## WASTE STREAM 5B310 Materials Test Reactor ILW

| | |
|---|---|
| **SITE** | Dounreay |
| **SITE OWNER** | Nuclear Decommissioning Authority |
| **WASTE CUSTODIAN** | Dounreay Site Restoration Limited |
| **WASTE TYPE** | ILW |

**WASTE VOLUMES**

| | | Reported |
|---|---|---|
| Stocks: | At 1.4.2019..... | 0 m³ |
| Future arisings - | 1.4.2019 - 31.3.2025..... | 15.0 m³ |
| Total future arisings: | | 15.0 m³ |
| Total waste volume: | | 15.0 m³ |

Comment on volumes: Arisings revised in line with Plant Waste Inventory walk round exercise.

Uncertainty factors on volumes:

| | | | |
|---|---|---|---|
| Stock (upper): | x | Arisings (upper) | x 1.2 |
| Stock (lower): | x | Arisings (lower) | x 0.8 |

**WASTE SOURCE** Reactor decommissioning.

### PHYSICAL CHARACTERISTICS

General description: Solid decommissioning waste from Materials Test Reactor internals and biological shields. There may be several items that may require special consideration either for weight or size reasons.

Physical components (%vol): Aluminium (1.83%), Graphite (46.48%), Mild Steel (51.69%). Reactor Tank and metallic structures and graphite reflector.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 0.65

Comment on density: No consignor's records for ILW. Therefore, use LLW (5B309).

### CHEMICAL COMPOSITION

General description and components (%wt): Aluminium (0.92%), Graphite (20.40%), Mild Steel (78.68%),

Chemical state: Neutral

Chemical form of radionuclides:
H-3: Possibly present.
C-14: Possibly present.
Cl-36: Not known to be present.
Se-79: Possibly present.
Tc-99: Possibly present.
I-129: Not known to be present.
Ra: Not known to be present.
Th: Not known to be present.
U: Not known to be present.
Np: Not known to be present.
Pu: Not known to be present.

Metals and alloys (%wt): Mostly bulk metals, proportions not specified.

| | |
|---|---|
| Stainless steel..... | |
| Other ferrous metals..... | 78.7 |
| Iron..... | |
| Aluminium..... | 0.92 |
| Beryllium..... | 0 |
| Cobalt..... | NE |
| Copper..... | NE |
| Lead..... | |
| Magnox/Magnesium..... | NE |
| Nickel..... | NE |

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| | | |
|---|---|---|
| | Titanium..... | |
| | Uranium..... | NE |
| | Zinc..... | NE |
| | Zircaloy/Zirconium..... | NE |
| | Other metals..... | Not specified. |
| Organics (%wt): | Cellulose, plastics and rubber may be present in trace quantities. Not specified. | |
| | Total cellulosics..... | TR |
| | Paper, cotton..... | TR |
| | Wood..... | TR |
| | Halogenated plastics ..... | TR |
| | Total non-halogenated plastics..... | TR |
| | Condensation polymers..... | NE |
| | Others..... | NE |
| | Organic ion exchange materials.... | 0 |
| | Total rubber..... | TR |
| | Halogenated rubber ..... | NE |
| | Non-halogenated rubber..... | NE |
| | Hydrocarbons..... | |
| | Oil or grease ..... | |
| | Fuel..... | |
| | Asphalt/Tarmac (cont.coal tar)... | |
| | Asphalt/Tarmac (no coal tar)..... | |
| | Bitumen..... | |
| | Others..... | |
| | Other organics..... | TR |
| 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..... | |
| | Graphite..... | 20.4 |
| | Desiccants/Catalysts..... | |
| | Asbestos..... | TR |
| | Non/low friable..... | |
| | Moderately friable..... | |
| | Highly friable..... | |
| | Free aqueous liquids..... | 0 |
| | Free non-aqueous liquids..... | 0 |
| | Powder/Ash..... | 0 |
| Inorganic anions (%wt): | About 3% inorganic anions present. | |

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| | |
|---|---|
| Fluoride | NE |
| Chloride | NE |
| Iodide | NE |
| Cyanide | NE |
| Carbonate | NE |
| Nitrate | NE |
| Nitrite | NE |
| Phosphate | NE |
| Sulphate | NE |
| Sulphide | NE |

Materials of interest for waste acceptance criteria: Possibly asbestos.

| | |
|---|---|
| Combustible metals | 0 |
| 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 | 0 |
| 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: Lead is present. Trace quantities of asbestos may be found.

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

Cadmium..... NE

Caesium.....

Selenium..... NE

Chromium..... NE

Molybdenum..... NE

Thallium.....

Tin..... NE

Vanadium..... NE

Mercury compounds.....

Others..... NE

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 a new facility at the Reactor; Start up date for waste packaging is 2020.

Plant Name: -

Location: Dounreay

Plant startup date: 2020

Total capacity (m³/y incoming waste): 15.0

Target start date for packaging this stream: 2020

Throughput for this stream (m³/y incoming waste): 15.0

Other information: The waste is likely to be packaged on arising, though some may be stored in the reactor building first.

Likely container type:

| Container | Waste packaged (%vol) | Waste loading (m³) | Payload (m³) | Number of packages |
|---|---|---|---|---|
| 6m³ concrete box (SD) | 100.0 | 5 | 5.76 | 3 |

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| | |
|---|---|
| Likely container type comment: | The waste will be packaged in a 6m3 concrete box (SD) |
| Range in container waste volume: | Not established. |
| Other information on containers: | Concrete |
| Likely conditioning matrix: | Cement |
| Other information: | - |
| Conditioned density (t/m³): | ~2.5 |
| Conditioned density comment: | The density is likely to be around 2 - 3 t/m³. |
| Other information on conditioning: | - |
| Opportunities for alternative disposal routing: | No |

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

### RADIOACTIVITY

| | |
|---|---|
| Source: | The main sources of activity are activated and contaminated equipment/structures. |
| Uncertainty: | Within a factor of three. |
| 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 activity has been taken from package data from the DMTR ILoC. Radionuclide data has been reevaluated since the 2016 UK Inventory. |
| Other information: | Specific Activities have been re-evaluated since the 2016 UK Inventory. |

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| Nuclide | Mean radioactivity, TBq/m³ | | | | Nuclide | Mean radioactivity, TBq/m³ | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 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 | | | 6.88E-02 | C C 2 | Gd 153 | | | | |
| Be 10 | | | | | Ho 163 | | | | |
| C 14 | | | 6.54E-03 | C C 2 | Ho 166m | | | | |
| Na 22 | | | | | Tm 170 | | | | |
| Al 26 | | | | | Tm 171 | | | | |
| Cl 36 | | | | | Lu 174 | | | | |
| Ar 39 | | | | | Lu 176 | | | | |
| Ar 42 | | | | | Hf 178n | | | | |
| K 40 | | | | | Hf 182 | | | | |
| Ca 41 | | | | | Pt 193 | | | | |
| Mn 53 | | | | | Tl 204 | | | | |
| Mn 54 | | | | | Pb 205 | | | | |
| Fe 55 | | | 3.16E-04 | C C 2 | Pb 210 | | | | |
| Co 60 | | | 4.03E-02 | C C 2 | Bi 208 | | | | |
| Ni 59 | | | | | Bi 210m | | | | |
| Ni 63 | | | 1.04E+00 | C C 2 | Po 210 | | | | |
| Zn 65 | | | | | Ra 223 | | | | |
| Se 79 | | | | | Ra 225 | | | | |
| Kr 81 | | | | | Ra 226 | | | | |
| Kr 85 | | | | | Ra 228 | | | | |
| Rb 87 | | | | | Ac 227 | | | | |
| Sr 90 | | | | | Th 227 | | | | |
| Zr 93 | | | | | Th 228 | | | | |
| Nb 91 | | | | | Th 229 | | | | |
| Nb 92 | | | | | Th 230 | | | | |
| Nb 93m | | | | | Th 232 | | | | |
| Nb 94 | | | | | Th 234 | | | | |
| Mo 93 | | | | | Pa 231 | | | | |
| Tc 97 | | | | | Pa 233 | | | | |
| Tc 99 | | | | | U 232 | | | | |
| Ru 106 | | | | | U 233 | | | | |
| Pd 107 | | | | | U 234 | | | | |
| Ag 108m | | | | | U 235 | | | | |
| Ag 110m | | | | | U 236 | | | | |
| Cd 109 | | | | | U 238 | | | | |
| Cd 113m | | | 2.48E-05 | C C 2 | Np 237 | | | | |
| Sn 119m | | | | | Pu 236 | | | | |
| Sn 121m | | | | | Pu 238 | | | | |
| Sn 123 | | | | | Pu 239 | | | | |
| Sn 126 | | | | | Pu 240 | | | | |
| Sb 125 | | | | | Pu 241 | | | | |
| Sb 126 | | | | | Pu 242 | | | | |
| Te 125m | | | | | Am 241 | | | | |
| Te 127m | | | | | Am 242m | | | | |
| I 129 | | | | | Am 243 | | | | |
| Cs 134 | | | | | Cm 242 | | | | |
| Cs 135 | | | | | Cm 243 | | | | |
| Cs 137 | | | 1.19E-05 | C C 2 | Cm 244 | | | | |
| Ba 133 | | | 4.42E-06 | C C 2 | Cm 245 | | | | |
| La 137 | | | | | Cm 246 | | | | |
| La 138 | | | | | Cm 248 | | | | |
| Ce 144 | | | | | Cf 249 | | | | |
| Pm 145 | | | | | Cf 250 | | | | |
| Pm 147 | | | | | Cf 251 | | | | |
| Sm 147 | | | | | Cf 252 | | | | |
| Sm 151 | | | | | Other a | | | | |
| Eu 152 | | | 2.95E-05 | C C 2 | Other b/g | | | | |
| Eu 154 | | | 9.20E-05 | C C 2 | **Total a** | **0** | | **0** | |
| Eu 155 | | | 2.36E-06 | C C 2 | **Total b/g** | **0** | | **1.15E+00** | **B B 2** |

**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