottish Policy:	No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	3.5 m^3
Future arisings -	1.4.2022 - 31.3.2025.....	0.1 m^3
Total future arisings:		0.1 m^3
Total waste volume:		3.6 m^3

Comment on volumes: Ion Exchange (IX) resin is only generated during periods of extended maintenance or decontamination operations, which are performed on infrequent occasions. Current site operating procedures require that IX resin in pond water treatment systems is changed before it exceeds LLW disposal criteria. Quantities of IX resin discharged from containers of known volumes. Assumptions on future arisings based on historical operations.

Uncertainty factors on volumes:

Stock (upper):	x 1.1	Arisings (upper)	x 1.1
Stock (lower):	x 0.9	Arisings (lower)	x 0.9

WASTE SOURCE IX resin from pond water treatment operations.

PHYSICAL CHARACTERISTICS

General description: The organic resins are in the form of loose spherical beads of 0.5-0.75mm diameter and consist of mixed anion/cation resins including Purolite NRW37, Purolite NRW3240, Purolite NRW400, Dowex MR-3 and Amberlite (MB20). There has been no physical/chemical processes or changes to the waste.

Physical components (%vol): 100% Ion exchange Resin

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m^3): ~0.7

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

CHEMICAL COMPOSITION

General description and components (%wt): 100% Ion Exchange resin. The resins are in the form of loose spherical beads and consist of mixed anion/cation resins including Purolite NRW37, Purolite NRW3240, Purolite NRW400, Dowex MR-3 and Amberlite (MB20).

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		

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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): Organic materials are present as anionic and cationic ion exchange resins - 100%

	(%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, Purolite NRW3240, Purolite NRW400, Dowex MR-3 and Amberlite (MB20)	
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): None

	(%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		

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Glass/Ceramics	0
Graphite	0
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): There are no iorganic ions associated with this waste stream.

	(%wt)	Type(s) and comment
Fluoride	0	
Chloride	0	
Iodide	0	
Cyanide	0	
Carbonate	0	
Nitrate	0	
Nitrite	0	
Phosphate	0	
Sulphate	0	
Sulphide	0	

Materials of interest for waste acceptance criteria: None

	(%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	

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Hazardous substances / non hazardous pollutants: None

	(%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	P	Pond water has been dosed with potassium tetraborate
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): No

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

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Potential for the waste to contain discrete items: No.

TREATMENT, PACKAGING AND DISPOSAL

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

Treatment	On-site / Off site	Stream volume %
Low force compaction		
Supercompaction (HFC)		
Incineration		
Solidification		
Decontamination		
Metal treatment		
Size reduction		
Decay storage		
Recyling / reuse		
Other / various		
None		

Comment on planned treatments: The waste treatment options have still to be determined.

Disposal Routes:

Disposal Route	Stream volume %	Disposal density t/m3
Expected to be consigned to the LLW Repository		
Expected to be consigned to a Landfill Facility		
Expected to be consigned to an On-Site Disposal Facility		
Expected to be consigned to an Incineration Facility		
Expected to be consigned to a Metal Treatment Facility		
Expected to be consigned as Out of Scope		
Expected to be recycled / reused		
Disposal route not known	100.0	NE

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

Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2022/23	2023/24	2024/25
Expected to be consigned to the LLW Repository			
Expected to be consigned to a Landfill Facility			
Expected to be consigned to an On-Site Disposal Facility			
Expected to be consigned to an Incineration Facility			
Expected to be consigned to a Metal Treatment Facility			
Expected to be consigned as Out of Scope			
Expected to be recycled / reused			
Disposal route not known			

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
-	-	-	-	-	-

Waste Packaging for Disposal: (Not applicable to this waste stream)

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Container	Stream volume %	Waste loading m³	Number of packages
1/3 Height IP-1 ISO 2/3 Height IP-2 ISO 1/2 Height WAMAC IP-2 ISO 1/2 Height IP-2 Disposal/Re-usable ISO 2m box (no shielding) 4m box (no shielding) Other			

Other information: The waste package option is still to be determined.

Waste Planned for Disposal at the LLW Repository: (Not applicable to this waste stream)

Container voidage: -

Waste Characterisation Form (WCH): -

Waste consigned for disposal to LLWR in year of generation: -

Non-Containerised Waste for In-Vault Grouting: (Not applicable to this waste stream)

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

RADIOACTIVITY

Source: Spent ion exchange resin.

Uncertainty: -

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: From sampling and theoretical modelling

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	3.34E-07	DD 2	3.09E-07	DD 2	Gd 153				
Be 10					Ho 163				
C 14	1.07E-04	DD 2	1.07E-04	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	8.25E-09	DD 2	1.65E-08	DD 2	Pb 205				
Fe 55	6.28E-06	DD 2	5.3E-06	DD 2	Pb 210				
Co 60	2.16E-04	DD 2	1.5E-04	DD 2	Bi 208				
Ni 59					Bi 210m				
Ni 63	5.25E-05	DD 2	5.33E-05	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	1.21E-06	DD 2	1.34E-06	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	8.04E-11	DD 5	8.04E-11	DD 5
Ru 106					U 233	1E-10	DD 5	1E-10	DD 5
Pd 107					U 234	1E-10	DD 5	1E-10	DD 5
Ag 108m	6.86E-06	DD 2	3.72E-06	DD 2	U 235	2E-10	DD 5	2E-10	DD 5
Ag 110m					U 236	2E-10	DD 5	2E-10	DD 5
Cd 109					U 238	7.11E-10	DD 5	7.11E-10	DD 5
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238	2.84E-08	DD 5	5.39E-08	DD 5
Sn 123					Pu 239	4E-10	DD 5	4E-10	DD 5
Sn 126					Pu 240	4E-10	DD 5	4E-10	DD 5
Sb 125	4.64E-08	DD 2	4.5E-08	DD 2	Pu 241	9.94E-08	DD 5	1.07E-07	DD 5
Sb 126					Pu 242	1.72E-09	DD 5	1.72E-09	DD 5
Te 125m					Am 241	9.53E-10	DD 5	1.37E-09	DD 5
Te 127m					Am 242m				
I 129					Am 243				
Cs 134	2.31E-08	DD 2	1.75E-08	DD 2	Cm 242	4.65E-10	DD 5	4.65E-10	DD 5
Cs 135					Cm 243	5E-10	DD 5	5E-10	DD 5
Cs 137	5.05E-07	DD 2	5.96E-07	DD 2	Cm 244	5E-10	DD 5	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	8.88E-08	DD 2	1.41E-07	DD 2	**Total a**	**3.57E-08**	**DD 2**	**6.14E-08**	**DD 2**
Eu 155	5.87E-08	DD 2	7.71E-08	DD 2	**Total b/g**	**3.91E-04**	**DD 2**	**3.22E-04**	**DD 2**

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