

| | | |
|---------------------|-------------|--|
| WASTE STREAM | 9D74 | Miscellaneous Activated Components - R2 |
|---------------------|-------------|--|

SITE Hinkley Point A

SITE OWNER Nuclear Decommissioning Authority

WASTE CUSTODIAN Magnox Limited

WASTE TYPE ILW; SPD3

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

| | | Reported |
|---------------------------------|----------------------|---------------------|
| Stocks: | At 1.4.2022..... | 30.0 m ³ |
| Total future arisings: | | 0 m ³ |
| Total waste volume: | | 30.0 m ³ |
| Comment on volumes: | - | |
| Uncertainty factors on volumes: | Stock (upper): x 1.2 | Arisings (upper) x |
| | Stock (lower): x 0.8 | Arisings (lower) x |

WASTE SOURCE Redundant or defective reactor components.

PHYSICAL CHARACTERISTICS

General description: There are two sizes of storage holes. The larger holes contain components such as fuelling charge chutes, control rod mechanisms, probe chutes and boron ball shut down devices. The smaller holes contain components such as: reactor normal shield plugs, charge chute legs or suspended irradiated items stored for later use. There are some large items. Special handling or treatment requirements have not been assessed.

Physical components (%vol): In the larger holes: fuelling charge chutes, control rod mechanisms, probe chutes and boron ball shut down devices. In the smaller holes: reactor normal shield plugs, charge chute legs or suspended irradiated items stored for later use. Volume breakdown not assessed.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1

Comment on density: The assumption of 1 t/m³ as the average bulk density may be subject to revision.

CHEMICAL COMPOSITION

General description and components (%wt): Irradiated components removed from the reactor. Principally steel. Other components have not been assessed.

Chemical state: Neutral

Chemical form of radionuclides:

- H-3: The chemical form of tritium has not been assessed but may be present as water or as other inorganic or organic compounds.
- C-14: The chemical form of carbon 14 has not been assessed.
- Cl-36: The chemical form of chlorine 36 has not been assessed.
- Se-79: The selenium content is insignificant.
- Tc-99: The chemical form of technetium has not been determined.
- Ra: Radium isotopes are not present in significant quantities.
- Th: The thorium isotope content is insignificant.
- U: The chemical form of uranium isotopes has not been assessed but may be present as uranium oxides.
- Np: The neptunium content is insignificant.
- Pu: The chemical form of plutonium isotopes has not been assessed but may be present as plutonium oxides.

Metals and alloys (%wt): The waste is predominantly metal. The proportions and dimensions of the metal have not been determined.

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| | (%wt) | Type(s) / Grade(s) with proportions | % of total C14 activity |
|------------------------------------|----------------|---|-------------------------|
| Stainless steel..... | <10.0 | Some stainless steel (BS316 and BS321) may be present. | |
| Other ferrous metals..... | <90.0 | The waste is principally carbon and low alloy steel. | |
| Iron..... | | | |
| Aluminium..... | 0 | | |
| Beryllium..... | 0 | | |
| Cobalt..... | | | |
| Copper..... | 0 | | |
| Lead..... | 0 | | |
| Magnox/Magnesium..... | 0 | | |
| Nickel..... | | | |
| Titanium..... | | | |
| Uranium..... | | | |
| Zinc..... | 0 | | |
| Zircaloy/Zirconium..... | 0 | | |
| Other metals..... | NE | The presence of "other" metals has not been determined. | |
| Organics (%wt): | None expected. | | |
| | (%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.... | 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..... | TR | | |
| Other materials (%wt): | - | | |

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| | (%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..... | | | |
| Glass/Ceramics..... | 0 | | |
| Graphite..... | NE | | |
| Desiccants/Catalysts..... | | | |
| Asbestos..... | 0 | | |
| Non/low friable..... | | | |
| Moderately friable..... | | | |
| Highly friable..... | | | |
| Free aqueous liquids..... | 0 | | |
| Free non-aqueous liquids..... | TR | | |
| Powder/Ash..... | 0 | | |

Inorganic anions (%wt): None expected, possibly trace quantities.

| | (%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: There are no materials identified in the waste likely to present a fire or other non-radiological hazard.

| | (%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..... | | |
| Putrescible wastes..... | 0 | |
| Non-putrescible wastes..... | | |

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| | |
|---|---|
| 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..... | |
| 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..... | |

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Complexing agents (%wt): No

(%wt) Type(s) and comment

EDTA.....

DPTA.....

NTA.....

Polycarboxylic acids.....

Other organic complexants.....

Total complexing agents..... 0

Potential for the waste to contain discrete items: Yes. Large Metal Items (LMIs)/"substantial" thickness items considered "durable" assumed DIs; Stainless items assumed DIs.

PACKAGING AND CONDITIONING

Conditioning method: The waste is not expected to be supercompacted. It will be placed in baskets in the waste package and is now assumed to be encapsulated.

Plant Name: None

Location: Hinkley Point A Site

Plant startup date: About 2085

Total capacity (m³/y incoming waste): ~5000.0

Target start date for packaging this stream: 2085

Throughput for this stream (m³/y incoming waste): ~14.2

Other information: The current proposal is to store the waste as at present until reactor dismantling. All waste is expected to be retrieved when a conditioning campaign is undertaken.

Likely container type:

| Container | Waste packaged (%vol) | Waste loading (m ³) | Payload (m ³) | Number of packages |
|-----------------------------------|-----------------------|---------------------------------|---------------------------|--------------------|
| 4m box (100mm concrete shielding) | 100.0 | 12.25 | 14.3 | 3 |

Likely container type comment: The waste is assumed to be in baskets in the waste package so the occupied volume in the package is greater than the original waste volume. Container choice may be influenced by Transport Regulations at the time of Final Site Clearance.

Range in container waste volume: No significant variability is expected.

Other information on containers: The container is expected to be made of stainless steel.

Likely conditioning matrix: Blast Furnace Slag / Ordinary Portland Cement

Other information: The matrix could be BFS / OPC.

Conditioned density (t/m³): ~3.0Conditioned density comment: The waste is now assumed to be encapsulated; the density of the conditioned product will probably be about 3 t/m³.Other information on conditioning: Waste will be in baskets placed in the waste packages. Baskets of different Final Dismantling ILW wastes may be in the same packages. The matrix would be likely to be BFS/OPC. The density of the encapsulated waste would probably be about 3 t/m³. Should encapsulation not be required, density would be about 1.0 t/m³.

Opportunities for alternative disposal routing: -

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

RADIOACTIVITY

| | |
|---|---|
| Source: | Neutron activated components removed from the reactor. Absorber bars and control rods are likely to be components of high activity. |
| 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'. |
| Measurement of radioactivities: | Estimates are based upon theoretical assessments. |
| Other information: | - |

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| 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 | <1.29E+00 | D 3 | | | Gd 153 | | 8 | | |
| Be 10 | | 8 | | | Ho 163 | | 8 | | |
| C 14 | 2.00E-02 | CD 2 | | | Ho 166m | | 8 | | |
| Na 22 | | 8 | | | Tm 170 | | 8 | | |
| Al 26 | | 8 | | | Tm 171 | | 8 | | |
| Cl 36 | 3E-05 | CD 2 | | | 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 | 1.57E-08 | CD 2 | | | Pb 205 | | 8 | | |
| Fe 55 | 8.74E-01 | CD 2 | | | Pb 210 | | 8 | | |
| Co 60 | 9.73E-01 | CD 2 | | | Bi 208 | | 8 | | |
| Ni 59 | 4E-02 | CD 2 | | | Bi 210m | | 8 | | |
| Ni 63 | 3.61E+00 | CD 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 | <4.19E-05 | D 3 | | | 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 | 4E-05 | CD 2 | | | Th 234 | 7E-09 | CD 2 | | |
| Mo 93 | | 8 | | | Pa 231 | | 8 | | |
| Tc 97 | | 8 | | | Pa 233 | | 8 | | |
| Tc 99 | <1E-08 | D 3 | | | U 232 | | 8 | | |
| Ru 106 | | 8 | | | U 233 | | 8 | | |
| Pd 107 | | 8 | | | U 234 | <6.13E-09 | D 3 | | |
| Ag 108m | 3.90E-05 | CD 2 | | | U 235 | | 8 | | |
| Ag 110m | | 8 | | | U 236 | | 8 | | |
| Cd 109 | | 8 | | | U 238 | <7E-09 | D 3 | | |
| Cd 113m | | 8 | | | Np 237 | | 8 | | |
| Sn 119m | | 8 | | | Pu 236 | | 8 | | |
| Sn 121m | | 8 | | | Pu 238 | <2.67E-06 | D 3 | | |
| Sn 123 | | 8 | | | Pu 239 | <3E-06 | D 3 | | |
| Sn 126 | | 8 | | | Pu 240 | <4.00E-06 | D 3 | | |
| Sb 125 | | 8 | | | Pu 241 | <9.74E-05 | D 3 | | |
| Sb 126 | | 8 | | | Pu 242 | | 8 | | |
| Te 125m | | 8 | | | Am 241 | <1.12E-05 | D 3 | | |
| Te 127m | | 8 | | | Am 242m | <1.85E-08 | D 3 | | |
| I 129 | | 8 | | | Am 243 | <6.00E-09 | D 3 | | |
| Cs 134 | <4.54E-09 | D 3 | | | Cm 242 | 1.53E-08 | CD 2 | | |
| Cs 135 | | 8 | | | Cm 243 | <4.25E-09 | D 3 | | |
| Cs 137 | <5.66E-05 | D 3 | | | Cm 244 | <4.51E-08 | D 3 | | |
| 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 | <3.81E-08 | D 3 | | | Cf 251 | | 8 | | |
| Sm 147 | | 8 | | | Cf 252 | | 8 | | |
| Sm 151 | <8.02E-07 | D 3 | | | Other a | | | | |
| Eu 152 | 9.19E-06 | CD 2 | | | Other b/g | | | | |
| Eu 154 | 5.97E-06 | CD 2 | | | Total a | 2.09E-05 | CD 2 | 0 | |
| Eu 155 | | 8 | | | Total b/g | 6.80E+00 | CD 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