

| | | |
|---------------------|-------------|-----------------------------------|
| WASTE STREAM | 9C02 | PWTP Ion Exchange Material |
|---------------------|-------------|-----------------------------------|

SITE Dungeness A
SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

| | | |
|------------------------|------------------|--------------------|
| | | Reported |
| Stocks: | At 1.4.2022..... | 2.1 m ³ |
| Total future arisings: | | 0 m ³ |
| Total waste volume: | | 2.1 m ³ |

Comment on volumes: There will be no further arisings. The tank is full. Around 1.5m³ of waste remains in the tank as a residual amount awaiting retrieval. Of the five forecast packages remaining on the stream, two packages are held in stock awaiting conditioning prior to transfer over to 9C02/C. The two packages contain residual resin retrieved from ST3 consisting of 1 Mosaik containing a volume of 0.465m³ and a second Mosaik with an unmeasurable volume.

| | | | | |
|---------------------------------|----------------|-------|------------------|---|
| Uncertainty factors on volumes: | Stock (upper): | x 1.2 | Arisings (upper) | x |
| | Stock (lower): | x 0.8 | Arisings (lower) | x |

WASTE SOURCE Pond water treatment plant caesium removal units.

PHYSICAL CHARACTERISTICS

General description: Spent ion exchange material arising from the treatment of pond waters. Material is stored under water in a tank. It should be easily pumped and have rapid settling characteristics. The ion exchange material flooded with water would be expected to have a voidage of 0.26 to 0.33, i.e. 0.26 to 0.33 of the volume of a bed of settled flooded ion exchange material would be interstitial water. There are no large items which may require special handling.

Physical components (%vol): Ion exchange material (70% vol), interstitial water (30% vol). Other minor components are not assessed.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 1.12

Comment on density: The bulk density of the waste flooded with water is 1.12 t/m³.

CHEMICAL COMPOSITION

General description and components (%wt): Waste consists of proprietary ion exchange materials, some of which are organic in nature, immersed in water. Proprietary ion exchange materials (70%) - including Lewatit DN (phenol formaldehyde) (~68%) and Duolite ARC 9359 (~32%), interstitial water (30%).

Chemical state: Neutral

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.
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.

Metals and alloys (%wt): There are no sheet or bulk metal items.

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

| | | |
|---------------------|-------------|-----------------------------------|
| WASTE STREAM | 9C02 | PWTP Ion Exchange Material |
|---------------------|-------------|-----------------------------------|

| | | |
|-------------------------|----|--|
| 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 | |

Organics (%wt): Ion exchange resins include Lewatit DN (phenol formaldehyde) and Duolite. There are no halogenated plastics or rubbers present.

| | (%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.... | ~70.0 | Ion exchange resins include Lewatit DN (phenol formaldehyde) (~68%) and Duolite ARC 9359 (~32%), | |
| 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.. | NE | | |
| Inorganic sludges and flocs..... | NE | | |
| Soil..... | 0 | | |
| Brick/Stone/Rubble..... | 0 | | |
| Cementitious material..... | 0 | | |

| | | |
|---------------------|-------------|-----------------------------------|
| WASTE STREAM | 9C02 | PWTP Ion Exchange Material |
|---------------------|-------------|-----------------------------------|

| | |
|-------------------------------|-------|
| Sand..... | |
| Glass/Ceramics..... | 0 |
| Graphite..... | 0 |
| Desiccants/Catalysts..... | |
| Asbestos..... | 0 |
| Non/low friable..... | |
| Moderately friable..... | |
| Highly friable..... | |
| Free aqueous liquids..... | ~30.0 |
| Free non-aqueous liquids..... | 0 |
| Powder/Ash..... | 0 |

Inorganic anions (%wt): Not fully assessed.

| | (%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: No materials likely to pose a fire or other non-radiological hazard have been identified.

| | (%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..... | | |
| Benzene..... | | |
| Chlorinated solvents..... | | |
| Formaldehyde..... | | |
| Organometallics..... | | |
| Phenol..... | | |
| Styrene..... | | |
| Tri-butyl phosphate..... | | |
| Other organophosphates..... | | |
| Vinyl chloride..... | | |
| Arsenic..... | | |
| Barium..... | | |
| Boron..... | 0 | |
| Boron (in Boral)..... | | |
| Boron (non-Boral)..... | | |
| Cadmium..... | | |
| Caesium..... | | |
| Selenium..... | | |
| Chromium..... | | |
| Molybdenum..... | | |
| Thallium..... | | |
| Tin..... | | |
| Vanadium..... | | |
| Mercury compounds..... | | |
| Others..... | | |
| Electronic Electrical Equipment (EEE) | | |
| EEE Type 1..... | | |
| EEE Type 2..... | | |
| EEE Type 3..... | | |
| EEE Type 4..... | | |
| EEE Type 5..... | | |

Complexing agents (%wt): Yes

| | (%wt) | Type(s) and comment |
|--------------------------------|-------|---------------------|
| EDTA..... | | |
| DPTA..... | | |
| NTA..... | | |
| Polycarboxylic acids..... | | |
| Other organic complexants..... | | |
| Total complexing agents..... | TR | |

WASTE STREAM**9C02****PWTP Ion Exchange Material**

Potential for the waste to contain discrete items:

No. In & of itself not a DI; assumed not likely to contain any "rogue" items that could be.

PACKAGING AND CONDITIONING

Conditioning method:

-

Plant Name:

AVDS

Location:

Dungeness A Site

Plant startup date:

-

Total capacity (m³/y incoming waste):

-

Target start date for packaging this stream:

-

Throughput for this stream (m³/y incoming waste):

-

Other information:

-

Likely container type:

| Container | Waste packaged (%vol) | Waste loading (m ³) | Payload (m ³) | Number of packages |
|------------------------|-----------------------|---------------------------------|---------------------------|--------------------|
| 500 l RS drum (0mm Pb) | 100.0 | 0.466 | 0.49 | 5 |

Likely container type comment:

MOSAIKs are expected to be IP2 (no B(U) requirement).

Range in container waste volume:

-

Other information on containers:

-

Likely conditioning matrix:

None

Other information:

-

Conditioned density (t/m³):

-

Conditioned density comment:

-

Other information on conditioning:

-

Opportunities for alternative disposal routing:

-

| Baseline Management Route | Opportunity Management Route | Stream volume (%) | Estimated Date that Opportunity will be realised | 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:

Specific activity is a function of Station operating history. The values quoted are indicative of the activities that might be expected.

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'.

WASTE STREAM

9C02

PWTP Ion Exchange Material

Measurement of
radioactivities:

-

Other information:

-

WASTE STREAM

9C02

PWTP Ion Exchange Material

| Nuclide | Mean radioactivity, TBq/m ³ | | | | Nuclide | Mean radioactivity, TBq/m ³ | | | |
|---------|--|----------------|-----------------|----------------|------------------|--|----------------|-----------------|----------------|
| | Waste at 1.4.2022 | Bands and Code | Future arisings | Bands and Code | | Waste at 1.4.2022 | Bands and Code | Future arisings | Bands and Code |
| H 3 | 2.97E-06 | CC 2 | | | Gd 153 | | 8 | | |
| Be 10 | | 8 | | | Ho 163 | 7.45E-09 | CC 2 | | |
| C 14 | 1.49E-06 | CC 2 | | | Ho 166m | 2.29E-06 | CC 2 | | |
| Na 22 | | 8 | | | Tm 170 | | 8 | | |
| Al 26 | | 8 | | | Tm 171 | 2.13E-08 | CC 2 | | |
| Cl 36 | 1.77E-09 | CC 2 | | | Lu 174 | 1.32E-09 | CC 2 | | |
| Ar 39 | 3.04E-07 | CC 2 | | | Lu 176 | | 8 | | |
| Ar 42 | | 8 | | | Hf 178n | 4.30E-06 | CC 2 | | |
| K 40 | | 8 | | | Hf 182 | | 8 | | |
| Ca 41 | 7.77E-09 | CC 2 | | | Pt 193 | 3.46E-08 | CC 2 | | |
| Mn 53 | | 8 | | | Tl 204 | 1.58E-06 | CC 2 | | |
| Mn 54 | | 8 | | | Pb 205 | | 8 | | |
| Fe 55 | 3.63E-07 | CC 2 | | | Pb 210 | | 8 | | |
| Co 60 | 4.64E-06 | BB 1 | | | Bi 208 | | 8 | | |
| Ni 59 | 2.66E-07 | CC 2 | | | Bi 210m | | 8 | | |
| Ni 63 | 8.04E-06 | CC 2 | | | Po 210 | | 8 | | |
| Zn 65 | | 8 | | | Ra 223 | | 8 | | |
| Se 79 | 7.7E-09 | CC 2 | | | Ra 225 | | 8 | | |
| Kr 81 | | CC 2 | | | Ra 226 | | 8 | | |
| Kr 85 | 4.03E-04 | CC 2 | | | Ra 228 | | 8 | | |
| Rb 87 | | 8 | | | Ac 227 | | 8 | | |
| Sr 90 | 5.93E-02 | BB 1 | | | Th 227 | | 8 | | |
| Zr 93 | 3.78E-07 | CC 2 | | | Th 228 | 1.15E-09 | CC 2 | | |
| Nb 91 | | 8 | | | Th 229 | | 8 | | |
| Nb 92 | | 8 | | | Th 230 | | 8 | | |
| Nb 93m | 9.95E-07 | CC 2 | | | Th 232 | | 8 | | |
| Nb 94 | 8.93E-08 | CC 2 | | | Th 234 | 2.22E-07 | CC 2 | | |
| Mo 93 | 5.28E-09 | CC 2 | | | Pa 231 | | 8 | | |
| Tc 97 | | 8 | | | Pa 233 | 2.33E-08 | CC 2 | | |
| Tc 99 | 9.91E-07 | CC 2 | | | U 232 | 1.12E-09 | CC 2 | | |
| Ru 106 | 1.35E-09 | CC 2 | | | U 233 | 2.22E-09 | CC 2 | | |
| Pd 107 | 1.88E-08 | CC 2 | | | U 234 | 2.29E-07 | CC 2 | | |
| Ag 108m | 3.66E-08 | CC 2 | | | U 235 | 1.44E-08 | CC 2 | | |
| Ag 110m | | 8 | | | U 236 | 5.32E-08 | CC 2 | | |
| Cd 109 | | 8 | | | U 238 | 2.22E-07 | CC 2 | | |
| Cd 113m | 1.24E-06 | CC 2 | | | Np 237 | 2.33E-08 | CC 2 | | |
| Sn 119m | | 8 | | | Pu 236 | | 8 | | |
| Sn 121m | 3.62E-06 | CC 2 | | | Pu 238 | 6.38E-05 | BB 1 | | |
| Sn 123 | | 8 | | | Pu 239 | 5.33E-05 | BB 1 | | |
| Sn 126 | 6.98E-08 | CC 2 | | | Pu 240 | 5.29E-05 | BB 1 | | |
| Sb 125 | 3.40E-06 | CC 2 | | | Pu 241 | 2.33E-03 | BB 1 | | |
| Sb 126 | 9.77E-09 | CC 2 | | | Pu 242 | 9.61E-08 | CC 2 | | |
| Te 125m | 8.51E-07 | CC 2 | | | Am 241 | 2.05E-04 | BB 1 | | |
| Te 127m | | 8 | | | Am 242m | 6.11E-07 | CC 2 | | |
| I 129 | 6.51E-09 | CC 2 | | | Am 243 | 1.81E-07 | CC 2 | | |
| Cs 134 | 4.35E-04 | BB 1 | | | Cm 242 | 5.04E-07 | CC 2 | | |
| Cs 135 | 1.5E-05 | CC 2 | | | Cm 243 | 1.77E-07 | BB 1 | | |
| Cs 137 | 1.26E+00 | CC 2 | | | Cm 244 | 2.69E-06 | BB 1 | | |
| Ba 133 | 1.12E-07 | CC 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 | 5.29E-05 | CC 2 | | | Cf 251 | | 8 | | |
| Sm 147 | | 8 | | | Cf 252 | | 8 | | |
| Sm 151 | 8.41E-05 | CC 2 | | | Other a | | | | |
| Eu 152 | 1.52E-07 | CC 2 | | | Other b/g | | | | |
| Eu 154 | 2.06E-05 | BB 1 | | | Total a | 3.79E-04 | CC 2 | 0 | |
| Eu 155 | 1.05E-05 | CC 2 | | | Total b/g | 1.32E+00 | CC 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