## WASTE STREAM 2D137 Miscellaneous Plants Final Decommissioning: Processing Plants, Tanks, Silos, etc.

**SITE** Sellafield

**SITE OWNER** Nuclear Decommissioning Authority

**WASTE CUSTODIAN** Sellafield Limited

**WASTE TYPE** ILW

**WASTE VOLUMES**

| | | Reported |
|---|---|---|
| Stocks: | At 1.4.2019..... | 0 m³ |
| Future arisings - | 1.4.2019 - 31.3.2041..... | 0 m³ |
| | 1.4.2041 - 31.3.2042..... | 15.0 m³ |
| | 1.4.2042 - 31.3.2043..... | 0 m³ |
| | 1.4.2043 - 31.3.2044..... | 1.5 m³ |
| | 1.4.2044 - 31.3.2045..... | 0.4 m³ |
| | 1.4.2045 - 31.3.2063..... | 0 m³ |
| | 1.4.2063 - 31.3.2064..... | 15.0 m³ |
| | 1.4.2064 - 31.3.2077..... | 0 m³ |
| | 1.4.2077 - 31.3.2099..... | 11458.8 m³ |
| | 1.4.2099 - 31.3.2103..... | 996.4 m³ |
| | 1.4.2103 - 31.3.2121..... | 0 m³ |
| Total future arisings: | | 12487.0 m³ |
| Total waste volume: | | 12487.0 m³ |

Comment on volumes: Arisings are in line with current decommissioning programmes and strategy. Arisings are from future decommissioning projects. Waste within this waste stream is generated from a number of decommissioning projects which will commence at a future date. As a result of this, minimal characterisation of waste volumes and fingerprints has been carried out and hence there is a large uncertainty in the potential arisings. Preliminary assessments indicate that the volumes may vary from -30% to +200% for ILW.

Uncertainty factors on volumes:

| | | | |
|---|---|---|---|
| Stock (upper): | x | Arisings (upper) | x 3.0 |
| Stock (lower): | x | Arisings (lower) | x 0.7 |

**WASTE SOURCE** Final decommissioning of processing plants, tanks, silos and service facilities.

### PHYSICAL CHARACTERISTICS

General description: Building structural materials, surface scabblings.Some large blocks of building structure may be present.

Physical components (%vol): Concrete, bricks and blockwork (100%). Note small amounts of reinforcing steelwork may be present if large blocks of material consigned.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): ~1

Comment on density: Density stated is average for ILW final decommissioning.

### CHEMICAL COMPOSITION

General description and components (%wt): Concrete (including reinforcing bar), bricks and blockwork (100%).

Chemical state: Alkali

Chemical form of radionuclides: Cl-36: Not expected to be present in significant quantity.
Se-79: Not expected to be present in significant quantity.
Ra: Not expected to be present in significant quantity.
Th: Not expected to be present in significant quantity.

Metals and alloys (%wt): -

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| | | | |
|---|---|---|---|
| | Stainless steel | 0 | |
| | Other ferrous metals | P | |
| | Iron | P | Cast iron may be present but the quantity is dependent on Plant POCO not yet started. |
| | Aluminium | | |
| | Beryllium | 0 | |
| | Cobalt | 0 | |
| | Copper | | |
| | Lead | 0 | |
| | Magnox/Magnesium | 0 | |
| | Nickel | | |
| | Titanium | | |
| | Uranium | 0 | |
| | Zinc | 0 | |
| | Zircaloy/Zirconium | 0 | |
| | Other metals | 0 | |
| Organics (%wt): | None present | | |
| | 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 | 0 | |
| Other materials (%wt): | - | | |
| | Inorganic ion exchange materials | 0 | |
| | Inorganic sludges and flocs | 0 | |
| | Soil | 0 | |
| | Brick/Stone/Rubble | 0 | |
| | Cementitious material | 100.0 | |

| | | |
|---|---|---|
| | Sand | |
| | Glass/Ceramics | 0 |
| | 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): | Inorganic anions are not expected to be present. | |
| | 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: | None present. | |
| | 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 | NE |
| | Soluble solids as bulk chemical compounds | 0 |

**WASTE STREAM 2D137 Miscellaneous Plants Final Decommissioning: Processing Plants, Tanks, Silos, etc.**

Hazardous substances / non hazardous pollutants: -

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

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### PACKAGING AND CONDITIONING

| | |
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| Conditioning method: | The waste will be subject to in-situ size reduction prior to placing in one of the following options, a 3 m³ Decommissioning Concrete Container (DCC) or a 3 m³ box liner. No further size reduction or compaction will be carried out. Waste may be flood grouted if required for disposal. |
| Plant Name: | Box Encapsualtion Plant, Low End Encapsulation Capability and future replacement facilties. |
| Location: | Sellafield. |
| Plant startup date: | BEP 2022, LEEC 2023. |
| Total capacity (m³/y incoming waste): | - |
| Target start date for packaging this stream: | 2041 |
| Throughput for this stream (m³/y incoming waste): | - |
| Other information: | LEEC treatment capability and capacity are currently under develoment.Use of BEP is dependent on spare operating capacity being released from High hazard and risk reduction priorities.For large through contaminated concrete structures it may be advisable to maintain the waste in discrete blocks rather than reduces the material to a rubble, this may require a dedicated facility |

Likely container type:

| Container | Waste packaged (%vol) | Waste loading (m³) | Payload (m³) | Number of packages |
|---|---|---|---|---|
| Sellafield 3m³ box | 79.8 | ~1.094 | 2.7 | 9109 |
| Other(DCC) | 20.2 | ~0.895 | ~2.1 | 2819 |

| | |
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| Likely container type comment: | DCC - external envelope of a Sellafield 3 m³ box however it is made of fiber reinforced concrete. |
| Range in container waste volume: | The volume of raw demolition waste in a container can vary from 20% to 65% by volume (Note a full container of dry sharp sand would be 50% by volume). |
| Other information on containers: | Stainless Steel for 500 l drums, Sellafield 3m³ box and decommissioning liner used to load boxes. Fibre reinforced concrete for DCC. |
| Likely conditioning matrix: | Not specified |
| Other information: | - |
| Conditioned density (t/m³): | NE |
| Conditioned density comment: | Conditioned waste density varies depending on waste loading. |
| Other information on conditioning: | - |
| Opportunities for alternative disposal routing: | Not yet determined |

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

### RADIOACTIVITY

| | |
|---|---|
| Source: | The main sources of activity are actinides and fission products. |
| Uncertainty: | Waste within this waste stream is generated from a number of decommissioning projects which will commence at a future date. The uncertainties quoted for each nuclide represent both the uncertainty in quantification without detailed sampling and the likely variation of |

| | |
|---|---|
| | nuclide in different building consigned wastes under this waste stream. It is exceptionally unlikely that all the waste included in this waste stream will have the same variation in nuclide fingerprint. Also activity levels will depend on degree of decontamination achieved. |
| 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: | - |
| Other information: | Other alpha not specified. Other beta/gamma includes Zr95 2.33E-6 TBq/m³, Nb95 3.8E-6 TBq/m³, Ru103 3.02E-7 TBq/m³ and Ta182 1.59E-7 TBq/m³. Nuclides making up remaining "other beta/gamma" not specified. |

## WASTE STREAM 2D137 Miscellaneous Plants Final Decommissioning: Processing Plants, Tanks, Silos, etc.

| Nuclide | Mean radioactivity, TBq/m³ Waste at 1.4.2019 | Bands and Code | Future arisings | Bands and Code | Nuclide | Mean radioactivity, TBq/m³ Waste at 1.4.2019 | Bands and Code | Future arisings | Bands and Code |
|---|---|---|---|---|---|---|---|---|---|
| H 3 | | | 1.66E-06 | C C 2 | Gd 153 | | | | |
| Be 10 | | | | 8 | Ho 163 | | | | |
| C 14 | | | 6.00E-06 | C C 2 | Ho 166m | | | | |
| Na 22 | | | | | Tm 170 | | | | |
| Al 26 | | | | | Tm 171 | | | | |
| Cl 36 | | | | 8 | Lu 174 | | | | |
| Ar 39 | | | | | Lu 176 | | | | |
| Ar 42 | | | | | Hf 178n | | | | |
| K 40 | | | | | Hf 182 | | | | |
| Ca 41 | | | | 8 | Pt 193 | | | | |
| Mn 53 | | | | | Tl 204 | | | | |
| Mn 54 | | | 1.44E-09 | C C 2 | Pb 205 | | | | |
| Fe 55 | | | 2.24E-07 | C C 2 | Pb 210 | | | | 8 |
| Co 60 | | | 3.80E-06 | C C 2 | Bi 208 | | | | |
| Ni 59 | | | | 8 | Bi 210m | | | | |
| Ni 63 | | | 1.42E-06 | C C 2 | Po 210 | | | | 8 |
| Zn 65 | | | 1.44E-09 | C C 2 | Ra 223 | | | | |
| Se 79 | | | | 8 | Ra 225 | | | | |
| Kr 81 | | | | | Ra 226 | | | | 8 |
| Kr 85 | | | | | Ra 228 | | | | |
| Rb 87 | | | | | Ac 227 | | | | |
| Sr 90 | | | 9.44E-04 | C C 2 | Th 227 | | | | |
| Zr 93 | | | 2.51E-09 | C C 2 | Th 228 | | | | |
| Nb 91 | | | | | Th 229 | | | | 8 |
| Nb 92 | | | | | Th 230 | | | | 8 |
| Nb 93m | | | | 8 | Th 232 | | | | 8 |
| Nb 94 | | | | 8 | Th 234 | | | | |
| Mo 93 | | | | 8 | Pa 231 | | | | 8 |
| Tc 97 | | | | | Pa 233 | | | | |
| Tc 99 | | | 2.79E-06 | C C 2 | U 232 | | | | |
| Ru 106 | | | 1.59E-05 | C C 2 | U 233 | | | | 8 |
| Pd 107 | | | | 8 | U 234 | | | 1.42E-06 | C C 2 |
| Ag 108m | | | | 8 | U 235 | | | 4.92E-08 | C C 2 |
| Ag 110m | | | | | U 236 | | | | 8 |
| Cd 109 | | | | | U 238 | | | 1.96E-06 | C C 2 |
| Cd 113m | | | | | Np 237 | | | 1.03E-06 | C C 2 |
| Sn 119m | | | | | Pu 236 | | | | |
| Sn 121m | | | | 8 | Pu 238 | | | 1.19E-05 | C C 2 |
| Sn 123 | | | | | Pu 239 | | | 1.85E-04 | C C 2 |
| Sn 126 | | | | 8 | Pu 240 | | | 3.12E-05 | C C 2 |
| Sb 125 | | | | | Pu 241 | | | 3.41E-04 | C C 2 |
| Sb 126 | | | | | Pu 242 | | | 3.92E-12 | C C 2 |
| Te 125m | | | | | Am 241 | | | 1.57E-05 | C C 2 |
| Te 127m | | | | | Am 242m | | | | 8 |
| I 129 | | | 3.15E-09 | C C 2 | Am 243 | | | | 8 |
| Cs 134 | | | 3.12E-05 | C C 2 | Cm 242 | | | 3.06E-09 | C C 2 |
| Cs 135 | | | | 8 | Cm 243 | | | 3.42E-08 | C C 2 |
| Cs 137 | | | 5.12E-03 | C C 2 | Cm 244 | | | 2.07E-06 | C C 2 |
| Ba 133 | | | | | Cm 245 | | | | 8 |
| La 137 | | | | | Cm 246 | | | | 8 |
| La 138 | | | | | Cm 248 | | | | |
| Ce 144 | | | 1.17E-05 | C C 2 | Cf 249 | | | | |
| Pm 145 | | | | | Cf 250 | | | | |
| Pm 147 | | | 1.97E-07 | C C 2 | Cf 251 | | | | |
| Sm 147 | | | | | Cf 252 | | | | |
| Sm 151 | | | 7.94E-07 | C C 2 | Other a | | | 1.34E-07 | C C 2 |
| Eu 152 | | | 7.94E-07 | C C 2 | Other b/g | | | 9.08E-06 | C C 2 |
| Eu 154 | | | 6.26E-09 | C C 2 | **Total a** | **0** | | **>2.51E-04** | **C 2** |
| Eu 155 | | | 9.72E-07 | C C 2 | **Total b/g** | **0** | | **>6.49E-03** | **C 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