## WASTE STREAM 9D65 Ion Exchange Material and Pond Sludge

| | |
|---|---|
| **SITE** | Hinkley Point 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..... | 5.0 m³ | | |
| Total future arisings: | | 0 m³ | | |
| Total waste volume: | | 5.0 m³ | | |
| Comment on volumes: | - | | | |
| Uncertainty factors on volumes: | Stock (upper): x 1.1<br>Stock (lower): x 0.9 | | Arisings (upper) x<br>Arisings (lower) x | |

**WASTE SOURCE** Spent ion exchange materials arising from the treatment of pond waters.

### PHYSICAL CHARACTERISTICS

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| General description: | The ion exchange material is stored in a disused sand pressure filter. The ion exchange material flooded with water would be expected to have a voidage of about 0.3, i.e. about 0.3 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, other than failed laterals which may result in plastic in waste. |
| Physical components (%wt): | Wet form resin (68%), wet form pond sludge (32%), trace of soluble organic material (<0.1%). |
| Sealed sources: | The waste does not contain sealed sources. |
| Bulk density (t/m³): | ~1.15 |
| Comment on density: | The bulk density of the waste is expected to range from about 1.1 to 1.2 t/m3. |

### CHEMICAL COMPOSITION

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|---|---|
| General description and components (%wt): | Exhausted resin composition is unknown but thought to be mixed bed anion resin. The sludge component will be consistent with 9D23. |
| Chemical state: | Alkali |
| Chemical form of radionuclides: | H-3: The chemical form of tritium has not been determined but may be present as water or as other inorganic compounds or as organic compounds.<br>C-14: The chemical form of carbon 14 has not been determined.<br>Cl-36: The chemical form of chlorine 36 has not been determined.<br>Se-79: The selenium content is insignificant.<br>Tc-99: The chemical form of technetium has not been determined.<br>Ra: The radium isotope content is insignificant.<br>Th: The thorium isotope content is insignificant.<br>U: The chemical form of uranium isotopes has not been determined but may be uranium oxides.<br>Np: The chemical form of neptunium has not been determined.<br>Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides. |
| Metals and alloys (%wt): | No bulk metal items present. |

| | (%wt) | Type(s) / Grade(s) with proportions | % of total C14 activity |
|---|---|---|---|
| Stainless steel..... | 0 | | |
| Other ferrous metals..... | <0.10 | | |
| Iron..... | | | |
| Aluminium..... | <0.10 | | |
| Beryllium..... | 0 | | |

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|---|---|---|
| Cobalt | | |
| Copper | 0 | |
| Lead | 0 | |
| Magnox/Magnesium | 0.20 | |
| Nickel | TR | as nimonic |
| Titanium | | |
| Uranium | | |
| Zinc | 0 | |
| Zircaloy/Zirconium | 0 | |
| Other metals | 0 | No "other" metals present. |

Organics (%wt): Proprietary ion exchange resin and traces of soluble organic material are present. No halogenated plastics or rubbers present.

| | (%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 | ~68.0 | | |
| 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 | <0.10 | | |

Other materials (%wt): -

| | (%wt) | Type(s) and comment | % of total C14 activity |
|---|---|---|---|
| Inorganic ion exchange materials | NE | | |
| Inorganic sludges and flocs | ~32.0 | | |
| Soil | 0 | | |
| Brick/Stone/Rubble | 0 | | |
| Cementitious material | 0 | | |
| Sand | | | |
| Glass/Ceramics | 0 | | |
| Graphite | TR | | |

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

Inorganic anions (%wt): Concentrations in supernate similar to demineralised water except basic magnesium carbonate may be present where ion exchange beds operate without upstream filters.

| | (%wt) | Type(s) and comment |
|---|---|---|
| Fluoride..... | 0 | |
| Chloride..... | 0.01 | |
| Iodide..... | 0 | |
| Cyanide..... | 0 | |
| Carbonate..... | 0.30 | |
| Nitrate..... | NE | |
| Nitrite..... | NE | |
| Phosphate..... | NE | |
| Sulphate..... | 0.05 | |
| Sulphide..... | 0 | |

Materials of interest for waste acceptance criteria: Magnox may be present, but is in such low concentrations so as not to pose a hazard.

| | (%wt) | Type(s) and comment |
|---|---|---|
| Combustible metals..... | 0.20 | |
| 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..... | 0.20 | |
| Higher activity particles..... | | |
| Soluble solids as bulk chemical compounds..... | | |

**WASTE STREAM 9D65 Ion Exchange Material and Pond Sludge**

Hazardous substances / non hazardous pollutants: No toxic metals expected.

| | (%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): No

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

## WASTE STREAM 9D65 Ion Exchange Material and Pond Sludge

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: Cement encapsulation into 3m3 box using PCF external mixer

Plant Name: -

Location: Hinkley Point A Site

Plant startup date: 2023

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

Target start date for packaging this stream: 2023

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 |
|---|---|---|---|---|
| 3$m^3$ box (round corners) | 100.0 | 1.25 | 2.9 | 4 |

Likely container type comment: -

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix:

Other information: -

Conditioned density (t/$m^3$): -

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. Contamination by 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'.

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| Measurement of radioactivities: | Values were derived by extrapolating from available measurements. |
| Other information: | - |

## WASTE STREAM 9D65 Ion Exchange Material and Pond Sludge

| 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 | 4.23E-03 | C C 2 | | | Gd 153 | | 8 | | |
| Be 10 | | 8 | | | Ho 163 | | 8 | | |
| C 14 | 3.39E-03 | C C 2 | | | Ho 166m | | 8 | | |
| Na 22 | | | | | Tm 170 | | 8 | | |
| Al 26 | | | | | Tm 171 | | 8 | | |
| Cl 36 | <3E-07 | C 3 | | | Lu 174 | | 8 | | |
| Ar 39 | | 8 | | | Lu 176 | | 8 | | |
| Ar 42 | | 8 | | | Hf 178n | | 8 | | |
| K 40 | | 8 | | | Hf 182 | | 8 | | |
| Ca 41 | | 8 | | | Pt 193 | | 8 | | |
| Mn 53 | | 8 | | | Tl 204 | | 8 | | |
| Mn 54 | | 8 | | | Pb 205 | | 8 | | |
| Fe 55 | 7.26E-09 | C C 2 | | | Pb 210 | | 8 | | |
| Co 60 | 2.74E-03 | C C 2 | | | Bi 208 | | 8 | | |
| Ni 59 | | 8 | | | Bi 210m | | 8 | | |
| Ni 63 | 1.83E-05 | C C 2 | | | Po 210 | | 8 | | |
| Zn 65 | | 8 | | | Ra 223 | | 8 | | |
| Se 79 | | 8 | | | Ra 225 | | 8 | | |
| Kr 81 | | 8 | | | Ra 226 | | 8 | | |
| Kr 85 | | 8 | | | Ra 228 | | 8 | | |
| Rb 87 | | 8 | | | Ac 227 | | 8 | | |
| Sr 90 | 8.08E-01 | C C 2 | | | Th 227 | | 8 | | |
| Zr 93 | | 8 | | | Th 228 | | 8 | | |
| Nb 91 | | 8 | | | Th 229 | | 8 | | |
| Nb 92 | | 8 | | | Th 230 | | 8 | | |
| Nb 93m | | 8 | | | Th 232 | | 8 | | |
| Nb 94 | <2E-06 | C 3 | | | Th 234 | | 8 | | |
| Mo 93 | | 8 | | | Pa 231 | | 8 | | |
| Tc 97 | | 8 | | | Pa 233 | <1.11E-07 | C 3 | | |
| Tc 99 | <6E-06 | C 3 | | | U 232 | | 8 | | |
| Ru 106 | | 8 | | | U 233 | | 8 | | |
| Pd 107 | | 8 | | | U 234 | 1.08E-06 | C C 2 | | |
| Ag 108m | <1.96E-06 | C 3 | | | U 235 | 3.23E-06 | C C 2 | | |
| Ag 110m | | 8 | | | U 236 | 2.48E-09 | C C 2 | | |
| Cd 109 | | 8 | | | U 238 | | 8 | | |
| Cd 113m | | 8 | | | Np 237 | 1.24E-07 | C C 2 | | |
| Sn 119m | | 8 | | | Pu 236 | | 8 | | |
| Sn 121m | | 8 | | | Pu 238 | 5.98E-02 | C C 2 | | |
| Sn 123 | | 8 | | | Pu 239 | 8.19E-02 | C C 2 | | |
| Sn 126 | | 8 | | | Pu 240 | 8.36E-02 | C C 2 | | |
| Sb 125 | | 8 | | | Pu 241 | 1.10E+00 | C C 2 | | |
| Sb 126 | | 8 | | | Pu 242 | | 8 | | |
| Te 125m | | 8 | | | Am 241 | 3.84E-01 | C C 2 | | |
| Te 127m | | 8 | | | Am 242m | | 8 | | |
| I 129 | 1E-07 | C C 2 | | | Am 243 | | 8 | | |
| Cs 134 | 3.79E-07 | C C 2 | | | Cm 242 | | 8 | | |
| Cs 135 | | 8 | | | Cm 243 | | 8 | | |
| Cs 137 | 7.76E-02 | C C 2 | | | Cm 244 | | 8 | | |
| Ba 133 | | 8 | | | 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 | 2.88E-07 | C C 2 | | | Cf 251 | | 8 | | |
| Sm 147 | | 8 | | | Cf 252 | | 8 | | |
| Sm 151 | | 8 | | | Other a | | | | |
| Eu 152 | <1.54E-06 | C 3 | | | Other b/g | | | | |
| Eu 154 | 4.74E-03 | C C 2 | | | **Total a** | **6.10E-01** | **C C 2** | **0** | |
| Eu 155 | 7.91E-07 | C C 2 | | | **Total b/g** | **2.00E+00** | **C C 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