| WASTE STREAM | 7E101 | Site and Facilities Decommissioning Waste: Steel and Building Rubble |
|---|---|---|

**SITE** Rosyth Royal Dockyard

**SITE OWNER** Ministry of Defence

**WASTE CUSTODIAN** Babcock International Group

**WASTE TYPE** LLW

**WASTE VOLUMES**

| | | Reported |
|---|---|---|
| Stocks: | At 1.4.2019..... | 0 m³ |
| Future arisings - | 1.4.2019 - 31.3.2020..... | 0 m³ |
| | 1.4.2020 - 31.3.2031..... | <25.0 m³ |
| Total future arisings: | | 25.0 m³ |
| Total waste volume: | | 25.0 m³ |

Comment on volumes: The arisings will not be constant because it will depend upon which particular facilities are being decommissioned in any given period. After 2028, when submarine dismantling is projected to finish, the only nuclear facilities on-site requiring to be decommissioned will be the ILW store, associated support facilities and an effluent treatment plant. This is projected to complete by 2031. The waste volumes represent the most likely arising volumes of decommissioning wastes.

Uncertainty factors on volumes:

| | | | |
|---|---|---|---|
| Stock (upper): | x | Arisings (upper) | x 2.0 |
| Stock (lower): | x | Arisings (lower) | x 0.2 |

**WASTE SOURCE** Decommissioning of site facilities: active ventilation systems; waste store building structure; portable effluent treatment facility.

## PHYSICAL CHARACTERISTICS

General description: Scrap steel, spoil and building rubble. There will be no large items present.

Physical components (%vol): Approximately 34% steel, 66% building rubble and spoil by volume.

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 2

Comment on density: The bulk density of the raw waste is 2 t/m³.

## CHEMICAL COMPOSITION

General description and components (%wt): The waste is composed of metals, spoil, building rubble, brick and concrete. The composition by weight is 8% mild steel, 26% stainless steel and 33% spoil, and 33% building rubble, brick and concrete.

Chemical state: Neutral

Chemical form of radionuclides:
H-3: May be present, but chemical form has not been determined.
C-14: May be present, but chemical form has not been determined.
Ra: May be present, but chemical form has not been determined.
Th: May be present, but chemical form has not been determined.
U: May be present, but chemical form has not been determined.

Metals and alloys (%wt): Mild steel contaminated metal is present as sheet (ex-ventilation trunking), typical thickness up to 5 mm.

| | |
|---|---|
| Stainless steel..... | ~26.0 |
| Other ferrous metals..... | ~8.0 |
| Iron..... | |
| Aluminium..... | |
| Beryllium..... | 0 |
| Cobalt..... | 0 |
| Copper..... | |
| Lead..... | 0 |
| Magnox/Magnesium..... | 0 |
| Nickel..... | |

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| | | |
|---|---|---|
| | Titanium | |
| | Uranium | 0 |
| | Zinc | 0 |
| | Zircaloy/Zirconium | 0 |
| | Other metals | 0 |
| Organics (%wt): | Polythene wrapping may be present in the waste. | |
| | 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 | ~33.0 |
| | Brick/Stone/Rubble | ~33.0 |
| | Cementitious material | 0 |
| | Sand | |
| | Glass/Ceramics | |
| | Graphite | 0 |
| | Desiccants/Catalysts | |
| | Asbestos | 0 |
| | Non/low friable | |
| | Moderately friable | |
| | Highly friable | |
| | Free aqueous liquids | 0 |
| | Free non-aqueous liquids | 0 |
| | Powder/Ash | |
| Inorganic anions (%wt): | There are no inorganic anions in the waste. | |

| | |
|---|---|
| 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 hazardous materials in the waste.

| | |
|---|---|
| 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 | 0 |
| Soluble solids as bulk chemical compounds | 0 |

Hazardous substances / non hazardous pollutants: There are no toxic materials expected to be present in this waste.

| | |
|---|---|
| Acrylamide | |
| Benzene | 0 |
| Chlorinated solvents | |
| Formaldehyde | |
| Organometallics | |
| Phenol | 0 |
| Styrene | |
| Tri-butyl phosphate | 0 |
| Other organophosphates | |
| Vinyl chloride | 0 |
| Arsenic | 0 |
| Barium | |
| Boron | 0 |

Cadmium..... 0

Caesium.....

Selenium..... 0

Chromium..... 0

Molybdenum..... 0

Thallium.....

Tin..... 0

Vanadium..... 0

Mercury compounds.....

Others..... 0

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

**TREATMENT, PACKAGING AND DISPOSAL**

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

| Treatment | On-site / Off site | Stream volume % |
|---|---|---|
| Low force compaction | | |
| Supercompaction (HFC) | | |
| Incineration | | |
| Solidification | | |
| Decontamination | | |
| Metal treatment | | |
| Size reduction | | |
| Decay storage | | |
| Recyling / reuse | | |
| Other / various | | |
| None | | 100.0 |

Comment on planned treatments: -

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**Disposal Routes:**

| Disposal Route | Stream volume % |
|---|---|
| Expected to be consigned to the LLW Repository<br>Expected to be consigned to a Landfill Facility<br>Expected to be consigned to an On-Site Disposal Facility<br>Expected to be consigned to an Incineration Facility<br>Expected to be consigned to a Metal Treatment Facility<br>Expected to be consigned as Out of Scope<br>Expected to be recycled / reused<br>Disposal route not known | ~100.0 |

**Upcoming (2019/20-2021/22) Waste Routing (if expected to change from above):**

| Disposal Route | Stream volume % | | |
|---|---|---|---|
| | 2019/20 | 2020/21 | 2021/22 |
| Expected to be consigned to the LLW Repository<br>Expected to be consigned to a Landfill Facility<br>Expected to be consigned to an On-Site Disposal Facility<br>Expected to be consigned to an Incineration Facility<br>Expected to be consigned to a Metal Treatment Facility<br>Expected to be consigned as Out of Scope<br>Expected to be recycled / reused<br>Disposal route not known | | | |

**Waste Packaging for Disposal:** (Not applicable to this waste stream)

| Container | Stream volume % | Waste loading m³ | Number of packages |
|---|---|---|---|
| 1/3 Height IP-1 ISO<br>2/3 Height IP-2 ISO<br>1/2 Height WAMAC IP-2 ISO<br>1/2 Height IP-2 Disposal/Re-usable ISO<br>2m box (no shielding)<br>4m box (no shielding)<br>Other | | | |

Other information: -

**Waste Planned for Disposal at the LLW Repository:** (Not applicable to this waste stream)

Container voidage: -

Waste Characterisation Form (WCH): -

Waste consigned for disposal to LLWR in year of generation: -

Potential for the waste to contain discrete items: -

**Non-Containerised Waste for In-Vault Grouting:** (Not applicable to this waste stream)

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

**RADIOACTIVITY**

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|---|---|---|

| | |
|---|---|
| Source: | Activation products, principally cobalt-60. |
| Uncertainty: | The specific activity data presented in the data sheet is the mean radioactivity contents of three Half-Height ISO Containers packed with 7E101 waste disposed of to the LLWR. This is likely to be representative of the radioactivity content of future disposals, taking radioactive decay into account. |
| 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 specific activity data is the mean radioactivity contents of three Half-Height ISO Containers packed with 7E101 waste disposed off to the LLWR. |
| Other information: | - |

## WASTE STREAM 7E101 Site and Facilities Decommissioning Waste: Steel and Building Rubble

| 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 | | | 1.57E-05 | A A 1 | Gd 153 | | | | |
| Be 10 | | | | | Ho 163 | | | | |
| C 14 | | | 2.66E-05 | A A 1 | 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 | | | 1.64E-07 | A A 1 | Pb 210 | | | | |
| Co 60 | | | 2.08E-06 | A A 1 | Bi 208 | | | | |
| Ni 59 | | | | | Bi 210m | | | | |
| Ni 63 | | | 2.62E-07 | A A 1 | 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 | | | | | Np 237 | | | | |
| Sn 119m | | | | | Pu 236 | | | | |
| Sn 121m | | | | | Pu 238 | | | | |
| Sn 123 | | | | | Pu 239 | | | | |
| Sn 126 | | | | | Pu 240 | | | | |
| Sb 125 | | | 2.69E-08 | A A 1 | 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 | | | 1.44E-08 | A A 1 | 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 | | | | | Other a | | | | |
| Eu 152 | | | | | Other b/g | | | | |
| Eu 154 | | | | | **Total a** | **0** | | **0** | |
| Eu 155 | | | | | **Total b/g** | **0** | | **4.48E-05** | **A A 1** |

**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