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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

WASTE VOLUMES

| | | | |
|---------------------------------|--|--------------------|--------------------|
| | | Reported | |
| Stocks: | At 1.4.2019..... | 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: -
 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.
 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.
 Titanium.....
 Uranium.....
 Zinc..... 0

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| | | | |
|-------------------------|--|----|--|
| | Zircaloy/Zirconium..... | 0 | |
| | Other metals..... | NE | |
| Organics (%wt): | No organic material expected. | | |
| | 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. | | |
| | 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..... | 0 | |
| | Powder/Ash..... | TR | |
| Inorganic anions (%wt): | Not fully assessed, possibly trace quantities. | | |

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

| | |
|--|---|
| 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 |
| Active particles..... | |
| Soluble solids as bulk chemical compounds..... | |

Hazardous substances / non hazardous pollutants:

| | |
|-----------------------------|--|
| - | |
| Acrylamide..... | |
| Benzene..... | |
| Chlorinated solvents..... | |
| Formaldehyde..... | |
| Organometallics..... | |
| Phenol..... | |
| Styrene..... | |
| Tri-butyl phosphate..... | |
| Other organophosphates..... | |
| Vinyl chloride..... | |
| Arsenic..... | |
| Barium..... | |
| Boron..... | |

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

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
 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 |

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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: No

| Treatment | Stream volume (%) | 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: -

WASTE STREAM

9C56

Miscellaneous Activated Components

| 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 | <2.04E+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 | 1.79E-05 | CD 2 | | | Pb 205 | | 8 | | |
| Fe 55 | 9.40E+00 | CD 2 | | | Pb 210 | | 8 | | |
| Co 60 | 4.13E+00 | CD 2 | | | Bi 208 | | 8 | | |
| Ni 59 | 4E-02 | CD 2 | | | Bi 210m | | 8 | | |
| Ni 63 | 3.68E+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 | <4.50E-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 | <6.09E-09 | D 3 | | |
| Ag 108m | 3.92E-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 | <2.73E-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 | <1.13E-04 | D 3 | | |
| Sb 126 | | 8 | | | Pu 242 | <2E-09 | D 3 | | |
| Te 125m | | 8 | | | Am 241 | <9.76E-06 | D 3 | | |
| Te 127m | | 8 | | | Am 242m | <1.88E-08 | D 3 | | |
| I 129 | | 8 | | | Am 243 | <6.00E-09 | D 3 | | |
| Cs 134 | <8.88E-08 | D 3 | | | Cm 242 | <1.55E-08 | D 3 | | |
| Cs 135 | | 8 | | | Cm 243 | <4.55E-09 | D 3 | | |
| Cs 137 | <1.51E-04 | D 3 | | | Cm 244 | <6.31E-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 | <4.20E-07 | D 3 | | | Cf 251 | | 8 | | |
| Sm 147 | | 8 | | | Cf 252 | | 8 | | |
| Sm 151 | <8.20E-07 | D 3 | | | Other a | | | | |
| Eu 152 | 1.07E-05 | CD 2 | | | Other b/g | | CD 2 | | |
| Eu 154 | 7.58E-06 | CD 2 | | | Total a | <1.96E-05 | D 3 | 0 | |
| Eu 155 | | 8 | | | Total b/g | 1.93E+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