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|---------------------|-------------|-------------------------|
| WASTE STREAM | 2C30 | Uranium Furnaces |
|---------------------|-------------|-------------------------|

SITE Chapelcross
SITE OWNER Nuclear Decommissioning Authority
WASTE CUSTODIAN Magnox Limited
WASTE TYPE ILW

WASTE VOLUMES

| | | |
|---------------------------------|------------------------------------|--------------------|
| | | Reported |
| Stocks: | At 1.4.2019..... | 0.7 m ³ |
| Total future arisings: | | 0 m ³ |
| Total waste volume: | | 0.7 m ³ |
| Comment on volumes: | There will be no further arisings. | |
| Uncertainty factors on volumes: | Stock (upper): x 1.2 | Arisings (upper) x |
| | Stock (lower): x 0.8 | Arisings (lower) x |

WASTE SOURCE Depleted Uranium Furnaces used as part of tritium processing operations. Waste stream will arise as part of the clean-out of the Chapelcross Processing Plant.

PHYSICAL CHARACTERISTICS

General description: Roburst stainless steel construction with external copper water cooling rings. Wrapped around the internal of the furnaces is a layer of silica wool. Each furnace contains chips of depleted uranium.

Physical components (%vol): Stainless Steel, Silica Wool, Copper, Depleted Uranium

Sealed sources: -

Bulk density (t/m³): 1.5

Comment on density: The mean density of 1.5t/m³ refers to the mass of the components divided by the volume as stored

CHEMICAL COMPOSITION

General description and components (%wt): Stainless Steel, Silica Wool, Copper, Depleted Uranium (~0.4% 235U)

Chemical state: -

Chemical form of radionuclides: H-3: Present in signification quantities
C-14: Not present
Se-79: Not present
Tc-99: Not present
Ra: Not present
Th: Not present
U: Present
Np: Not present
Pu: Not present

Metals and alloys (%wt): NE

| | |
|---------------------------|------|
| Stainless steel..... | 80.0 |
| Other ferrous metals..... | 0 |
| Iron..... | |
| Aluminium..... | 0 |
| Beryllium..... | 0 |
| Cobalt..... | |
| Copper..... | 10.0 |
| Lead..... | 0 |
| Magnox/Magnesium..... | 0 |
| Nickel..... | |
| Titanium..... | |

WASTE STREAM

2C30

Uranium Furnaces

| | | | |
|-------------------------|-------------------------------------|-------|-------------------------------|
| | Uranium..... | ~0.40 | Depleted Uranium (~0.4% 235U) |
| | Zinc..... | 0 | |
| | Zircaloy/Zirconium..... | 0 | |
| | Other metals..... | 0 | |
| Organics (%wt): | - | | |
| | Total cellulosics..... | 5.0 | |
| | Paper, cotton..... | 0 | |
| | Wood..... | 5.0 | |
| | 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..... | 0 | |
| Other materials (%wt): | - | | |
| | Inorganic ion exchange materials. | 0 | |
| | Inorganic sludges and flocs..... | 0 | |
| | Soil..... | 0 | |
| | Brick/Stone/Rubble..... | 0 | |
| | Cementitious material..... | 0 | |
| | Sand..... | | |
| | Glass/Ceramics..... | NE | Silica wool |
| | Graphite..... | 0 | |
| | 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): | - | | |

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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:

| | |
|--|---|
| - | |
| 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: -
 Plant Name: -
 Location: -
 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 drum | 100.0 | 0.117 | 0.47 | 6 |

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Likely container type comment: -

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix: Not specified

Other information: -

Conditioned density (t/m³): 1.0

Conditioned density comment: -

Other information on conditioning: Streams 2C07, 2C29, 2C30, 2C34 & 2C36 are assumed to be co-packaged.

Opportunities for alternative disposal routing:

| Treatment | Stream volume (%) | Comment |
|-----------|-------------------|---------|
| - | - | - |

RADIOACTIVITY

Source: Tritium contamination from processing operations.

Uncertainty: The waste stream is in-situ and has not as yet been characterised. Activities are indicative only.

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: The waste stream is in-situ and has not as yet been characterised. Activities are indicative only.

Other information: -

WASTE STREAM 2C30 Uranium Furnaces

| 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 | 4.22E-02 | C C 2 | | | Gd 153 | | 8 | | |
| Be 10 | | 8 | | | Ho 163 | | 8 | | |
| C 14 | | 8 | | | Ho 166m | | 8 | | |
| Na 22 | | 8 | | | Tm 170 | | 8 | | |
| Al 26 | | 8 | | | Tm 171 | | 8 | | |
| Cl 36 | | 8 | | | 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 | | 8 | | | Pb 210 | | 8 | | |
| Co 60 | | 8 | | | Bi 208 | | 8 | | |
| Ni 59 | | 8 | | | Bi 210m | | 8 | | |
| Ni 63 | | 8 | | | 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 | | | 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 | | 8 | | | Th 234 | | 8 | | |
| Mo 93 | | 8 | | | Pa 231 | | 8 | | |
| Tc 97 | | 8 | | | Pa 233 | | 8 | | |
| Tc 99 | | 8 | | | U 232 | | 8 | | |
| Ru 106 | | 8 | | | U 233 | | 8 | | |
| Pd 107 | | 8 | | | U 234 | | 8 | | |
| Ag 108m | | 8 | | | U 235 | | 8 | | |
| Ag 110m | | 8 | | | U 236 | | 8 | | |
| Cd 109 | | 8 | | | U 238 | | 8 | | |
| Cd 113m | | 8 | | | Np 237 | | 8 | | |
| Sn 119m | | 8 | | | Pu 236 | | 8 | | |
| Sn 121m | | 8 | | | Pu 238 | | 8 | | |
| Sn 123 | | 8 | | | Pu 239 | | 8 | | |
| Sn 126 | | 8 | | | Pu 240 | | 8 | | |
| Sb 125 | | 8 | | | Pu 241 | | 8 | | |
| Sb 126 | | 8 | | | Pu 242 | | 8 | | |
| Te 125m | | 8 | | | Am 241 | | 8 | | |
| Te 127m | | 8 | | | Am 242m | | 8 | | |
| I 129 | | 8 | | | Am 243 | | 8 | | |
| Cs 134 | | 8 | | | Cm 242 | | 8 | | |
| Cs 135 | | 8 | | | Cm 243 | | 8 | | |
| Cs 137 | | 8 | | | 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 | | 8 | | | Cf 251 | | 8 | | |
| Sm 147 | | 8 | | | Cf 252 | | 8 | | |
| Sm 151 | | 8 | | | Other a | | | | |
| Eu 152 | | 8 | | | Other b/g | | | | |
| Eu 154 | | 8 | | | Total a | 0 | | 0 | |
| Eu 155 | | 8 | | | Total b/g | 4.22E-02 | 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