| WASTE STREAM | 7A109 | Decommissioning Waste from Reactors ILW |
|---|---|---|

**SITE** AWE Aldermaston

**SITE OWNER** Ministry of Defence (MOD)

**WASTE CUSTODIAN** AWE plc

**WASTE TYPE** ILW

**WASTE VOLUMES**

| | | Reported ($m^3$) |
|---|---|---|
| Stocks: | At 1.4.2025 | = 5.6 |
| Future arisings: | 1.4.2025 - 31.3.2045 | = 0 |
| | 1.4.2046 - 31.3.2047 | = 4.0 |
| | 1.4.2048 - 31.3.2080 | = 0 |
| Total future arisings: | | **4.0** |
| Total waste volume: | | **9.6** |

**OR**

| Conditioned ($m^3$) | Packaged ($m^3$) |
|---|---|
| | |

Number of waste packages in stock: At 1.4.2025…… - packages

Comment on arising rates: Additional 3m3 box added to site inventory. The decommissioning of the Viper and Herald reactors will not be a continuous process. Future arisings are estimated based on the current decommissioning plans for facilities on site, which is subject to change over time.

Additional information on quantities: The total volume of arisings will depend on the longevity of the AWE site. Estimates have been made based on a site closure date of 2080.

Uncertainty factors on volumes:

| | | | |
|---|---|---|---|
| Stock (upper): | x 2.00 | Arisings (upper): | x 3.00 |
| Stock (lower): | x 1.00 | Arisings (lower): | x 0.50 |

**WASTE SOURCE** Decommissioning waste from a research reactor facility and associated buildings including the removal of reactor elements and other items stored in the Used Fuel Store Tank. No fuel is present in this waste stream.

**PHYSICAL CHARACTERISTICS**

General description: Components from the reactor core. Aluminium plate and pipe, beryllium billets, stainless steel and stainless steel clad cadmium. The reactor core box (4 x 2 x 1m) is difficult to handle and is likely to require cutting up. Contents reviewed and updated for 2022 UKRWI.

Changes since waste generated: -

Bulk density (t/m³): = 3.2

Comment on density: Based upon a revised 'in-stock' waste figure for 2025.

**CHEMICAL COMPOSITION**

General description and components (%wt): Metal (99.31%) and resin (0.69%)

Chemical state: Neutral

Sheet metal proportion / thickness: This waste is 99.31% bulk metal.

Metals and alloys (%wt):

| | (%wt) | Type(s) / Grades(s) with proportions | % of total C14 activity |
|---|---|---|---|
| Stainless steel…… | = 14.8 | - | |
| Other ferrous metals…… | = 0 | - | |
| Iron…… | = 0 | - | |
| Aluminium…… | = 78.3 | - | |
| Beryllium…… | = 5.5 | - | |
| Cobalt…… | = 0 | - | |
| Copper…… | = 0 | - | |
| Lead…… | = 0 | - | |
| Magnox/Magnesium…… | = 0 | - | |
| Nickel…… | = 0 | - | |
| Titanium…… | = 0 | - | |
| Uranium…… | = 0 | - | |
| Zinc…… | = 0 | - | |
| Zircaloy/Zirconium…… | = 0 | - | |
| Other metals…… | = 1.2 | Cadmium (1.15% wt) | |

Organics (%wt):

| | (%wt) | Type(s) and comment | % of total C14 activity |
|---|---|---|---|
| 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 | 0 | - | |
| Oil or grease | 0 | - | |
| Fuel | 0 | - | |
| Asphalt/Tarmac (cont.coal tar) | 0 | - | |
| Asphalt/Tarmac (no coal tar) | 0 | - | |
| Bitumen | 0 | - | |
| Others | 0 | - | |
| Other organics | 0 | - | |

Other materials (%wt):

| | (%wt) | Type(s) and comment | % of total C14 activity |
|---|---|---|---|
| Inorganic ion exchange materials | = 0.35 | - | |
| Inorganic sludges and flocs | = 0 | - | |
| Soil | = 0 | - | |
| Brick/Stone/Rubble | = 0 | - | |
| Cementitious material | = 0 | - | |
| Sand | = 0 | - | |
| Glass/Ceramics | = 0 | - | |
| Graphite | = 0 | - | |
| Desiccants/Catalysts | = 0 | - | |
| Asbestos | = 0 | - | |
| Non/low friable | = 0 | - | |
| Moderately friable | = 0 | - | |
| Highly friable | = 0 | - | |
| Free aqueous liquids | = 0 | - | |
| Free non-aqueous liquids | = 0 | - | |
| Powder/Ash | = 0 | - | |

**COMPONENTS OF MATERIALS, WASTE PROPERTIES, MATERIALS NOT CONTRIBUTING TO MASS**

Inorganic anions (%wt):

| | (%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:

| | (%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 | 0 | - |
| Putrescible wastes | 0 | - |
| Non-putrescible wastes | 0 | - |
| Corrosive materials | 0 | - |
| Pyrophoric materials | 0 | - |
| Generating toxic gases | 0 | - |
| Reacting with water | 0 | - |
| Higher activity particles | 0 | - |
| Soluble solids as bulk chemical compounds | 0 | - |

Hazardous substances / non hazardous pollutants: -

| | (%wt) | Type(s) and comment |
|---|---|---|
| Acrylamide | = 0 | - |
| Benzene | NE | - |
| Chlorinated solvents | = 0 | - |
| Formaldehyde | = 0 | - |
| Organometallics | = 0 | - |
| Phenol | NE | - |
| Styrene | = 0 | - |
| Tri-butyl phosphate | NE | - |
| Other organophosphates | = 0 | - |
| Vinyl chloride | = 0 | - |
| Arsenic | NE | - |
| Barium | = 0 | - |
| Boron | NE | - |
| Boron (in Boral) | NE | - |
| Boron (non-Boral) | = 0 | - |
| Cadmium | P | - |
| Caesium | = 0 | - |
| Selenium | NE | - |
| Chromium | NE | - |
| Molybdenum | NE | - |
| Thallium | = 0 | - |
| Tin | NE | - |
| Vanadium | NE | - |
| Mercury compounds | = 0 | - |
| Others | NE | - |

Complexing agents (%wt): No

| | (%wt) | Type(s) and comment |
|---|---|---|
| EDTA | = 0 | - |
| DPTA | = 0 | - |
| NTA | = 0 | - |
| Polycarboxylic acids | = 0 | - |
| Other organic complexants | = 0 | No complexing agents are present in the waste stream. |
| Total complexing agents | = 0 | - |

Physical components:

| | Number | Type(s) and comment |
|---|---|---|
| Sources | | - |
| Electronic & Electrical Equipment (EEE) | | - |
| EEE Type 1 | | - |
| EEE Type 2 | | - |
| EEE Type 3 | | - |
| EEE Type 4 | | - |
| EEE Type 5 | | - |

**TREATMENT, PACKAGING AND DISPOSAL**

Planned on-site / off-site treatment(s):

| Treatment | On-site / Off-site | Stream volume % |
|---|---|---|
| Size reduction | | |
| Decay storage | | |
| Low force compaction | | |
| Supercompaction (HFC) | | |
| Incineration | | |
| Drying/dewatering/liquid separation | | |
| Tie down/fixatives/strippable coating/painting application | | |
| Decontamination | | |
| Metal treatment | | |
| Recycling / reuse | | |
| Thermal treatment, including vitrification | | |
| Encapsulation | | |
| Polymer encapsulation | | |
| Other physical treatment | | |
| Other chemical treatment | | |
| Containerisation | | |
| Treatment not yet determined | Off-site | = 100.0 |
| None | | |

Comments on planned treatments: The three containers consist of 2 x 3m3 boxes and 1 x 205L drum. The internal area of the 3m3 is assumed to be ~2.7m3.

Conditioning method: -

Conditioning plants:

| Plant Name | Location |
|---|---|
| | |

Likely conditioning matrix: -

Further information on the conditioning matrix: -

**Waste Packaging:**

Likely container type:

| Container | Waste packaged (vol%) | Waste loading (m³) | Payload (m³) | Number of packages | Estimated start date for packaging |
|---|---|---|---|---|---|
| 3 m³ box (side lifting) | 100.0 | 5.4 | 2.7 | 2 | - |

Range in container waste loading:

Other information on packaging and conditioning: -

Conditioned density (t/m³): ~ 3.2
Conditioned density comment: The conditioned density is an estimate which may be subject to change.

**Management Routes:**

| Disposal Route | Stream volume % | Raw density t/m$^3$ | Start date |
|---|---|---|---|
| Expected to be consigned to a Near Site, Near Surface Disposal Facility (Scotland) | | | |
| Expected to be Non-NSD HAW managed under Scottish Government's policy | | | |
| Expected to be disposed to LLW Vaults NRS Dounreay | | | |
| Expected to be consigned to the Geological Disposal Facility | = 100.0 | | |
| Expected to be consigned to a Near Surface Disposal Facility | | | |
| Expected to be consigned to the LLW Repository | | | |
| Expected to be consigned to a Landfill Facility | | | |
| Expected to be disposed On-Site | | | |
| Expected to be managed by In-Situ Disposal | | | |
| Expected to be consigned to an Incineration Facility | | | |
| Expected to be consigned to a Metal Treatment Facility | | | |
| Expected to be Out of Scope | | | |
| Expected to be recycled / reused | | | |
| Disposal route not known | | | |

Classification codes for waste expected to be consigned to a landfill facility:

**Opportunities for alternative disposal routing:** Yes

| Baseline Management Route | Opportunity Management Route | Stream volume (%) | Opportunity Confidence | Comment |
|---|---|---|---|---|
| GDF | LLWR | NE | RED | Currently assumed the 3m³ boxes will be emptied as the expectation is that the waste would have decay to LLW levels, as such being disposed of as LLW, but this has not been officially confirmed. |

**RADIOACTIVITY**

Source: Principally neutron activation of solids in solid form.

Note the only activity that has been quantified on the legacy waste card is Co-60, any other radionuclides have been inferred but not characterised. Also worth noting the Co-60 activity would have decayed to LLW figures by the time the stock is to be disposed of. Unknown currently whether these items will be repacked.

Uncertainty: Specific activities owing to future arisings are based on the current in-stock waste activities, which may be inaccurate if the decommissioning window is delayed. In stock gross beta activities/associated nuclides are thought to be accurate.

Measurement of radioactivities: The activity was derived from historical data using High Resolution Gamma-ray Spectroscopy assay and computer modelling software.

Chemical form of radionuclides:

H-3: Not present in this waste stream
C-14: Not present in this waste stream
Cl-36: Not present in this waste stream
Se-79: Not present in this waste stream
Tc-99: Not present in this waste stream
I-129: Not present in this waste stream
Ra: Present in this waste stream In the form of oxide.
Th: Present in this waste stream In the form of oxide.
U: Not present in this waste stream
Np: Not present in this waste stream
Pu: Not present in this waste stream

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| Nuclide | Mean radioactivity, TBq/m³ Waste at 1.4.2025 | Bands and Code | Future Arisings | Bands and Code | Nuclide | Mean radioactivity, TBq/m³ Waste at 1.4.2025 | Bands and Code | Future Arisings | Bands and Code |
|---|---|---|---|---|---|---|---|---|---|
| H 3 | | | | 5 | Gd 153 | | | | |
| Be 10 | | | | 5 | Ho 163 | | | | |
| C 14 | | | | 5 | Ho 166m | | | | |
| Na 22 | | | | | Tm 170 | | | | |
| Al 26 | | | | | Tm 171 | | | | |
| Cl 36 | | | | 5 | Lu 174 | | | | |
| Ar 39 | | | | | Lu 176 | | | | |
| Ar 42 | | | | | Hf 178n | | | | |
| K 40 | | | | | Hf 182 | | | | |
| Ca 41 | | | | 5 | Pt 193 | | | | |
| Mn 53 | | | | | Tl 204 | | | | |
| Mn 54 | | | | 5 | Pb 205 | | | | |
| Fe 55 | | | | 5 | Pb 210 | | | | |
| Co 60 | = 1.26E-02 | B B 2 | ~ 2.82E-01 | C C 2 | Bi 208 | | | | |
| Ni 59 | | | | 5 | Bi 210m | | | | |
| Ni 63 | | | | 5 | Po 210 | | | | |
| Zn 65 | | | | 5 | Ra 223 | | | | |
| Se 79 | | | | | Ra 225 | | | | |
| Kr 81 | | | | | Ra 226 | | | | |
| Kr 85 | | | | | Ra 228 | | | | |
| Rb 87 | | | | | Ac 227 | | | | |
| Sr 90 | | | | | Th 227 | | | | |
| Zr 93 | | | | 5 | Th 228 | | | | |
| Nb 91 | | | | | Th 229 | | | | |
| Nb 92 | | | | | Th 230 | | | | |
| Nb 93m | | | | 5 | Th 232 | | | | |
| Nb 94 | | | | 5 | Th 234 | | | | |
| Mo 93 | | | | 5 | Pa 231 | | | | |
| Tc 97 | | | | | Pa 233 | | | | |
| Tc 99 | | | | | U 232 | | | | |
| Ru 106 | | | | | U 233 | | | | |
| Pd 107 | | | | | U 234 | | | | |
| Ag 108m | | | | 5 | U 235 | | | | |
| Ag 110m | | | | | U 236 | | | | |
| Cd 109 | | | | | U 238 | | | | |
| Cd 113m | | | | | 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 | | | | | Cm 244 | | | | |
| Ba 133 | | | | | 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 | | | | | Unsp a | | | | |
| Eu 152 | | | | | Unsp b/g | | | | |
| Eu 154 | | | | | **Total a** | **0** | * | **0** | * |
| Eu 155 | | | | | **Total b/g** | **1.26E-02** | * | **2.82E-01** | * |

**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 the 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
* Total calculated from the 114 declared radionuclides