

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**WASTE VOLUMES**

Reported

Stocks: At 1.4.2019..... ~3.6 m³Future arisings - 1.4.2019 - 31.3.2028..... ~0.1 m³Total future arisings: 0.1 m³Total waste volume: 3.7 m³

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 1.2 Arisings (upper) x 1.4
 Stock (lower): x 0.8 Arisings (lower) x 0.6

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). They are stored as a water slurry, either in storage tanks or in the original process columns. The physical and chemical properties are still to be confirmed through sampling. There has been no physical/chemical processes or changes to the waste.

Physical components (%wt): Resin and water - %wt ratio to be determined.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1.1

Comment on density: Estimated value. The waste is stored as a water slurry therefore the bulk density is based on the ion exchange resin and the interstitial water.

CHEMICAL COMPOSITION

General description and components (%wt): 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). They are anticipated to be stored as a water slurry, either in storage tanks or in the original process columns. The chemical properties will be confirmed through the ongoing sampling and analysis programme.

Chemical state: Neutral

Chemical form of radionuclides: H-3: Not yet assessed. Detailed analysis is to be carried out.
 C-14: Not yet assessed. Detailed analysis is to be carried out.
 Cl-36: Not yet assessed. Detailed analysis is to be carried out.
 Se-79: Not yet assessed. Detailed analysis is to be carried out.
 Tc-99: Not yet assessed. Detailed analysis is to be carried out.
 I-129: Not yet assessed. Detailed analysis is to be carried out.
 Ra: Not yet assessed. Detailed analysis is to be carried out.
 Th: Not yet assessed. Detailed analysis is to be carried out.
 U: Not yet assessed. Detailed analysis is to be carried out.
 Np: Not yet assessed. Detailed analysis is to be carried out.
 Pu: Not yet assessed. Detailed analysis is to be carried out.

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

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Stainless steel.....	NE	Yet to be characterised
Other ferrous metals.....	NE	Yet to be characterised
Iron.....	NE	Yet to be characterised
Aluminium.....	NE	Yet to be characterised
Beryllium.....	NE	Yet to be characterised
Cobalt.....	NE	Yet to be characterised
Copper.....	NE	Yet to be characterised
Lead.....	NE	Yet to be characterised
Magnox/Magnesium.....	NE	Yet to be characterised
Nickel.....	NE	Yet to be characterised
Titanium.....	NE	Yet to be characterised
Uranium.....	NE	Yet to be characterised
Zinc.....	NE	Yet to be characterised
Zircaloy/Zirconium.....	NE	Yet to be characterised
Other metals.....	NE	Yet to be characterised

Organics (%wt):

Organic material will be present as anionic and cationic ion exchange resin.

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.... NE

The IX resins are in a water slurry but the water/IX ratio is still to be determined

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):

The percentage of interstitial water has not been determined.

Inorganic ion exchange materials.	0
Inorganic sludges and flocs.....	0
Soil.....	0
Brick/Stone/Rubble.....	0
Cementitious material.....	0

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Sand..... 0

Glass/Ceramics..... 0

Graphite..... 0

Desiccants/Catalysts..... 0

Asbestos..... 0

Non/low friable..... 0

Moderately friable..... 0

Highly friable..... 0

Free aqueous liquids..... NE

The IX resins are in a water slurry but the water/IX ratio is still to be determined

Free non-aqueous liquids..... 0

Powder/Ash..... 0

Inorganic anions (%wt):

There are no inorganic ions associated with this waste stream.

Fluoride..... NE

Yet to be characterised

Chloride..... NE

Yet to be characterised

Iodide..... NE

Yet to be characterised

Cyanide..... NE

Yet to be characterised

Carbonate..... NE

Yet to be characterised

Nitrate..... NE

Yet to be characterised

Nitrite..... NE

Yet to be characterised

Phosphate..... NE

Yet to be characterised

Sulphate..... NE

Yet to be characterised

Sulphide..... NE

Yet to be characterised

Materials of interest for waste acceptance criteria:

Not yet determined.

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

Active particles..... NE

Soluble solids as bulk chemical compounds..... NE

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non hazardous pollutants:

The resins may contain some chemical elements from the decontamination process.

Acrylamide..... NE
 Benzene..... NE
 Chlorinated solvents..... NE
 Formaldehyde..... NE
 Organometallics..... NE
 Phenol..... NE
 Styrene..... NE
 Tri-butyl phosphate..... NE
 Other organophosphates..... NE
 Vinyl chloride..... NE
 Arsenic..... NE
 Barium..... NE
 Boron..... NE
 Cadmium..... NE
 Caesium..... NE
 Selenium..... NE
 Chromium..... NE
 Molybdenum..... NE
 Thallium..... NE
 Tin..... NE
 Vanadium..... NE
 Mercury compounds..... NE
 Others..... NE

Pond water has been dosed with
potassium tetraborate

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
 EDTA..... 0
 DPTA..... 0
 NTA..... 0
 Polycarboxylic acids..... 0
 Other organic complexants..... 0
 Total complexing agents..... 0

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 Recycling / reuse Other / various None		

Comment on planned treatments:

The waste treatment options have still to be determined.

Disposal Routes:

Disposal Route	Stream volume %
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

Upcoming (2019/20-2021/22) Waste Routing (if expected to change from above):

Disposal Route	Stream volume %		
	2019/20	2020/21	2021/22
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			

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

Container	Stream volume %	Waste loading m ³	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: -

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Waste Characterisation Form (WCH): -

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

Potential for the waste to contain discrete items: -

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: The specific activity will be verified following sampling & analysis therefore no radionuclide data is available.

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: The specific activity will be verified following sampling & analysis.

Other information: A sampling & analysis programme will be carried out to give a full physical, chemical and radiological inventory.

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Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2019	Bands and Code	Future arisings	Bands and Code
H 3					Gd 153				
Be 10					Ho 163				
C 14					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					Pb 210				
Co 60					Bi 208				
Ni 59					Bi 210m				
Ni 63					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					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					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					Other a				
Eu 152					Other b/g				
Eu 154					Total a	NE			NE
Eu 155					Total b/g	NE			NE

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