

**WASTE STREAM****7N03****MOD Donnington Miscellaneous LLW****SITE** MOD Donnington**SITE OWNER** Ministry of Defence**WASTE CUSTODIAN** Ministry of Defence**WASTE TYPE** LLW

Is the waste subject to Scottish Policy: No

**WASTE VOLUMES**

|                        |                           | Reported              |
|------------------------|---------------------------|-----------------------|
| Stocks:                | At 1.4.2022.....          | 0 m <sup>3</sup>      |
| Future arisings -      | 1.4.2022 - 31.3.2023..... | ~~4.0 m <sup>3</sup>  |
|                        | 1.4.2023 - 31.3.2033..... | ~~20.0 m <sup>3</sup> |
|                        | 1.4.2033 - 31.3.2053..... | ~~20.0 m <sup>3</sup> |
| Total future arisings: |                           | 44.0 m <sup>3</sup>   |
| Total waste volume:    |                           | 44.0 m <sup>3</sup>   |

Comment on volumes: MOD Donnington is a repository for in-service and redundant MOD equipment, some of which contain radioactive sources. Waste arisings do not occur at a constant rate. No wastes are currently stored. Items are declared as waste by equipment manager. MOD Donnington then make arrangements for appropriate disposal or recycling. Any future waste arisings are difficult to determine as they are dependent on a number of factors such as equipment being declared obsolete by equipment managers and legacy items being returned following site closures etc. There is uncertainty in the volume as many radioactive components are fitted in equipment, or are equipment spares sealed in an original polythene bag / box packaging. The items remain in the equipment or packaging until an authorised waste contractor downsizes the equipment / packaging and selects an appropriate disposal route.

Uncertainty factors on volumes: Stock (upper): x Arisings (upper) x 10.0  
 Stock (lower): x Arisings (lower) x 0.1

**WASTE SOURCE** The waste arises from disposal of redundant military equipment.**PHYSICAL CHARACTERISTICS**

General description: Scrap luminised dials, gauges, compasses, signs, mostly luminised with radium-226 or tritium. Thoriated engine parts and thoriated optical lenses. Smoke detectors, spark gaps instrument functional check sources

Physical components (%wt): Metal (80%), glass (10%), plastic/perspex (5%), paper (2%), wood (3%).

Sealed sources: The waste contains sealed sources. Instrument functional check sources - number not determined but likely to be low

Bulk density (t/m<sup>3</sup>): NE

Comment on density: No information available as items not stored for immediate disposal.

**CHEMICAL COMPOSITION**

General description and components (%wt): Metal (80%), glass (10%), plastic/perspex (5%), paper (2%), wood (3%).

Chemical state: Neutral

Chemical form of radionuclides: H-3: Luminised compound, elemental tritium and tritiated water  
 Cl-36: None present  
 I-129: None present  
 Ra: Luminised compound and radium sulphate  
 Th: Thorium/magnesium metal alloy and thorium oxide

Metals and alloys (%wt): Sheet metal is not present in this waste stream. Majority of metal is in the form of instrument and dial casings.

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|                                     | (%wt) | Type(s) / Grade(s) with proportions | % of total C14 activity |
|-------------------------------------|-------|-------------------------------------|-------------------------|
| Stainless steel.....                | 60.0  |                                     |                         |
| Other ferrous metals.....           |       |                                     |                         |
| Iron.....                           |       |                                     |                         |
| Aluminium.....                      | 11.0  |                                     |                         |
| Beryllium.....                      |       |                                     |                         |
| Cobalt.....                         |       |                                     |                         |
| Copper.....                         | 2.0   | Brass (2% wt)                       |                         |
| Lead.....                           |       |                                     |                         |
| Magnox/Magnesium.....               | 7.0   |                                     |                         |
| Nickel.....                         |       |                                     |                         |
| Titanium.....                       | 0     |                                     |                         |
| Uranium.....                        |       |                                     |                         |
| Zinc.....                           |       |                                     |                         |
| Zircaloy/Zirconium.....             |       |                                     |                         |
| Other metals.....                   |       |                                     |                         |
| Organics (%wt):                     | NE    |                                     |                         |
|                                     | (%wt) | Type(s) and comment                 | % of total C14 activity |
| Total cellulose.....                | ~~5.0 |                                     |                         |
| Paper, cotton.....                  | ~~2.0 |                                     |                         |
| Wood.....                           | ~~3.0 |                                     |                         |
| Halogenated plastics .....          |       |                                     |                         |
| Total non-halogenated plastics..... | ~~5.0 |                                     |                         |
| Condensation polymers.....          |       |                                     |                         |
| Others.....                         | ~~5.0 |                                     |                         |
| Organic ion exchange materials....  |       |                                     |                         |
| Total rubber.....                   |       |                                     |                         |
| Halogenated rubber .....            |       |                                     |                         |
| Non-halogenated rubber.....         |       |                                     |                         |
| Hydrocarbons.....                   |       |                                     |                         |
| Oil or grease .....                 |       |                                     |                         |
| Fuel.....                           |       |                                     |                         |
| Asphalt/Tarmac (cont.coal tar)...   |       |                                     |                         |
| Asphalt/Tarmac (no coal tar)....    |       |                                     |                         |
| Bitumen.....                        |       |                                     |                         |
| Others.....                         |       |                                     |                         |
| Other organics.....                 |       |                                     |                         |
| Other materials (%wt):              | -     |                                     |                         |

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|                                    | (%wt) | Type(s) and comment | % of total C14 activity |
|------------------------------------|-------|---------------------|-------------------------|
| Inorganic ion exchange materials.. | 0     |                     |                         |
| Inorganic sludges and flocs.....   | 0     |                     |                         |
| Soil.....                          | 0     |                     |                         |
| Brick/Stone/Rubble.....            | 0     |                     |                         |
| Cementitious material.....         | 0     |                     |                         |
| Sand.....                          | 0     |                     |                         |
| Glass/Ceramics.....                | ~10.0 |                     |                         |
| Graphite.....                      | 0     |                     |                         |
| Desiccants/Catalysts.....          | 0     |                     |                         |
| Asbestos.....                      | 0     |                     |                         |
| Non/low friable.....               |       |                     |                         |
| Moderately friable.....            |       |                     |                         |
| Highly friable.....                |       |                     |                         |
| Free aqueous liquids.....          |       |                     |                         |
| Free non-aqueous liquids.....      |       |                     |                         |
| Powder/Ash.....                    |       |                     |                         |

Inorganic anions (%wt):            Apart from the entry for Sulphate and Sulphide, none known to be present

|                | (%wt) | Type(s) and comment |
|----------------|-------|---------------------|
| Fluoride.....  |       |                     |
| Chloride.....  |       |                     |
| Iodide.....    |       |                     |
| Cyanide.....   |       |                     |
| Carbonate..... |       |                     |
| Nitrate.....   |       |                     |
| Nitrite.....   |       |                     |
| Phosphate..... |       |                     |
| Sulphate.....  | <1.0  |                     |
| Sulphide.....  | <1.0  |                     |

Materials of interest for waste acceptance criteria:            None known to be present

|                                | (%wt) | Type(s) and comment |
|--------------------------------|-------|---------------------|
| Combustible metals.....        |       |                     |
| Low flash point liquids.....   |       |                     |
| Explosive materials.....       |       |                     |
| Phosphorus.....                |       |                     |
| Hydrides.....                  |       |                     |
| Biological etc. materials..... |       |                     |
| Biodegradable materials.....   |       |                     |
| Putrescible wastes.....        |       |                     |
| Non-putrescible wastes.....    |       |                     |

- Corrosive materials.....
- Pyrophoric materials.....
- Generating toxic gases.....
- Reacting with water.....
- Higher activity particles.....
- Soluble solids as bulk chemical compounds.....

Hazardous substances / None known to be present  
 non hazardous pollutants:

|                                       | (%wt) | Type(s) and comment |
|---------------------------------------|-------|---------------------|
| Acrylamide.....                       |       |                     |
| Benzene.....                          |       |                     |
| Chlorinated solvents.....             |       |                     |
| Formaldehyde.....                     |       |                     |
| Organometallics.....                  |       |                     |
| Phenol.....                           |       |                     |
| Styrene.....                          |       |                     |
| Tri-butyl phosphate.....              |       |                     |
| Other organophosphates.....           |       |                     |
| Vinyl chloride.....                   |       |                     |
| Arsenic.....                          |       |                     |
| Barium.....                           |       |                     |
| Boron.....                            |       |                     |
| Boron (in Boral).....                 |       |                     |
| Boron (non-Boral).....                |       |                     |
| 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.....                       |       |                     |

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Complexing agents (%wt): Not yet determined

(%wt) Type(s) and comment

EDTA.....  
 DPTA.....  
 NTA.....  
 Polycarboxylic acids.....  
 Other organic complexants.....  
 Total complexing agents.....

Potential for the waste to contain discrete items: No.

**TREATMENT, PACKAGING AND DISPOSAL**

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

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

Comment on planned treatments:

Tritium wastes are consigned from the Donnington site by an authorised waste contractor (for example ACB) to SRB technologies for re-cycling. The planned treatment for the remaining other waste is unknown.

**Disposal Routes:**

| Disposal Route  | Stream volume % | Disposal density t/m3 |
|---|-----------------|-----------------------|
| 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           |                       |

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

**Upcoming (2022/23-2024/25) Waste Routing (if expected to change from above):**

| Disposal Route  | Stream volume % |         |         |
|---|-----------------|---------|---------|
|   | 2022/23         | 2023/24 | 2024/25 |
| 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 STREAM****7N03****MOD Donnington Miscellaneous LLW****Opportunities for alternative disposal routing:** Not yet determined

| Baseline Management Route | Opportunity Management Route | Stream volume (%) | Estimated Date that Opportunity will be realised | Opportunity Confidence | Comment |
|---------------------------|------------------------------|-------------------|--|------------------------|---------|
| -                         | -                            | -                 | -  | -                      | -       |

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

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

Other information: The waste is managed by consignment to an authorised waste contractor for disposal. They will determine the quantity that requires routing as radioactive waste and consign it as appropriate to the LLWR, metal decontamination, incineration, recycling/reuse, out of scope etc

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

Container voidage: -

Waste Characterisation Form (WCH): It is not yet determined if the waste meets LLWR's Waste Acceptance Criteria (WAC).

Waste consigned for disposal to LLWR in year of generation: Not yet determined. An appropriate waste disposal or recycling route is identified when the equipment manager authorises items for disposal.

**Non-Containerised Waste for In-Vault Grouting:**

Stream volume (%): -

Waste stream variation: -

Bounding cuboidal volume:

Inaccessible voidage: -

Other information: -

**RADIOACTIVITY**

Source: Radioactivity from radium-226 and associated daughter products and tritium arising from scrap luminised military equipment. Thoriated alloys arising from scrap military aircraft and thoriated optical lenses. Americium from redundant equipment including smoke detectors.

Uncertainty: -

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: -

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| Nuclide | Mean radioactivity, TBq/m <sup>3</sup> |                |                 |                | Nuclide          | Mean radioactivity, TBq/m <sup>3</sup> |                |                 |                |
|---------|--|----------------|-----------------|----------------|------------------|--|----------------|-----------------|----------------|
|         | Waste at 1.4.2022                      | Bands and Code | Future arisings | Bands and Code |                  | Waste at 1.4.2022                      | Bands and Code | Future arisings | Bands and Code |
| H 3     |  |                |                 | 6              | Gd 153           |  |                |                 |                |
| Be 10   |  |                |                 |                | Ho 163           |  |                |                 |                |
| C 14    |  |                |                 | 8              | Ho 166m          |  |                |                 |                |
| Na 22   |  |                |                 | 4              | Tm 170           |  |                |                 |                |
| Al 26   |  |                |                 | 4              | 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   |  |                |                 |                | Pb 210           |  |                |                 |                |
| Co 60   |  |                |                 | 4              | Bi 208           |  |                |                 |                |
| Ni 59   |  |                |                 |                | Bi 210m          |  |                |                 |                |
| Ni 63   |  |                |                 |                | Po 210           |  |                |                 |                |
| Zn 65   |  |                |                 |                | Ra 223           |  |                |                 |                |
| Se 79   |  |                |                 |                | Ra 225           |  |                |                 |                |
| Kr 81   |  |                |                 |                | Ra 226           |  |                |                 | 6              |
| Kr 85   |  |                |                 | 8              | Ra 228           |  |                |                 |                |
| Rb 87   |  |                |                 |                | Ac 227           |  |                |                 |                |
| Sr 90   |  |                |                 | 8              | Th 227           |  |                |                 |                |
| Zr 93   |  |                |                 |                | Th 228           |  |                |                 |                |
| Nb 91   |  |                |                 |                | Th 229           |  |                |                 |                |
| Nb 92   |  |                |                 |                | Th 230           |  |                |                 |                |
| Nb 93m  |  |                |                 |                | Th 232           |  |                |                 | 6              |
| 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            |  |                |                 | 8              |
| 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           |  |                |                 | 6              |
| Te 127m |  |                |                 |                | Am 242m          |  |                |                 |                |
| I 129   |  |                |                 |                | Am 243           |  |                |                 |                |
| Cs 134  |  |                |                 |                | Cm 242           |  |                |                 |                |
| Cs 135  |  |                |                 |                | Cm 243           |  |                |                 |                |
| Cs 137  |  |                |                 | 4              | Cm 244           |  |                |                 |                |
| Ba 133  |  |                |                 | 8              | Cm 245           |  |                |                 |                |
| La 137  |  |                |                 |                | Cm 246           |  |                |                 |                |
| La 138  |  |                |                 |                | Cm 248           |  |                |                 |                |
| Ce 144  |  |                |                 |                | Cf 249           |  |                |                 |                |
| Pm 145  |  |                |                 |                | Cf 250           |  |                |                 |                |
| Pm 147  |  |                |                 | 8              | Cf 251           |  |                |                 |                |
| Sm 147  |  |                |                 |                | Cf 252           |  |                |                 |                |
| Sm 151  |  |                |                 |                | Other a          |  |                |                 |                |
| Eu 152  |  |                |                 |                | Other b/g        |  |                |                 |                |
| Eu 154  |  |                |                 |                | <b>Total a</b>   | <b>0</b>                               |                |                 | <b>NE</b>      |
| Eu 155  |  |                |                 |                | <b>Total b/g</b> | <b>0</b>                               |                |                 | <b>NE</b>      |

**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