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|---------------------|-------------|---|
| WASTE STREAM | 9C56 | Miscellaneous Activated Components |
|---------------------|-------------|---|

SITE Dungeness 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..... | 9.8 m ³ |
| Total future arisings: | | 0 m ³ |
| Total waste volume: | | 9.8 m ³ |
| Comment on volumes: | The station ceased generation on 31/12/2006. | |
| 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: Redundant or defective reactor components (storage turrets).
 Physical components (%vol): .
 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): Storage turrets removed from the reactor. The material is principally steel (mild steel, stainless steel). Presence of other minor components is not assessed.
 Chemical state: Neutral
 Chemical form of radionuclides: H-3: The tritium is likely to be incorporated into the steel.
 C-14: Carbon 14 is principally incorporated in steel. There may also be some graphite contamination.
 Cl-36: The chemical form of chlorine 36 has not been determined.
 U: The chemical form of uranium isotopes has not been determined but may be uranium oxides.
 Pu: The chemical form of plutonium isotopes has not been determined but may be plutonium oxides.
 Metals and alloys (%wt): Metal thicknesses have not been fully assessed but bulk metal items may be present.

| | (%wt) | Type(s) / Grade(s) with proportions | % of total C14 activity |
|---------------------------|-------|--|-------------------------|
| Stainless steel..... | ~50.0 | | |
| Other ferrous metals..... | ~50.0 | | |
| Iron..... | | | |
| Aluminium..... | 0 | | |
| Beryllium..... | 0 | | |
| Cobalt..... | | | |
| Copper..... | 0 | | |
| Lead..... | 0 | | |
| Magnox/Magnesium..... | 0 | | |
| Nickel..... | NE | Chromium and nickel will be present in steel alloys. | |

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Titanium.....
 Uranium.....
 Zinc..... 0
 Zircaloy/Zirconium..... 0
 Other metals..... NE

Organics (%wt): No organic material expected.

| | (%wt) | Type(s) and comment | % of total C14 activity |
|-------------------------------------|-------|--|-------------------------|
| Total cellulose..... | 0 | | |
| Paper, cotton..... | 0 | | |
| Wood..... | 0 | | |
| Halogenated plastics | 0 | Halogenated plastics are not expected but may possibly be present in small quantities. | |
| Total non-halogenated plastics..... | 0 | | |
| Condensation polymers..... | 0 | | |
| Others..... | 0 | | |
| Organic ion exchange materials.... | 0 | | |
| Total rubber..... | 0 | | |
| Halogenated rubber | 0 | Halogenated rubbers are not expected but may possibly be present in small quantities. | |
| Non-halogenated rubber..... | 0 | | |
| Hydrocarbons..... | | | |
| Oil or grease | | | |
| Fuel..... | | | |
| Asphalt/Tarmac (cont.coal tar)... | | | |
| Asphalt/Tarmac (no coal tar).... | | | |
| Bitumen..... | | | |
| Others..... | | | |
| Other organics..... | 0 | | |

Other materials (%wt): Traces of graphite may be present.

| | (%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..... | TR | | |
| Desiccants/Catalysts..... | | | |
| Asbestos..... | 0 | | |
| Non/low friable..... | | | |

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Moderately friable.....

Highly friable.....

Free aqueous liquids..... 0

Free non-aqueous liquids..... 0

Powder/Ash..... TR

Inorganic anions (%wt): Not fully assessed, 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 represent 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.....

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.....

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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.....

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 will be packaged in 4m boxes (with no shielding) and grouted in.
 Plant Name: None
 Location: Dungeness A Site
 Plant startup date: 2092

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

Target start date for packaging this stream: 2092

Throughput for this stream (m³/y incoming waste): ~33.0

Other information: The waste will be placed in baskets, then in the 4m box and grouted.

| | | | | | |
|------------------------|-----------------------|-----------------------|---------------------------------|---------------------------|--------------------|
| Likely container type: | Container | Waste packaged (%vol) | Waste loading (m ³) | Payload (m ³) | Number of packages |
| | 4m box (no shielding) | 100.0 | 16.2 | 18.9 | < 1 |

Likely container type comment: -

Range in container waste volume: Not yet determined.

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

Likely conditioning matrix: BFS/OPC and PFA/OPC

Other information: It is not yet known which grouting mix will be used when this waste is processed

Conditioned density (t/m³): ~3.0

Conditioned density comment: The density assumes conditioning with a cement based grout

Other information on conditioning: The waste will be packaged in baskets, then the 4m box and grouted. Baskets of other SPD3 waste may be in the same package.

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: Irradiated 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 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 | <1.73E+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 | 2E-08 | CD 2 | | | Tm 171 | | 8 | | |
| Cl 36 | 3E-05 | CC 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-06 | CD 2 | | | Pb 205 | | 8 | | |
| Fe 55 | 4.39E+00 | CD 2 | | | Pb 210 | | 8 | | |
| Co 60 | 2.79E+00 | 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 | CC 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 | <6.12E-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 | <2.66E-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 | <2E-09 | D 3 | | |
| Te 125m | | 8 | | | Am 241 | <1.02E-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 | <3.24E-08 | D 3 | | | Cm 242 | <1.53E-08 | D 3 | | |
| Cs 135 | | 8 | | | Cm 243 | <4.25E-09 | D 3 | | |
| Cs 137 | <1.41E-04 | D 3 | | | Cm 244 | <5.63E-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 | <1.9E-07 | D 3 | | | Cf 251 | | 8 | | |
| Sm 147 | | 8 | | | Cf 252 | | 8 | | |
| Sm 151 | <8.01E-07 | D 3 | | | Other a | | | | |
| Eu 152 | 9.19E-06 | CD 2 | | | Other b/g | | CD 2 | | |
| Eu 154 | 5.95E-06 | CD 2 | | | Total a | <2.00E-05 | D 3 | 0 | |
| Eu 155 | | 8 | | | Total b/g | 1.26E+01 | 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